Proposal for
City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Submitted by
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January 9, 2007

Kathy Bradley  
City of Palo Alto  
Purchasing and Contracts Administration  
250 Hamilton Avenue, Mail Stop MB  
Palo Alto, CA 94301  

Dear Ms. Bradley and the Vendor Selection Committee:

Thank you for the opportunity to respond to the City of Palo Alto’s RFP for an Ultra-High-Speed Broadband System, RFP #FTTH01.

Our objective is to assist Palo Alto in establishing a publicly-owned network. Indeed, we have prepared a proposal response that will allow the city to retain ownership and control of the network—which will be a benefit to all city constituents and stakeholders for decades.

Since September of 2004, DynamicCity has carefully studied Palo Alto’s opportunity to provide the benefit of an advanced communication network to the entire community. We have used our experience with UTOPIA, the nation’s largest publicly-sponsored fiber-to-the-home network, and other cities to analyze the various approaches Palo Alto may use. Our proposal clearly lays out the plans and options to achieve all the city’s objectives, both primary and secondary. As a city-sponsored project, we look forward to working with the various city departments, council, and other stakeholder groups to implement the network.

In combination with DynamicCity’s experience, Palo Alto’s excellent demographics, committed and supportive residential and business communities, public power department, local university and successful trial are unique elements to bring about a next generation communications network—today. We look forward to working with you throughout your selection process.

Best regards,

Joel Sybrowsky  
Executive Vice President  
jsybrowsky@dynamiccity.com  
801-376-3046 mobile  
801-443-6507 office
Chapter 1: Proposal Summary

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The City of Palo Alto seeks to improve services to its community by installing and managing a citywide Ultra-High-Speed Broadband System. The benefits of such a system to the city are many, and include but are not limited to:

- Improved delivery of technology and information to schools, libraries and medical centers, expanding the reach of knowledge and data sharing to Palo Alto citizens, businesses and institutions
- Improved delivery of technology and information to Palo Alto businesses, increasing the speed and reliability for data flow, increasing performance and providing strong incentives for businesses to locate and remain in Palo Alto
- Leveraging the dark fiber backbone to the extent possible while protecting the bandwidth required by the City's mission-critical services
- Increased revenue for the City through the reselling of fiber bandwidth to telecommunications carriers, ISPs and local businesses
- Decreasing the overhead of managing the city’s own fiber-optic backbone, thus reducing expenses and drain on City resources

In order to realize these benefits, several goals have been identified by the City for its broadband system:

- Capability of providing to each customer a minimum bandwidth of 100 megabits per second symmetrical service
- Provision of at least data, video, and telephony services
- Eventual city ownership of the physical system
- Promote competition between multiple service providers
- Openness of the system
- Network neutrality
- Minimal financial risk to the City

Before the network can be designed or construction can begin, Palo Alto needs to secure funding for this project. Until that funding is secure, little else can be done by way of planning, designing, or deploying the network. All else is a natural result of having the financing in place to begin work.

DynamicCity has experience and resources to use in helping Palo Alto seek and secure financing for its fiber network, and proposes to use those resources to help the City take the primary steps toward immediate network ownership (not eventual, as may be proposed by other vendors).

In direct response to this RFP, DynamicCity proposes a three-month Project Design and Finance Package during which DynamicCity will:

- Help to design a sound business plan
- Assist in securing financing
- Design a solid phased roll-out plan and secure contractors for the physical deployment of the fiber
- Actively seek and recruit service providers
- Help Palo Alto design an information campaign to inform its citizenry of the availability of the fiber network

Proposed pricing for the three month Project Design and Finance Package: $150,000. Once funding has been secured and a phased roll-out plan is in place, DynamicCity

DynamicCity
can then be further contracted to:

- Coordinate building of the network with trusted and experienced contractors
- Negotiate contracts with service providers; test and integrate services
- Monitor and troubleshoot network operations through its world-class and secure Network Operations Center (NOC)
- Manage billing and leasing of network bandwidth between the City and its service providers
- Monitor the financial performance of the network

Pricing for DynamicCity continued services beyond the **Project Design and Finance Package** can be provided upon request.

The **Open Service Provider Network** (OSP) model starts with a principle-based business model that fundamentally transforms the broadband market landscape for communities across the country by placing ownership of networks in the hands of cities, while provisioning wholesale broadband service from competitive service carriers. In this way, the OSP model enables community-owned fiber networks to supersede existing service provider monopolies.

Some of the benefits of the OSP model include:

- overcomes the monopolistic forces of incumbent carriers by allowing a community to make its network infrastructure available to as many competing third-party service and content providers as possible
- provides breakthrough telecommunications services and true broadband capacity
- significantly reduced cost for consumers
- full fiber deployment city-wide

Superior video, voice, and data services, distance education, tele-medicine, and video conferencing all become commonplace in the dynamic cities which operate under the OSP model.

**Bandwidth Requirements**

An active fiber network, as proposed by DynamicCity, will easily meet the City's 100 Mbps requirement. Full details regarding the technology used and the capacity of the network can be found in the response to **Attachment C, Scope of Work**. Designs and plans for installation of the network in Palo Alto will be one of the deliverables included as part of the three-month **Project Design and Finance Package**.

**Services Provided**

The active fiber network proposed by DynamicCity will not only support triple-play services, but will also support development and delivery of new applications made both possible and practical by the superior data transfer rate of an active fiber network, including telemedicine, distance education, SaaS (Software as a Service) applications, offsite data storage, and other economic development oriented and life-enhancing services.

**City Ownership**

Private industry will only be motivated to lay fiber where they believe they stand to gain the highest return on their investments; this leaves many businesses and neighborhoods out of the loop. This problem is only solved through a City-owned network infrastructure.

The DynamicCity model provides for immediate City ownership of its fiber network. This provides the benefit of open competition among service providers.
using the same fiber.

Think of a city's airport facilities—the city owns the airport, but many different airlines use the facilities, ensuring fair and open competition for consumers. This, in turn, benefits the city in terms of increased usage fees and taxes. The same paradigm would be true for Palo Alto's fiber network.

If the City chooses to implement the Neutral Network Provider model instead of the OSPN model, the city would own the infrastructure as well as provide fiber connection services to residents and businesses, providing an additional revenue stream for the City and affordable high-speed access for its residents.

Promoting Competition

Open System Access

Network Neutrality

Minimizing Risk

Option B — Neutral Network Provider

The 'neutral' part of the NNP refers to the fact that the City network would not discriminate against or provide preferential treatment for particular users, content providers or application providers—it is a 'dumb' network which simply moves data packets across the network without regard as to who sent them or what they contain.

DynamicCity Contact

We look forward to working closely with Palo Alto as it reviews this proposal. For follow-up information or to schedule a live presentation or discussion, please contact Joel Sybrowsky, Executive Vice President at jsybrowsky@dynamiccity.com or 801-443-6507.
Chapter 2: Profile on Proposing Firm

submitted by

DynamicCity

Own the Future
Vendor Profile — DynamicCity, Inc.

Company Highlights

DynamicCity is the catalyst for the digital revitalization of metro markets across America. It creates community-owned communication networks that deliver true broadband connections, service provider independence, and life-enhancing services to residents and businesses.

DynamicCity is a services organization that designs, develops and manages next generation telecommunication systems pursuant to long-term operating agreements. DynamicCity assists local governmental entities and others in all aspects of the development, financing and long-term operation of “open access” advanced communication systems.

Founded in 2000, DynamicCity enables communities to obtain and offer affordable advanced communications services essential to economic development in the 21st Century. As an Open Access Architect, DynamicCity delivers unmatched expertise in designing, financing, implementing, and managing transformational fiber-to-the-premise projects.

DynamicCity developed the innovative business model validated by the buildout of a groundbreaking Open Service Provider Network called UTOPIA. DynamicCity also architected the UTOPIA project, which is the largest municipal fiber network project in the United States. UTOPIA includes 14 founding member cities and 160,000 potential subscribers throughout the state of Utah.

Some of the benefits provided to DynamicCity clients include:

- Empowers local communities to provide businesses and residents with widely accessible, affordable, reliable and converged communications (voice, video and data) at unprecedented speeds from 100 Mbps to 1 Gbps and beyond
- Delivers comprehensive creative financing options
- Operates the network as an asset to maximize return on investment
- Provides a framework that enables competition and innovation from a range of competing content, commerce, communications and application service providers
- Delivers a superior infrastructure for fostering economic growth and development within communities
- Designs unique dedicated Ethernet systems providing the highest broadband performance available to the business and home – upload and download speeds 400 to 4,000 times faster than DSL and upload speeds 5 to 50 times faster than passive optical fiber networks (PON)

DynamicCity is the leader in helping municipalities plan, finance, build, and operate advanced fiber-to-the-premises (FTTP) communications networks. Its comprehensive solutions make it possible for any qualified community to deploy and implement cutting-edge infrastructure and services.
DynamicCity offers true asset management for municipalities: its efforts are dedicated to maximizing the community's investments while minimizing costs.

DynamicCity's comprehensive services include:

**Assessments**

Primary research to analyze market environments and to ascertain likely take-rates or penetration for service offerings, average revenue per user, overall revenues, and all capital and operating costs projections. Includes educating and building a common vision among city management, elected officials, and community leaders.

**Design**

Custom pre-engineering design for a redundant, reliable, scalable and secure active fiber-optics network capable of delivering a minimum of 100 Mbps of duplexed and symmetrical bandwidth to every connected premises.

**Financing**

Assistance in securing construction financing, including support through creation of a business case. Also includes assistance in procuring contractors, equipment and vendors, in recruiting service providers, and in negotiating contracts with all.

**Implementation**

Oversight and management of physical deployment and construction of the network infrastructure through contracted construction labor. Includes engineering services and award-winning fiber inventory management systems. Special emphasis is made on service provider development and integration, lighting and the testing of key services.

**Operations And Management**

Ongoing management of day-to-day operations, including maintenance, upgrades, billing and management of vendor and service provider relationships and contracts. Also includes provisioning support to ensure a smooth transition from service provider sales efforts to end-user service delivery.

DynamicCity has the ability to scale resources to deliver on Palo Alto's needs. In the installation phases of this contract, we will only recommend contractors who are able to sufficiently scale to meet Palo Alto's rollout goals. In addition, our Network Operations Center can be rapidly scaled up to support the additional workload that supporting the Palo Alto network would provide.

Backed by an independent investment firm in Connecticut, DynamicCity has ample resources to fulfill a contract with the City.
Leadership

D. Keith Wilson  
Chairman, President and Chief Executive Officer

Mr. Wilson has 25 years experience as founder and President of a series of successful companies both national and international in scope. Mr. Wilson is the former CEO of Progressive Solutions, and Co-founder/President of EmerGen. He was founder and executive vice president of Dynix, which was acquired by Ameritech, Chicago. Mr. Wilson was an executive vice president with Ameritech for four years. He has extensive expertise in new market development, sales and operations. The companies that he has founded have earned over $1.4 billion dollars in profitable revenue. Mr. Wilson is Board Advisor and member of the Board of Directors for numerous companies and foundations, including Ear Huggers, Zion's Management, The Rose Foundation, American Indian Services, and Cause for Hope, a foundation supporting educational opportunities in Central America. Member of TechNet and the Broadband Task Force. Summa cum laude graduate of BYU, Provo. For his outstanding contributions in the science and technology industries, Mr. Wilson was selected to receive the Utah Governor's Medal for Science and Technology in 1994. Recipient of numerous other national and industry awards.

Mr. Wilson serves as DynamicCity's Chairman, President, and Chief Executive Officer.

Joel Sybrowsky  
Executive Vice President

With over 10 years experience working closely with local governments in business development capacities, Joel contributes valuable expertise to the DynamicCity team. He helped found DynamicCity in response to the needs of municipal clients seeking advanced communication systems in 2001 and brought market and business development expertise. Joel was instrumental in helping to organize and manage the cities that comprise UTOPIA, arguably the largest and most politically complex project of its kind in the United States. He has lobbied for the rights of municipalities at a state and federal level. He continues to lead client development efforts in numerous states.

Joel’s most recent experience includes 4+ years in senior leadership positions at Management Dynamics, a successful decision-support software corporation, which he co-founded. Management Dynamics provided critical solutions for many state and local government agencies until it was sold to a billion-dollar book wholesale and distribution company in 2000.

Previously, Joel worked for Ameritech Library Services, working with local government entities to harness the Internet providing database applications to patrons. Joel’s skills include product management and business development activities.

Joel received an MBA from the Marriott School of Management at Brigham Young University. He volunteers for Cause for Hope and serves on the Library Board for Utah Valley State College.
Jeff Fishburn  
**Vice President and Chief Technology Officer**  
Jeff has over 17 years of experience in emerging communications technologies, starting at AT&T Bell Laboratories and most recently at WINfirst—a Fiber To The Home (FTTH) overbuilder in Sacramento. As CTO of WINfirst, Jeff developed the technical design for the first-ever large-scale deployment of a dedicated FTTH network, capable of providing a complete voice, video, and data service package, including lifeline local and long-distance telephony, more than 200 channels of video (including PPV/VOD), and up to 100 Mbps of symmetrical dedicated bandwidth to each subscriber.  
As CTO of WINfirst, Jeff's responsibilities included contract negotiation, as well as technology assessment and systems integration. Specifically, Jeff focused on optical and electrical control plane integration progress, optical components developments including VCSEL and optical cross-connect technologies, optical termination switches, and residential gateways including video-over-fiber solutions.  
As CTO of DynamicCity Jeff has discovered and works to optimize the solutions to the unique challenges represented in the design and deployment of networks which are inherently open and transparent to the applications which ride over them. The open networks operational model especially when coupled with end user ownership inherent in the municipal networks environment has allowed Jeff to contribute to the development of a new class of operational models for telecommunications networks.  
Jeff's experience also includes basic research and development in optical receiver design, asynchronous and SONET ADM/DACS product definition, and optical amplifier and C/DWDM product design. He has been responsible for topology and network architecture designs covering voice/video/data access architectures over DOCSIS as well as ATM/Ethernet fiber-based infrastructures, dedicated transport over SONET/CWDM/DWDM protocols for local/metropolitan/long-haul deployments, packet-based data networking access and metropolitan networks over ATM and IP fiber infrastructures. He has experience in both vendor/manufacturer as well as service provider environments.

Bernadete Hill  
**Vice President**  
**Strategic Alliances**  
Bernadete has extensive business development experience across multiple business sectors including information technology, education, and e-business. She has over 15 years experience as an executive in the technology industry having been Vice President of e-business for Expanets, Co-founder of EmerGen, and VP/GM with Ameritech.  
Ms. Hill has been highly successful in establishing new business units, forging strategic relationships, and executing new and highly recognized go-to-market plans for both start-up and established companies. As an early advocate of using the web to leverage business assets, Ms. Hill has been a frequent media resource both in the press and on local and national television.  
Ms. Hill conducted postgraduate work at Mills College in Oakland, California.
and has a Master's degree from the University of Washington, Seattle.

Nate Taylor
Financial Analysis Director
Nate brings over 11 years of management experience, including 4 years as head of product management for Management Dynamics.

He has also been associated with such notable firms as Host Marriott, fonix, Zuka Juice, Solitude Ski Resort, I-Link and others.

At DynamicCity, Nate is responsible for overseeing the development of feasibility studies and business models for all clients. Typically this includes detailed capital cost modeling, pricing, revenue projections, sensitivity analysis and financing strategies.

Nate has both a bachelor’s degree in psychology and a Masters of Business Administration from Brigham Young University.

Cory Turner
Vice President
Operations and Information Technology
Cory brings 14 years of professional experience to the DynamicCity team. Having worked with companies large and small, Cory has developed extensive expertise in operations performance and quality management, as well as in information technology management.

After completing three years of employment with the Ball Corporation, Cory joined the Flowserve Corporation and led the IT project teams that successfully completed infrastructure integration following the mergers and acquisition of multiple billion dollar companies. As a member of the CIO’s senior staff at Flowserve, Cory and team were recognized for five consecutive years in the Information Week 500 as one of the top information technology organizations in the country.

In 1999, Cory co-founded a small Fiber to the Home (FTTH) company, and shortly thereafter joined DynamicCity on a part-time basis, moving to a full-time position in 2004.

Cory received a Bachelor’s degree from Brigham Young University in mechanical engineering and an MBA from the University of Colorado.
Proposal for

City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Chapter 3: Qualifications of the Firm

submitted by

Dynamic City
Own the Future
Qualifications of the Firm

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</table>
Qualifications of the Firm

Experience

Palo Alto is seeking to work with a vendor who is not only qualified to fulfill its goals, but which has also been successful in providing broadband systems to other municipalities. The success of other past projects should include financial responsibility, service, and meeting the implementation goals set forth at the beginning of the contract.

DynamicCity is the management company responsible for the installation and management of the UTOPIA project, the largest municipal fiber project in the country.

As requested by your RFP, please see the table format outlining DynamicCity's involvement in the UTOPIA project.

Qualifications of Firm Relative to City's Needs

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Client</th>
<th>Description of work performed</th>
<th>Total Project Cost</th>
<th>Percentage of work firm was responsible for</th>
<th>Period work was completed</th>
<th>Client contact information</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTOPIA</td>
<td>14 cities in the State of Utah</td>
<td>Please see below.</td>
<td>$325 million</td>
<td>2004-2008</td>
<td>Please see References.</td>
<td></td>
</tr>
</tbody>
</table>

Did your firm meet the project schedule (Circle one): Yes* No

* Ongoing project begun in 2004 and scheduled for completion in 2008-2009

Give a brief statement of the firm's adherence to the schedule and budget for the project:

We have kept on schedule in accordance with UTOPIA'S financing of the project and our mutually-agreed upon timetables for implementation.

Description of UTOPIA Project

DynamicCity's unique and innovative OSPN™ model is the basis of a landmark fiber-to-the-home project along Utah's Wasatch Front. The Utah Telecommunications Open Infrastructure Agency (UTOPIA) is a group of Utah cities dedicated to accelerating economic development and quality of life in their communities by deploying a publicly owned advanced telecommunications Open Service Provider Network™ over the “last mile” to all homes and businesses.

The largest municipal fiber network project in the country, UTOPIA embraces 14 founding member cities and 160,000 potential subscribers throughout Utah. Approximately 60% of Utah’s population lives in cities adjacent to the members, suggesting opportunity for significant expansion.
Initial construction began towards the end of 2004 with completion projected for sometime towards the end of 2008. Services began to roll out in limited communities during Q1 2005. Currently, a typical internet connection (dedicated, not shared, and fully symmetrical) of 15 Mbps costs $39.95; 50 Mbps costs $59.95; and 100 Mbps costs $89.95. Triple play packages (voice, video, & data) start at around $100.

<table>
<thead>
<tr>
<th>Member City</th>
<th>Residential Population</th>
<th># of Households</th>
<th>Business Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tremonton</td>
<td>5,592</td>
<td>1,808</td>
<td>369</td>
</tr>
<tr>
<td>Brigham City</td>
<td>17,411</td>
<td>5,840</td>
<td>454</td>
</tr>
<tr>
<td>Perry</td>
<td>2,383</td>
<td>786</td>
<td>51</td>
</tr>
<tr>
<td>Layton</td>
<td>66,474</td>
<td>19,144</td>
<td>2,435</td>
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<td>Centerville</td>
<td>14,585</td>
<td>4,238</td>
<td>269</td>
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<tr>
<td>West Valley</td>
<td>108,806</td>
<td>33,460</td>
<td>3,906</td>
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<tr>
<td>Murray</td>
<td>34,024</td>
<td>10,720</td>
<td>1,601</td>
</tr>
<tr>
<td>Midvale</td>
<td>27,029</td>
<td>10,720</td>
<td>1,601</td>
</tr>
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<td>Riverton</td>
<td>25,011</td>
<td>8,654</td>
<td>690</td>
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<td>Cedar Hills</td>
<td>3,054</td>
<td>1,701</td>
<td>83</td>
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<tr>
<td>Lindon</td>
<td>8,383</td>
<td>1,977</td>
<td>527</td>
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<tr>
<td>Orem</td>
<td>12,716</td>
<td>24,156</td>
<td>2,938</td>
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<tr>
<td>Payson</td>
<td>10,720</td>
<td>3,869</td>
<td>371</td>
</tr>
<tr>
<td>Cedar City</td>
<td>20,527</td>
<td>7,134</td>
<td>1,223</td>
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<tr>
<td>TOTALS</td>
<td>422,429</td>
<td>134,742</td>
<td>17,434</td>
</tr>
</tbody>
</table>

Acting as an open access architect, DynamicCity plays a fundamental role in designing, financing, implementing, and managing this breakthrough fiber-to-the-premise project that is showcasing the power of the OSPN™ model. Having recruited multiple high-quality service providers and technology partners, DynamicCity is further empowering UTOPIA to offer homes and businesses generally accessible, affordable and reliable voice, video and data at unprecedented speeds from 100 Mbps to 1 Gbps and beyond. The potential for these Utah communities to attract providers who will offer their residents and businesses a wide variety of services such as distance education, tele-medicine, and video conferencing is becoming commonplace and affordable.

True to its name, UTOPIA is becoming a collection of dynamic cities taking control of their digital future and raising the bar for all communities across America. DynamicCity is working with other cities to replicate the initial success and value proposition of the UTOPIA project.

The UTOPIA project involves deployment and long-term operation of a $325 million all fiber-optic network serving the homes and businesses in 14 municipalities in Utah. When completed, the network will connect over 160,000 homes and businesses, a number which will increase as additional cities join. The first phase of UTOPIA is in commercial operation with multiple service providers offering services over the fiber; other phases continue under construction. The service providers are marketing voice, video and data services.

DynamicCity has a 25-year Master Services Agreement with UTOPIA under which the Company provides services. The statements of work attached to the contract call for DynamicCity to provide Project Management, Asset Management, Procurement and other Consulting
The UTOPIA Metronet has two primary goals: within all participating communities, provide an infrastructure capable of delivering advanced telecommunications that 1) enhance economic development and, 2) improve quality of life for residents. UTOPIA plans to accomplish this by building the open, wholesale transport infrastructure across which competing retail service providers can serve the Utah market. By constructing and owning the infrastructure, UTOPIA can ensure a ubiquitous distribution of the advanced telecommunications network within participating communities, and can “level the playing field” for competing service providers, thus eliminating monopolistic business approaches by service providers.

UTOPIA offers wholesale transport across an open-access network, allowing interested service providers to serve the retail market. In exchange for use of the transport medium, service providers pay UTOPIA transport charges and usage fees. UTOPIA’s network is capable of delivering a wide variety of services. In particular, the system provides resources for a provider to offer new IP-based optical services for IP broadcast video, IP-based voice services, and high-speed data services. Future possibilities include telemedicine, distance education, security monitoring, interactive game playing, and many others.

As a wholesale provider of carrier-class transport, UTOPIA provides ubiquitous deployment (residence, business, government) over an all-fiber network delivering 100Mbps/1000Mbps edge connectivity through 5.6Tbps of distributed core switch fabric. Professionally managed carrier-class SLAs—including maintenance and repair, flexible provisioning, granular scalable services, security, and symmetrical transmissions—guarantee the highest levels of QoS.
the time of service launch, AT&T as well as MStar.net were under contract to offer services over the system, and contracts with other service providers were in negotiations. Five individual service providers currently offer services on the network.

Company Background

DynamicCity was organized as a Utah LLC in 2000 and as a Utah Corporation in 2002. For more details, please refer to Chapter 1 of this proposal.

Organization Chart

DynamicCity operates in a “flat” organization model, which provides the ability to form teams on-the-fly to solve problems and deliver solutions. Every client is provided with one main contact to interface with the company, but all employees are accessible. Key managers double as client leads in functional areas, such as business case modeling / financing, service provider development, network technologies, construction, and operations.

Please see Attachment 1 of this section for an organization chart. Company principals are listed in Chapter 2 of this proposal.

Current Operations

Current operations include:

- UTOPIA (see description above)
- Portland
- Seattle
- Las Cruces
- Iron Range
- New housing developments in various states
- Other city projects not currently announced

Please see Attachment 2 of this document for details on the Portland, Seattle, Las Cruces and Iron Range projects.

Contractual Issues

DynamicCity:

- has not filed for bankruptcy, dissolution or reorganization in the past five years
- has not been suspended or barred from bidding on government (federal, state or local) contracts
- has not been subjected to any federal, state, or local audits
- has not had any contracts relevant to the work requested in this RFP terminated prior to completion either voluntarily or involuntarily within the past five years

Most Relevant Completed Projects

The UTOPIA project is DynamicCity's most recent and relevant completed project. Please see the description of this project above.
References

**Paul Morris**
Executive Director, UTOPIA  
1385 West 2200 South, Suite 302  
West Valley City, UT 84119  
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pmorris@utopianet.org

*(Please see Page 2 of this section for details.)*

**David Olson**
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1120 SW Fifth Ave., # 1305  
Portland, OR 97204  
(503) 823-5290  
davido@ci.portland.or.us

*(Please see Attachment 2 of this section for details.)*

**Tony Perez**
Director, City of Seattle  
Key Tower, Suite 2700  
700 Fifth Avenue  
Seattle, WA 98104-5065  
(206) 386-0070  
tonyperez@seattle.gov

*(Please see Attachment 2 of this section for details.)*

**Patrick Hale**
IT Director, City of Las Cruces  
200 North Church St.  
Las Cruces, NM 88004  
(505) 541-2280  
phale@las-cruces.org

*(Please see Attachment 2 of this section for details.)*

**Richard Nordvold**
Blandin Foundation consultant for Iron Range Network  
3210 Second Ave E  
Hibbing, MN 55746  
(218) 263-5670  
rnordvold1@aol.com

*(Please see Attachment 2 of this section for details.)*

**Dee Atkin**
Land Developer  
3366 E 2170th S  
St. George, UT 84790  
(435) 668-6862  
dee@castlecliff.com
UTOPIA Details

**Total Capital**
- $73M of network assets
- $30M of cash
- $115M of outstanding bonds

**Annual Operating Costs**
- $3.2M of annual operating costs

**Time between Project Milestones**
- Created - May 2003
- Issued First Bonds - July 2004
- Network Launch (Data only)- Apr 2005
- Launch Voice - Jun 2005
- Launch Video - Sep 2005
- All footprints active - Mar 2006
- Signed AT&T as Provider - Dec 2003
- Signed MSTAR as Provider - Sep 2004
- Signed XMission as Provider - Feb 2005
- Signed Veracity as Provider - July 2005

**Marketing and Sales Performance**
- 5200 subscribers
- 22% of homes available for marketing
- 26% of Subs - Data only
- 40% of subs - Data + Voice
- 14% of subs - Data + Video
- 20% of subs - Triple Play
- $2.5M of annual revenue

**Role of DynamicCity Principals in the Project**
- Paul Recanzone - project management
- Scott Carlile - construction management, inspection
- Joe Howell - pre-engineering, as-built documentation
- Dave Knowles - installation and configuration of network electronics, integration of service providers
- Charles Stamper - customer turn up and new service provisioning, integration of service providers

**Quality of Service Characteristics**

In order to provide transparency to higher-layer services, the UTOPIA network does not reorder or prioritize packets across switch elements within a service VLAN. All packets entering and exiting a service VLAN are therefore treated in a First-In First-Out (FIFO) manner. Service providers may perform their own prioritization schemes before packets ingress UTOPIA's fiber network. However, the network reorders or prioritizes Ethernet packets based on VLAN IDs or Ethernet ports, and also reorders or prioritizes MPLS packets based on MPLS experimental (exp) bits through the MPLS cloud.
Public-Private Partnerships, Diverse Stakeholders and Public Processes

**Explanation of Relevant Regulatory Issues**

- **2001**: House Bill 149: Utah municipalities restricted from offering retail communications services, but incumbent providers agreed to a wholesale exception.
- **2004**: Senate Bill 66: Cities not currently involved in communications services restricted from pledging taxes as a finance backstop without a referendum until 2007.
- No regulation by State Public Utilities Commission due to open access to the communications infrastructure.

Many of DynamicCity’s management staff have worked in and for local or city governments for years; the company used that wealth of experience to assist in the creation of UTOPIA. The Utah Interlocal Cooperation Act allows cities to create new government agencies for specific purposes, such as joint powers authorities. DynamicCity was supportive and instrumental in defense of municipalities’ rights to create such agencies in 2001 with House Bill 149 and again in 2004 with Senate Bill 66.

UTOPIA is a political subdivision of the State of Utah. In accordance with Utah House Bill (HB)149, UTOPIA has all the rights, provisions, and obligations of municipalities to form and enter into interlocal operating agreements under the Utah Interlocal Cooperation Act, which grants cities (and other public agencies) the authority to form legal subdivisions of the state to do anything a single city can do, including providing telecommunications services. The fourteen member cities have agreed to the UTOPIA by-laws, paid membership fees, and signed UTOPIA’s Interlocal agreement.

DynamicCity has gained considerable experience in working with public-private partnerships through its implementation of UTOPIA and other municipal projects. As a result, the company is active in promoting open broadband connectivity at the municipal level.

The company has actively lobbied for municipal rights at the state level in a number of states, as well as at the federal level with members of U.S. Congress, with the FCC, with numerous consumer and industry groups, and with high-tech organizations.

In addition, DynamicCity has been involved with NATOA (the National Association of Telecommunications Officers and Advisors) as well as TechNet, the “bipartisan, political network of CEOs and Senior Executives that promotes the growth of technology and the innovation economy.” TechNet is based in Palo Alto, and actively promotes net neutrality initiatives, broadband availability, and public-private partnerships.
In California, DynamicCity has met with Governor Schwarzenegger and his legislative liaison, as well as the chair for the communications committee for the California state assembly. DynamicCity has attended CENIC and the League of California Cities conferences to promote broadband connectivity to academic institutions, as well as all residents and businesses.
Attachment 1 -- Organization Chart
Dynamic City Executive Team

D. Keith Wilson
President & CEO

Joel Sybrowsky
Executive Vice President
Business Development

Jeff Fishburn
CTO, Vice President
Engineering

Bernadete Hill
Vice President
Strategic Alliances

Nate Taylor
Director Financial Analysis

Cory Turner
Vice President
Operations & IT
Attachment 2 — Details on Current Operations
Ongoing Projects
DynamicCity is currently involved in numerous projects, in various stages of completion. Many of these projects cannot be disclosed at this time; what follows is a partial list of current DynamicCity projects.

Portland, Oregon
Statistics
- Population: 529,121
- Potential subscriber count: 263,606

Status
- DynamicCity completed Cost/Revenue Analysis as joint project between city telecommunications agency and economic development agency
- City council has officially accepted staff recommendations and unanimously directed staff to create an RFP for a Business Plan, to be released by the end of 2006.

Seattle, Washington
Statistics
- Population: 569,101
- Potential subscriber count: 316,000

Status
- DynamicCity completed Cost/Revenue Analysis
- City currently in a Request for Information process seeking a private partner to enhance financing opportunities

Las Cruces, New Mexico
Statistics
- Population: 74,267
- Potential subscriber count: 37,735

Status
- Under contract for Cost/Revenue Analysis
Iron Range, Minnesota

Statistics
- Approximately 14 rural cities in NE Minnesota
- Aggregate population: 80,958
- Aggregate unit count: 39,375
- Multi-jurisdictional entity led by the City of Hibbing (17,000 population)

Status
- Business Case contract between DynamicCity and the Iron Range Resources agency
- Currently focused on creating a Joint Powers Authority - an entity which will allow all participating cities to act as a single unit
Chapter 4: Financial Qualifications

submitted by Dynamic City

Own the Future
Financial Qualifications

Narrative Description of DynamicCity's Financial Condition

Incorporated in the State of Utah in the Year 2000, Dynamic City is profitable and has shown strong performance since it began the implementation of the UTOPIA project in 2003. Moreover, the business model of the UTOPIA project guarantees solid financial results for both UTOPIA participants and DynamicCity for the foreseeable future. DynamicCity’s business plan includes steady, sustainable expansion in key geographic regions over the next several years.

DynamicCity is a privately-held company; thus, its financial information is considered proprietary information.

Should the City of Palo Alto have further questions or require more information regarding DynamicCity’s financial status, please contact:

D. Keith Wilson
Chief Executive Officer
801-443-6524
kwilson@dynamiccity.com

Bank Reference

Bank of America
300 S. Fourth Street
Las Vegas, NV 89101
Olivia Rivera
702-654-7260
Olivia.R.Rivera@bankofamerica.com
Proposal for

City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Chapter 5: Project Staffing

submitted by

Dynamic City
Own the Future
If chosen as your project management firm, DynamicCity will likely hire and train additional qualified staff to work on different aspects of this implementation. They will be directed by our senior team, who consist of the following personnel.

Mr. Wilson has 25 years experience as founder and President of a series of successful companies both national and international in scope. Mr. Wilson is the former CEO of Progressive Solutions, and Co-founder/President of EmerGen. He was founder and executive vice president of Dynix, which was acquired by Ameritech, Chicago. Mr. Wilson was an executive vice president with Ameritech for four years. He has extensive expertise in new market development, sales and operations. The companies that he has founded have earned over $1.4 billion dollars in profitable revenue. Mr. Wilson is Board Advisor and member of the Board of Directors for numerous companies and foundations, including Ear Huggers, Zion's Management, The Rose Foundation, American Indian Services, and Cause for Hope, a foundation supporting educational opportunities in Central America. Member of TechNet and the Broadband Task Force. Summa cum laude graduate of BYU, Provo. For his outstanding contributions in the science and technology industries, Mr. Wilson was selected to receive the Utah Governor's Medal for Science and Technology in 1994. Recipient of numerous other national and industry awards.

Mr. Wilson serves as DynamicCity's Chairman, President, and Chief Executive Officer.

With over 10 years experience working closely with local governments in business development capacities, Joel contributes valuable expertise to the DynamicCity team. He helped found DynamicCity in response to the needs of municipal clients seeking advanced communication systems in 2001 and brought market and business development expertise. Joel was instrumental in helping to organize and manage the cities that comprise UTOPIA, arguably the largest and most politically complex project of its kind in the United States. He has lobbied for the rights of municipalities at a state and federal level. He continues to lead client development efforts in numerous states.

Joel's most recent experience includes 4+ years in senior leadership positions at Management Dynamics, a successful decision-support software corporation, which he co-founded. Management Dynamics provided critical solutions for many state and local government agencies until it was sold to a billion-dollar book wholesale and distribution company in 2000.

Previously, Joel worked for Ameritech Library Services, working with local government entities to harness the Internet providing database applications to patrons. Joel's skills include product management and business development activities.

Joel received an MBA from the Marriott School of Management at Brigham Young University.
Jeff Fishburn  
Vice President and  
Chief Technology  
Officer

Bernadete Hill  
Vice President  
Strategic Alliances

Brigham Young University. He volunteers for Cause for Hope and serves on the Library Board for Utah Valley State College.

Jeff has over 17 years of experience in emerging communications technologies, starting at AT&T Bell Laboratories and most recently at WINfirst—a Fiber To The Home (FTTH) overbuilder in Sacramento. As CTO of WINfirst, Jeff developed the technical design for the first-ever large-scale deployment of a dedicated FTTH network, capable of providing a complete voice, video, and data service package, including lifeline local and long-distance telephony, more than 200 channels of video (including PPV/VOD), and up to 100 Mbps of symmetrical dedicated bandwidth to each subscriber.

As CTO of WINfirst, Jeff's responsibilities included contract negotiation, as well as technology assessment and systems integration. Specifically, Jeff focused on optical and electrical control plane integration progress, optical components developments including VCSEL and optical cross-connect technologies, optical termination switches, and residential gateways including video-over-fiber solutions.

As CTO of DynamicCity Jeff has discovered and works to optimize the solutions to the unique challenges represented in the design and deployment of networks which are inherently open and transparent to the applications which ride over them. The open networks operational model especially when coupled with end user ownership inherent in the municipal networks environment has allowed Jeff to contribute to the development of a new class of operational models for telecommunications networks.

Jeff's experience also includes basic research and development in optical receiver design, asynchronous and SONET ADM/DACS product definition, and optical amplifier and C/DWDM product design. He has been responsible for topology and network architecture designs covering voice/video/data access architectures over DOCSIS as well as ATM/Ethernet fiber-based infrastructures, dedicated transport over SONET/CWDM/DWDM protocols for local/metropolitan/long-haul deployments, packet-based data networking access and metropolitan networks over ATM and IP fiber infrastructures. He has experience in both vendor/manufacturer as well as service provider environments.

Bernadete has extensive business development experience across multiple business sectors including information technology, education, and e-business. She has over 15 years experience as an executive in the technology industry having been Vice President of e-business for Expanets, Co-founder of EmerGen, and VP/GM with Ameritech.

Ms. Hill has been highly successful in establishing new business units, forging strategic relationships, and executing new and highly recognized go-to-market plans for both start-up and established companies. As an early advocate of using the web to leverage business assets, Ms. Hill has been a frequent media resource both in the press and on local and national television.
Ms. Hill conducted postgraduate work at Mills College in Oakland, California and has a Master's degree from the University of Washington, Seattle.

Nate brings over 11 years of management experience, including 4 years as head of product management for Management Dynamics.

He has also been associated with such notable firms as Host Marriott, fonix, Zuka Juice, Solitude Ski Resort, I-Link and others.

At DynamicCity, Nate is responsible for overseeing the development of feasibility studies and business models for all clients. Typically this includes detailed capital cost modeling, pricing, revenue projections, sensitivity analysis and financing strategies.

Nate has both a bachelor's degree in psychology and a Masters of Business Administration from Brigham Young University.

Cory brings 14 years of professional experience to the DynamicCity team. Having worked with companies large and small, Cory has developed extensive expertise in operations performance and quality management, as well as in information technology management.

After completing three years of employment with the Ball Corporation, Cory joined the Flowserve Corporation and led the IT project teams that successfully completed infrastructure integration following the mergers and acquisition of multiple billion dollar companies. As a member of the CIO’s senior staff at Flowserve, Cory and team were recognized for five consecutive years in the Information Week 500 as one of the top information technology organizations in the country.

In 1999, Cory co-founded a small Fiber to the Home (FTTH) company, and shortly thereafter joined DynamicCity on a part-time basis, moving to a full-time position in 2004.

Cory received a Bachelor’s degree from Brigham Young University in mechanical engineering and an MBA from the University of Colorado.

Nate Taylor will be charged with business plan modeling and financial analysis. 

Joel Sybrowsky will be charged with overall account management responsibilities.

Matt Jolley will be ultimately responsible for project management; he will be assisted by a yet-to-be determined team of DynamicCity personnel.

In addition to the above listed staff, other DynamicCity staff will also assist in the implementation and ongoing operation of Palo Alto’s network, if DynamicCity is awarded the contract to do so. These staff may include:

Jeff Fishburn—contract oversight and project management.
Bernadete Hill—service provider attainment, contracts, and ongoing development

Cory Turner—Network Support and Operations

Cory Hendrickson—GIS Manager

Andrew Thomas—Business Analyst

It is not customary for DynamicCity to specifically name individuals to a project team until a contract has been signed. However, DynamicCity operates in a very ‘flat’ organization, which enables fast team organization for both long-term projects and fast issue resolution. DynamicCity’s success is entirely based upon our customers’ success, and so we always strive to ensure that the right staff, based on experience, knowledge and availability, are assigned to complete necessary tasks for each customer. In addition, DynamicCity senior managers are always open to feedback regarding its project staff.
Chapter 6: End User License Agreements
(Samples from Service Providers)

submitted by

Dynamic City
Own the Future
End User License Agreement

In the OSPN™ model, the city is the network owner and does not provide services. A truly open network also requires an independent and neutral operator. This is a role DynamicCity could fill. The private service providers would market to and retain their own customers, and each would have their own end user license agreement. It is assumed that the network owner (the city) would also have an agreement with the end user that may be termed a "property access license," which would set forth the terms of usage of the network and provide access for maintenance, etc.

As a frame of reference, we have attached a sample agreement between the network owner and the end user, along with a sample End User License Agreement from a private service provider. Similar agreements could be used in Palo Alto, whether the City uses the OSPN™ or the Neutral Network Provider model.
PROPERTY ACCESS LICENSE

1. Grant of License. Subscriber understands and agrees that delivery of Service Provider's services requires [Network Owner] to connect its network to the premises. Subscriber grants [Network Owner] a non-exclusive license to access the premises to install and maintain fiber optic cable(s), electronic access portal(s), and any other equipment, to the premises, including rights of ingress and egress for maintenance purposes (the "License"). The License shall be irrevocable with respect to the outdoor premises and shall extend throughout the term of this agreement or until the date [Network Owner's] equipment is removed, whichever is later, with respect to the indoor premises. The License shall run with the land and, at [Network Owner's] sole discretion, may be recorded with the county recorder. Unless otherwise provided by law, the fiber optic cable(s), electronic access portal(s), and any other equipment shall remain [Network Owner's] property. If Subscriber is not the owner of the premises, Subscriber represents and warrants that the owner has granted Subscriber authority to grant the License.

2. Damage Covenant. Neither the owner(s), nor Subscriber or premises occupants shall damage [Network Owner's] Network, including, but not limited to, fiber optic cable(s), electronic access portal(s), and any other equipment. Subscriber shall be jointly and severally liable to [Network Owner] directly, and [Network Owner] may obtain reimbursement directly from Subscriber, for such damages, including enforcement and court costs, and attorney fees. Service Provider shall directly bill Subscriber for any such damages and transfer any funds recovered to [Network Owner]. [Network Owner] may also directly bill for any such damages. For the purposes of this provision, [Network Owner] is a third party beneficiary under any user agreement with Service Provider for services at the property. This provision shall survive the termination of any such agreement.

3. Temporary Drops. If, for any reason, a permanent connection to the property premises cannot be made, a temporary drop may be used to install [Network Owner's] network to the property. Authorized Representative and owner(s) shall hold [Network Owner] harmless from any and all claims arising from or related to injuries or damages, of whatever kind or nature, caused by such temporary drops.

4. LIMITATION OF LIABILITY. [NETWORK OWNER'S] LIABILITY TO AUTHORIZED REPRESENTATIVE, OWNER(S) AND/OR THE USERS OF [NETWORK OWNER'S] NETWORK AT THE PROPERTY ("NETWORK USERS") ON ACCOUNT OF ANY ACT OR OMISSION RELATED TO SUCH USE OF THE NETWORK SHALL BE LIMITED TO ACTUAL DAMAGE TO REAL OR TANGIBLE PERSONAL PROPERTY, OR BODILY INJURY OR DEATH PROXIMATELY CAUSED BY [NETWORK OWNER'S] INTENTIONAL MISCONDUCT OR GROSS NEGLIGENCE. EXCEPT FOR SUCH DAMAGES, NETWORK USERS WILL NOT BE ENTITLED TO ANY OTHER DAMAGES FROM [NETWORK OWNER], INCLUDING INDIRECT, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES OR OTHER ECONOMIC LOSSES, REGARDLESS OF THE FORM OF ACTION. [NETWORK OWNER], ITS EMPLOYEES, OFFICERS, AGENTS, CONTRACTORS AND REPRESENTATIVES WILL HAVE NO LIABILITY WHATSOEVER FOR ANY DAMAGES OR MODIFICATIONS TO, OR LOSS OR DESTRUCTION OF, NETWORK USERS' ELECTRONIC HARDWARE OR SOFTWARE, INCLUDING, WITHOUT LIMITATION, LOSS OF DATA. AUTHORIZED REPRESENTATIVE ASSUMES FULL RESPONSIBILITY FOR EDUCATING NETWORK USERS REGARDING VIRUSES, TROJAN HORSES, HACKER ATTACKS, ETC., AND AGREE TO HOLD [NETWORK OWNER] HARMLESS THEREFROM.

This Property Access License is specific and proprietary to the [Network Owner]. It is not to be modified without [Network Owner's] prior written consent. For any legal questions please contact [Network Owner] at [XXX-XXX-XXXX].

DynamicCity
END USER SERVICE AGREEMENT (MDU AND COMMERCIAL)

This END USER SERVICE AGREEMENT ("Agreement") is made and entered into as of the _____ day of __________, 2005 ("Effective Date") by and between _______________ ("Customer"), with its principal place of business at ___________________________ and MSTARMetro.net, LLC ("MSTAR"), with its principal place of business at 480 East 6400 South, Suite 200, Murray, UT 84107. Landlord and MSTAR are referred to herein individually as a "Party" and collectively as the "Parties." The Parties agree as follows:

Use of MSTAR's Services by Customer or any User constitutes acceptance of this Agreement in full, together with its attachments (each, an "Attachment"). This Agreement is effective on the date that MSTAR's Services are first made available to Customer and continues until all Service are terminated by either party in accordance with this Agreement.

1. Definitions.

"Account" means the billing account assigned to Customer and all associated Services.

"Agreement" means this Agreement and any applicable sub-agreements, such as the Internet Service Agreement, Voice Service Agreement, and Television Service Agreement.

"Customer" means the entity designated above as "Customer" together with its employees, agents, franchisees, contractors, licensees and successors.

"Equipment" means the physical equipment that is purchased by or provided to Customer for the specific purpose of ensuring interoperability between Customer's computer, television, or telephone and the relevant Services.

"Internet Service" means access to the Internet, web page hosting, and e-mail accounts that are offered to Customer by MSTAR.

"MSTAR" means MSTARMetro.net, LLC and its subsidiaries and agents.

"Programming" means television (broadcast, cable, and premium), music, schedules, and pay-per-view performances that may be transmitted over MSTAR's fiber optic cable.

"Service" means, generally, any use of the fiber optic cable that is provided by MSTAR, including Internet Service, Voice Service, and/or Television Service.

"Service Location" means the location(s) at which the Services are provided by MSTAR.

"Service Order" means MSTAR's service order document related to the Services.

"Software" means any software programs provided to Customer by MSTAR or any third party that are specifically related to Customer's use of the Service(s).

"Support Service" means the support that is available to Customer by calling 1-877-MSTARMetro (1-888-678-6387) or through other means described at the applicable MSTAR website.

"Television Service" means television Programming delivered over the fiber optic cable by MSTAR or its agent or affiliate.

"Term" means the term of the Agreement, as designated on the order form. The Term may be month-to-month or a fixed term.

"User" means any person, authorized or unauthorized, who uses, views, accesses, manipulates, or otherwise exercises any control over the Services, including but not limited to Customer, its occupants, tenants, renters, customers, clients, visitors, guests, family members, friends, strangers, minors, employees, contractors, licensees and other users.

"Unit" means a separate office, apartment, condominium or other unit at the Service Location. Multiple units that share the same address (e.g., Suite 201) will be considered one Unit unless otherwise agreed in a Service Order.

2. Terms of Service.

a. Services; Service Order. To order and receive Services, Customer must submit one
or more properly completed Service Order(s) to MSTAR. Each Service Order submitted shall be deemed a legally binding offer by Customer to purchase the Services described in the Service Order, this Agreement and the applicable Attachments hereto. A Service Order shall become effective upon the earlier of the time MSTAR begins (a) installation services required for the Services described in the Service Order, or (b) providing the Services described in the Service Order. All Services provided by MSTAR, and Customer’s use of such Services, are subject to the terms of this Agreement, the Attachments to this Agreement, and each Service Order executed by both parties. In the event of any conflict between or among any such documents, the terms of this Agreement will control, followed by the terms of the Attachments.

b. Access. Customer shall be responsible for securing for MSTAR, on an initial and ongoing basis during the applicable Term, all necessary rights of access to each Service Location for MSTAR to install and provide the Services. MSTAR, its employees, agents, contractors and representatives, will comply with the reasonable security procedures applicable to each Service Location. Except as otherwise set forth herein, Customer shall be responsible for the payment of any fees imposed by the owner of each Service Location or its manager or agent for access to the Service Location.

c. Demarcation Point. The demarcation point for the Services shall be designated by MSTAR. Provided Customer provides the required access to the Service Location for MSTAR to install and provide the Services, MSTAR will be responsible for delivery of the Services to the demarcation point. Customer shall be responsible for everything from the demarcation point, including without limitation the computers, software, network interface cards and any local area network equipment. Unless otherwise agreed by the parties in writing, MSTAR is not responsible for certifying or configuring Customer’s computers, hardware or network.

d. Engineering Review. Activation and installation of the Services to each Service Location is subject to MSTAR’s engineering review. In the event MSTAR determines that the Services are not available to a Service Location or installation of the Services is commercially impractical, the Service Order with respect to such Services at such Service Location shall be void.

e. Customer and Users. Customer will be responsible for all persons who access the Services through a Service Location, including Customer and all Users of the Service, authorized or unauthorized. Access to the Services by any person will be governed by the terms and conditions of this Agreement, which is effective on Customer from the date Customer submits the applicable Service Order. All obligations in this Agreement, including the Attachments, that refer to “Customer” also jointly and severally apply to Users. Customer shall make all Users at each Service Location reasonably aware of the restrictions and limitations associated with the Services, and Customer shall be responsible for any breach of any portion of this Agreement by any User. MSTAR reserves the right to refuse service to anyone at anytime for any reason.

f. Legal capacity. By entering into this Agreement, Customer warrants that Customer is authorized to enter into binding agreements with regard to the Service Locations.

g. Installation. Customer shall be available for MSTAR or its designee to install the Services at each Service Location. If Customer or an authorized agent is not at the appropriate Service Location at the designated installation time (or reasonable time thereafter), or if Customer does not cancel an installation appointment at least 48 hour in advance, then Customer shall pay MSTAR a service fee of $199 for each missed appointment. Customer acknowledges that from time to time installations require materials or tools that might not be immediately available to the installer, and that installations might require more than one visit. MSTAR shall not be liable to Customer for any delay or failure of an installer to install the proper fiber optics, wiring or equipment. Customer further acknowledges that installation of the Services might initially involve a temporary installation of the cabling and equipment, and that the installer might return at a later date to complete the installation. Customer shall reasonably cooperate with the installer and MSTAR in such circumstances. Customer shall hold MSTAR harmless from any and all claims arising from or related to injuries or damages, of whatever kind or nature, caused by installation of the Services.

h. Services availability. Customer understands that the Services provided by
MSTAR may be interrupted for several reasons. These include, but are not limited to, malfunctions, maintenance, and improvement or as required to protect network resources in the event of malfunctions or misuse. Customer understands that it may not be possible for MSTAR to give Customer advance notification of any such interruption of Service. MSTAR shall not be liable for any delay in or failure to perform the services caused by circumstances beyond its control such as those occasioned by other companies or organizations, acts of God or other causes, or which it could not have reasonably foreseen or any other cause, which similarly impedes the providing of service.

i. **Responsibility for charges.** Customer will be responsible for paying all charges accrued in connection with a Service Order, and may not assign the Service Order or associated account(s) to any other person without MSTAR's written permission. If this Agreement is terminated by either party, Customer is still responsible for any charges it incurred prior to termination.

j. **Relationship is service provider/Customer only.** Customer is only a subscriber to MSTAR's Services. Customer is given no authority to speak for or bind MSTAR in any manner, or to make representations on MSTAR's behalf.

k. **Redistribution.** Customer and its Users are not permitted to resell or redistribute the Services to any third party (provided that Customer may make the Services available to its tenants occupying the Service Location). Customer may not (and may not allow any User to) make access to the Services publicly available or available to third parties through use of radio or other wireless devices.

l. **Units.** Customer will designate the number of Units on a Service Order, and only that number of Units will be entitled to receive the Services. Unless otherwise agreed by the parties, all Units within a complex of Units must be included on a Service Order. If Customer designates a number of Units less than the actual number of Units existing at the Service Location, Customer must indicate the reasons for such lower designation on the Service Order (e.g., 25 Units are undergoing repairs and will not be leased for 12 months). If the number of Units at a Service Location is later increased for any reason (e.g., new Units are constructed or previously damaged Units are repaired), then Customer shall promptly notify MSTAR of the additional Units. No additional Units may receive the Services unless and until a new or amended Service Order that includes the Units is executed by the parties. Customer hereby consents to allow MSTAR to monitor and check the Service Location from time to time to ensure that the Units are properly accounted for in the Service Order.

3. **Charges and Payments.**

   a. **Credit check.** MSTAR may perform a credit check on Customer in order to make a determination about Customer's creditworthiness in relation to the Services. Customer hereby grants MSTAR permission to request Customer's credit report from any credit reporting agency for the purpose of making a determination about Customer's credit risk. MSTAR will not discriminate in its risk assessment on the basis of race, color, sex, creed, religion, nationality, sexual orientation, or marital status.

   b. **Deposit may be required.** Customer understands that if, in MSTAR's determination, Customer does not have adequate credit, Customer may be required to pay a deposit not to exceed one month's fees for the Services. MSTAR may apply any unpaid charges against this deposit, at MSTAR's discretion.

   c. **Billing method.** MSTAR will invoice Customer in advance on a monthly basis for all charges and fees for the Services. Customer agrees to pay all invoiced amounts within 5 days of the invoice date. Payments will be made to MSTAR by check or money order in United States dollars drawn on a United States bank. MSTAR may, in its discretion, accept payments by credit card. If Customer elects to pay with a credit card, a convenience charge of 4% will be automatically added to the invoiced amount and all credit cards will be charged automatically on or about the date of the invoice for each billing period. If a charge is declined or MSTAR determines it will not take payment by credit card, MSTAR will notify Customer and Customer will promptly make payment through another acceptable payment form. Invoices will be sent via e-mail or via the United States Postal Service.
d. Late payment and non-payment.

i. Definition. Payments are "late" when they have not been received by MSTAR within five calendar days of the due date printed on the bill.

ii. Suspension and cancellation of service. MSTAR may suspend or cancel service at any time due to late payment by Customer. MSTAR may, at its sole discretion, accept late payments and reinstate Customer's Services, but MSTAR is under no obligation to do so once payment is late.

iii. Late payment fee. MSTAR retains the right to assess a late payment fee not to exceed the then-current late payment charge listed on the applicable MSTAR website, plus a monthly service charge of 1 1/2% per month on all past due amounts. If Customer's account is referred to collection, Customer agrees to pay any collection costs incurred including reasonable attorney's fees, filing fees and court costs.

iv. Reconnect fee. MSTAR may charge a reconnect fee to reconnect any Services that MSTAR previously disconnected. Such fee shall be disclosed to Customer when Customer requests the reconnection.

v. Returned checks. MSTAR will charge Customer the then-current returned check fee listed at the applicable MSTAR website for any returned checks.

vi. Credit card disputes. If Customer disputes a valid credit card charge levied by MSTAR, Customer's account with MSTAR will be disabled and Customer will be charged the then-current service fee listed at the applicable MSTAR website.

4. Changes or cancellation.

a. Changes. Customer may make changes to a Services Order or its Account by contacting MSTAR's Support Service. Certain charges may apply to some changes. A list of these charges is available from MSTAR upon request.

b. Automatic renewal.

i. Fixed-term. If Customer purchases the Services in a Service Order on a fixed term basis (for example, a three-year Term), such Services will automatically renew for subsequent renewal Terms equal to the initial Term unless Customer notifies MSTAR, at least ninety (90) days prior to the expiration of the then-current Term, of its intent to terminate the Agreement.

ii. Month-to-month. If Customer purchases the Services in a Service Order on a month-to-month basis, such Services will automatically renew each month unless terminated in accordance with Section 4(c)(ii) below.

c. Cancellation by Customer without cause.

i. Fixed-term. If Customer purchases the Services in a Service Order for a fixed term (for example, a three-year Term) and Customer wishes to terminate all or part of the Service Order without cause, Customer must notify MSTAR in writing 90 days prior to such cancellation. The termination notice must either be faxed or mailed to MSTAR or otherwise delivered in accordance with the MSTAR's policies. A termination fee equal to six months' fees under the Service Order will apply, and Customer acknowledges that this is a fair and reasonable fee to terminate the Service Order.

ii. Month-to-month. If Customer purchases the Services in a Service Order on a month-to-month basis and Customer wishes to terminate all or part of the Service Order without cause, Customer must notify MSTAR in writing 30 days in advance, provided that termination will not be effective until the end of the month in which the 30 days period expires (e.g., if termination notice is given on April 15, the termination will be effective on May 31). The termination notice must either be faxed or mailed to MSTAR or otherwise delivered in accordance with the MSTAR's policies. No refunds will be made for unused Services, and Customer acknowledges that this is fair and reasonable to terminate the Service Order.

d. Cancellation by Customer for cause. If MSTAR commits a material breach of a Service Order that is not substantially remedied within 30 days after Customer provides MSTAR with written notice describing the breach, then Customer may
terminate the Service Order upon written notice to MSTAR. No termination fee will apply to cancellation of a Service Order for cause.

e. Cancellation by MSTAR. MSTAR may terminate all or any part of a Service Order or an Account at any time upon notice to Customer.

5. Dispute Resolution. MSTAR agrees to attempt to promptly resolve disputes when Customer utilizes MSTAR's Support Service. In the event that Support Service is unable to resolve a dispute submitted orally or via email, Customer agrees to submit the dispute to MSTAR in writing to the mailing address listed on the applicable MSTAR website. After receiving a written description of the dispute from Customer, MSTAR will have sixty (60) days to investigate and attempt to resolve the dispute. In the event that the dispute remains unresolved after this time, Customer and MSTAR each agree to submit the dispute for confidential, binding arbitration in accordance with the CPR Institute for Dispute Resolution Rules for Non-Administered Arbitration by a sole arbitrator appointed in accordance with those rules. Any such controversy or claim shall be arbitrated on an individual basis, and will not be consolidated in any arbitration with any claim or controversy of any other party. The place of the arbitration will be Salt Lake County, Utah (unless Customer and MSTAR otherwise agree prior to the initiation of the arbitration). The arbitration will be governed by the Federal Arbitration Act, 9 U.S.C. §§ 1-16, and judgment on the arbitration award may be entered into by any court having jurisdiction thereof. The award of the arbitrator will be final and binding upon the parties without appeal or review except as permitted by Utah law. This includes loss of data resulting from delays, non-deliveries, wrong deliveries, and any and all services interruptions caused by MSTAR parties (as defined below) or Customer's errors or omissions. To the fullest extent permitted by law, Customer hereby waives and releases all claims and causes of action accrued at any time and whether known on unknown, against MSTAR and its Shareholders, Directors, Officers, Employees, Agents, Representatives, Subcontractors, Suppliers, Successors and Assigns (the "MSTAR Parties") for any and all loss and damage caused in whole or part by the MSTAR Parties and/or Customer's use of the Services. If this waiver and release is not given full effect, then the total amount of any liability of the MSTAR Parties, including all Attorney's fees and costs, shall not exceed the total fees actually paid by Customer for the Services (excluding amounts paid for other goods or services provided by MSTAR or its affiliates) for the one month preceding MSTAR's receipt of written notice of Customer's claim.

7. Indemnification. CUSTOMER acknowledges full responsibility for Customer's use of the Service and agrees to indemnify and hold harmless MSTAR against any legal proceeding arising out of or related to Customer's use of the Service including, without limitation, claims of libel, unfair competition, unfair trademarks, trade names or patents, violations of rights of privacy and infringement of copyrights and property rights resulting from Customer's use of the Services provided by the MSTAR. Customer will make no representations to third parties that MSTAR has agreed to, condoned, or authorized Customer's activities when using the Service. Customer agrees to indemnify and hold harmless all MSTAR Employees, Officers, Directors, Shareholders, Warranties of Merchantability, Fitness for a Particular Purpose and Non-Infringement. In no event shall MSTAR be liable for any loss, loss of data, or other damage, including but not limited to special, incidental, consequential or other damages. This includes loss of data resulting from delays, non-deliveries, wrong deliveries, and any and all services interruptions caused by MSTAR parties (as defined below) or Customer's errors or omissions. To the fullest extent permitted by law, Customer hereby waives and releases all claims and causes of action accrued at any time and whether known on unknown, against MSTAR and its Shareholders, Directors, Officers, Employees, Agents, Representatives, Subcontractors, Suppliers, Successors and Assigns (the "MSTAR Parties") for any and all loss and damage caused in whole or part by the MSTAR Parties and/or Customer's use of the Services. If this waiver and release is not given full effect, then the total amount of any liability of the MSTAR Parties, including all Attorney's fees and costs, shall not exceed the total fees actually paid by Customer for the Services (excluding amounts paid for other goods or services provided by MSTAR or its affiliates) for the one month preceding MSTAR's receipt of written notice of Customer's claim.
AGENTS, ASSIGNS, CONTRACTORS, PARTNERS, THIRD PARTY BENEFICIARIES, AND ANY PARTY WITH WHOM MSTAR HAS CONTRACTED FOR THE PROVISION OF SERVICE(S) TO CUSTOMER.

8. Access License. The parties have entered into a separate Access and License Agreement permitting MSTAR to enter the Service Locations, and such agreement is essential to the purpose of this Agreement. Because the Access and License Agreement is required for MSTAR to provide Services under this Agreement, Customer may not terminate the Access and License Agreement during the Term of this Agreement. If the Access and License Agreement is held to be unenforceable by a court of competent jurisdiction for any reason, the parties will use good faith efforts to enter into another access agreement mutually agreeable to both parties, provided that if such agreement is not signed by both parties within ten (10) days after termination of the Access and License Agreement, this Agreement will be deemed to have been terminated according to Section 4.e, above.

9. Damage Covenant. Neither Customer or premises occupants shall damage the network managed by MSTAR, including, but not limited to, fiber optic cable(s), electronic access portal(s), and any other equipment. Customer shall be jointly and severally liable to MSTAR directly, and MSTAR may obtain reimbursement directly from Customer, for such damages, including enforcement and court costs, and attorney fees. This provision shall survive the termination of the Agreement.

10. Software. MSTAR may provide Customer with certain Software to facilitate Customer’s and the Users’ use of the Services. Customer agrees that its use of the software will be governed by the applicable Software licenses, and that Customer is solely responsible for Customer’s use of the Software. MSTAR does not grant, convey, or transfer any licenses to Customer under this Agreement. All Software licenses and rights are transferred pursuant to the applicable license for that particular Software.

11. Equipment. Customer owns only the Equipment that Customer has purchased and received title to. Equipment provided by MSTAR will remain the property of MSTAR, and any Equipment provided by a third party will remain the property of the third party. Customer’s physical possession of any Equipment does not constitute a transfer of any property rights in that equipment. Any Equipment not owned by Customer must be returned to MSTAR or the third party owner promptly upon termination of this Agreement in its original condition (reasonable wear and tear excepted). Customer shall reimburse MSTAR or its supplier for the replacement value of any Equipment not returned within a reasonable time.

12. Regulation and Export.

a. This Agreement is expressly made subject to any laws, regulations, orders or other restrictions on the use or export of information or technology that may be imposed from time to time. Customer warrants that it is in compliance with all relevant export and usage laws, regulations and orders, including those promulgated by the U.S. Treasury Department and the U.S. Commerce Department.

b. Customer acknowledges that Software received in connection with the Service(s) is subject to export controls. Customer agrees to not export the Software to any country in a manner which violates United States law or the law of the country into which the Software is exported.

13. Governing Law. All matters relating to Customer’s access to and use of the Services are governed in all respects by the laws of the State of Utah as such laws are applied to agreements entered into and to be performed entirely within Utah between Utah residents, without reference to conflicts of law provisions.

14. Right to Modify. MSTAR reserves the right to change its rates and otherwise modify the terms and conditions of this Agreement at any time by notifying Customer 30 days in advance of the effective date of such changes. In the event that Customer wishes to terminate its account due to a price increase, Customer will have 10 days from the date of notification of the effective increase to either mail or fax MSTAR a written request to terminate services. Otherwise, the existing service will be billed at the new rate. Such rate increases will not apply to a fixed-term Service Order until the expiration of the applicable term.

15. Severability. In the event that any part of this Agreement is found to be unlawful or otherwise unenforceable, that part will be severed and the remainder of this Agreement shall remain in effect.

16. Survival. Sections 1, 2(c), 3, 5-11, 13, 15, 16, 17 and 18 survive any termination of this Agreement.
17. **Transfer.** Customer agrees to notify MSTAR immediately, but in any event not more than 5 days, after Customer moves, sells, gives away, or otherwise transfers to anyone else any Fiber Equipment owned by Customer. Customer is considered the registered owner of the Fiber Equipment that it purchases or leases, and is deemed the recipient of the MSTAR Services until MSTAR receives such notice of transfer. Customer may be liable for any charges or fees incurred by the use of its Fiber Equipment by anyone else up to the time that MSTAR receives Customer's notice of transfer. Customer may not assign or transfer its Services or this Agreement without MSTAR's prior written consent, and any unauthorized transfer of this Agreement by Customer is grounds for immediate termination by MSTAR. MSTAR may assign this Agreement to any third party without limitation.

18. **Complete Agreement.** This Agreement hereby supersedes all previous representations, understanding, or agreements, written or oral, by or between Customer and MSTAR, and shall prevail notwithstanding any variance with terms and conditions of any and all orders submitted.

The Parties have executed this Agreement as of the Effective Date set forth above.

"CUSTOMER"

________________________________________

By: _________________________________

Name: _______________________________

Title: ________________________________

"MSTAR"

MSTARMetro.net, LLC

By: _________________________________

Name: _______________________________

Title: ________________________________
ATTACHMENT A
Internet Service Agreement

1. Incorporation. In addition to the terms of the Agreement, this Internet Service Agreement provides additional terms specifically related to Customer's Internet Service. By signing up for Internet Service, Customer agrees to be bound by the additional terms of this Internet Service Agreement. This Internet Service Agreement incorporates the terms and definitions contained in the Agreement. All obligations in this Internet Service Agreement that refer to "Customer" also jointly and severally apply to Users. Customer shall make all Users at each Service Location reasonably aware of the restrictions and limitations associated with the Internet Services, and Customer shall be responsible for any breach of any portion of this Internet Service Agreement by any User.

2. Description of Service. Customer will be provided with access to the Internet via fiber optic cable. MSTAR will make every effort to ensure consistently high upload and download speeds, but makes no warranty regarding the Internet Service.

   Each Unit will be provided with:

   An Internet connection speed of up to XX megabits/sec

   XXX gigabytes of total bandwidth usage per month. If a Unit uses bandwidth in excess of this amount, then MSTAR may invoice Customer at the then-current per gigabyte overage charges for all usage over 100 gigabytes, and Customer shall promptly pay such charges. Overage charges are listed at the applicable MSTAR website. All additional bandwidth shall be sold in units of 1 gigabyte each. Any unused bandwidth shall be automatically forfeited at the end of each month, and no unused bandwidth amounts will roll-over into any subsequent month. No credits will be given for unused bandwidth.

3. Acceptable Use Policies
   a. CUSTOMER AGREES TO USE THE SERVICE ONLY FOR LAWFUL PURPOSES.
   b. Unacceptable uses include, but are not limited to:
      i. Spam. Customer may not utilize the Internet Service for the purpose of sending direct mailings, solicitations, bulk mail, spam, or any other high volume e-mailing function. Customer will not send e-mail to persons who are not personally known to Customer, or who did not personally request e-mail from Customer. Customers whose activities result in the MSTAR domain name being banned from an e-mail server due to spamming may be assessed fees associated with the cost of lifting the ban. Any violation of this policy may result in the immediate termination of Customer's account, at the sole discretion of MSTAR. If Customer violates this spamming policy, it will be assessed the following fines and fees, which Customer hereby agree to pay:
         (1) First offense: $100
         (2) Second offense: $500
         (3) Third offense: $500 and automatic termination of Customer's account.
      ii. Newsgroup posting. The posting of any advertisement or other commercial solicitation to any newsgroup is prohibited. MSTAR reserves the right to determine whether a post constitutes an advertisement or commercial solicitation. The posting of a single article or substantially similar articles to an excessive number of newsgroups or mailing lists, or continued posting of articles that are off-topic is strictly prohibited. A posting will be considered off-topic when it provokes complaints from the regular readers of the newsgroup or is deemed so by MSTAR. A violation of this policy will result in the immediate termination of Customer's account.
iii. **Obscenity.** Customers may not utilize the Internet Service to send or receive obscene materials.

iv. **Impersonation.** Customers may not utilize the Internet Service to impersonate another person.

v. **Defamation.** Customers may not utilize the Internet Service to defame, harm, harass, or libel another person.

vi. **Trade secrets.** Customers may not utilize the Internet Service to send or receive trade secrets in violation of applicable state or federal law.

vii. **Malicious software or code.** Customers may not utilize the Internet Service to send or intentionally receive any viruses, spyware, worms, Trojan horses or any other malicious computer software or code designed to damage or make use of any third party's property.

viii. **Intellectual property.** Customers may not utilize the Internet Service infringe on any party's intellectual property rights. Customers may not engage in the illegal or unauthorized transfer of intellectual property, including but not limited to music, written works, movies, software, videogames, instructions, data, and code.

ix. **Unauthorized access to computers.** Customers may not utilize the Internet Service for the purpose of hacking or other conduct related to unauthorized access of computers, servers or systems.

c. **Bandwidth limits and fluctuations.** MSTAR may, when necessary to control network congestion, impose reasonable bandwidth limits on Customer's use of the Service in order to ensure equitable access for other Customers. MSTAR will use commercially reasonable efforts to provide the bandwidth speed described in this Attachment, but Customer acknowledges that bandwidth speeds may fluctuate from time to time throughout the day and that Customer may not receive the designated speeds at all times during the day. At MSTAR's discretion, MSTAR may restrict or limit upload speeds.

d. **Minors.** Customer will be fully responsible for monitoring minors' access to the Service, and will take appropriate steps to ensure that minors do not have access to harmful content. Customer acknowledges that MSTAR does not monitor minors' access to the Service and is not responsible for minors' access to inappropriate or harmful content.

e. **Personal Accounts.** Customers that have paid for a personal account (as opposed to a business account) are not permitted to use MSTAR's Internet connection to sell or advertise goods or services. This is only permitted to those who have purchased a business account or a virtual server.

f. **Enforcement.** MSTAR reserves the right to take whatever actions it deems appropriate to enforce these policies. MSTAR also reserves the right to change these policies without prior notice at any time. The actions MSTAR takes may include account suspension or termination. MSTAR does not issue any credits for accounts cancelled due to policy violations. Any Internet activity, which references back to MSTAR or its services in a damaging manner, will result in suspension or termination of account(s). Illegal Internet activity using or referencing to MSTAR or an account or services provided by MSTAR will result in immediate termination, possible prosecution, and assessment of legal fees accrued. In addition to any other fees and penalties that may be assessed by the MSTAR, as provided herein, Customer shall be held liable for any and all costs incurred by the MSTAR as a result of Customer's violation of any terms and conditions of this Agreement. This includes, but is not limited to, attorneys' fees and costs resulting from MSTAR responses to complaints from and the cleanup of unsolicited
commercial mailings and/or unauthorized bulk mailings and/or news server violations. MSTAR’s current hourly rate for responses to complaints and cleanup of unsolicited commercial mailings and/or unauthorized bulk mailings and/or news server violations is listed at are listed at the applicable MSTAR website.

4. Responsibility for Security and Filtering

a. Security and viruses. Customer acknowledges that by connecting to the Internet, Customer’s and its User’s computer system and files are vulnerable to access by unauthorized third parties (including hackers). Customer is solely responsible for installing, implementing and using computer security precautions such as closing unnecessary ports and using firewall technology. CUSTOMER AND ITS USERS ARE STRONGLY ENCOURAGED TO INSTALL AND ROUTINELY UPDATE FIREWALL AND ANTIVIRUS SOFTWARE. In the event that Customer is found to be spreading a virus, whether intentionally or unintentionally, MSTAR may suspend Customer’s account until such time as MSTAR believes that Customer has effectively remedied the situation.

b. Passwords. Customer may be provided with initial passwords to access the Internet Service. Customer agrees to change the password upon initializing the account, and will protect any passwords associated with the account. Customer agrees that its username and password, and changes to both of these items, are Customer’s responsibility.

c. Web and E-mail Filtering. From time to time MSTAR may make available to Customer certain Web, E-mail and other Internet filtering tools and features. Customer acknowledges that, because the Internet is constantly changing and evolving, these tools and features are not guaranteed to restrict all obscene, immoral or other unwanted content, email or websites. Further, these tools and features may not be able to monitor all data, email or materials accessed or downloaded by Customer (e.g., file sharing utilities). The Web, E-mail and other Internet filtering tools and features are provided AS-IS, WHERE-IS and MSTAR makes no warranty as to their effectiveness or usefulness.

d. Wireless connections. Customer acknowledges that using wireless networking connectivity may present certain security risks. Customer is solely responsible for implementing and using wireless security measures, including but not limited to enabling encryption technology (e.g., Wired Equivalent Privacy (WEP) or Wi-Fi Protected Access (WPA)) on the relevant equipment, including the access point.

e. Disclaimer of liability. Customer acknowledges and agrees that MSTAR has no liability for any unauthorized access of any Customer computer or system by any third party, and that Customer is solely liable for any damages arising from such unauthorized access. MSTAR is not providing any security advice or consulting services to Customer and is not responsible for installing or maintaining any security systems on behalf of Customer.

5. IP Addressing. MSTAR uses static and dynamic IP Addresses for Customers. Assignment of an IP address to Customer creates no ownership rights in Customer of the IP address. MSTAR retains all rights to any IP addresses it assigns to Customer.

6. Ownership of Content. Except for content on the MSTAR website, MSTAR does not own, license, or have any rights in content that Customer may upload or download, nor in e-mails that Customer may send or receive, nor in any content that Customer may upload to the server space provided by MSTAR under this Agreement. The content of all uploads, downloads, and e-mails associated with Customer’s use of the Internet Service is solely the property and responsibility of Customer.

7. Forwarding Upon Termination. MSTAR will not forward Customer’s email or URL after termination, and MSTAR does not offer a discounted forwarding option. For this reason, it is recommended that Customer’s continue their account with MSTAR for as long as necessary for
forwarding purposes. As long as MSTAR forwards Customer's email or website, Customer must continue its account with MSTAR.
ATTACHMENT B
Television Service Agreement

1. Incorporation. In addition to the terms of the Agreement, this Television Service Agreement provides additional terms specifically related to Customer's Television Service. By signing up for Television Service, Customer agrees to be bound by the additional terms of this Television Service Agreement. This Television Service Agreement incorporates the terms and definitions contained in the Agreement. All obligations in this Television Service Agreement that refer to "Customer" also jointly and severally apply to Users. Customer shall make all Users at each Service Location reasonably aware of the restrictions and limitations associated with the Television Services, and Customer shall be responsible for any breach of any portion of this Television Service Agreement by any User.

2. Description of Service. Customer will be provided with television Programming. A complete list of the Programming channels, services and equipment provided under this Television Service Agreement can be found at the applicable MSTAR website. MSTAR may update this list, add and delete programs from time to time. MSTAR does not warrant the provision of any particular Programming in conjunction with this agreement.

3. Private Viewing. CUSTOMER AGREES TO USE (AND REQUIRE THAT ITS USERS USE) THE TELEVISION SERVICE FOR PRIVATE VIEWING ONLY. Customer will not provide public transmissions or retransmissions of any Programming without the written consent of the party holding a license to the transmitted or retransmitted content. Customer will not transmit or retransmit Programming in a commercial establishment without the written consent of the party holding a license to the transmitted or retransmitted content.

4. Unauthorized Devices. Customer agrees not to attach any unauthorized devices to the Service that are designed to unlock, descramble, unencrypt, find, or otherwise manipulate the Programming that MSTAR offers.

5. Audit Rights. MSTAR reserves the right to audit Customer's use of the Television Service to determine whether Customer has engaged in any unauthorized uses. Customer consents to MSTAR's access to and manipulation of Customer's equipment or software for the purpose of such audit.

6. Compliance. Customer agrees to comply with all relevant laws, rules and regulations related to the Television Services, and will not engage in any practice nor use any tools or techniques (including television piracy tools) in violation of any law, rule or regulation. Should Customer engage in any illegal activity associated with the Television Services, then at MSTAR's option it may cancel this Attachment B (Television Service Agreement) immediately and without notice.
ATTACHMENT C
Voice Service Agreement

1. **Incorporation.** In addition to the terms of the User Agreement, this Voice Service Agreement provides additional terms specifically related to Subscriber's Voice Service. By signing up for Voice Service, Subscriber agrees to be bound by the additional terms of this Voice Service Agreement. This Voice Service Agreement incorporates the terms and definitions contained in the User Agreement.

2. **Description of Service.** As part of the Voice Services, Subscriber will be provided with a basic dial tone service and those other services and features described at http://www.mstar.net. The use or availability of certain premium services and features may require Subscriber to pay additional fees, as described on the Voice Service Page. MSTAR may update the Voice Service Page from time to time, and it is Subscriber's responsibility to check the page periodically for changes. If Subscriber has subscribed to MSTAR's residential services, the Voice Service and any devices are provided to Subscriber as a residential user for personal, residential, non-business and non-professional use. This means that Subscriber may not use them for any commercial or governmental activities, profit-making or non-profit, including but not limited to home office, business, sales, tele-commuting, telemarketing (including without limitation charitable or political solicitation or polling), autodialing, continuous or extensive call forwarding, fax broadcast, fax blasting or any other activity that would be inconsistent with normal residential usage patterns. Subscriber acknowledges that use of the Voice Service for any commercial or governmental purpose could obligate Subscriber to pay MSTAR's higher rates for commercial service on account of all periods, including past periods, in which Subscriber uses, or used, the Voice Service for commercial or governmental purposes. MSTAR reserves the right to immediately terminate or modify the Voice Service if MSTAR determines, in its sole discretion, that Subscriber's Voice Service is being used for non-residential or commercial use, is being used for illegal activities, or is in violation of any of the terms of the User Agreement.

3. **Calling.** By paying the Voice Service subscription fee, Subscriber will receive the following services:
   
   a. **Local calls.** Subscriber may place unlimited local voice-over IP ("VoIP") calls at no additional charge.
   
   b. **Long distance calls.** Subscriber may place unlimited long distance VoIP calls within the continental United States and Canada at no additional charge when included as part of a package or paid for separately on a monthly basis.
   
   c. **International calls.** Subscriber may place unlimited international calls by paying the rates listed at http://www.mstar.net. All international calls are billed on a usage basis in one-minute increments. International rates are subject to change from time to time, and it is Subscriber’s responsibility to check http://www.mstar.net periodically for changes.
   
   d. **911 AND E911 CALLS.** SUBSCRIBER ACKNOWLEDGES AND UNDERSTANDS THAT ACCESS TO EMERGENCY SERVICES THROUGH 911 AND E911 CALLS IS LIMITED. The Voice Services support E911 (where available) and traditional 911. Subscriber acknowledges and understands that the Voice Service supports traditional 911 or E911 access to emergency services ONLY IF THE SERVICE IS OPERATED FROM THE SERVICE LOCATION OF RECORD, and then only if Subscriber has an active connection to the service, in accordance with the terms of the User Agreement. Subscriber acknowledges and understands that if there is a service outage for ANY reason, such outage may prevent ALL Voice Service, including 911 dialing. Such outages may occur for a variety of reasons, including, but not limited to those reasons described elsewhere in this Agreement. Subscriber hereby acknowledges that MSTAR's liability is limited for any Voice Service outage and/or inability to dial 911 from Subscriber's line or to access emergency service personnel, as set forth in this Attachment. Subscriber agrees to defend, indemnify, and hold harmless MSTAR, its officers, directors,
employees, affiliates and agents and any other service provider who furnishes services to Subscriber in connection with this Agreement or the Voice Service, from any and all claims, losses, damages, fines, penalties, costs and expenses (including, without limitation, reasonable attorneys’ fees) by, or on behalf of, Subscriber or any third party as such relate to the absence, failure or outage of the Voice Service, including 911 dialing and/or inability of Subscriber or any third person or party or user of Subscriber’s Voice Service to be able to dial 911 or to access emergency service personnel. Subscriber further agrees to indemnify, defend and hold harmless MSTAR and its third party providers from any claim or action arising out of misroutes of 911 calls, including but not limited to Subscriber’s failure to follow correct usage procedures for 911 calling or Subscriber’s provision to MSTAR of incorrect information in connection therewith. Neither MSTAR nor its officers or employees will be liable for any claim, damage, or loss related to this Section 3(d), and Subscriber hereby waives any and all such claims or causes of action arising from or relating to 911 dialing.

e. Toll calls, 0+ Calls, and x11 Calls. Subscriber may not place calls to certain numbers using the Voice Service. These include, but are not limited to, toll calls placed to numbers with the 900, 976, or 101 area codes, calls involving 555-1212 directory assistance, 0+ calling (including without limitation collect, third party billing or calling card calling) and 311, 511 and/or other x11 (other than 911) calling services. MSTAR will have the right to restrict Subscriber’s access to these types of calls, and may assess a $75 penalty, in addition to any charges incurred, for any calls placed to such numbers on Subscriber’s Account.

f. Directory Assistance Calls. Subscriber may place directory assistance calls by paying the rates listed at http://www.mstar.net. Directory assistance rates are subject to change from time to time, and it is Subscriber’s responsibility to check the rates page periodically for changes.

4. Installation and Equipment. In order to install the Voice Service, MSTAR or its providers may be required to make physical changes to the telephone wiring of Subscriber’s residence, and Subscriber will cooperate with MSTAR so that these changes may be made. The Voice Service may not be compatible with certain telecommunications equipment that Subscriber may own. MSTAR makes no representations or warranties regarding compatibility between the Voice Service and Subscriber’s alarm system, particular telephones, or other telecommunications equipment. Subscriber agrees that it will not tamper with or attempt to modify any equipment or devices provided by MSTAR or its service providers.

5. Telephone Numbers

a. Telephone number portability. If Subscriber elects to switch an existing telephone number to the Voice Service, the following terms apply: (i) Subscriber hereby consents to the transfer of the telephone number to MSTAR, and will execute all documents and assist in all reasonable ways to cause such transfer to occur, (ii) Subscriber warrants that the telephone number is in Subscriber’s name and that Subscriber has all rights necessary to permit such transfer (iii) Subscriber acknowledges and understands that several factors affect the porting of telephone numbers, and that all numbers may not be eligible for porting. MSTAR makes no representations or warranties regarding the timing or success of the porting process. Subscriber agrees to provide MSTAR with all information requested by MSTAR to assist in the porting process. Additional charges may apply to porting requests.

b. Assignment of telephone numbers. Subscriber will be assigned a telephone number by MSTAR. Subscriber will have no right to request a specific number. MSTAR may accommodate such a request, at its sole discretion, on a case-by-case basis. Additional charges may apply to specific number requests.

c. Release of telephone numbers. Upon termination of the Service, MSTAR may, at its sole discretion, release a telephone number that was ported in from a previous service provider to MSTAR by Subscriber (and used in connection with Subscriber’s Voice Service) to Subscriber's new service provider, if such new service provider is able to accept such
number, and provided that (i) Subscriber’s account has been terminated; (ii) Subscriber’s account is completely current including payment for all charges and disconnect fees; and (iii) Subscriber requests the transfer upon terminating its account.

6. Other Terms

a. **Power failures.** Subscriber acknowledges and understands that the Voice Service does not function in the event of power failure. You also acknowledge and understand that the Voice Service requires a fully functional broadband connection to the Internet and that, accordingly, in the event of an outage of, or termination of service with or by MSTAR, the Voice Service will not function. A power failure or disruption may require Subscriber to reset or reconfigure equipment prior to utilizing the Voice Service. Power disruptions, failures or other outages will also prevent dialing to emergency service numbers including the 911 calling feature. Should MSTAR or its providers suspend or terminate the Voice Service, the service will not function until such time as MSTAR restores the Voice Service (which may require payment of all invoices and reconnection fees owed by Subscriber or cure of any breach by Subscriber of this Agreement).

b. **Not a telephone service.** Subscriber acknowledges and understands that the Voice Service is not a telephone service. Important distinctions (some, but not necessarily all, of which are described in this Agreement) exist between telephone service and the Voice Services provided by MSTAR. The Voice Service is subject to different regulatory treatment than telephone service. This treatment may limit or otherwise affect your rights of redress before federal and state telecommunications regulatory agencies. Subscriber acknowledges and agrees that, in some cases, Voice Services may not be as reliable or have the clarity of telephone services provided by a common carrier. In addition to the other sections limiting MSTAR's liability, Subscriber agrees that MSTAR will not be liable for any delay or failure to provide the Voice Services, including 911 dialing, at any time or from time to time, or any interruption or degradation of voice quality that results from the Voice Services being a VoIP-related service, or from any act or omission of an underlying carrier, service provider, vendor or other third party.

c. **Compatibility of certain devices.** SUBSCRIBER ACKNOWLEDGES AND UNDERSTANDS THAT SOME PRODUCTS USING A MODEM OR OTHER TELEPHONE-BASED COMMUNICATIONS DEVICE TO CONNECT TO OUTSIDE SERVICES (E.G., FAX MACHINES, DIGITAL VIDEO RECORDERS, HOME SECURITY SYSTEMS, LIFE ALERT, ETC.) MAY NOT FUNCTION PROPERLY WHEN SWITCHED TO AN IP-BASED VOICE SYSTEM SUCH AS THE VOICE SERVICES. Subscriber is solely responsible to test such products and confirm compatibility with the Voice Services. MSTAR is not responsible for any incompatibility or Subscriber’s inability to use such products with the Voice Services, and hereby releases MSTAR from all related claims and liability.
Proposal for

City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Chapter 7: Default Consequences

submitted by DynamicCity
Own the Future
Default Consequences

Consequences for Default

The suppliers and contractors used by DynamicCity will be required to supply performance bonds for default.

Possible Scenarios for Removal of Fiber for Public Rights-of-Way

This is not applicable in the case of a City-owned network.

Exceptions to Attachment D

Section 4. Not to Exceed Compensation and Section 5. Invoices

Exception: Most typically, DynamicCity contracts for services using a fixed price/milestone payment approach, providing details for milestone deliverables and city sign-off prior to invoicing. DynamicCity does not usually provide information on the hours worked by its staff nor does it charge by an hourly rate.

Section 14. Ownership of Materials

Exception: DynamicCity requests negotiation of this section on the basis that the work we do for our clients incorporates significant research and tools, both internally developed and third party. The proposed pricing is not set at a level that would include transfer of all intellectual property to the City. DynamicCity would welcome further discussion on this. It has not been an impediment as we have worked with many other cities and we believe that we can deliver on what the City desires while still protecting other interests.

Section 18. Insurance

Please see the Insurance Certificate included in Attachment G.

Section 20. Termination or Suspension of Agreement or Services

20.1 Exception: DynamicCity suggests that a 10 day termination is appropriate for some stages of work, but not for all. For example, a 10-day termination clause is fitting for services surrounding the creation of a business plan. A 10-day termination clause is not appropriate for an asset management/network operation service contract.

20.4 Exception: DynamicCity wishes to negotiate and/or clarify the phrase “of direct or immediate benefit.” DynamicCity suggests that this leaves open the possibility for the City not to pay for work that is completed simply by claiming that all work done has no benefit to them.
Proposal for

City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Attachment A

submitted by

Dynamic City
Own the Future
ATTACHMENT A
Bidder's Information Form

BIDDER (please print):

Name: Dynamic City, Inc.
Address: 384 S 400 West
        Suite 210
        Lindon, UT 84042
Telephone: 801-443-6500
FAX: 801-442-6501

Contact person, title, telephone and fax number:

Joel Sybrowsky, Executive Vice President
801-443-6507
801-443-6501 (fax)
jsybrowsky@dynamiccity.com

Bidder, if selected, intends to carry on the business as (check one)

☐ Individual
☐ Partnership
☐ Corporation
☐ Joint Venture
☐ Limited Liability Partnership
☐ Limited Liability Company

When incorporated? 2001
In what state? Utah
When authorized to do business in California?: (application in process)

☐ Other (explain): ________________________________

ADDENDA

To assure that all Bidders have received each addendum, check the appropriate box(es) below. Failure to acknowledge receipt of an addendum/addenda may be considered an irregularity in the Proposal:

Addendum number(s) received: ☑1; ☑2; ☑3; ☑4; ☑5; ☑6;

Or, ☐ No Addendum/Addenda Was/Were Received (check and initial).
By signing below, the submission of a proposal shall be deemed a representation and certification by the Bidder that they have investigated all aspects of the RFP, that they are aware of the applicable facts pertaining to the RFP process, its procedures and requirements, and they have read and understand the RFP. No request for modification of the proposal shall be considered after its submission on the grounds that the Bidder was not fully informed as to any fact or condition.

BIDDER’S SIGNATURE
No proposal shall be accepted which has not been signed in ink in the appropriate space below:

1. If Bidder is INDIVIDUAL, sign here

Date: ____________________________
Bidder’s Signature

Bidder’s typed name and title

2. If Bidder is PARTNERSHIP or JOINT VENTURE, at least (2) Partners or each of the Joint Venturers shall sign here:

Partnership or Joint Venture Name (type or print)
Date: ____________________________
Member of the Partnership or Joint Venture signature

Date: ____________________________
Member of the Partnership or Joint Venture signature

3. If Bidder is a CORPORATION, the duly authorized officer(s) shall sign as follows:

The undersigned certify that they are respectively:

Chief Executive Officer and Executive Vice President

Title

Of the corporation named below; that they are designated to sign the Proposal Cost Form by resolution (attach a certified copy, with corporate seal, if applicable, notarized as to its authenticity or Secretary’s certificate of authorization) for and on behalf of the below named CORPORATION, and that they are authorized to execute same for and on behalf of said CORPORATION.

DynamicCity, Inc.
Corporation Name (type or print)

By: ____________________________ Date: January 4, 2007

Title: D. Keith Wilson, Chief Executive Officer

By: ____________________________ Date: January 4, 2007

Title: Joel Sybrowsky, Executive Vice President
DYNAMICCITY, INC.
CERTIFICATE OF CEO

The undersigned certifies that he is the President and Chief Executive Officer of DynamicCity, Inc., a Utah corporation (the "Company"), and that, as such, he is authorized to execute and deliver this Certificate and other documents, including the Proposal Cost Form to Palo Alto, on behalf of the Company, pursuant to minutes of the board of directors of the Company dated October 15, 2002, which include the following resolution:

RESOLVED, that any and all contracts, including contracts of employment, and agreements of every nature whatsoever relating to any of the ordinary affairs or business of the Company shall be executed on behalf of the Company by the President, and such contracts and agreements shall contain such terms, provisions, and limitations as may be agreed upon by said officer.

DATED this 5th day of January, 2007.

DYNAMICCITY, INC.

By: D. Keith Wilson
Chief Executive Officer
Proposal for
City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Attachment B — Certificate of Non-Discrimination

submitted by
Dynamic City
Own the Future
ATTACHMENT B
Certification of Non-discrimination

As suppliers of goods or services to the City of Palo Alto, the firm and individuals listed below certify that they do not discriminate in employment of any person because of race, skin color, gender, age, religion, disability, national origin, ancestry, sexual orientation, housing status, marital status, familial status, weight or height of such person; that they are in compliance with all Federal, State and local directives and executive orders regarding nondiscrimination in employment.

1. If Bidder is INDIVIDUAL, sign here:

   Date: ____________________________
   Bidder's Signature

   Bidder's typed name and title

2. If Bidder is PARTNERSHIP or JOINT VENTURE, at least (2) Partners or each of the Joint Venturers shall sign here:

   Partnership or Joint Venture Name (type or print)

   Date: ____________________________
   Member of the Partnership or Joint Venture signature

   Date: ____________________________
   Member of the Partnership or Joint Venture signature

3. If Bidder is a CORPORATION, the duly authorized officer(s) shall sign as follows:

   The undersigned certify that they are respectively:

   _______________ and _______________
   Chief Executive Officer and Executive Vice President

   of the corporation named below; that they are designated to sign the Proposal Cost Form by resolution (attach a certified copy, with corporate seal, if applicable, notarized as to its authenticity or Secretary's certificate of authorization) for and on behalf of the below named CORPORATION, and that they are authorized to execute same for and on behalf of said CORPORATION.

   DynamicCity, Inc.
   Corporation Name (type or print)

   By: ____________________________ Date: January 4, 2007
   Title: D. Keith Wilson, Chief Executive Officer

   By: ____________________________ Date: January 4, 2007
   Title: Joel Sybrowsky, Executive Vice President
DYNAMICCITY, INC.
CERTIFICATE OF CEO

The undersigned certifies that he is the President and Chief Executive Officer of DynamicCity, Inc., a Utah corporation (the “Company”), and that, as such, he is authorized to execute and deliver this Certificate and other documents, including the Proposal Cost Form to Palo Alto, on behalf of the Company, pursuant to minutes of the board of directors of the Company dated October 15, 2002, which include the following resolution:

RESOLVED, that any and all contracts, including contracts of employment, and agreements of every nature whatsoever relating to any of the ordinary affairs or business of the Company shall be executed on behalf of the Company by the President, and such contracts and agreements shall contain such terms, provisions, and limitations as may be agreed upon by said officer.

DATED this _1_ day of January, 2007.

DYNAMICCITY, INC.

By: D. Keith Wilson
Chief Executive Officer
Proposal for
City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Attachment C — Response to Scope of Work

submitted by

DynamicCity
Own the Future
# Response to Scope of Work

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V. SCOPE OF WORK

A. Requirements of the System

System requirements include:

• Provision of citywide access to service to residences and businesses in Palo Alto. Bidders may be wholesalers or integrated suppliers of those services.

**DynamicCity:** The system that DynamicCity proposes for the City of Palo Alto will provide citywide access to symmetrical 100/Mbps network bandwidth, including capabilities for voice, video, and data.

**DynamicCity:** is a systems integrator, bringing provider-agnostic services to all Palo Alto communities.

• Voice, Video and Data “triple-play”. This standard broadband service offering as outlined below is the minimum acceptable service level. The transmission medium is left to the Bidder’s discretion, but must be able to provide 100 Mbps symmetrical data rate for each end-user’s hardware connection, with the following services available:
  o Voice: telephony (legacy analog or VoIP)
  o Video: commercial full spectrum “Cable” (analog) TV including HDTV and Video on demand.
  o Data: 100 Mbps symmetrical rate

**DynamicCity:** Acknowledged. The fiber system that DynamicCity proposes will easily accommodate voice, video and data traffic. We have proposed an active fiber network as the only truly scalable broadband medium which will accomplish Palo Alto’s goals. The characteristics of a non-metallic conductor such as fiber are far superior to copper based solutions, and even more so when compared with wireless:

• It is impervious to electromagnetic interference
• It is impervious to corrosion
• It does not “leak” radiation, or signals, so it is more secure
• It cannot be tapped without losing the signal, making it more secure
• It is not subject to weather disturbances
• It has no latency issues as some satellite-based systems do

The capacity of an active fiber network supports not only multiple service providers but also current as well as future services without the physical network owner needing to mediate disputes due to an inherently scarce physical network resource. While copper and wireless may provide sufficient bandwidth for a single carrier delivering a single service to a small number of dedicated users, neither medium can accommodate the vast amount of bandwidth required by multiple competing service providers offering a variety of services.

The fiber network we put forward as a solution to Palo Alto will accommodate voice data including VoIP, commercial full spectrum video, visual
communications, HDTV and Video-on-Demand, and data traffic over a symmetrical dedicated 100 Mbps access link.

- Highly Available, with reliability comparable to other competitive systems. Bidders will be asked to comment on the uptime characteristics of their proposed system.

**DynamicCity:** Acknowledged. Reliability is at the heart of any Carrier Class network.

An active fiber network as proposed by DynamicCity provides far superior uptime and reliability when compared to other fiber solutions such as Passive Optical Networks (PONs). By installing an active fiber network, the City of Palo Alto can expect to achieve a minimum of 99.9% uptime in the access network and 99.99% availability in the core and for redundant feeds in the access network.

There are aspects to reliability over which the network owner has no control, and there are those over which it clearly does. For example: while the occurrence of "backhoe fade" (the cutting of a line by a backhoe) is beyond the control of the physical network provider, the effect of backhoe fade on the delivered services is dependent on the topology of the solution. The following diagram shows that effect in different network topologies (the unprotected portion of a signal's path is indicated as a dotted line and the protected path as a solid line).

**PON: Unprotected optical paths - Larger exposure to fiber cut failures**

![PON Diagram](image)

**Active: Protected optical paths - Minimize exposure to fiber cut failures**

![Active Diagram](image)

Physical diverse and switched distribution fibers reduces exposure to downtime due to outside plant failures by 10 times.
Furthermore, inasmuch as fiber cuts are an inevitable fact of life, the analysis of system reliability ultimately comes down to an assessment of the impact of the cut.

Assessing the potential impact of downtime in a PON solution first requires an analysis of the failure group size per cable and the probability for the cable cut. Estimating both the frequency of cable cuts and the average number of subscribers affected per unprotected optical path, we can determine the impact of an inevitable cut. The larger number of unprotected subscribers carried on a PON solution near a hub makes the PON insufficiently reliable to be called “Carrier Class.” Applying the same rates, based on historical data found in Utah for cable cut occurrences across all layers of the network; DynamicCity derived the following conclusions concerning network reliability in a PON:

### Maximum limit to availability due to fiber cuts

<table>
<thead>
<tr>
<th>Single Homed No Diversity</th>
<th>Topology</th>
<th>Failure Group Size</th>
<th>Annual cuts per cables</th>
<th>MTTR (hrs)</th>
<th>Downtime per subscriber each year (minutes)</th>
</tr>
</thead>
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<tr>
<td><strong>Access Cut</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PON</td>
<td>96</td>
<td>0.0012</td>
<td>6</td>
<td>41.5</td>
<td></td>
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<tr>
<td>Active</td>
<td>96</td>
<td>0.0012</td>
<td>6</td>
<td>41.5</td>
<td></td>
</tr>
<tr>
<td><strong>Distribution Cut</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PON</td>
<td>800</td>
<td>0.0012</td>
<td>6</td>
<td>345.6</td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td>N/A - Physically Diverse/Redundant Transport</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum Availability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PON</td>
<td>99.93%</td>
<td>THREE 9s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td>99.99%</td>
<td>FOUR 9s</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Active (as proposed by DynamicCity)**
- Downtime due to fiber cuts extremely unlikely

**PON (as proposed by other vendors)**
- Large exposure to Fiber cuts in unprotected distribution plant
- Doubling cost is required to achieve minimum of 99.99% uptime

**Typical cable cut impact on maximum reliability in active and PON architectures**

Passive optical networks have up to 10 times more unprotected optical path than a comparable active network. Therefore, it is expected that the cut rate/failure rate of a PON would be as much as 10 times higher than its active counterpart, thus further reducing its reliability even below the 99.93% indicated above.

The conclusion here is easily reached, given this data: an active fiber network is far more reliable due to its inherent redundancy and protected optical paths.
• Phased Roll-Out: The network owner and service providers in their response should provide their strategy and plans to achieve full deployment.

DynamicCity: As described in our Proposal Summary, DynamicCity believes the first step to deploying an active fiber network for the City of Palo Alto includes securing your financing and then creating a detailed project deployment plan. Once your financing is secured, project plans may be drawn and technology vendors/partners can be sourced. DynamicCity can be the force that pulls all the different aspects of deploying and operating this network together. Any deployment plans put forth by our competitors will also be highly contingent upon the financing secured by Palo Alto, and may not have the end result of network ownership by the City.

Using the plan put forth by this proposal, the first three months after contract award will be spent working with Palo Alto in order to secure your financing with investors and banks, and to begin conversations with Google, AT&T and other service providers who could potentially lease space on Palo Alto’s network. Ownership of the network by Palo Alto will be the primary goal; this scenario is the only sustainable business model that will guarantee long-term success of the network while providing an eventual revenue stream for the City. Once the financing for the network is in place, the detailed roll out plans can be designed and approved, and then put into play.

DynamicCity has experience with securing financing for projects like Palo Alto’s, and business relationships that can be quickly leveraged once DynamicCity has a contract in force and permission to move forward. DynamicCity’s strength lies in its unique qualifications to help Palo Alto own its network, install its network, manage network traffic and leasing, and support its network for the long term.

DynamicCity believes firmly in a phased roll-out and will work closely with Palo Alto to ensure that project plans are designed in an environment which reflects Palo Alto’s ultimate goals for this network. Having experience with a phased roll-out of a network of this type (with the UTOPIA project) gives DynamicCity the advantage over many other vendors. We know how to design and install networks and we leverage dozens of technology partners to get them installed on time and within budget.

• For low-density areas of the City, such as areas west of Highway 280, the 100 Mbps requirement may be relaxed, if access to basic service is provided to all users.

DynamicCity: Acknowledged. The financing structure arrived at with the City will influence the nature of the connectivity to these areas.

• Quality of System Service (QoS): Bidders need to provide QoS and packet prioritization for various classes of service such as First Responders, and various applications such as Voice over Internet Protocol (VoIP). Bidders must describe the quality of service capabilities of the proposed network.

DynamicCity: Please see the architecture description included in response to Item H: Technology Description.

• Systems Management: The network owner’s Network Operations Center, (NOC) is responsible for the monitoring and management of the network. NOC staff should have the tools and capability to centrally manage the network, be immediately notified in the event of network problems, and be able to dynamically reroute traffic or dynamically resolve capacity problems. The
network owner must provide the capability to produce performance reports based on traffic classes and area served.

**DynamicCity:** Acknowledged. DynamicCity's NOC is capable of providing all the services you list above.

DynamicCity's NOC has incorporated a Network Management System (NMS) which provides active incident identification, notification and escalation through established channels of communication. We have the ability to monitor networks on-site in our NOC as well as remotely via secure connections. The integration of our NMS with our trouble-ticketing system allows for proper incident management through to resolution of the incident. We have defined processes to perform root cause analysis and problem identification to continually improve the quality of services which we deliver. The combination of these tools and processes result in rapid response for restoration of services and continuously improved resource performance and service availability. As part of a contract with Palo Alto, DynamicCity will provide the following operating deliverables.

**Fault & Performance Monitoring**

- DynamicCity will monitor certain Palo Alto Network element alarms via DynamicCity's network management systems (NMS) and, to the extent within its control, will isolate, identify and resolve network incidents.
- DynamicCity will: (a) provide a service desk to perform second, third and fourth tier incident management for the Palo Alto Network using NMS alarms; (b) provide problem management as provided in Exhibit C; (c) coordinate with, and escalate such problems to the appropriate Palo Alto Contractors or Service Providers for resolution as needed; and (d) track and manage such trouble tickets through resolution.
- DynamicCity will monitor and report on certain performance metrics applicable to the performance of both parties, as well as each of Palo Alto's Contractors and Service Providers, in support of the Palo Alto Network. The performance metrics applicable to DynamicCity are found in the attached Exhibit E (Service Level Agreements). If either party becomes aware that either of the parties, or a Palo Alto Contractor or Service Provider, has failed to meet an applicable performance metric, then the parties will work together to determine appropriate corrective action.

**Network Element Repair and Maintenance**

- Design a Maintenance Performance rider to the contract which will delineate which parties are responsible for the maintenance and repair of which components of the network.
- To the extent DynamicCity is designated as having maintenance performance obligations for core and distribution switches, DynamicCity will provide technicians to maintain and replace such switches. To the extent DynamicCity is designated as having such repair and maintenance obligations for particular Network elements in Exhibit A, DynamicCity will install all necessary firmware and software updates to such Network elements.
• Aesthetically Pleasing: All equipment and cabling for the network mounted within public view should blend into the existing architecture and not negatively affect the appearance of existing structures.

**DynamicCity:** Understood; cabling for the network will either be buried underground along existing utility lines or will be strung from existing utility poles. Other equipment will be designed to blend into existing architecture and landscape. Because the City will own the network, the City will have the final decision on all installation plans and would be intrinsically involved with the design and approval of equipment. DynamicCity has successfully worked with other municipalities in the past in locating equipment to minimize this concern.

• Adherence to City Ordinances: All equipment must adhere to the Palo Alto Municipal Code and other City requirements and be approved by the City and its appropriate Boards and Commissions prior to deployment.

**DynamicCity:** Understood; all equipment will adhere to all applicable city codes. Palo Alto will be the network owner and will thus have final say in all designs and equipment prior to deployment.

• Standards-Based: The System will need to be capable of delivering broadband services to devices built on industry standards-based technologies.

**DynamicCity:** DynamicCity believes that emphasizing the use of global or cross-industry standards is key to minimizing long term costs and maximizing business model flexibility. An active fiber network, as proposed by DynamicCity, complies with the one global standard which has the broadest level of implementation by server, PC, and peripheral manufacturers: Ethernet. DynamicCity is open to discussing other industry/consortium standards which Palo Alto wishes to implement on its network; we will implement relevant standards whenever practical as judged by how widely spread its adoption by the global telecommunications industry at large.

• The successful bidder will be required to apply for a cable franchise in accordance with P.A.M.C. Chapter 2.10, if the bidder proposes one or more technologies by which the bidder would be deemed to provide cable service in accordance with federal, state and/or local law TO THE EXTENT SUCH REQUIREMENT IS CONSISTENT WITH APPLICABLE LAW.

There is pending before Governor Schwarzenegger for his signature AB 2987, which would permit a video provider (one providing cable television as well as open video system services) to obtain a state franchise from the California Public Utilities Commission, not the JPA, in order to provide video programming services. If the video provider obtains a state franchise to provide these services, then it is unnecessary for the provider to also obtain a franchise from the JPA.

**DynamicCity:** Understood. AB 2987 has since been signed into law. Compliance with AB 2987 would be the responsibility of any service provider for video services.

**B. Project Manager / Management**
The bidder must provide a Master Project Manager (PM) as the central point of contact for both the network owner installation and service provider(s) teams.
The PM is responsible for the identification and management of resources and dependencies including people, physical assets, financial or otherwise. The PM is responsible for the management and allocation of resources for the construction, implementation and operation of the network.

The successful Bidder must cooperate with the City on the use of Utility poles and under-grounding, and the PM will be the chief contact for this coordination.

**DynamicCity:** Understood and will comply.

### C. Project Work Plan and Schedule

The PM must develop and present for City approval a complete Project Work Plan, including a full description of major tasks and subtasks, along with a proposed timeline for completing each one. The PM will be responsible for continuously maintaining the schedule for the complete roll-out of the project, and for providing status updates on a regular basis. The project schedule for design, implementation, and go-live activities shall be aligned and coordinated such that they are time- and cost-efficient. The PM is responsible for providing a detailed plan and schedule for each logical phase. The plan for each phase must be kept up to date, along with the roll-ups into the Master Plan.

**DynamicCity:** Please see the attached high-level sample project plan, which would be one of the deliverables to Palo Alto.

### D. Milestones

The PM is responsible for clearly identifying major milestones and their planned completion dates for the project. On-track, on-schedule, and on-budget information and status of overall project and next-step milestones will be included in regularly scheduled update meetings.

**DynamicCity:** Acknowledged; DynamicCity will comply with this requirement.
E. Customer Service

Bidder must, at minimum, adhere to the Quality of Service requirements of the Joint Powers Authority cable franchise and all applicable FCC rules. (See http://www.cityofpaloalto.org/cable/franchise-agreement.html for complete text of the agreement.) In addition, proof of customer service performance that exceeds industry standards is required, with the goal of meeting the high service standards of the existing City Utilities.

Furthermore, bidders must describe how they plan to handle customer support calls, and detail any procedures that will be implemented due to an escalation of complaints. Lastly, bidders shall describe how they plan to handle customer trouble calls and dispatch emergency repair crews.

DynamicCity: With a focus on providing the best customer experience possible. DynamicCity’s quality of customer care stands above that of our competitors. DynamicCity personnel jointly have accrued decades of experience in managing top-notch inbound call centers and network operations centers.

DynamicCity is able to accept direct (tier 1) or indirect (tier 2) customer contact in our operations center, which will provide, through our trouble-ticketing system, high-quality incident management and support. Through additional tiers of support, we provide technical troubleshooting and complex issue resolution, working with suppliers and partners as needed. Our systems and processes are based on ITIL, the generally accepted industry best practices for incident management and problem management.

Our tools allow us to receive and report incidents through our trouble-ticketing interfaces and immediately dispatch crews through an integrated dispatch system to incidents which require a physical presence to resolve. Auto-escalation of incidents are built into our predefined business rules which allow visibility for management into progress towards resolution.

F. Customer Acquisition

The bidder must have proven ability to acquire and retain customers in a highly competitive environment that includes competition with no less than one incumbent provider.

DynamicCity: In an OSPN™ (Option A) environment, the service providers maintain customer ownership and therefore have first responsibility for customer acquisition. The network operator would be responsible for recruiting providers, negotiating and managing contracts with those providers, testing and integration of those providers onto the network, and providing Tier 2 and 3 support to those providers.

In the NNP environment the network operator could be tasked with direct customer acquisition responsibilities including marketing, sales, billing, support, etc.

In its role as network operator in UTOPIA, DynamicCity has provided extensive customer acquisition support to UTOPIA’s service providers including:
• Focus groups
• Messaging
• Marketing materials (brochures, signage, door hangers)
• Sales presentation
• Sales force recruitment
• Sales force compensation plans
• Promotions and incentives
• Community meetings and events
• New service provisioning and scheduling management

As a network operator, DynamicCity is ready to support providers in the OSPN environment or managing customer acquisition on behalf of the network owner in the NNP (Option B) environment.

G. Proposed technologies to achieve the City’s primary goals

The bidder may propose any technology that has a proven field success rate that fulfills the requirements of this RFP.

DynamicCity: Understood. As described elsewhere in this proposal, DynamicCity proposes an active fiber network, which is the only technology proven capable of fulfilling the requirements of this RFP.

H. Technology Description

Bidders must describe their technical approach, including as a minimum the following information:

• Technologies: Any technology that is based on industry standards and meets the City’s 100 Mbps symmetrical service goal may qualify. Bidders should be able to demonstrate the capacity of the proposed technology.

DynamicCity: Please see the following detailed technological description.

• Network Design: A description of the design criteria, network elements, physical media, switching and routing architecture, interfaces, topology, protocols, system reliability, fault tolerance, availability, and operations and maintenance. In addition, describe the degradation of service expected under the worst case scenario.

DynamicCity: Please see the following detailed technological description.

• Network Equipment: A description of the type of networking equipment proposed, and reasons for its selection.

DynamicCity: Please see the following detailed technological description.

• Interconnection and Interoperability: A description of interconnection, interoperability, and conformance to published standards. A description of where, when, and how interconnection will occur. A description of how
interoperability between networks will be achieved is also required.

DynamicCity: Please see the following detailed technological description.

- Schematic: A schematic view of how the networking equipment will be interconnected and integrated to create a citywide network.

DynamicCity: Please see the following detailed technological description.

- Upgrade Plan: A plan for upgrading infrastructure as service requirements grow.

DynamicCity: The system takes into account not only current Internet applications and services, but also potential new applications and services and the bandwidth required by such advancements. Should the network eventually become inadequate to handle the traffic, hardware upgrades can be implemented easily and affordably without changing the fiber.

- Network Security: Any network security measures that will be deployed to ensure privacy of customer communications and prevent intrusions on customer computers must be described in full.

DynamicCity: The network solution proposed provides a high degree of traffic isolation available on individual subscribers and/or on subscriber types. Security can be gained by utilizing content management techniques such as encryption at the end points of VPN.

- Data Transport Performance Characteristics: Bidders are requested to characterize the anticipated performance of the proposed network design for data transport. At a minimum, the following attributes shall be described:
  - Throughput: Describe the anticipated peak, mean, and minimum throughput for data transport between any two end stations on the network (specified in Megabits per second);

DynamicCity: The access bandwidth available for an active fiber network is 100 Mbps access level bandwidth for every home and business connected to the network. The interface between the access layer and the distribution layers of the network provide 1 Gbps of bandwidth per 100-150 users with the capability of providing a full 100 Mbps as the usage on the network increases. Our cost to scale bandwidth analysis has shown a significant advantage to scale an active solution vs. the cost to scale a PON solution.

  - Latency: Describe the anticipated mean, minimum, and maximum latency for data transport between any two nodes on the network (specified in microseconds).

DynamicCity: We expect to see less than 1,000 microseconds of latency through the switches in the network and less than 1,000 microseconds of latency due to the speed of light.

Technology and Design Selections
The fundamental technology selections when planning new triple-play deployments relate to the control and protocol architecture, the last mile technology, and whether the network is designed as an open or closed network. Please see the following discussion of these selection factors in regard to Palo Alto’s network.

A Layered Approach

One of the goals in building the City of Palo Alto’s fiber network is to build a network that is as simple and direct as possible without compromising the scalability and robustness of that network. Another goal is to build a system that is as open and “Transparent” as is possible to attract many service providers. These goals led to a decision to focus on Layer 2 of the OSI (Open System Interconnection) model.

For a description of the OSI model, please see: http://en.wikipedia.org/wiki/Open_System_Interconnection

The lower 4 levels of the OSI model (Layers 4, 3, 2, and 1) are, strictly speaking, the actual Network layers, while levels 7, 6 and 5 are relevant to the application. From that perspective, it is possible to discuss network architecture from the perspective of any of the 4 lower layers. However, for every layer of the network’s architecture you interact with on a service provider’s behalf, you add a level of complexity that translates into management overhead, equipment cost, standards issues, and more. Keeping the network design at the lowest possible level reduces the overall complexity for service providers and increases the inter-operability of the network.

For this reason, we will design the City’s fiber network to focus on a Layer 2 interface to service providers. This means that we will design the fiber network to address transport issues for providers and subscribers up to and including Layer 2 of the OSI model.

Essentially, a Layer 2 design is a transport system for the service providers comparable to the asphalt roads and the trucks that ride across them. Just as an asphalt road can accommodate virtually any type of truck that wishes to travel across it, and just as the truck is hardly concerned with its cargo, a Layer 2 network allows virtually any and all types of data types and formats, speeds, and technologies to travel across it, making it a very “user friendly” network for service providers. The specifics and complexities of delivering services are then left to the service providers, which is very consistent with the OSPN™ business model pioneered by DynamicCity.

Now that we’ve determined that a Layer 2 architecture will be used, we are left to decide what kind. DynamicCity proposes a Layer 2 architecture running MPLS.

In the late 1990’s, competitive carriers started to offer new transport services which were cheaper, faster and more flexible than the traditional leased lines or Frame Relay access services. These new services were based on Ethernet, serving as both a service User Network Interface (UNI) for end-users, and also as a switching/transport technology.

Initially, regular Ethernet switches were used for this transport due to the requirements to support the full range of 802.1Q Virtual LANs (VLANs) and the ability to support a large number of Media Access Control (MAC) addresses.
However, new requirements quickly emerged in order to scale and cost-effectively operate service provider Ethernet backbones. These new requirements included:

- support for customers with overlapping VLANs (Virtual LANs)
- transparently carry customer spanning tree Bridge Protocol Data Units (BPDUs)
- accommodate the full range of VLANs per customer, independently of the service provider VLANs—a function known as “Q-in-Q”.

It quickly became necessary to provide a more scalable approach to operate such networks. This implied that switches used for transport had to become carrier-class, providing the same reliability, scalability and security capabilities that traditional TDM or ATM switches offered.

MPLS (Multi-Protocol Label Switching) has most of the attributes required to meet such challenges, including:

- strong tunneling
- traffic engineering
- QoS
- fast protection capabilities

MPLS came to the forefront of the industry when IP WAN routers could not perform longest prefix match lookups at wire-speed. By tagging an IP packet at the ingress point of an MPLS enabled network, further hops along the path only need to perform a label lookup instead of a longest prefix lookup, which is a simpler, and thus faster operation.

Using an MPLS switch, maximum latency between any two end points is less than 2 microseconds—even when passing through the fully meshed core network. These tags, known as MPLS labels, are actually used to create a circuit, and hence augment IP with a connection oriented approach.

Based on these capabilities, traffic engineering (TE) was one of the first applications of MPLS.

In addition, the ability to run standard routing protocols such as OSPF and ISIS is a big improvement over the use of STP, in their ability to resolve loops within the SP network. These protocols received extensions to carry traffic related attributes making both traffic engineering and QoS possible.

Quality of Service and Traffic Engineering

There are additional benefits to a Layer 2 network running MPLS. Because of the unique label attached to a packet, it is possible to specify even more granular and predictable traffic engineering than is possible in other protocols or at other network levels. With MPLS, critical packets can be prioritized and delivered ahead of other packets of lesser importance. Furthermore, when there is a bandwidth or capacity issue, MPLS can determine which circuits to keep operating and which ones to shut down.
ensuring that there are not "slowdown" and "congestion" issues created by low priority packets continually trying to access the network.

The simplicity of its management and its overall openness make OSI Layer 2 the ideal level at which to architect a network to achieve the goals and principles of Palo Alto’s fiber network.

Dynamic signaling protocols such as the Label Distribution Protocol and Resource Reservation Protocol allow tunnels to be set-up over such a routed network. Such tunnels can be protected with the use of back up paths or RSVP-TE fast re-route to deliver sub-1 second restoration time. These MPLS features paved the way for both traffic engineering and QoS support into IP.

The next application of MPLS was Virtual Private Network (VPN) services. It started with Border Gateway Protocol (BGP) VPNs and evolved into a carrier’s carrier model, followed by Martini and the Virtual Private LAN Service (VPLS).

More recently, carriers have converged on the use of VPLS for their residential triple-play services. The use of MPLS and VPLS mandates deployment of a carrier-grade platform.

Remember – what is being asked here is the use of Ethernet as a replacement for the carrier’s existing ATM and Frame Relay aggregation network. However, the benefit of this is its ability to meet the demands that triple-play services place upon the device’s QoS and IP multicast capabilities. This is described later.

Last Mile Architecture

The next issue is the selection of the last mile architecture. The industry has four major physical mediums available for access infrastructures – wireless, twisted copper pairs, coax cable, and fiber. Each of these physical infrastructures have been analyzed to discover which best met municipalities’ needs as represented by the principles as described in the OSPN™ model. For the network to deliver services transparent to the service providers, municipalities require an infrastructure that is capable of delivering nearly limitless capacity.

The below graph compares the current state of the deployments in the US for each of these physical mediums to determine which best fit the open provider and scalability ideals of the OSPN™ model. Using a sample footprint (a couple of kilometers) we added up the total throughput each physical medium is delivering in existing deployments.
Dedicated Fiber 150,000 Mbps

Qwest Copper - DSL 256 Mbps

Coax - Cable Modem 150 Mbps

WiMAX Wireless 90 Mbps

The available throughput of a dedicated fiber system is clearly superior to any other available medium, and will accommodate not only the needs of current applications and services, but those to emerge in coming years.

As can be seen in the above graph, the dedicated nature of fiber's bandwidth combined with fiber's ability to support 100Mbps/1Gbps speeds allows a fiber based solution (150,000 Mbps per footprint) to exceed other mediums by several orders of magnitude.

Though fiber itself is capable of supporting incredible speeds, not all fiber solutions deliver on that promise—depending on the network architecture, the resulting available bandwidth can vary greatly. Some solutions start out with high bit rate optical speeds, but after those speeds have been shared across multiple end-users, the bandwidth that is ultimately available to the end-user is often no better than what is available to them today over traditional metallic systems.

Currently, the telecommunications industry deploys fiber networks in two main scenarios:

- Active/Dedicated Fiber Network
- Passive Optical Network (PON)

A simple analysis of some typical fiber deployments for a 1,000 home neighborhood reveals some startling differences in capacity:
It is obvious that an Active solution is as much of an improvement over Passive solutions as Passive solutions are over existing DSL.

Only an active fiber solution is capable of delivering a fully symmetrical 100Mbps to every home and business.

**Definitions and Physical Architecture**

The Palo Alto network architecture proposed by DynamicCity is segmented into functional layers, and switches bridge the frontiers between these layers. The following chart depicts these layers and switches. Although the network as initially deployed will be designed to scale to 50K+ connections (homes, businesses, and utility access nodes), adding additional network components will allow the network to scale well beyond initial needs.

The fiber network for Palo Alto will have several basic divisions: the Subscriber (Customer Premise Equipment) Layer, the Access Layer, the Distribution Layer, the Local Core Layer, the Provider Access Layer, the Provider Layer, and the Region Core Layer.

Customers, both business and residential, connect from their CPE an Access Portal (AP) which then connects via FE fiber to an Access Distribution Switch (ADS) located in a utility cabinet. Each ADS is sized for approximately 200 subscribers, and there are four to six ADSs in each cabinet. The cabinet can be located up to two miles from the subscriber. Redundant GE fiber links extend approximately five miles to a Distribution Core Switch (DCS) serving approximately 10,000 subscribers. This then connects via 10GE fiber to a Regional Core Switch (RCS) pair serving up to 40,000 subscribers. DCSs are dual-homed to the RCSs, and the RCSs are meshed. The RCSs then
connect to the service entry points in the network. This is the role of the Provider Access Switch (PAS). Service Provider Equipment (SPE) provided by the actual provider connects to the PAS. As additional service providers connect to the network, additional PASs may be added.

Think of the fiber supplying bandwidth in the network as roads. Within and between towns, we have various types of roads that function in different ways. Residential roads with reduced speed limits handle small amounts of local traffic. We use larger avenues and feeder streets to make slightly longer trips, and these roads collect the local traffic from neighborhoods and route it to other parts of town. If we want to take longer trips still, we take on-ramps that put us on freeways where large amounts of traffic travel at high speeds. The roads are each designed to meet specific travel needs, and the rules (speed limit, direction of traffic, access rules, etc.) that govern use of those roads is unique for each type of road. The same is true of electronic traffic traveling on a fiber network. We design different layers of fiber access to address the specific needs of that segment of traffic.

Connecting the roads are intersections. Some intersections take cars off of large, high-traffic roads and route them onto smaller, slower speed roads. The same function has to be performed on the network: electronic pieces of equipment called switches direct traffic from one type of electronic road (layer) to another. This means that a switch actually sits at the intersection of two layers and does not actually fit inside either one.

Subscriber Layer

Just as a residential driveway is the final destination point where passengers load and unload, the Subscriber Layer is the part of the fiber network where end-users will "load" and "unload" their particular network service. There are three types of equipment that fit in this layer: the Access Portal (AP) Palo Alto supplied devices (Video Gateways) and the customer owned Premise Equipment (CPE).

Access Portal (AP)

The Access Portal (AP) is an electronic device that looks like a box and is attached to the exterior or interior of a building much like telephone demarcation boxes are currently attached. The function of the AP is, like a phone demarcation, to terminate the city’s fiber and to provide a connection point into which the building (business building, private residence, or utility site) can connect its devices. As the demarcation point, it is also the point at which the city’s responsibility for many of the network services ends—most devices connected to or located beyond the AP will be the responsibility of the end-user or the service provider with the exception of the video gateway which will be Palo Alto’s responsibility.

The Access Portal will have a number of connection points (6-8 Ethernet ports.) All devices within the building that need to connect to the fiber network will aggregate and connect to the AP through one of those ports. The capacity of the Ethernet ports is at least 100 Mbps access level bandwidth—equal to the speed of a typical business LAN. All ports are configurable, and specific types of data traffic will be routed to the AP ports to deliver the configured services.

Customer Premise Equipment (CPE)
Some services to which customers may choose to subscribe will require a piece of equipment inside the customer's house. For example, subscribers who want wireless connectivity in their home will have a wireless access point connected to the Access Portal; in that case the wireless access point is owned by the subscriber or service provider. These types of devices are referred to as Customer Premise Equipment (CPE). Each service provider requiring some type of CPE will be responsible for making it available to the customer and will be responsible for maintaining and repairing it.

CPE and other equipment within the home owned by the subscriber or service provider may operate at OSI levels up to Layer 7. But by terminating ownership of the fiber network at the AP we are able to keep the Open Service Provider Network™ Principle satisfied—no individual service provider owns the on ramp or gateway to the fiber network.

Distribution and Access Layers

When the family car leaves the driveway, it first travels across neighborhood streets to City or County streets. City planners design neighborhood (edge) and city (access) streets to handle a portion of the number of cars that are parked at all the houses in neighborhoods. It is highly unlikely that every car in a neighborhood will back out the driveway and attempt to use the neighborhood street at exactly the same moment—if they did, the streets would be unmanageably congested very quickly. Instead, the reasonable expectation is that the streets can be designed to handle a smaller portion of the potential traffic that exists in neighborhoods and cities.

In the same way, Access Distribution Switches (ADS) at the edge of the Access Layer are designed to handle network traffic from the Access Portals spread throughout a neighborhood or business district. The function of the Distribution Core Switches (DCS) at the edge of the Distribution layer is to collect the traffic from the Access Layer and feed it upstream to the next layer, called the local Core Layer, which is designed to handle heavier traffic. The reverse is also true: traffic from the Core layers is channeled through the Distribution and Access Layers for delivery to the AP. The design of the Core Layers “oversubscribes” traffic the same way the residential and city streets oversubscribe the number of cars they can handle at any point in time. Current and imminent services, coupled with technology costs lead the design to support approximately 1Gbps of bandwidth from the distributed ADS' to the DCS' for every 100 subscribers—with the ability to scale as future services become present on the network.

Core Layers

The Core Layers of the fiber network are like the freeway in our analogy: they take all the data aggregated from the Distribution and Access Layers and pass it along at the highest speeds and capacity of the network. The core layers handle all traffic from all parts of the network. As with the other layers, it is oversubscribed, but it has tremendous capacity and can be upgraded by adding switches and/or ports.

Sitting in the intersection between the Distribution Layer and the Core Layers are Distribution Core Switches. Distribution Core Switches will initially support 1Gbps and 10Gbps Ethernet connections. These then connect to the Regional Core Switches (RCSs) located at the edge of the Regional Core Layer.

Provider Access Layer
The function of the fiber network is to provide high-speed, high-capacity roads across which service providers can deliver their services. While the Core Layer is the freeway across which service providers will transport their services, they need a different kind of access point to the freeway than the residential and business customers use: they are coming on to the freeway from another location, not from within the cities' neighborhoods. The Provider Access Layer is like one freeway (Provider Access) merging into another freeway (Core) for the service providers so that they can put their traffic directly onto the core.

Provider Access Switches (PAS) are deployed in pairs to provide Service Providers the option for fully redundant connectivity into the Palo Alto infrastructure. As large numbers of service providers sign up to deploy services across the fiber network, additional PAS switches can be added. Before Service Providers hit the Provider Access Layer freeway, they have all their equipment lined up and ready to go using their own on-ramps to the freeway. Quite literally, the Service Provider brings in Service Provider Equipment (SPE) that will facilitate the distribution of services across the fiber network. This equipment accesses the Provider Layer by hooking up to the Provider Access Switch (PAS). The SPE typically include large storage vaults of video programming, large interactive gaming servers, routers, and the like.

Logical Architecture

Logical data, voice, and video flows map across the physical topology described above. This relies on a combination of MPLS-based Virtual Private LAN Services and VLAN Tagged Ethernet packets at the Access and Distribution Layers to create logical Ethernet Media Access Control (MAC) forwarding topologies. Native Untagged Ethernet packets are presently used at the subscriber demarcation to an AP element. A given VLAN is used to create individual service topologies that emulate a single redundant geographically disperse Ethernet switch for a particular service. The network will initially be configured to support three logical topologies within broadcast domains or service VLANs to encompass all broadcast and unicast traffic.
Like UTOPIA, Palo Alto’s network will have a full mesh of two physically diverse MPLS Traffic Engineered “Tunnel” LSPs between all PE elements (DCS). The data network will use VC LSP load sharing across both Tunnel LSPs between all PE elements. This eliminates the need for Fast Reroute or backup LSPs for “data services”.

Multipoint to Multipoint service topology VC LSPs are configured to support 7 QoS levels through MPLS EXP bit mapping. All Multipoint to Multipoint service VLANs will be assigned one of the seven QoS levels and configured through the entire MPLS cloud to ADS element lag ports. This architecture limits VPLS domains to seven reducing complexity and LDP signaling. When new services are requested a service VLAN is created and simply added to the appropriate VPLS instance. When subscribers request a service from a service provider the service VLAN only needs to be provisioned on the ADS subscriber facing port and AP.
Point To Point service topologies use the same seven VPLS instances as Multipoint to Multipoint topologies. However, Point to Point services will use Q on Q stacking on the ingress port connected to the AP. The outer Q on Q VLAN tag/id of a packet will be added to the appropriate port/VLAN FEC for a specific VPLS instance. This again greatly reduces the number of VC LSPs (pseudo wires, martini tunnels or what ever the newest name may be) configured through the cloud. The other benefit is that only one of the 4k VPLS "core" service VLANs can support 4k Point to Point connections. Committed Information Rate (CIR) point to point VLANs will be supported through VPLS instance configured with QoS 7. Service providers may use these (CIR) Point to Point service VLANs to support back haul of circuit emulation devices (T1, DS3, etc.). Business intranet and extranet TLS services will also use Q on Q stacking to map service VLANs into existing VPLS instances. Note that at present, each Point to Multipoint service topology will be custom configured as requested. Given these different MPLS topologies, we now look at actual delivery of different QOS type traffic - voice, data, and video across the network.
Logical Point-to-Point Topology

Figure 4

Logical MPLS Data Connectivity

North Region

MPLS Tunnel LSPs

City Responsibility

P to P Topology

South Region

Ethernet

AP: Access Portal
ADS: Access Distribution Switch
DCS: Distribution Core Switch
RCS: Regional Core Switch
PAS: Provider Access Switch
SPE: Service Provider Equipment

Logical Point-to-Multipoint Topology

Figure 3

Logical MPLS Data Connectivity

North Region

MPLS Tunnel LSPs

City Responsibility

P to MP Topology

South Region

Ethernet

AP: Access Portal
ADS: Access Distribution Switch
DCS: Distribution Core Switch
RCS: Regional Core Switch
PAS: Provider Access Switch
SPE: Service Provider Equipment

Access Distribution Switch (ADS)
ADS elements are each configured based on specific service VLANs provided through Access Portals to subscribers. Service VLANs are based on unique VLAN IDs, which are configured for specific topologies and QoS. As noted above, the topologies supported are Point to Point (p2p), Point to Multipoint (p2mp) and Multipoint to Multipoint (mp2mp). Topologies on the ADS are constructed by configuring combinations of Layer 2 bridging filters and VLAN IDs. The ADS supports four QoS levels, three (High, Medium, and Low) that are used for retail services/VLANs and one (Control) that is used for management.

All ADS configuration instances have specific ingress Layer 2 filters to protect the wholesale transport network from attack on all service VLANs. Retail Service Providers may also request supported Layer 3 ACL filters to mitigate specific retail DOS service attacks. Certain TCP/IP and/or UDP port numbers and IP addresses may also be filtered if requested by retail service providers. ACLs to block MS File and Print sharing on the ingress to configuration may be requested from Service Providers. Service Providers may also request other supported specific retail configuration enhancements on service VLANs like DHCP Option 82, which allows them the ability to trace or designate dynamically allocated IP addresses and correlate them to specific physical geographic subscriber addresses. All service VLANs also collect billing information (ingress and egress bytes) for each service VLAN, which is passed to the network OSS/BSS applications.

ADS configurations also include global configuration filters that include blocking ingress (subscriber sourced) multicast traffic on all service VLANs. ADS elements also perform ingress port/VLAN to MAC address locking for learned MACs on the AP management VLAN and the Video Gateway management VLAN. ADS elements limit the number of subscriber devices that may be learned on a specific service VLAN at any single point in time. ADS elements have an ingress ACL which limits ICMP traffic (pings). ADS elements have DOS filters, which limit ingress L2 misses, and L3 misses. ADS elements also rate limit ingress broadcast traffic.

Physically, ADS elements initially include two physical Gigabit Ethernet connections with diverse paths to DCS elements. These physical ports to DCS elements are configured as a LAG. LAGs aggregate multiple physical ports into a single logical port. LAGs also have all service VLANs configured on them, and include layer filters configured to protect the fiber network.

**Distribution Core Switch (DCS)**

DCS elements are also configured with LAGs as described above to aggregate ADS elements. These LAGs map service VLANs into the MPLS/VPLS cloud using service VLAN specific port/VLAN MPLS Forwarding Equivalence Class (FECs). LAGs also perform Layer 2 bridging for mp2mp topologies across DCS Ethernet ports towards other attached ADS elements when configured with the same port VLAN FEC. DCS elements will allow the ability to restrict local bridging for p2mp topology service VLANs between multiple ADS elements attached to the same port VLAN FEC.

Port VLAN FECs will enforce Ethernet QoS based on VLAN IDs and map into the corresponding MPLS QoS based on EXP bit correlation.
**Provider Access Switch (PAS)**

PAS elements serve a similar function as the ADS elements other than it is Service Provider facing instead of subscriber facing and has more ports configured in its LAG connecting to the PAS.

**Multicast Video**

The multicast physical topology differs from the unicast topology in that, at present, a multicast overlay based on PIM routers is formed. These PIM routers connect to any Service Provider Content (SPC) devices as well as to the RCSs. With future planned multicast enhancements, described later, these PIM routers could be eliminated.

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**Multicast Physical Topology**

Two redundant PIM-SM (PIM1A and PIM1B) routers are each configured to aggregate all video subnets from the video sources (head end, studio feeds, municipal parks/bldg) into a single subnet that is attached to the "multicast video VLAN". All multicast groups are statically joined through the PIM-SM routers to the "multicast video VLAN" that support all STBs on the network. Each PIM-SM router has two LAGs configured for the multicast video VLAN. One lag is used to connect the PIM-SM routers together at Layer 2 for the multicast video VLAN subnet which passes through the RCS elements without VLAN tags. The other LAG uses VLAN tagged frames from the PIM-SM routers to the RCS elements which are a PEs for the multicast video VLAN.

One of the PIM-SM routers is configured as the primary RP and the other as backup RP. The backup RP in normal operating mode prunes all multicast groups. The primary RP floods all multicast groups across both lags. The LAGs on RCS elements receiving tagged packets (from primary or backup RP) for the multicast video VLAN are mapped into a VPLS instance using...
port/VLAN FECs. All multicast groups (200+) are transmitted across the MPLS cloud to each DCS. The DCS elements are PEs for the multicast video VLAN / VPLS instance as well. The DCS elements perform IGMP snooping on the Ethernet LAGs connected to ADS elements for the multicast video VLAN. The ADS elements perform L2 Proxy IGMP-Snooping on the multicast video VLAN. The AP performs IGMP-Snooping for IGMP joins and leaves. The PIM-SM routers filter all IGMP traffic to reduce CPU overhead as all multicast groups are statically joined which allows them to scale and support all IGMP hosts (Set Top Boxes/ Video Gateways) network wide.

RCS elements act as PE devices for multicast video and P devices for all other data traffic. The RCS elements are also configured for HVPLS on the video VLAN to reduce multicast replication across the Regional Core Layer to DCS elements which act as 'spokes'. HVPLS also allows backup or standby LSPs to terminate on separate PEs (dual homed). Note: In normal operation PIM 1A floods packets and PIM 1B is pruning. The 10GE physical path between RCS elements is used as a MPLS hot standby or backup path protecting against a RCS to DCS primary path failure. This path is needed in the event of a primary path failure as OSPF and PIM would not be aware and would not reroute. RCS elements act as PE devices only for multicast video and are P devices for all other traffic.

APs and ADS elements support Proxy IGMP Snooping, and the DCS elements support IGMP Snooping with Fast Leave enabled. IGMP is limited on ADS elements and PIM elements.
Quality of Service and Traffic Engineering

In order to provide transparency to higher-layer services, the network does not reorder or prioritize packets across switch elements within a service VLAN. All packets entering and exiting a service VLAN are therefore treated in a First-In First-Out (FIFO) manner. Service providers may perform their own prioritization schemes before packets ingress Palo Alto's fiber network. However, the network will reorder or prioritize Ethernet packets based VLAN IDs on Ethernet ports, and will also reorder or prioritize MPLS packets based on MPLS experimental (exp) bits through the MPLS cloud.

Load balancing is supported as an intrinsic part of the active fiber network.

Link load balancing is supported across all layers with the exception of the Access Layer, and the Distribution Layer load balances Ethernet traffic flows across multiple physical (single logical) links (LAG). MPLS links implement MPLS Administration Group Traffic Engineering and load balance VC LSPs across two Tunnel LSPs between MPLS Label Edge Routers (LERs).
Logical Redundancy

The Palo Alto fiber network will support physical and logical link redundancy across all layers with the exception of the Access Layer. The Access Layer is only made redundant when specifically required for critical public support requirements and as per specific customer requests. The Distribution Layer has a minimum of 2 links between ADS and DCS elements configured as a single logical link (LAG). If one of the physical links becomes inoperable all traffic falls over to the operating link without any OSI Layer 3 interaction. The PAS to CPS link has links which will also be configured a single LAG. MPLS links use traffic-engineered backup Label Switched Paths (LSPs) to reroute around any MPLS link failure.

Each switching element has high availability capabilities. Besides standard hardware redundancy such as dual power supplies, switch fabrics and main processor cards, additional protection capabilities are available. Upon failure or crash of the main processor card, the backup card which keeps a synchronized state of the main processor takes over without affecting the data traffic flows handled in hardware. This includes restart capabilities for most routing and MPLS protocols. A separation of control and forwarding functions is maintained. Control processors are dedicated to control and management functions while ASICs and micro-processors handle the data forwarding functions. This separation enables data to be forwarded even in the case of control software failures. Graceful restart capabilities are available for both routing protocols such as OSPF or BGP but also MPLS signaling protocols like LDP and RSVP.

Capacity Planning – Throughput between layers by potential services

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DynamicCity
Specific Vendor Solutions

DynamicCity interacts with, is familiar with and has analyzed solutions from many of the vendors capable of delivering technical solutions suitable to deliver against the aforementioned architectural template. Below is a partial list of vendors whose product we have analyzed in the past for similar deployments. We would look to the following vendors as potential suppliers for the network base upon a critical review of their current product offerings and the projected financial framework defined in the detailed business case.

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The vendors which we would select for the project would represent the best blend of technical functionality, support for global standards, market presence, ability to deliver long term support, and the best fit with Palo Alto's financial model.
VI. CITY OF PALO ALTO OFFERING

The City’s dark fiber ring may be considered a potential resource to the bidder. For example, the City will consider licensing to the successful bidder spare capacity along the fiber backbone, and, for a fee, CPAU may extend the fiber optic backbone more deeply into Palo Alto neighborhoods to interconnect with a successful bidder’s nodes, hubs, or other centralized distribution points.

The City of Palo Alto owns the utility poles in Palo Alto, along with AT&T and/or Pacific Gas and Electric Company. All construction of new plant or relocation of existing plant in Palo Alto shall meet California General Order (GO) 95 and GO128 rules and regulations, among others. The City also owns conduits, and the City has the rights-of-way needed to provide distribution of utility services within Palo Alto.

Bidders are encouraged to propose other services the City could offer to help successfully deploy the requested services.

DynamicCity: Please see the description of the Project Design and Finance Package proposed by DynamicCity, described in Chapter 1 of this proposal.

VII. ADDITIONAL REQUIRED ELEMENTS OF THE PROPOSAL

In addition to the required attachments listed above and in Section 5 of the main body of this RFP which need to be submitted, the bidder must include information on the following:

A. Financial Risk to the City:

The City wishes to minimize its financial exposure in the development, construction and operation of the proposed system. However, the City recognizes the potential need to contribute financial or other assets to the project to achieve the primary goals. The financial risks assumed by the bidder should also be detailed regarding quantity and timing. Bidder must include specifically:

- Proposed financial and other contributions required from the City;
- Assessment of financial risk to the City; and
- Ways of mitigating the financial risk to the City.

DynamicCity: Please see the attached PowerPoint Presentation in Attachment 2, the Palo Alto financial statements spreadsheet in Attachment 3, as well as the electronic versions of these files included on the Proposal CD (included in the binder marked “original”). The following narrative describes the PowerPoint presentation slide-by-slide.

Slide 1: Title Slide

Assumptions

Slide 3: Palo Alto can stand alone on $51 million financing.

Fixed system assets include engineering, construction labor, fiber, conduit, splicing, enclosures and cabinets. We assumed that Palo Alto saved several
million dollars by using fibers on the existing ring. Fixed system assets also includes the core electronics gear.

The variable connection assets include everything involved with connecting a subscriber to the network. This is the drop labor and materials, terminating electronics (access portal), and set-top boxes. Premise wiring, home routers, etc. are not included in this number because they are paid for by the service provider.

Issuance costs include bond insurance, financial advisory fees, underwriting fees, and bond counsel. The debt service reserve fund is one year's debt service. The capitalized interest fund represents the 2 years' worth of interest payments.

Slide 4: Palo Alto's density has a significantly positive impact on the economics of the project despite moderate amount of aerial plant.

The network will require approximately 231 miles of fiber. The biggest components of the capital costs are:

- how much of the fiber can be placed aerially
- the density, or how many homes can be passed for every mile of fiber laid.

We assumed that 48% of the plant would be installed underground. Although there may be more electric lines in the air, we assumed that a portion of those would be too loaded already to add another line.

The density of 131 homes per mile represents a favorable concentration. However, the downside is that is represents a large quantity of apartment buildings that already have long term contracts place, and for which building entry is more complex (and costly).

Slide 5: Construction costs per foot are modeled in range with other telecom projects.

We assumed construction costs on par with other projects. As illustrated, the cost per foot for underground is about 3x that of aerial.

Slide 6: Total capital costs are consistent with Verizon's FIOS fiber to the home project.

Overall, the capital costs per home/business passed are consistent with other projects, particularly with Verizon's FIOS build out. On the cost to connect a home, the Verizon costs include premise wiring and home routers that are not included on the Palo Alto side. This means that Verizon's costs are actually lower than what is modeled for Palo Alto. However, the fact that costs are consistent is what is most important.

Slide 7: Palo Alto's network operating expenses are consistent with the RBOCs, but above average for smaller independent telcos.

Operating costs include network operations (network elements monitoring, network elements configuring, wholesale bill rendering and mediation, new service provisioning, etc.), field maintenance (break fix repair, facilities locating, electricity, service trips, pole attachment fees), co-locating, and other miscellaneous expenses. The fact that the smaller independent ILECs are operating more cost-efficiently than the larger RBOCs suggests that the big ones have some overhead that may not be applicable to Palo Alto. Nevertheless, operation expenses are consistent with the RBOCs and modeled slightly higher than the smaller independent companies.
Verizon suggests that the FiOS plant will save 15% or more on the operating expenses versus their existing copper plant. 80% of these savings are related to installation and maintenance on the copper plant versus the fiber plant.

**Slide 8: Palo Alto represents a highly educated population and a large percentage is likely to have Internet access.**

This is an attempt to benchmark the demographics of Palo Alto versus other municipalities that have municipal networks. As shown on the next slide, education attainment is perhaps the best indicator of Internet access. As you can see, Palo Alto represents one of the most highly educated areas in the country and that bodes well for success of the network.

DynamicCity focuses somewhat on the Internet penetration because the pricing and bundling on the fiber network tends to center on the Internet product. The Internet product has the most margin opportunity for the wholesaler. Large portions of the video bill go the content owners, leaving a relatively small portion of the revenue for capital cost recovery on the plant. Voice revenues can be on the network but always are in jeopardy of simply being absorbed into the internet product by providers such as AT&T (with CaliVantage), Vonage, and Skype or simply by the local provider. If the charges are not too high, the local providers are apt to pay a little extra for special service level agreements that will ensure high quality voice. If the price is too high, they will simply insert the voice traffic into the high-bandwidth Internet product and skip the wholesale fees. Therefore, wholesale voice revenues are relatively small compared to the other products, and probably insufficient to carry the cost of installation without bundling it with Internet.

In contrast, the network owner on Internet tends to command a large portion of the data margin. In addition, the Internet product is the most differentiated of the three. Therefore it is important to understand if the Internet penetration will be high in the area because that is the anchor product of the suite.

**Slide 9: Educational attainment is a good indicator of access to the Internet.**

This is the finding from the Pew Internet & American Life Project that shows that those with more education are significantly more likely to have Internet access than those without. Again, this shows that Palo Alto is well-positioned for this project.

**Slide 10: The majority of homes in Palo Alto have household incomes greater than $35k, again supporting a positive outlook for penetration.**

Another important indicator is income. Education may be important for overall Internet access, but income seems to be important in the type of access, especially concerning broadband. The findings suggest that households with incomes above $35K/year are most likely to have Internet access. Palo Alto is a very affluent area with 80%+ of households falling into this category.

**Slide 11: Households with income greater than $30,000 are very likely to have Internet access.**

This is the data referenced on the previous slide.

**Slide 12: The forecasted take rate is reasonable compared to the performance of other municipal telecom projects.**
As we look at other municipal projects we find a range of experience. Spanish Fork, Alameda, Tacoma and Ashland are all hybrid fiber/coax networks. Bristol and Kutztown are both fiber-to-the-home, although both have an analog video overlay so they are not offering IPTV over the fiber. Tacoma wholesales Internet connectivity to three local ISPs, but direct sells its video service. All the others sell directly to end customers. Orem represents the Orem part of the UTOPIA network.

The pro formas have forecasted Palo Alto in the middle of the other cities despite its highly favorable demographics. Certainly this take rate is achievable and slightly more conservative than the FIOS projections.

**Slide 13:** The fiber network could offer a significantly better broadband service, especially on upload speeds, which create a distinct advantage for sharing digital photos and multimedia, and for applications such as video teleconferencing.

One of the key differentiators is the Internet product. On the UTOPIA network in Utah, providers offer download speeds at least double the competition and upload speeds 40x faster than cable or DSL. Upload is becoming increasingly important as content from digital cameras, camcorders, and MP3 players all need to be moved around and shared in a more interactive fashion. The Internet product is also priced competitively and, with its superior speed, represents a great value.

**Slide 14:** Retail providers on other municipal networks are pricing their services competitively with incumbent providers in Palo Alto.

A review of the market in Palo Alto shows that Comcast is offering its digital voice product in the area, so they do offer a triple play. Typically Comcast tries to take the premium position in the market. And they succeed—as you can see. They are running a 12 month special with three products for $99, but they do have a history of enforcing the end of the promotional period rather than simply extending the offer. Most consumers are smart enough to understand what happens at the end of the promotion, but it may create some delays. A savvy provider can certainly sell around this to consumers.

AT&T is taking the entry/"value" position in the market with their low end DSL for $14.99. Their voice and data combinations are very inexpensive and actually less than UTOPIA’s retail provider MStar. We expect that consumers in Palo Alto will respond well to the higher speed offering from the fiber and be willing to pay more than $14.99 or even $24.99 for it. In comparison, it is also important to factor in the subscriber line charge of around $6.50 that will be added to the phone company's bill in the taxes section, but is never advertised. AT&T’s triple play represents a deal with Dish Network to resell satellite service. This is not as tightly integrated, but still viable and certainly price competitive.
Slide 15: Over time, average revenue per user (ARPU) will increase as customers take more services over the fiber network.

It is assumed that the Internet service will be the anchor product and that phone and TV will be add-on services to this product. It is important to understand how much revenue will be generated by each connection and obviously the best way to do that is to up-sell a customer into taking a voice or voice & TV bundle. The model assumes that service providers will be successful in having customers take more of their services over time. Our experience has been that many customers switch over to the Internet + phone package and then over time, as more features become available on IPTV or On Demand, will migrate to the video service.

Performance

Slide 17: Palo Alto can stand alone on $51 million financing.

As discussed earlier, total financing will be for $51M. In order to minimize expenses, DynamicCity assumed a long financing term. This creates the best opportunity for the network to create positive cash flow; the principal repayment can always be accelerated if there is sufficient cash. It is assumed that the bonds are credit-enhanced with bond insurance or with a letter of credit. The city would need to pledge revenues from the general fund of $3.4M annually for the life of the bonds to secure the financing. The model suggests that the city will not actually be required to pay this much annually, but it needs to be available.

Slide 18: The network will require 13,400 subscribers to fully cover operating expenses and debt service.

Using the assumptions outlined, the network could cover operating expenses and debt in the 4th year, or around 13,400 subscribers. This represents approximately 44% of potential homes. EBITDA will be covered before the end of the second year at around 7,000 subscribers, or 21%.

Slide 19: A number of municipal networks have already surpassed the break even point for Palo Alto's network.

A review of other municipal projects shows that some projects have exceeded the take rate required for Palo Alto's break even point. Others appear to be on track, but have not yet had sufficient time. This chart underscores how the execution and the selection of the right service providers is crucial to the take rate. Those that have been most successful are providing services themselves.

Slide 20: Years 5-7 (2011-2013) represent the critical years from a cash perspective as bond proceeds have been expended and the system is now fully dependent on subscribers and service revenue

The initial 5 years (through 2011) are characterized by heavy capital spending to build the network and add subscribers. By 2011, revenue generated by the customer base is sufficient to cover the operating expenses, debt, capital required for additional subscriber connections, and on-going electronics repair and replacement. The next three years are spent in a tight financial position with barely enough inflowing revenue to cover all the cash needs. After 2014, the network begins to create surplus cash flow and builds the cash balance.

Slide 21: Palo Alto Baseline Income Statement Pro Forma

Please see Attachment 3 of the Response to Scope of Work.
Risks

Slide 23: The major downside risk categories are increased capital costs and lower than anticipated revenue.

The two biggest risk categories are cost increases and revenue shortfalls. The revenue shortfalls can come from lack of subscribers and/or not enough revenue per subscriber (ARPU = average revenue per subscriber).

The risk scenario tested is that overall costs are 10% higher than modeled. A number of factors could influence this. Two examples are extremely rocky construction conditions, or unusual permitting requirements—each of these scenarios may drive up costs. Other cost escalation factors may include more underground fiber installation that previously estimated, or needing more fiber than estimated to pass all homes.

On the take rate side, it is also possible that the performance falls short of expectations. The two most likely reasons for this include stiff competition from the incumbents (including pre-marketing, price wars, etc.) and service provider efforts (or lack of efforts). The providers will need to provide highly reliable services, excellent customer support, and have an aggressive sales and marketing approach—including a door-to-door sales force. If the providers are not providing good support or if there are service problems, word-of-mouth will dampen take rate. What is modeled is a take rate that eventually reaches the break even mark, but just takes longer to get there. Obviously, any downside scenario more extreme than this would create a situation where the system would not break even and would consistently generate negative cash flows.

With ARPU, the largest risk is that not enough customers take enough of the services. They may only take Internet and pass on the voice and TV. This leaves their connection somewhat underutilized. They may have existing contracts on those services, or they may simply have more confidence in their existing provider and those products are not yet differentiated enough on the network to cause them to switch. Another concern is the large portion of the units that live in apartment complexes where bulk billing contracts may be in place which reduce the overall revenue per customer. We have already accounted for these, but the complex owners may require steeper bulk discounts to switch over to the network. One last risk is that the data connection is so good that applications like Skype or Vonage work really well and subscribers elect to use those providers instead of the contracted providers, which in turn means that Palo Alto does not get revenue for carrying that traffic.

Slide 24: While these scenarios do have an adverse effect on the cash position of the network, a number of strategies exist to mitigate that risk.

In all three cases the impact was around $5M, but what is more interesting is where the shortage occurs and where it is heading.

On capital, the annual cash flow is the same, but the starting balances are lower. The simplest way to mitigate this risk is simply to borrow a little more on the bonds to guard against this or to create a contingency fund using other city funds that would only kick in for higher capital costs.

The take rate and ARPU downsides create a different set of problems because under these scenarios, the network does not generate positive cash flow—thus it is constantly decreasing and would get worse if we extended the model beyond 10 years. On the take rate side, eventually at the latter end of this scenario, the take rate does reach the breakeven mark and cash flow.
flow appears to be stabilizing. Thus a slightly higher bond amount could provide a cushion long term that could provide cash long enough to get to the higher take rate.

Other steps include the city increasing its own marketing presence to either augment or compensate for the sales and marketing efforts of the providers. Another possibility would be to attempt to bring on additional providers that could increase the overall amount of sales and marketing efforts. However, the risk with this approach is that the network may not be large enough to support those additional providers.

On the ARPU side, the cash flow does not appear to be stabilizing on the lower ARPUs. Price competition could be driving down the ability to sell; however, this is less likely to last for 10 years. The incumbents are typically providing promotional pricing which expires after several months. If the lower ARPU can be attributed to fewer customers taking video and voice, then some investment in these products could increase penetration. Investments might include better customer support, changing technology platforms or intermediate providers. Other methods to increase penetration could include better cross selling approaches, sales compensation plans, and more marketing initiatives.

Another possible reason for poor penetration is inadequate marketing to businesses, and an increased effort in that area could improve average revenue. If the reason is related to substitution for providers like Vonage and Skype, there may be little that can be done within the confines of this model.

Alternatives

Slide 26: Alternatives to reduce risk.

Thus far the approach has been for the city to fully guarantee the debt and take on all the project risk. Next we examine some approaches which can reduce the amount of project risk to the city. The first approach is to find private equity that could reduce the overall indebtedness. The second approach is to change the operating assumptions of the model in a way which produces a more favorable cash flow. These scenarios can be combined for greater overall risk reduction.

Slide 27: As the city minimizes the amount of debt service it will guarantee, the amount of additional capital required increases.

Slide 27 outlines the amount of private equity required for various levels of city guaranteed debt payments. In other words, if the city guarantees $0.5m/year, they would be able to raise about $8M through bonds. This would leave $29M of additional capital that would need to be located. If the city could guarantee up to $2.0M, then it would need to locate about $15M in private equity. The overall capital required decreases as the private equity increases because reductions in interest and principal payments free up more cash to cover ongoing success capital and reduce the overall amount needed.

We acknowledge that there are a number of ways to finance this network and we anticipate working closely with Palo Alto to determine the best solution for the City.
Slide 28: Private investors will likely require a return of at least 20%, which may limit investment to $5M.

Given the risk profile of the project, what kind of return would an investor require? A normal arms-length, market rate investor would likely need more than 20% return in order to complete the transaction. Some investors with local stakes or more altruistic motives may be willing to receive a lower return.

For modeling purposes, the investment is structured such that all the investment capital is received up-front in place of bond proceeds. The investor receives 95% of free cash flow once it becomes positive. While there are certainly other structures possible, DynamicCity has chosen this for modeling purposes. The results suggest that the more they invest, the lower their returns. This is because greater investments are not changing the ability of the network to produce greater revenue—it stays the same. The resulting savings from a 5.1% bond are insufficient to lift the investors return. This suggests that an investor who requires at least 20% return on investment is unlikely to invest more than $5M. The city could enhance the return for a provider in an attempt to motivate one to actually close on the deal by matching the investor’s dollars. The orange and yellow lines show how a $5M and $10M matching contribution from the city could affect the investor’s return.

Slide 29: Each $5M of private equity reduces the number of subscribers required for break even by 1,000

How much risk has been mitigated with the investment? The impact on risk can be measured by the number of subscribers required to hit breakeven. An investment of $5M takes the number of breakeven subscribers from 13,400 to 12,300 and reduces the required take rate 41% from 44% to 4%.

Slide 30: Although the private equity investment improves the cash flow of the network, most of that cash is returned to the private equity partner.

The investment does change the cash flow of the network. Private equity investment changes the cash flow such that the network could begin to create significant cash reserves. However, the assumed terms of the investment requires that this surplus cash be returned to the investor. As such, the network does not really begin to accumulate a large cash balance. Nevertheless, the cash disbursements to the investor will be after the cash needs of the network, so there is more insulation in this approach against the downside risks than without it.

Slide 31: A Neutral Network Provider (NNP) model offers an innovative approach to mitigating some of the key downside risk factors.

The Neutral Network Provider model offers a fairly dramatic alternative to the base case assumptions presented.

The Open Service Provider Network™ model (Option A) assumes that the city provides a low level transport medium but anything on top of that, including access to the Internet, is provided by an outside service provider. In contrast, the Neutral Network Provider model (Option B) recognizes that innovation on and around the Internet is beginning to offer more and more of the services and products that have traditionally been required of a local service provider. Now all that is required is a connection to the Internet and many of these services become instantly available to a subscriber. VoIP telephony is the prime example with AT&T’s CallVantage and Vonage being
response to project scope of work

the category leaders. Service-related issues with these services are typically more related to the Internet connection speed than the service itself, e.g. a 512 Kbps Internet connection (or even a shared 4 Mbps connection) simply doesn’t perform well enough to keep VoIP quality high. This is not true of a 15 Mbps or higher connection. Typically these services perform extremely well with that type of speed and offer the customer a superior price. Skype is completely free for calling other Skype customers and for a small fee can be used to call non-Skype customers (SkypeOut). For those that don’t like using the computer for Skype, a number of Skype phones are available from such notable vendors as Uniden that provide all the functionality of Skype on a cordless handset that consumers are accustomed to. The phone’s cradle attaches to the computer via USB. Some of these phones can be used dual purpose with the normal landline.

Similar trends are developing with video. Google’s major acquisition of YouTube shows their attention to the video space, and it may not be long before Google becomes the electronic program guide to a wide array of content that is all available on demand. BitTorrent is actively seeking distribution deals with major studios and broadcasting companies such as NBC. Studios are generally interested in bypassing some of the content distributors (the cable companies such as Comcast, TimeWarner, and Cox, as well as the video rental stores such as Blockbuster and Hollywood Video) and we are beginning to see video content models appear that may enjoy some of the same success attributed to iTunes.

In the Neutral Network Provider model, the City of Palo Alto would provide the transport and connection all the way to the Internet, and would therefore collect not just the wholesale transport fees, but also the Internet connectivity revenues from individual subscribers. Email would be provided by national email providers such as Google’s Gmail, Yahoo!, Hotmail, MSN, etc. Many consumers already have accounts with these providers. These offer multiple accounts, large storage space, web access, and typically excellent spam filters and virus protection. Telephony services would be provided by the large national players such as AT&T CallVantage, Vonage, and Skype. Some of these providers offer a bounty for each new subscriber referred to them, so the city could actively promote these services and collect commissions on new sales. Video services would be provided initially via a distributor relationship with the large satellite providers DirecTV and Dish Network. These also offer profitable sales commissions for new sales, and provide a stable, high quality product. This service offering would be on par with that offered by AT&T, so only Comcast would have a better bundling opportunity. As the video distribution model on the Internet matures and as home networking solutions mature (to enable moving video content off the PC in the study over to the TV in the family room), traditional viewing behavior (and providers) will be replaced with services from BitTorrent, Google, Netflix, etc. Skype founder Nicklas Zennstrom is also working on a disruptive video solution referred to as the Venice Project that also appears to have great potential. The key ingredient in enabling these solutions is a fast enough broadband connection to the Internet, which the city would provide via the fiber.

In the OSPN™ model, the service providers on the network act as middle men distributors for video and telephony services, and are therefore threatened by the national service providers such as Skype. As wholesale transporter, the city collects wholesale revenue for transporting voice and video content, and is likewise threatened if this traffic is routed over the Internet connection rather than through a specialized transport layer
dedicated to each service type. Thus because of its need for revenue, the Open Service Provider Network™ model does not fully embrace the disruptive innovations occurring on the Internet.

On the other hand, the Neutral Network Provider model collects additional revenue from providing connectivity to the Internet, and therefore can offset loss of revenue for specialized transport of voice and video traffic. Because it can provide the required bandwidth to make these services perform well, and is not threatened by lost revenue, it can more fully embrace and promote these services.

*Slide 32: The city will need to evaluate the merits of the Neutral Network Provider model against its disadvantages to determine which approach best meets the city's objectives for this project.*

There are a number of other key benefits of the Neutral Network Provider model.

- Unlike OSPN™, the Neutral Network Provider model likely passes the IRS's private use test and could therefore qualify to issue tax-exempt bonds. The lower interest rate on these bonds increases cash flow and could reduce the total bond size or could maintain the current bond size of $51M while creating a larger cash cushion against downside risks.
- The NNP model would not require certain customer premise equipment such as batteries and set top boxes, which also reduces the required capital. Home battery solutions could still be provided, but these could represent a category of add-on sales to those who would like them. After all, if the power is out, the computer is out and the computer is required to connect to the Internet. There is also a significant savings in the later years of the network when these batteries and set tops needed to replaced. The Neutral Network Provider model conserves significant cash by removing the need to expend the capital or labor to replace these devices.
- The NNP model also offers more opportunity for high margin add-on sales such as static IP-addresses, home networking, wireless router sales, specialized content such as games, etc.
- The NNP reduces dependence on the third party providers for network success. In the OSPN™, the city is heavily dependent on the service providers' ability to market, sell, and support the services on the network. If the provider is not performing well, the City is somewhat limited in its ability to change the behavior or performance of the provider. In contrast, the City would self perform (or sub-contract) these services in such a way that it had direct control of performance, and therefore more control over the project's success and its own exposure to project risk, which it is underwriting by guaranteeing the debt.

There are a few downsides to the model as well.

- The operating expenses increase, as the City would do the selling and marketing, provide Tier 1 customer support, perform end-user billing, and provide back-haul and Internet connectivity. These functions can be sub-contracted to
minimize the city's involvement. Additionally, some of these functions could be combined with the existing systems in the power department and create operating efficiencies.

- There is less opportunity for bundling and single billing. Bundling does have a positive influence on churn and there is a convenience to a single provider and single bill. However, providing the Internet bill on the same account as the city's utility bill would provide a similar convenience for residents and businesses.

- The local ISPs would not have an opportunity to use the network and therefore would likely be more opposed to this model. The local voice and video providers are probably equally opposed no matter the model.

- The NNP is likely to be more politically controversial since the city would in fact be competing more directly with existing Internet service providers including AT&T and Comcast. This model is perhaps no less threatening to AT&T and Comcast as the OSPN™, since both represent facilities-based competition to these providers. But the local ISPs are likely to also be opposed and the OSPN™ better diffuses the argument of government competing with private sector. The counter is of course that the government is enabling better access to the existing national, brand name private sector providers such as Vonage, Skype, Google, etc. and that this model better reduces the taxpayers risk.

*Slide 33: Operationally, the higher cost of customer service and marketing is offset by the increased revenue and lower interest rate, resulting in approximately the same breakeven point.*

On an operating performance basis, the increased revenue and lower debt service are offset by the increased operating expenses. Thus the operating breakeven point is still about the same—13,000 subscribers. Better operating efficiencies and increased revenue opportunities could improve this outlook and provide a greater advantage to the NNP model as compared to the OSPN™. There is also less risk of the downside cases materializing in the NNP than in the OSPN™ because the city is not dependent on third parties for its success; this provides a robustness to the NNP that is not represented operationally.

*Slide 34: The long term cash position is much stronger in the Neutral Network Provider model as compared to the Open Service Provider Network™ model.*

The real advantage in the NNP is on the cash outlook. Without such devices as batteries and set top boxes, the initial capital outlay is lower. In the later years, these devices would need to be replaced, so the NNP again saves cash because it does not need to use cash to replace these devices. The reduced capital expenditures can either serve as a cash cushion against the downside risk scenarios outlined earlier (and over which the city would have more control) or could reduce the bonded amount, and therefore reduce the city's required guarantee by $300,000 per year. The city's risk could further be reduced by combining the NNP with private equity.

**B. Ownership:**
The City desires to own the system’s fiber infrastructure, and at a minimum, it must maintain use and control over the dark fiber network. The City understands that the limitations of such ownership could be partly determined by the extent of the City’s financial contributions to the project. The bidder should clarify the amount of investment required from the City in order to achieve substantial City ownership of the system infrastructure.

DynamicCity proposes that the City achieve full ownership of its fiber infrastructure through financing; DynamicCity’s initial proposal includes assistance in securing the necessary funding. Once that is in place, a project plan and contract for deployment will be designed and then executed.

Full ownership and management of the City’s fiber network is the only business case that truly protects the best interests of the City’s residents and business by ensuring healthy competition among service providers, 99.99% uptime, carrier-class bandwidth and citywide, scheduled deployment.

C. City Roles and Responsibilities:
The bidder must specify the proposed roles of the City versus roles of the bidder vis-à-vis the construction, implementation, and operation of the high-speed-broadband network.

<table>
<thead>
<tr>
<th>These services are proposed in response to RFP #FTTH01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Palo Alto</strong></td>
</tr>
<tr>
<td>Project Design &amp; Finance Package</td>
</tr>
<tr>
<td>• Approve requirements definitions</td>
</tr>
<tr>
<td>• Ascertain existing assets</td>
</tr>
<tr>
<td>• Financial reviews</td>
</tr>
<tr>
<td>• Governance plans</td>
</tr>
<tr>
<td>• City/community leader support</td>
</tr>
<tr>
<td>• Determine role and level of involvement of CPAU</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The services below would be negotiated following completion of the Project Design and Finance Package.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Palo Alto</strong></td>
</tr>
<tr>
<td>Construction &amp; Implementation</td>
</tr>
<tr>
<td>• Create policy</td>
</tr>
<tr>
<td>• Provide administrative oversight</td>
</tr>
<tr>
<td>• Financial management</td>
</tr>
<tr>
<td>▪ accounting</td>
</tr>
<tr>
<td>▪ payables</td>
</tr>
<tr>
<td>▪ invoicing</td>
</tr>
<tr>
<td>▪ financial reporting</td>
</tr>
<tr>
<td>• Determining</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Response to Project Scope of Work

<table>
<thead>
<tr>
<th>Purchasing Needs</th>
<th>Standardize addresses and calculate addressable units</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Procure overall services including engineering, construction, etc.</td>
<td>• As needed perform field verification of unit counts</td>
</tr>
<tr>
<td>• Negotiate and formalize all contracts</td>
<td>• Design footprint boundaries based on new unit counts</td>
</tr>
<tr>
<td>• Develop marketing plans and public relations campaigns</td>
<td>• Suggest plans for critical facilities</td>
</tr>
<tr>
<td>• Additional roles may be outlined pending definition of role of CPAU</td>
<td>• Review and approve engineering designs and documents</td>
</tr>
<tr>
<td></td>
<td>• General program management for Palo Alto construction including development of master plan, overseeing reporting, and progress tracking, etc.</td>
</tr>
<tr>
<td></td>
<td>• Administer contracts and manage relationships with Palo Alto contractors on behalf of and in conjunction with Palo Alto</td>
</tr>
<tr>
<td></td>
<td>• Enter as-built documents into a database for on-going operational needs</td>
</tr>
<tr>
<td></td>
<td>• Technical support necessary to activate and deliver of basic services for voice, video, and data</td>
</tr>
<tr>
<td></td>
<td>• Conduct field trials to verify and stabilize performance and service quality</td>
</tr>
<tr>
<td></td>
<td>• Manage relationships with service providers including coordination of technical and non-technical business, contractual, marketing, and policy matters</td>
</tr>
<tr>
<td></td>
<td>• Install, configure, test, and release for service all electronics in the network with the exception of access portals</td>
</tr>
<tr>
<td></td>
<td>• Assist Palo Alto in development of marketing plans and public relations</td>
</tr>
<tr>
<td></td>
<td>• Assist Palo Alto in clarifying purchasing needs</td>
</tr>
</tbody>
</table>

### Operation

<table>
<thead>
<tr>
<th>Overall administrative oversight Develop and implement service provider strategy</th>
<th>Jointly work with Palo Alto to develop and implement service provider strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Long term management of service provider relationships and agreements</td>
<td>• Provide day-to-day management of service provider relationships and agreements</td>
</tr>
<tr>
<td>• Contract negotiations with service providers</td>
<td>• Target, recruit, and develop prospective service providers and work to enhance and increase retail services of existing service providers</td>
</tr>
<tr>
<td>• Approve pricing schema</td>
<td>• Participate in contract negotiations with current and prospective providers</td>
</tr>
</tbody>
</table>
| • Financial management  
  ▪ Receivables  
  ▪ Payables | • Facilitate and monitor the physical and logical network interconnections of providers to Palo Alto |
<p>| | • Provide necessary services to set-up |</p>
<table>
<thead>
<tr>
<th>Response to Project Scope of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Enforce contracts and performance obligations of providers and contractors</td>
</tr>
<tr>
<td>• On-going marketing and public relations including community/political support</td>
</tr>
<tr>
<td>• Develop, recommend, and maintain pricing schema for wholesale services</td>
</tr>
<tr>
<td>• Calculate applicable charges for providers and generate and send invoices on Palo Alto's behalf and provide Palo Alto with electronic copies of such billings</td>
</tr>
<tr>
<td>• Respond to and resolve billing and payment inquiries from providers</td>
</tr>
<tr>
<td>• Negotiate settlements with providers regarding billing and payment disputes</td>
</tr>
<tr>
<td>• Receive and validate work orders from service providers for retail services</td>
</tr>
<tr>
<td>• Generate, receive, and validate work orders for repair and maintenance of the network</td>
</tr>
<tr>
<td>• Allocate work order fulfillment to Palo Alto contractors</td>
</tr>
<tr>
<td>• Ensure timely and proper completion of work orders</td>
</tr>
<tr>
<td>• Track status of work orders and escalate resolution on order that are not completed satisfactorily</td>
</tr>
<tr>
<td>• Monitor certain network elements via the element management system (EMS) and isolate, identify, and resolve EMS alarms</td>
</tr>
<tr>
<td>• Provide Tier II and III support to providers and coordinate and escalate problems to appropriate Palo Alto contractor</td>
</tr>
<tr>
<td>• Monitor and report on certain performance metrics applicable to performance of responsible parties</td>
</tr>
<tr>
<td>• Provide technicians to maintain and replace switches as required or manage Palo Alto contractors performing maintenance functions</td>
</tr>
<tr>
<td>• Document logical and physical inventory of equipment, fiber cables, conduit, cabinets, enclosures, and splice matrices</td>
</tr>
<tr>
<td>• Document addresses passed including connection status, services, and provider subscribed to at each address</td>
</tr>
<tr>
<td>• Administer network technology and business policies for the network including security, new service introduction, addition on new service providers, escalation procedures and wholesale pricing</td>
</tr>
<tr>
<td>• Define and recommend operational policies such as network addressing schema, quality of service parameters</td>
</tr>
</tbody>
</table>

DynamicCity
D. Description of Service Offerings:
Bidders are requested to provide a detailed description of the services to be offered to residents and businesses at project inception, and others that will be phased in within the first 3 years of the project.

**DynamicCity:**

The services offered to Palo Alto residences and businesses will be dependent upon the service providers who sign up to lease space on the network; because DynamicCity is "provider-agnostic," and provides equal access to all providers. Your residents and business stand to reap all the benefits of a very competitive environment.

Once a project management contract is awarded to DynamicCity, our project team will begin discussions and contract development with literally dozens of potentials service providers. We have already received interest from SP groups (local and national) who would like to provide service in Palo Alto. We are continuing those discussions. There is an interest to provide a mix of national and local providers to deliver services to residents and businesses.

AT&T, MSTAR, Veracity and XMission are the current service providers operating on the UTOPIA network. AT&T is offering data services; MSTAR is offering voice, video and data; Veracity offers voice and data service; and XMission offers data services. Several more providers are in various stages of participation on the UTOPIA network: negotiation, integrating, readiness testing, etc.

E. Services by Outside Parties:
Bidders are requested to identify any services, if applicable, that will be provided by outside parties. Any available documents related to agreements with outside parties shall be attached.

**DynamicCity:**

Services provided by subcontractors will be discussed and agreed upon by Palo Alto prior to execution; DynamicCity will seek out and employ reliable, proven firms to deploy specific phases of this project, including the actual cable installation.

DynamicCity is service-provider and contractor-agnostic and will work with a variety of partners in construction, electronics, and so forth. We will work with the City on procurement for these services to ensure that City procurement procedures are followed.

The benefit to DynamicCity's provider-agnostic stance is that it frees the City from being locked into any proprietary agreements with a single contractor or service provider. This ensures that the City has the freedom to work with the best and most cost-efficient contractors.

F. Financial Model and Business Case:
Bidders are expected to provide a Financial Model and Business Case in their response. These shall include:

1. Pro-Forma Income (Profit & Loss) Statement (years 1-10)
2. Annual cash flow projections, and a Statement of Cash Position (years 1-
10)  
3. Expected annual net income to the City based on the bidder’s proposed contractual arrangement, and appropriate cash flow and breakeven analyses  
4. Source of funding for Ultra-High-Speed Broadband system construction and operation  
5. Preliminary market and competitive analyses to support the pro-forma income and cash flow statements  
6. Forecasted customers by year and by service classification (years 1, 5, 10)  

**DynamicCity:** Please see the attached PowerPoint Presentation in Attachment 2, the UTOPIA financial statements spreadsheet in Attachment 3, as well as the electronic versions of these files included on the Proposal CD.

**G. Warranty Terms:**  
Describe all warranty terms and conditions, including price and performance guarantees.  

**DynamicCity:** Under an asset management contract with Palo Alto, DynamicCity will obtain warranty coverage for all network equipment or components, and/or maintain current maintenance contracts for all network assets. Price and performance guarantees for contractors will also be managed by DynamicCity under an asset management contract.
<table>
<thead>
<tr>
<th>ID</th>
<th>ID</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Predecessors</th>
<th>Resource Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Typical Municipal Network Project Plan</td>
<td>210 days</td>
<td>Mon 1/27/07</td>
<td>Fri 9/14/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Startup Tasks</td>
<td>170 days</td>
<td>Mon 1/27/07</td>
<td>Fri 7/20/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Pre-Engineering</td>
<td>45 days</td>
<td>Mon 1/27/07</td>
<td>Fri 1/28/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Identify Natural Boundaries</td>
<td>1 wk</td>
<td>Mon 1/27/07</td>
<td>Fri 12/11/06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Preliminary Address Counts</td>
<td>3 wks</td>
<td>Mon 1/27/07</td>
<td>Fri 12/15/06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Logical Network Design</td>
<td>3 wks</td>
<td>Mon 1/27/07</td>
<td>Fri 12/15/06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Establish Preliminary Footprint Boundaries</td>
<td>3 wks</td>
<td>Mon 1/27/07</td>
<td>Fri 1/15/07</td>
<td>4,5,6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>Overlay Logical Network on Preliminary Footprint Boundaries</td>
<td>1 wk</td>
<td>Mon 1/8/07</td>
<td>Fri 1/12/07</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Validate Design using Optimal Fiber Allocation Planning (OFAP) Tools</td>
<td>2 wks</td>
<td>Mon 1/15/07</td>
<td>Fri 1/25/07</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>Core Network Deployment</td>
<td>80 days</td>
<td>Mon 1/27/07</td>
<td>Fri 3/18/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>Electronics Vendor Selection</td>
<td>3 mos</td>
<td>Mon 1/27/07</td>
<td>Fri 2/18/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Data Center Selection</td>
<td>3 mos</td>
<td>Mon 1/27/07</td>
<td>Fri 2/18/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>Deploy Core Network</td>
<td>4 wks</td>
<td>Mon 2/19/07</td>
<td>Fri 3/18/07</td>
<td>11,12</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>Service Provider Integration</td>
<td>163 days</td>
<td>Mon 1/27/07</td>
<td>Wed 7/11/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>Recruit Service Providers</td>
<td>3 mos</td>
<td>Mon 1/27/07</td>
<td>Fri 2/19/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>Develop Joint Methods and Procedures</td>
<td>3 mos</td>
<td>Mon 2/19/07</td>
<td>Fri 5/11/07</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>Network and Service Integration</td>
<td>3 mos</td>
<td>Mon 2/19/07</td>
<td>Fri 5/11/07</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>Process Validation Test (PVT)</td>
<td>3 days</td>
<td>Mon 5/14/07</td>
<td>Wed 5/16/07</td>
<td>16,17</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>Network Validation Test (NVT)</td>
<td>2 wks</td>
<td>Mon 5/14/07</td>
<td>Fri 5/25/07</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>Service Readiness Test (SRT)</td>
<td>1 mon</td>
<td>Thu 5/17/07</td>
<td>Wed 6/13/07</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>Operational Readiness Test (ORT)</td>
<td>1 mon</td>
<td>Thu 6/14/07</td>
<td>Wed 7/11/07</td>
<td>18,20</td>
<td></td>
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<tr>
<td>22</td>
<td>22</td>
<td>Prototype Footprint</td>
<td>125 days</td>
<td>Mon 1/28/07</td>
<td>Fri 7/20/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>Footprint Engineering and Easement Acquisition</td>
<td>9 wks</td>
<td>Mon 1/29/07</td>
<td>Fri 3/30/07</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>Prototype Footprint Construction</td>
<td>4 mos</td>
<td>Mon 4/2/07</td>
<td>Fri 7/20/07</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>Pilot User Selection and Installation</td>
<td>4 wks</td>
<td>Mon 4/2/07</td>
<td>Fri 4/27/07</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>26</td>
<td>Pilot User Feedback</td>
<td>6 wks</td>
<td>Mon 4/30/07</td>
<td>Fri 6/8/07</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>27</td>
<td>Repeat Tasks per 1,000 Addresses/Service Area</td>
<td>165 days</td>
<td>Mon 1/29/07</td>
<td>Fri 9/14/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td>Easement Acquisition</td>
<td>8 wks</td>
<td>Mon 1/29/07</td>
<td>Fri 3/23/07</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>29</td>
<td>Engineering</td>
<td>6 wks</td>
<td>Mon 3/25/07</td>
<td>Fri 5/4/07</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>Distribution Ring Deployment</td>
<td>8 wks</td>
<td>Mon 5/7/07</td>
<td>Fri 6/29/07</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>31</td>
<td>Construction</td>
<td>4 mos</td>
<td>Mon 5/7/07</td>
<td>Fri 8/24/07</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>32</td>
<td>Production Turn-Up</td>
<td>3 wks</td>
<td>Mon 6/27/07</td>
<td>Fri 9/14/07</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>33</td>
<td>Marketing Support</td>
<td>2 mos</td>
<td>Mon 5/7/07</td>
<td>Fri 6/29/07</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>
Financial Proposal
City of Palo Alto
January 9, 2007
Assumptions
Performance
Risks
Alternatives
3. Palo Alto can stand alone on $51 million financing.

System Related Costs

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed System Assets</td>
<td>$28,623,349</td>
</tr>
<tr>
<td>Variable Connection Assets</td>
<td>12,822,723</td>
</tr>
<tr>
<td></td>
<td>$41,446,072</td>
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</tbody>
</table>

Financing Relating Costs

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issuance Costs</td>
<td>$2,376,992</td>
</tr>
<tr>
<td>Debt Service Reserve</td>
<td>2,684,430</td>
</tr>
<tr>
<td>Capitalized Interest Fund</td>
<td>4,985,520</td>
</tr>
<tr>
<td></td>
<td>$10,046,942</td>
</tr>
</tbody>
</table>

Total Debt

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$51,000,000</td>
</tr>
</tbody>
</table>
4. Palo Alto’s density has a significant positive impact on the economics of the project despite moderate amount of aerial plant.

Source: City of Palo Alto, UTOPIA
5. Construction costs per foot are modeled in range with other telecom projects.
6. Total capital costs are consistent with Verizon's FiOS fiber to the home project.

**Cost per Premise Passed**
- 30,700 Premises
- Palo Alto: $974
- Verizon FiOS 2005: $1,021
- Verizon FiOS 2006: $873

**Cost to Connect a Subscriber**
- 14,000 subscribers
- Palo Alto: $851
- Verizon FiOS 2005: $1,163
- Verizon FiOS 2006: $880

*Note: Palo Alto's connection costs do not include premise wiring or home routers as this cost is born by the service provider.*
7. Palo Alto’s network operating expenses are consistent with the RBOCs, but above average for smaller independent telcos.
8. Palo Alto represents a highly educated population and a large percentage is likely to have Internet access.
9. Educational attainment is a good indicator of access to the Internet.

Source: Pew Internet & American Life Project
10. The majority of homes in Palo Alto have household incomes greater than $35k, again supporting a positive outlook for penetration.
11. Households with income greater than $30,000 are very likely to have Internet access.
12. The forecasted take rate is reasonable compared to the performance of other municipal telecom projects.
13. The fiber network could offer a significantly better broadband service, especially on upload speeds, which create a distinct advantage for sharing digital photos and multimedia, and for applications such as video teleconferencing.
14. Retail providers on other municipal networks are pricing their services competitively with incumbent providers in Palo Alto.
15. Over time, average revenue per user (ARPU) will increase as customers take more services over the fiber network.

**Service Mix**

% of subscribers taking multiple services

<table>
<thead>
<tr>
<th>Year</th>
<th>Internet + TV</th>
<th>Internet Only</th>
<th>Internet + Phone</th>
<th>Internet + Phone + TV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>6%</td>
<td>28%</td>
<td>35%</td>
<td>31%</td>
</tr>
<tr>
<td>Year 2</td>
<td>6%</td>
<td>28%</td>
<td>33%</td>
<td>34%</td>
</tr>
<tr>
<td>Year 3</td>
<td>6%</td>
<td>27%</td>
<td>31%</td>
<td>36%</td>
</tr>
<tr>
<td>Year 4</td>
<td>6%</td>
<td>27%</td>
<td>28%</td>
<td>39%</td>
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<tr>
<td>Year 5</td>
<td>6%</td>
<td>27%</td>
<td>26%</td>
<td>41%</td>
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<td>Year 6</td>
<td>7%</td>
<td>27%</td>
<td>24%</td>
<td>44%</td>
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<td>Year 7</td>
<td>7%</td>
<td>26%</td>
<td>22%</td>
<td>46%</td>
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<tr>
<td>Year 8</td>
<td>7%</td>
<td>26%</td>
<td>19%</td>
<td>49%</td>
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<tr>
<td>Year 9</td>
<td>7%</td>
<td>26%</td>
<td>17%</td>
<td>51%</td>
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<tr>
<td>Year 10</td>
<td>7%</td>
<td>25%</td>
<td>15%</td>
<td>54%</td>
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</table>
17. Palo Alto can stand alone on $51 million financing.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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<tbody>
<tr>
<td>System Assets</td>
<td>$41,446,072</td>
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<tr>
<td>Financing Relating Costs</td>
<td></td>
</tr>
<tr>
<td>Issuance Costs</td>
<td>$2,376,992</td>
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<tr>
<td>Debt Service Reserve</td>
<td>2,684,430</td>
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<tr>
<td>Capitalized Interest Fund</td>
<td>4,985,520</td>
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<tr>
<td>Total Financing Costs</td>
<td>$10,046,942</td>
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<tr>
<td>Total Debt</td>
<td>$51,000,000</td>
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</table>

**Assumptions**

<table>
<thead>
<tr>
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<th>Value</th>
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<td>Bond Insurance</td>
<td>150 bp</td>
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<tr>
<td>Maturity</td>
<td>30 yrs</td>
</tr>
<tr>
<td>Yield</td>
<td>5.1%</td>
</tr>
<tr>
<td>Annual Payments</td>
<td>$3,355,537</td>
</tr>
</tbody>
</table>
18. The network will require 13,400 subscribers to fully cover operating expenses and debt service.
19. A number of municipal networks have already surpassed the break even point for Palo Alto’s network.
20. Years 5-7 (2011-2013) represent the critical years from a cash perspective as bond proceeds have been expended and the system is now fully dependent on subscribers and service revenue.
Palo Alto Baseline Income Statement Pro Forma

Please see Attachment 3 of the Response to Scope of Work
23. The major downside risk categories are increased capital costs and lower than anticipated revenue.

**CAPEX**

- **Baseline**: $374
- **Downside**: $469
- **Baseline**: $570
- **Downside**: $840

10% Increase

Possible reasons:
- Construction conditions
- Less aerial plant
- More footage than estimated

15% Decrease

Possible reasons:
- Incumbent competition
- Provider related circumstances
  e.g. sales efforts, customer support, etc.

**Take Rate**

- **Baseline**:
  - Year 0: 0%
  - Year 1: 25%
  - Year 2: 50%
  - Year 3: 75%
  - Year 4: 100%

**ARPU**

- **2008**: $24
- **2010**: $22
- **2012**: $24
- **2014**: $29
- **2015**: $41

15% Decrease

Possible reasons:
- Price competition
- Provider related circumstances
- Substitution & innovation
  e.g. Skype, BitTorrent, etc.
- Lower business take rate
24. While these scenarios do have an adverse effect on the cash position of the network, a number of strategies exist to mitigate that risk.

**CAPEX**

10% increase leads to . . .
$5.0M decrease in cash
Possible solutions:
- Increase bond size
- Identify source of contingency funds

**Take Rate**

15% decrease leads to . . .
$5.5M decrease in cash
Possible solutions:
- Increase marketing expenditures
- Identify additional provider(s)
- Increase bond size

**ARPU**

15% decrease leads to . . .
$5.5M decrease in cash
Possible solutions:
- Improve bundling incentives and cross selling
- Identify new products, services, and revenue streams
- Increase/change prices
- Better business marketing & sales
Assumptions
Performance
Risks

→ Alternatives
Alternatives to reduce risk
- Private equity
- Neutral Network Provider (NNP) model
27. As the city minimizes the amount of debt service it will guarantee, the amount of additional capital required increases.
28. Private investors will likely require a return of at least 20%, which may limit investment to $5M.
29. Each $5M of private equity reduces the number of subscribers required for breakeven by 1,000.
30. Although the private equity investment improves the cash flow of the network, most of that cash is returned to the private equity partner.
31. A neutral network provider model can offers an innovative approach to mitigating some of the key downside risk factors.

<table>
<thead>
<tr>
<th>Provider</th>
<th>Internet Connectivity</th>
<th>Email</th>
<th>Voice</th>
<th>Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palo Alto</td>
<td></td>
<td>Gmail, Yahoo!, Hotmail, MSN</td>
<td>AT&amp;T CallVantage, Vonage, Skype, Lingo, Sunrocket, Broadvoice</td>
<td>DirecTV, Dish Network, BitTorrent, NetFlicks, YouTube (Google), Venice</td>
</tr>
<tr>
<td>Revenue Source</td>
<td>Direct bill to subscriber (w/ electric)</td>
<td>NA</td>
<td>$ from provider for referrals</td>
<td>$ from provider for referrals</td>
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</tbody>
</table>
Pros
• Passes private use test and allows tax-exempt bond status
• Reduces capital spending on customer premise equipment such as batteries and set top boxes
• Increases revenue for services and provides cleaner access to add-on products and services
• Minimizes dependence on third parties for project success
• Embraces disruptive applications and services such as Skype that bypass typical service providers
• Can either maintain same bond amount for increased insulation against downside scenarios or reduce bond amount to reduce interest expenses

Cons
• Increases operating expenses because of increased responsibility for sales & marketing, customer service, backhaul, etc.
• Reduces opportunity for bundling and unified billing
• Minimizes opportunity for local providers
• Introduces more political controversy
33. Operationally, the higher cost of customer service and marketing is offset by the increased revenue and lower interest rate, resulting in approximately the same breakeven point.
34. The long term cash position is much stronger in the neutral network provider model as compared to the open service provider model.
Open Access Architects
enabling the telecommunications infrastructure for the next century
Attachment 3 – Baseline Income Statement Pro Forma
## STATEMENT OF OPERATIONS

**Projected Data - Calendar Year**

<table>
<thead>
<tr>
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<tr>
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<td>13,383</td>
<td>14,890</td>
<td>15,800</td>
<td>16,356</td>
<td>16,700</td>
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<td>13%</td>
<td>24%</td>
<td>36%</td>
<td>44%</td>
<td>49%</td>
<td>51%</td>
<td>53%</td>
<td>54%</td>
<td>54%</td>
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<td>Operating Revenue</td>
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<td>$3,251,184</td>
<td>$4,568,722</td>
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<td>$7,816,835</td>
<td>$8,824,063</td>
<td>$9,591,494</td>
<td>$10,155,263</td>
<td>$10,572,616</td>
<td>$10,901,834</td>
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<td>Network Costs</td>
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<td>$1,927,291</td>
<td>$2,107,821</td>
<td>$2,214,116</td>
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<td>$2,455,943</td>
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<td>$1,349,864</td>
<td>$1,369,360</td>
<td>$1,432,071</td>
<td>$1,475,033</td>
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<td>$4,092,759</td>
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<td>$5,624,993</td>
<td>$6,274,546</td>
<td>$6,824,189</td>
<td>$6,867,333</td>
<td>$7,096,482</td>
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<td>Interest Income</td>
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<td>$685,519</td>
<td>$499,403</td>
<td>$191,046</td>
<td>$72,824</td>
<td>$36,243</td>
<td>$30,526</td>
<td>$25,000</td>
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<td>$(2,476,988)</td>
<td>$(2,723,202)</td>
<td>$(2,907,479)</td>
<td>$(3,008,223)</td>
<td>$(3,087,770)</td>
<td>$(3,115,690)</td>
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<td>$(3,146,329)</td>
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<td>$(93,683)</td>
<td>$(93,683)</td>
<td>$(93,683)</td>
<td>$(93,683)</td>
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### STATEMENT OF CASH FLOWS

#### Projected Data - Calendar Year

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<td>Adjustments - Accrual to Cash Basis:</td>
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<tr>
<td>Depreciation</td>
<td>475,940</td>
<td>1,617,528</td>
<td>2,999,976</td>
<td>2,476,588</td>
<td>2,723,292</td>
<td>2,967,479</td>
<td>3,008,223</td>
<td>3,687,778</td>
<td>3,115,650</td>
<td>3,121,929</td>
<td>3,140,326</td>
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<td>Amortization of Bond Issuance</td>
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<td>93,683</td>
<td>93,683</td>
<td>93,683</td>
<td>93,683</td>
<td>93,683</td>
<td>93,683</td>
<td>93,683</td>
<td>93,683</td>
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<td>Changes in Operating Assets And Liabilities:</td>
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<tr>
<td>Change In Cap I</td>
<td>(2,784,013)</td>
<td>2,519,007</td>
<td>265,006</td>
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<tr>
<td>(Increase) Decrease In Accounts Receivable</td>
<td>(156,981)</td>
<td>(112,190)</td>
<td>(103,948)</td>
<td>(95,257)</td>
<td>(83,196)</td>
<td>(68,822)</td>
<td>(53,038)</td>
<td>(39,206)</td>
<td>(29,924)</td>
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<td><strong>Cash Flow from Investing Activities</strong></td>
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<td>System Capital Expenditures-Assets</td>
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<td>Construction in Process</td>
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<tr>
<td>Outside Plant</td>
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<td>(1,312,992)</td>
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<td>(414,722)</td>
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<td>(95,802)</td>
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<td>(1,335,760)</td>
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<td>Office Equipment</td>
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<td>(10,000)</td>
<td>-</td>
<td>(10,000)</td>
<td>-</td>
<td>(10,000)</td>
<td>(10,000)</td>
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<td>(20,000)</td>
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<td>Customer Premise Equipment</td>
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<td>(2,333,187)</td>
<td>(1,730,306)</td>
<td>(1,285,738)</td>
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<td>(1,538,011)</td>
<td>(1,934,740)</td>
<td>(1,659,310)</td>
<td>(1,145,381)</td>
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<td><strong>Cash Flow from Financing Activities</strong></td>
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<tr>
<td>Increase (Decrease) in Long Term Debt</td>
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<td>(793,018)</td>
<td>(833,462)</td>
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<td>(967,596)</td>
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<td>(1,123,317)</td>
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<tr>
<td>(Increase) Decrease in Debt Issuance Costs</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>(Increase) Decrease in Debt Service Reserve</td>
<td>(2,810,882)</td>
<td>(143,768)</td>
<td>(151,124)</td>
<td>(158,865)</td>
<td>(166,813)</td>
<td>(175,526)</td>
<td>(184,506)</td>
<td>(193,946)</td>
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<td>(214,299)</td>
<td>(225,263)</td>
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<td>Net Cash Provided (Used) By Financing Activities:</td>
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<td><strong>Net Increase (Decrease) in Cash</strong></td>
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<td>Cash - Beginning Of Year</td>
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<td>14,192,488</td>
<td>10,149,011</td>
<td>5,011,835</td>
<td>1,763,430</td>
<td>412,194</td>
<td>436,227</td>
<td>628,902</td>
<td>1,701,057</td>
<td>1,435,889</td>
<td>1,554,581</td>
</tr>
<tr>
<td>Cash - End Of Year</td>
<td>$14,192,488</td>
<td>$16,149,011</td>
<td>$5,011,835</td>
<td>1,763,430</td>
<td>412,194</td>
<td>436,227</td>
<td>628,902</td>
<td>1,701,057</td>
<td>1,435,889</td>
<td>1,554,581</td>
<td>2,965,603</td>
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</table>
### Balance Sheet

**Projected Data - Calendar Year**

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<tbody>
<tr>
<td><strong>Assets</strong></td>
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<tr>
<td><strong>Current Assets</strong></td>
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<tr>
<td>Cash</td>
<td>$14,192,498</td>
<td>$10,149,011</td>
<td>$5,011,835</td>
<td>$1,763,430</td>
<td>$412,194</td>
<td>$436,227</td>
<td>$628,522</td>
<td>$1,701,057</td>
<td>$1,435,889</td>
<td>$1,554,581</td>
<td>$2,565,903</td>
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<tr>
<td>Accounts Receivable</td>
<td>$156,981</td>
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<td>$551,572</td>
<td>$623,393</td>
<td>$873,433</td>
<td>$712,639</td>
<td>$743,563</td>
<td>$767,329</td>
<td>$789,228</td>
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<td>Total Current Assets</td>
<td>$14,349,469</td>
<td>$10,418,181</td>
<td>$5,384,954</td>
<td>$2,231,805</td>
<td>$963,766</td>
<td>$1,056,620</td>
<td>$1,301,935</td>
<td>$2,413,696</td>
<td>$2,178,451</td>
<td>$2,321,910</td>
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<td><strong>Non Current Assets</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Debt Service Reserve</td>
<td>$2,810,062</td>
<td>$2,533,830</td>
<td>$3,104,953</td>
<td>$3,263,039</td>
<td>$3,439,791</td>
<td>$3,663,171</td>
<td>$3,790,823</td>
<td>$3,984,769</td>
<td>$4,188,637</td>
<td>$4,402,936</td>
<td>$4,628,198</td>
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<td>Deferred charges, net of amortization</td>
<td>$823,650</td>
<td>$780,300</td>
<td>$736,950</td>
<td>$693,600</td>
<td>$650,250</td>
<td>$606,900</td>
<td>$563,550</td>
<td>$520,200</td>
<td>$476,850</td>
<td>$433,500</td>
<td>$396,150</td>
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<td><strong>Fixed Assets</strong></td>
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<td></td>
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<td></td>
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<tr>
<td>Construction in Process</td>
<td>$1,835,088</td>
<td>$2,914,067</td>
<td>$2,934,270</td>
<td>$6,697,900</td>
<td>$8,099,942</td>
<td>$6,183,744</td>
<td>$7,573,149</td>
<td>$11,122,976</td>
<td>$14,448,338</td>
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<tr>
<td>Outside Plant</td>
<td>$1,208,760</td>
<td>$2,243,029</td>
<td>$2,474,172</td>
<td>$5,046,916</td>
<td>$5,940,202</td>
<td>$6,873,942</td>
<td>$7,727,340</td>
<td>$9,112,796</td>
<td>$10,448,338</td>
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<tr>
<td>Inside Plant</td>
<td>$35,000</td>
<td>$35,000</td>
<td>$45,000</td>
<td>$55,000</td>
<td>$55,000</td>
<td>$55,000</td>
<td>$55,000</td>
<td>$55,000</td>
<td>$55,000</td>
<td>$55,000</td>
<td>$55,000</td>
</tr>
<tr>
<td>Office Equipment</td>
<td>$2,946,569</td>
<td>$5,930,952</td>
<td>$8,759,230</td>
<td>$14,188,641</td>
<td>$17,604,791</td>
<td>$19,538,532</td>
<td>$21,197,843</td>
<td>$22,343,224</td>
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<tr>
<td>Less Accumulated Depreciation</td>
<td>$33,183,160</td>
<td>$33,903,758</td>
<td>$35,806,730</td>
<td>$36,123,035</td>
<td>$34,372,038</td>
<td>$33,079,624</td>
<td>$32,345,624</td>
<td>$31,704,392</td>
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<tr>
<td><strong>Total Long Term Assets</strong></td>
<td>$33,456,075</td>
<td>$33,626,302</td>
<td>$33,806,750</td>
<td>$34,006,072</td>
<td>$34,593,354</td>
<td>$35,635,075</td>
<td>$36,026,302</td>
<td>$36,601,952</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Liabilities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Liabilities</td>
<td>$524,682</td>
<td>$601,072</td>
<td>$684,251</td>
<td>$753,827</td>
<td>$787,570</td>
<td>$824,011</td>
<td>$869,919</td>
<td>$876,420</td>
<td>$883,529</td>
<td>$903,218</td>
<td>$902,599</td>
</tr>
<tr>
<td>Noncurrent Liabilities</td>
<td>$51,000,000</td>
<td>$51,000,000</td>
<td>$50,245,463</td>
<td>$49,452,445</td>
<td>$48,618,992</td>
<td>$47,743,013</td>
<td>$46,822,370</td>
<td>$45,954,774</td>
<td>$44,837,830</td>
<td>$43,799,203</td>
<td>$42,645,766</td>
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<tr>
<td><strong>Total Liabilities</strong></td>
<td>$51,524,682</td>
<td>$51,601,072</td>
<td>$50,290,714</td>
<td>$49,085,993</td>
<td>$48,567,024</td>
<td>$47,892,289</td>
<td>$46,731,194</td>
<td>$45,721,359</td>
<td>$44,872,241</td>
<td>$43,548,394</td>
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</tr>
<tr>
<td><strong>Equity - Retained Earnings</strong></td>
<td>$(3,991,453)</td>
<td>$(7,279,133)</td>
<td>$(9,738,030)</td>
<td>$(11,396,967)</td>
<td>$(12,245,308)</td>
<td>$(12,387,369)</td>
<td>$(12,018,318)</td>
<td>$(11,237,840)</td>
<td>$(10,086,284)</td>
<td>$(8,646,939)</td>
<td>$(6,946,353)</td>
</tr>
</tbody>
</table>
Proposal for

City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Attachment G – Insurance Requirements

submitted by

DynamicCity
Own the Future
ATTACHMENT G
INSURANCE REQUIREMENTS

I. CONTRACTORS TO THE CITY OF PALO ALTO (CITY), AT THEIR SOLE EXPENSE, SHALL FOR THE TERM OF THE CONTRACT OBTAIN AND MAINTAIN INSURANCE IN THE AMOUNTS FOR THE COVERAGE SPECIFIED BELOW, AFFORDED BY COMPANIES WITH A BEST’S KEY RATING OF A-VII, OR HIGHER, LICENSED TO TRANSACT INSURANCE BUSINESS IN THE STATE OF CALIFORNIA.

AWARD IS CONTINGENT ON COMPLIANCE WITH CITY’S INSURANCE REQUIREMENTS, AS SPECIFIED, BELOW:

<table>
<thead>
<tr>
<th>REQUIRED</th>
<th>TYPE OF COVERAGE</th>
<th>REQUIREMENT</th>
<th>MINIMUM LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>WORKER’S COMPENSATION AUTOMOBILE LIABILITY</td>
<td>STATUTORY STATUTORY</td>
<td>EACH OCCURRENCE AGGREGATE</td>
</tr>
<tr>
<td>YES</td>
<td>COMPREHENSIVE GENERAL LIABILITY, INCLUDING PERSONAL INJURY, BROAD FORM PROPERTY DAMAGE BLANKET CONTRACTUAL, AND FIRE LEGAL LIABILITY</td>
<td>BODILY INJURY</td>
<td>$1,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PROPERTY DAMAGE</td>
<td>$1,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BODILY INJURY &amp; PROPERTY DAMAGE COMBINED</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>YES</td>
<td>COMPREHENSIVE AUTOMOBILE LIABILITY, INCLUDING, OWNED, HIRED, NON-OWNED</td>
<td>BODILY INJURY</td>
<td>$1,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- EACH PERSON</td>
<td>$1,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- EACH OCCURRENCE</td>
<td>$1,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PROPERTY DAMAGE</td>
<td>$1,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BODILY INJURY AND PROPERTY DAMAGE, COMBINED</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>YES</td>
<td>PROFESSIONAL LIABILITY, INCLUDING, ERRORS AND OMISSIONS, MALPRACTICE (WHEN APPLICABLE), AND NEGLIGENT PERFORMANCE</td>
<td>ALL DAMAGES</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>YES</td>
<td>THE CITY OF PALO ALTO IS TO BE NAMED AS AN ADDITIONAL INSURED: PROPOSER, AT ITS SOLE COST AND EXPENSE, SHALL OBTAIN AND MAINTAIN, IN FULL FORCE AND EFFECT THROUGHOUT THE ENTIRE TERM OF ANY RESULTANT AGREEMENT, THE INSURANCE COVERAGE HEREIN DESCRIBED, INSURING NOT ONLY PROPOSER AND ITS SUBCONSULTANTS, IF ANY, BUT ALSO, WITH THE EXCEPTION OF WORKERS’ COMPENSATION, EMPLOYER’S LIABILITY AND PROFESSIONAL INSURANCE, NAMING AS ADDITIONAL INSURES CITY, ITS COUNCIL MEMBERS, OFFICERS, AGENTS, AND EMPLOYEES.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I. INSURANCE COVERAGE MUST INCLUDE:

A. A PROVISION FOR A WRITTEN THIRTY DAY ADVANCE NOTICE TO CITY OF CHANGE IN COVERAGE OR OF COVERAGE CANCELLATION; AND

B. A CONTRACTUAL LIABILITY ENDORSEMENT PROVIDING INSURANCE COVERAGE FOR CONTRACTOR’S AGREEMENT TO INDEMNIFY CITY – SEE SECTION 18, SAMPLE AGREEMENT FOR SERVICES.

II. SUBMIT CERTIFICATE(S) OF INSURANCE EVIDENCING REQUIRED COVERAGE, OR COMPLETE THIS SECTION AND IV THROUGH V, BELOW.

DynamicCity: Please see the attached Insurance Certificate.

A. NAME AND ADDRESS OF COMPANY AFFORDING COVERAGE (NOT AGENT OR BROKER):

B. NAME, ADDRESS, AND PHONE NUMBER OF YOUR INSURANCE AGENT/BROKER:

C. POLICY NUMBER(S):
D. DEDUCTIBLE AMOUNT(S) (DEDUCTIBLE AMOUNTS IN EXCESS OF $5,000 REQUIRE CITY'S PRIOR APPROVAL):

III. AWARD IS CONTINGENT ON COMPLIANCE WITH CITY’S INSURANCE REQUIREMENTS, AND PROPOSER’S SUBMITTAL OF CERTIFICATES OF INSURANCE EVIDENCING COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN.

IV. ENDORSEMENT PROVISIONS, WITH RESPECT TO THE INSURANCE AFFORDED TO “ADDITIONAL INSURES”

A. PRIMARY COVERAGE

WITH RESPECT TO CLAIMS ARISING OUT OF THE OPERATIONS OF THE NAMED INSURED, INSURANCE AS AFFORDED BY THIS POLICY IS PRIMARY AND IS NOT ADDITIONAL TO OR CONTRIBUTING WITH ANY OTHER INSURANCE CARRIED BY OR FOR THE BENEFIT OF THE ADDITIONAL INSURES.

B. CROSS LIABILITY

THE NAMING OF MORE THAN ONE PERSON, FIRM, OR CORPORATION AS INSURES UNDER THE POLICY SHALL NOT, FOR THAT REASON ALONE, EXTINGUISH ANY RIGHTS OF THE INSURED AGAINST ANOTHER, BUT THIS ENDORSEMENT, AND THE NAMING OF MULTIPLE INSUREDS, SHALL NOT INCREASE THE TOTAL LIABILITY OF THE COMPANY UNDER THIS POLICY.

C. NOTICE OF CANCELLATION

1. IF THE POLICY IS CANCELED BEFORE ITS EXPIRATION DATE FOR ANY REASON OTHER THAN THE NON-PAYMENT OF PREMIUM, THE ISSUING COMPANY SHALL PROVIDE CITY AT LEAST A THIRTY (30) DAY WRITTEN NOTICE BEFORE THE EFFECTIVE DATE OF CANCELLATION.

2. IF THE POLICY IS CANCELED BEFORE ITS EXPIRATION DATE FOR THE NON-PAYMENT OF PREMIUM, THE ISSUING COMPANY SHALL PROVIDE CITY AT LEAST A TEN (10) DAY WRITTEN NOTICE BEFORE THE EFFECTIVE DATE OF CANCELLATION.

V. PROPOSER CERTIFIES THAT PROPOSER’S INSURANCE COVERAGE MEETS THE ABOVE REQUIREMENTS:

THE INFORMATION HEREIN IS CERTIFIED CORRECT BY SIGNATURE(S) BELOW. SIGNATURE(S) MUST BE SAME SIGNATURE(S) AS APPEAR(S) ON SECTION II, ATTACHMENT A, PROPOSER’S INFORMATION FORM.

Firm: DYNAMIC CITY, INC.

Signature: [Signature]

Name: KEITH WILSON
(Print or type name)

Signature: [Signature]

Name: [Signature]
(Print or type name)

NOTICES SHALL BE MAILED TO:

PURCHASING AND CONTRACT ADMINISTRATION
CITY OF PALO ALTO
P.O. BOX 10250
PALO ALTO, CA 94303.
Insurance Certificate
CERTIFICATE OF INSURANCE

DATE (MM/DD/YY) 12/29/06

PRODUCER
Acordia
973-437-2300
7 Girada Farms, 2nd Floor
Madison, NJ 07940

INSURED
Dynamic City Metronet Advisors
380 South 400 West
Lindon UT 84042

COMPANIES AFFORDING COVERAGE

A Federal Insurance
B American International
C
D

COVERAGES

This is to certify that the policies of insurance listed below have been issued to the insured named above for the policy period indicated, notwithstanding any requirement, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusions and conditions of such policies. Limits shown may have been reduced by paid claims.

<table>
<thead>
<tr>
<th>CO LTR</th>
<th>TYPE OF INSURANCE</th>
<th>POLICY NUMBER</th>
<th>POLICY EFF. DATE (MM/DD/YY)</th>
<th>POLICY EXP. DATE (MM/DD/YY)</th>
<th>LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>GENERAL LIABILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMM. GENERAL LIABILITY</td>
<td></td>
<td>10/07/06</td>
<td>10/07/07</td>
<td>GENERAL AGGREGATE 2000000</td>
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<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>A</td>
<td>AUTOMOBILE LIABILITY</td>
<td></td>
<td>10/07/06</td>
<td>10/07/07</td>
<td>COMBINED SINGLE LIMIT 1000000</td>
</tr>
<tr>
<td></td>
<td>ANY AUTO</td>
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<tr>
<td></td>
<td>ALL OWNED AUTOS</td>
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</tr>
<tr>
<td></td>
<td>SCHEDULED AUTOS</td>
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</tr>
<tr>
<td></td>
<td>HIRED AUTOS</td>
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<tr>
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<td>EXCESS LIABILITY</td>
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<td>10/07/06</td>
<td>10/07/07</td>
<td>AGGREGATE 4000000</td>
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<td>UMBRELLA FORM</td>
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</tr>
<tr>
<td></td>
<td>OTHER THAN UMBRELLA FORM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>WORKERS COMPENSATION AND EMPLOYERS' LIABILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>THE PROPRIETOR/ PARTNERS/EXECUTIVE OFFICERS ARE:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>INCL</td>
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<tr>
<td></td>
<td>EXCL</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>ERRORS &amp; OMISSIONS</td>
<td></td>
<td>8/23/06</td>
<td>8/23/07</td>
<td>$3,000,000 LIMIT</td>
</tr>
</tbody>
</table>

DESCRIPTION OF OPERATIONS/Locations/VEHICLES/SPECIAL ITEMS
RE: #7TH01; CITYWIDE ULTRA-HIGH-SPEED BROADBAND SYSTEM; THE CITY OF PALO ALTO, ITS COUNCIL MEMBERS, OFFICERS, AGENTS & EMPLOYEES ARE ADD'L INS'D W/RESPECTS TO GENERAL LIABILITY

10 DAY NOTIFICATION OF CANCELLATION FOR NON-PAYMENT APPLIES

CERTIFICATE HOLDER

CITY OF PALO ALTO
PURCHASING & CONTRACT ADMIN.
PO BOX 10250
PALO ALTO, CA 94303

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE COMPANY, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE
General Liability

Bodily Injury/Property Damage Exclusions

Aircraft, Autos Or Watercraft (continued)

2. it is rented with a trained, paid crew; and
3. it does not transport persons or cargo for a charge

Alcoholic Beverage Type Businesses

This insurance does not apply to bodily injury or property damage for which any insured may be held liable by reason of:

• causing or contributing to the intoxication of any person;
• furnishing alcoholic beverages to a person under the legal drinking age or under the influence of alcohol; or
• any statute, ordinance or regulation relating to the sale, gift, distribution or use of alcoholic beverages.

This exclusion applies only if you are in the business of manufacturing, distributing, selling, serving or furnishing alcoholic beverages.

Contracts

This insurance does not apply to bodily injury or property damage for which the insured is obligated to pay damages by reason of assumption of liability in a contract or agreement.

This exclusion does not apply to the liability for damages:

• that such insured would have in the absence of such contract or agreement; or
• assumed in an oral or written contract or agreement that is an insured contract, provided the bodily injury or property damage, to which this insurance applies, occurs after the execution of such contract or agreement.

Damage To Alienated Premises

This insurance does not apply to property damage to any premises you sell, give away or abandon, if the property damage arises out of any part of those premises.

This exclusion does not apply if the premises are your work and were never occupied, rented or held for rental by you.

Damage To Impaired Property Or Property Not Physically Injured

This insurance does not apply to property damage to:

• impaired property; or
• property that has not been physically injured; arising out of any:
• defect, deficiency, inadequacy or dangerous condition in your product or your work; or
Definitions (continued)

Impaired Property

Impaired property means tangible property, other than your product or your work, that cannot be used or is less useful because:

- it incorporates your product or your work that is known or thought to be defective, deficient, inadequate or dangerous; or
- you have failed to fulfill the terms or conditions of a contract or agreement;

if such property can be restored to use by:

- the repair, replacement, adjustment or removal of your product or your work; or
- your fulfilling the terms or conditions of the contract or agreement.

Insured

Insured means a person or an organization qualifying as an insured in the Who Is An Insured section of this contract.

Insured Contract

Insured contract:

A. means:

1. a lease of premises;
2. a sidetrack agreement;
3. an easement or license agreement;
4. an obligation, as required by ordinance, to indemnify a municipality, except in connection with work for a municipality;
5. an elevator maintenance agreement; or
6. any other contract or agreement pertaining to your business (including an indemnification of a municipality in connection with work performed for such municipality) in which you assume the tort liability of another person or organization to pay damages, to which this insurance applies, sustained by a third person or organization.

B. does not include that part of any contract or agreement that indemnifies an architect, engineer or surveyor for damages arising out of:

1. preparing, approving or failing to prepare or approve maps, drawings, opinions, reports, surveys, field orders, change orders, designs or specifications; or
2. giving directions or instructions, or failing to give them.
Proposal for

City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Attachment H – Vendor Experience Checklist

submitted by

Dynamic City
Own the Future
ATTACHMENT H

VENDOR EXPERIENCE CHECK LIST

Please check off the items with which your firm has had experience, and describe that experience.

DynamicCity: Please see the Vendor Experience section of this proposal.

<table>
<thead>
<tr>
<th>Mark with &quot;X&quot; below</th>
<th>Type of Experience</th>
<th>Municipal govt. context?</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Engineering services delivery</td>
<td>Yes</td>
</tr>
<tr>
<td>X</td>
<td>Regulatory and legal requirement fulfillment</td>
<td>We were involved in this aspect for UTOPIA and more generally in many other areas; please see Section 3.</td>
</tr>
<tr>
<td>X</td>
<td>Procurement</td>
<td>Yes (electronics, construction, engineering services, fiber and related components, and recruiting service providers.)</td>
</tr>
<tr>
<td>X</td>
<td>Operation and Maintenance</td>
<td>Yes</td>
</tr>
<tr>
<td>X</td>
<td>Business Plan Development</td>
<td>Yes</td>
</tr>
<tr>
<td>X</td>
<td>Financing Plan Devt and Implementation</td>
<td>Yes</td>
</tr>
<tr>
<td>X</td>
<td>Personnel Training</td>
<td>Yes</td>
</tr>
<tr>
<td>X</td>
<td>Resource Planning</td>
<td>Yes</td>
</tr>
<tr>
<td>X</td>
<td>Customer Service</td>
<td>Yes—2nd and 3rd Tier. (1st Tier is provided by service providers.)</td>
</tr>
<tr>
<td>X</td>
<td>Customer Billing</td>
<td>Yes—of service providers.</td>
</tr>
<tr>
<td>X</td>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

DynamicCity
Proposal for

City of Palo Alto

RFP #FTTH01
Citywide Ultra-High-Speed Broadband System

January 9, 2007

Additional Information

submitted by

Dynamic City
Own the Future
DynamicCity's® team approach simplifies the process for municipalities to get critical, last mile fiber optic infrastructure to every home and business in their community.

Working together with our clients, we design, finance, build, and operate advanced communications networks founded on our Open Service Provider Network™ (OSPN™) business model.

Our Open Service Provider Networks provide an open architecture offering true broadband (bandwidths of 100 Mbps to a gigabit per second and beyond), scalability and reliability. Combine that with our back-end operations suite and you get a ubiquitous, advanced fiber network that attracts local and national service providers keeping the quality of service high and costs low.

At DynamicCity we set the standard with The Utah Telecommunication Open Infrastructure Agency (UTOPIA). UTOPIA is the largest municipally sponsored fiber-to-the-premises project in the country. DynamicCity has the tools, methods and support to help communities with every aspect of the creation, operation, and ownership of broadband open service provider networks.

To get your municipal fiber project going, call DynamicCity today. It's the stroke of genius leading to success.
ABSTRACT

Broadband in North America is now at critical mass, passing the inflection point from the early adopter to the early majority. In fact, Strategy Analytics [1] predicts that by 2010, over 78 million U.S. households will have some form of broadband connectivity, much of it capable of delivering the triple play of voice, video, and high-speed Internet access. Their providers will consist of local exchange carriers, multiservice operators, and municipalities that have deployed their own triple play networks. Why the municipalities, and what do they bring to the table? In many instances, smaller cities and towns have been bypassed by the first phases of the incumbent operators' triple play deployments. For reasons of economic development, quality of living, education, and the retention of skilled workforces, the government has stepped in to fill the void. This article looks at the most ambitious municipality-driven triple play deployment in North America, the UTOPIA MetroNet in Utah. The system integrator for UTOPIA is DynamicCity, which early on defined a set of design principles that would make the network successful. These included the requirement that the network be open to multiple service providers, be carrier class, be scalable and based on future-proof technology, and that the architecture be based on open standards while keeping costs to a minimum. This article looks at the most ambitious municipality-driven triple play deployment in North America, the UTOPIA MetroNet in Utah. The system integrator for UTOPIA is DynamicCity, which early on defined a set of design principles that would make the network successful. These included the requirement that the network be open to multiple service providers, be carrier class, be scalable and based on future-proof technology, and that the architecture be based on open standards while keeping costs to a minimum. The article first reviews some of the considerations behind the choice of the technology and deployment approach based on these guidelines, and then describes in detail the network topology and services architecture, the current status of the deployment, and future plans. Specific topics covered include the use of multiprotocol label switching/virtual private LAN service, IP multicasting, and traffic engineering.

TECHNOLOGY AND DESIGN SELECTIONS

The fundamental technology selections when planning new triple play deployments relate to the control and protocol architecture, the last mile technology, and whether the network is designed as an open or closed network. We now look at each of these in the context of the UTOPIA architecture.

A LAYERED APPROACH

One of the goals in building the UTOPIA MetroNet was to build a network that is as simple and direct as possible without compromising the scalability and robustness of that network. Another goal was to build a system that is as open and "transparent" as possible to attract many service providers. For every layer of the network's architecture you interact with on the service provider's behalf, you add a level of complexity that translates into management overhead, equipment cost, and standards issues. Keeping the network design at the lowest possible level reduces the overall complexity for service providers and increases the interoperability of the network. These goals led to a decision to focus on layer 2. Multiprotocol label switching (MPLS) [2] has most of the attributes required to construct a network at this layer, including support for tunneling, traffic engineering, quality of service (QoS), and link protection.

LAST MILE ARCHITECTURE

The next issue is the selection of the last mile architecture. The industry has four major physical media available for access infrastructures: wireless, twisted copper pairs, coaxial cable, and fiber. Each of these physical media types was analyzed to discover which best met the municipalities needs as represented by the design principles. For the network to deliver services transparent to service providers, an infrastructure capable of delivering nearly limitless capacity is required. Using a sample footprint (a couple of kilometers across) we added up the total throughput each physical medium was delivering in existing deployments. As depicted in Fig. 1, the dedicated nature of fiber's bandwidth combined with its ability to support 100 Mb/s to 1 Gb/s speeds allows a fiber-
based solution to exceed alternate physical transport media by several orders of magnitude. Various fiber optic topologies, designs, and strategies exist for delivering services to subscribers.

**Open and Closed Networks**

An important consideration, particularly for municipal owned networks, is whether the infrastructure is designed as "open" or "closed." By open, we refer to a network designed as a utility, over which multiple service and content providers may operate. This model is ideal when the network is installed by the municipality, and is operated as a utility much like water or electricity. The actual service providers, whether they provide voice over IP (VoIP), business virtual private networks (VPNs), or video, have the direct relationship with the customer, and a given customer is not bound to the services offered by a single provider. While it is very traditional for the government to be responsible for the deployment of infrastructure (water, sewer, highway, airports, telephone), it is generally accepted that government should not be involved in what is considered the private content and services arena.

A closed network is designed to be deployed and operated by a single service provider. Here, the local exchange carrier (LEC) or multiservice operator (MSO) not only builds the network, but is also responsible for delivering the services. Although these networks theoretically support open access by other providers, in reality the technical, legal, and cost barriers to entry are too great to make this a viable model. One only need look at the MSOs or LECs and their percentage of their customers using Internet service providers (ISPs) controlled by the LECs and MSOs to draw this conclusion. This reality is not expected to change as part of their ongoing triple play deployments.

The UTOPIA architecture enables affordable high-speed communications by leveraging the ability of municipalities to access low-cost capital which in turn permits a sustainable return to service and content providers by vastly decreasing their capital expenditures. Residents and businesses contract with service providers for video, voice, data, or other services, while these service providers pay the city transport fees to use the advanced communications network. In doing this, the UTOPIA network balances technology, financing, and regulatory constraints with business and consumer demands.

Adopting a model developed by DynamicCity, the consulting firm for the UTOPIA project, the UTOPIA MetroNet operates under a model called the Open Service Provider Network™ (OSPN™) [3]. Under the OSPN model, a city constructs and maintains an advanced communications network as basic city infrastructure, an independent private entity designs, operates, and maintains the city infrastructure, and private industry service providers offer services over the network (Fig. 2).

**Definitions and Physical Architecture**

The UTOPIA network architecture is segmented into functional layers, and Ethernet routers bridge the frontiers between these layers. Figure 3 depicts these layers and routers (referred to as switches in the figures). Although the network as
Initially deployed is designed to scale to 150K households over a three hundred mile area in Utah, there is no reason why the architecture could not scale into the millions of subscribers by adding additional network elements.

The UTOPIA MetroNet has several basic divisions: the subscriber (customer premises equipment, CPE) layer, access layer, distribution layer, local core layer, provider access layer, provider layer, and regional core layer. Customers, both business and residential, connect from their CPE, an access portal (AP), which then connects via a Fast Ethernet fiber connection to an access distribution switch (ADS) located in a streetside cabinet. Each ADS is sized for on the order of 200 subscribers, and there are up to six ADSs in a cabinet. The cabinet is located up to 2 mi from the subscriber. Redundant Gigabit Ethernet fiber links extend up to five miles to a distribution core switch (DCS) serving on the order of 10,000 subscribers. This then connects via 10 Gb/s fiber to a regional core switch (RCS) pair serving up to 40,000 subscribers. DCSs are dual-homed to the RCSs, and the RCSs are meshed. The RCSs then connect to the service entry points in the network. This is the role of the core provider switch (CPS) and provider access switch (PAS), analogous to the DCS-RCS pairing on the customer side. Service provider equipment (SPE) provided by the actual service provider connects to the PAS. As additional service providers connect to the network, additional CPS-PAS pairs may be added. Later, we describe the logical topology following this physical topology.

**SUBSCRIBER LAYER**

Drawing an analogy, just as a residential driveway is the final destination point where passengers load and unload in a road system, the subscriber layer is the part of the MetroNet where end users “load” and “unload” their particular network service. There are three types of equipment that fit in this layer: the AP, UTOPIA supplied devices (video gateways), and CPE.

**Access Portal** — The AP is an electronic device attached to the exterior or interior of a building much as telephone demarcation boxes are currently attached. The function of the AP is, like a phone demarc, to terminate the city’s fiber and provide a connection point into which the building (business building or private residence) can connect its devices. As the demarc point, it is also the point at which the city’s responsibility for many of the network services ends, and most devices connected to or located beyond the AP will be the responsibility of the end user or service provider, with the exception of the video gateway, which will be UTOPIA’s responsibility.

The AP will have a number of connection points (Ethernet ports) and a number of built-in VoIP gateway analog voice ports. All devices within the building that need to connect to the MetroNet will aggregate and connect to the AP through one of those ports. The capacity of the Ethernet ports is 100 Mb/s, equal to the speed of a typical business LAN. All ports are configurable, and specific types of data traffic will be routed to the AP ports to deliver the services the consumer purchases.

**Customer Premises Equipment** — Some services to which customers may choose to subscribe will require a piece of equipment inside the customer’s house. For example, subscribers wanting wireless connectivity in their home will have a wireless access point connected to the AP. In that case the wireless access point is owned by the subscriber or service provider. These types of devices are referred to as CPE. Each service provider requiring some type of CPE will be responsible for making it available to the customer, and maintaining and repairing it.

CPE and other equipment within the home owned by the subscriber or service provider may operate at open system interconnection (OSI) levels up to layer 7. But by terminating ownership of the MetroNet at the AP, VoIP gateway, and video gateway, UTOPIA is able to keep the OSPN principle satisfied, since no individual service provider owns the on ramp or gateway to the fiber network. As voice and video CPE evolves to support direct connection to Ethernet networks (like computers today), the voice and video gateway functionality will no longer need to be deployed to maintain subscribers’ independence from the service provider.

**DISTRIBUTION AND ACCESS LAYERS**

Access distribution switches at the edge of the access layer are designed to handle network traffic from the APs spread throughout a neighborhood or business district. The function of the distribution core switches at the edge of the distribution layer is to collect the traffic from the access layer and feed it upstream to the next layer, called the local core layer, which is designed to handle heavier traffic. The reverse is also true. Traffic from the core layers is channeled through the distribution and access layers for delivery to the AP. The design of the core layers “oversubscribes” traffic the same way residential and city streets oversubscribe the number of cars they can handle at any point in time, while at the same time supporting the requirements for guaranteed QoS traffic.
**Figure 3. UTOPIA physical architecture.**

**CORE LAYERS (REGIONAL, LOCAL)**

The local and regional core layers of the MetroNet take all the data aggregated from the distribution and access layers, and passes it along at the highest speeds and capacity of the network. The core layers handle all traffic from all parts of the network. As with the other layers, they are oversubscribed, but have tremendous capacity and can be upgraded by adding routers and/or ports.

Sitting in the intersection between the distribution layer and the core layers are distribution core switches. In the architecture for the UTOPIA MetroNet, the distribution core switches have fully redundant control, power, and switch fabrics. Core switches will initially support 1 Gb/s and 10 Gb/s Ethernet connections. These then connect to the regional core switches located at the edge of the regional core layer.

**PROVIDER ACCESS LAYER**

The function of the MetroNet is to provide a high-speed high-capacity backbone across which service providers can deliver their services. While the core layer is the freeway across which service providers will transport their services, they need a different kind of access point to the freeway than residential and business customers use: they are coming on to the freeway from another location, not from within the cities' neighborhoods. The provider access layer is like one freeway (provider access) merging into another freeway (core) for the service providers so that they can put their traffic directly onto the core.

At the intersection of the core layers and the provider access layer is the core provider switch. CPSs are deployed in pairs to provide service providers the option of fully redundant connectivity into the UTOPIA infrastructure. As large numbers of service providers sign up to deploy services across the MetroNet, additional CPS and PAS switches can be added. Before service providers access the provider access layer freeway, they have all their equipment lined up and ready to go using their own ramps to the freeway. Quite literally, the service provider brings in SPE that will facilitate the distribution of services across the MetroNet. This equipment accesses the provider layer by hooking up to the provider access switch. The SPE may include large storage vaults of video programming, large interactive gaming servers, routers, and the like.

**LOGICAL ARCHITECTURE**

Logical data, voice, and video flows map across the physical topology described above. This relies on a combination of MPLS-based virtual private LAN services [4] and VLAN tagged Ethernet packets at the access and distribution layers to create logical Ethernet MPLS or VLAN-based forwarding topologies. Native untagged Ethernet packets are presently used at the subscriber demarcation to an AP element. A given VLAN is used to create individual service topologies that emulate a single redundant geographically disperse Ethernet switch for a particular service. The network will initially be configured to support three logical topologies (multipoint-to-multipoint, point-to-point, and point-to-multipoint) within broadcast domains or service VLANs to encompass all broadcast and unicast traffic.

The network has a full mesh of two physically diverse MPLS traffic engineered "tunnel" label switched paths (LSPs) between all PE elements (DCS and CPS), while the data network uses virtual circuit (VC) LSP load sharing across both tunnel LSPs between all PE elements. This eliminates the need for fast reroute
or backup LSPs for data services. The MPLS tunnels are established via Resource Reservation Protocol (RSVP), while the VC tunnels use LDP signaling.

**TOPOLOGY TYPES**

Multipoint-to-multipoint (mpt2mpt) service topology VC LSPs are configured to support seven QoS levels through MPLS EXP bit mapping. All mpt2mpt service VLANs will be assigned one of the seven QoS levels and configured through the entire MPLS cloud to the ADS element link aggregation group (LAG) based on the IEEE 802.3ad standard, and there is a one-to-one relationship between VPLS instances and QoS. This architecture limits VPLS domains to seven (one for each QoS level), reducing complexity and LDP signaling. When new services are requested, a service VLAN is created and simply added to the appropriate VPLS instance. This is accomplished by mapping multiple VLANs into the same “vc-identifier.” When subscribers request a service from a service provider, the service VLAN only needs to be provisioned on the ADS subscriber facing port and AP.

Point-to-point (pt2pt) service topologies use the same seven VPLS instances as mpt2mpt topologies, also by mapping VLANs. However, pt2pt services will use Q-in-Q (based on IEEE 802.1ad) stacking on the ADS ingress port connected to the AP. The outer VLAN tag/id of a packet will be added to the appropriate port/VLAN forward equivalence class (FEC) for a specific VPLS instance, defining a service in the same way as non-Q-in-Q services. This again greatly reduces the number of VC LSPs configured through the cloud. The other benefit is that a single one of the 4096 VPLS core service VLANs is capable of supporting 4096 pt2pt circuits defined via the inner VLAN tag. Committed information rate (CIR) pt2pt VLANs using the same inner tags will be supported through a VPLS instance configured with QoS seven. Service providers may use these CIR pt2pt service VLANs to support backhaul of circuit emulation devices (T1, DS3, etc.). Business intranet and extranet transparent LAN services (TLS) will also use Q-in-Q stacking to map service VLANs into existing VPLS instances. This technique permits users of the service such as municipalities and corporations to maintain their existing VLAN IDs across the network.

Point-to-multipoint (pt2mp2) service topologies are also possible, but these are custom configured as requested. Given these different MPLS topologies, we now look at actual delivery of voice, data, and video across the network.

**VOICE AND DATA**

Revisiting the physical architecture, Fig. 4 depicts unicast data or voice traffic originating at a subscriber and traversing the network to the service provider. The next sections describe the role of the various network elements in this flow.

**Access Distribution Switch** — ADS elements are each configured based on specific service VLANs provided through APs to subscribers. Service VLANs are based on unique VLAN IDs, which are configured for specific topologies and QoS. As noted above, the topologies supported are pt2pt, pt2mp2, and mpt2mpt. Topologies on the ADS are constructed by configuring combinations of layer 2 bridging filters and VLAN IDs. The ADS supports four QoS levels: three (high, medium, and low) used for retail services/VLANs and one (control) used for management. Mapping into the MPLS EXP bits is as follows: Control = 7 = Reserved; High = 6 = Circuit Emulation; High = 5 = Voice; High = 4 = Video; Medium = 3 and 2 = Data; Low = 1 and 0 = Data.

All ADS configuration instances have specific ingress layer 2 filters to protect the wholesale transport network from an attack on all service VLANs, and limit ICMP traffic (pings) as well as broadcast traffic. Retail service providers may also request supported layer 3 access control list (ACL) filters to mitigate specific retail denial-of-service attacks such as L2 and L3 misses. Certain TCP/IP and/or UDP port numbers and IP addresses may also be filtered if requested by retail service providers. ACLs to block MS file and print sharing on the ingress port/VLAN to medium access control (MAC) address locking for learned MACs on the AP management VLAN and video gateway management VLAN.

Service providers may also request other supported specific retail configuration enhancements on service VLANs like Dynamic Host Configuration Protocol (DHCP) Option 82, which allows them the ability to trace or designate dynamically allocated IP addresses and correlate them to specific physical geographic subscriber addresses. All service VLANs also collect billing information (ingress and egress bytes) for each service VLAN, which is passed to the network operation support system/business support system (OSS/BSS) applications.

Physically, ADS elements include two physical Gigabit Ethernet connections with diverse paths to separate blades on a single redundant DCS element. These physical ports to DCS elements are configured as a LAG. LAGs aggregate multiple physical ports into a single logical port. LAGs also have all service VLANs configured on them, and include layer filters configured to protect the MetroNet.

**Distribution Core Switch (DCS)** — DCS elements are also configured with LAGs as described above to aggregate ADS elements. These LAGs map service VLANs into the MPLS/VPLS cloud using service-VLAN-specific port/VLAN MPLS FECs. LAGs also perform layer 2 bridging for mpt2mpt topologies across DCS Ethernet ports toward other attached ADS elements when configured with the same port VLAN FEC. DCS elements will allow the ability to restrict local bridging for pt2mp2 topology service VLANs between multiple ADS elements attached to the same port VLAN FEC.

Port VLAN FECs will enforce Ethernet QoS
based on service VLAN IDs and map into the corresponding MPLS QoS based on EXP bit correlation.

**Core Provider Switch** — CPS elements serve a similar function as DCS ones, but are service provider facing instead of subscriber facing and have more ports configured in their LAG connecting to the PAS.

**Provider Access Switch** — PAS elements serve a similar function as the ADS elements, but are service provider facing instead of subscriber facing, and have more ports configured in its LAG connecting to the CPS.

**MULTICAST VIDEO**

The multicast physical topology (Fig. 5) differs from the unicast topology in that, at present, a multicast overlay based on Protocol Independent Multicasting (PIM) [5] routers is formed. These PIM routers connect to any service provider content (SPC) devices as well as to the RCSs. With future planned multicast enhancements, described later, these PIM routers could be eliminated.

Two redundant PIM-SM (PIM1A and PIM1B) routers are each configured to aggregate all video subnets from the head-end into a single subnet that is attached to the multicast video VLAN (McastVLAN). One router is configured as the primary multicast rendezvous point (RP) and the other as the backup (Fig. 6).

The backup RP in normal operating mode prunes all multicast groups. The primary RP floods all multicast groups across both LAGs, and if the RCS element being flooded with video traffic from one of the PIM-SM routers fails, the redundant PIM-SM router begins flooding.

All multicast groups are statically joined through the PIM-SM routers to this VLAN that supports all set-top boxes (STBs) on the network. Each PIM-SM router has two LAGs configured for the McastVLAN, mapped into a VPLS instance using port/VLAN FECs. One LAG is used to connect the PIM-SM routers together at layer 2 for the McastVLAN subnet. This passes through the RCS elements without VLAN tags. It is not replicated into the MPLS cloud, and is simply passed through the RCS elements to connect the video VLAN between the PIM-SM routers so they can negotiate pruning. The other LAG uses VLAN tagged frames from the PIM-SM routers to the RCS elements that are the PEs for the McastVLAN. This LAG replicates packets based on PIM pruning.

The multicast groups (200+) are transmitted across the MPLS cloud to each DCS, and the...
DCS elements are PEs for the McastVLAN/VPLS instance as well. The DCS elements perform Internet Group Management Protocol (IGMP) snooping on the Ethernet LAGs connected to ADS elements for the multicast video VLAN, while the ADS elements perform layer 2 proxy IGMP snooping [6] on the McastVLAN and the AP performs IGMP snooping for IGMP joins and leaves. The PIM-SM routers filter all IGMP traffic to reduce CPU overhead as all multicast groups are statically joined, which allows them to scale and support all IGMP hosts (set-top boxes/video gateways) network-wide. The 10 Gigabit Ethernet physical path between RCS elements is used as an MPLS hot standby or backup path protecting against an RCS to DCS primary path failure. This path is needed in the event of a primary path failure as OSPF and PIM would not be aware and would not reroute.

**QoS AND TRAFFIC ENGINEERING**

In order to provide transparency to higher-layer services, the network does not reorder or prioritize packets across switch elements within a service VLAN. All packets entering and exiting a service VLAN are therefore treated in a first-in first-out (FIFO) manner. Service providers may perform their own prioritization schemes before packets enter the UTOPIA MetroNet. However, the network will reorder or prioritize Ethernet packets based on VLAN IDs on Ethernet ports, and will also reorder or prioritize MPLS packets based on MPLS experimental (exp) bits through the MPLS cloud.

Link load balancing is supported across all layers with the exception of the access layer, and the distribution layer load balances Ethernet traffic flows across multiple physical (single logical) links (LAGs). MPLS links implement MPLS administration group traffic engineering and load balance VC LSPs across two tunnel LSPs between MPLS label edge routers (LERs).

**LOGICAL REDUNDANCY REQUIREMENTS**

The UTOPIA MetroNet supports physical and logical link redundancy across all layers with the exception of the access layer. The distribution layer has a minimum of two links between ADS and DCS elements configured as a single logical link (LAG). If one of the physical links becomes inoperable, all traffic fails over to the operating link without any layer 3 interactions. The PAS to CPS link has links that will also be configured into a single LAG. MPLS links use traffic-engineered backup LSPs to reroute around any MPLS link failure.

Each switching element has high availability capabilities. Besides standard hardware redundancy such as dual power supplies, switch fabrics, and control modules, additional protection capabilities are available. Upon failure or crash of the main control module, the backup module,
which keeps a synchronized state of the main processor, takes over without affecting the data traffic flows handled in hardware. This includes restart capabilities for most routing and MPLS protocols. Separation of control and forwarding functions is maintained. Control processors are dedicated to control and management functions, while application-specific integrated circuits (ASICs) and microprocessors handle the data forwarding functions. This separation enables data to be forwarded even in the case of control software failures. Graceful restart capabilities are available for both routing protocols such as OSPF or BGP but also MPLS signaling protocols like LDP and RSVP.

**FUTURE OPTIMIZATIONS**

In the future, it is planned to move from a flat VPLS topology, where all the core switches such as RCS, DCS, and CPS nodes are fully meshed today, to a hierarchical VPLS (HVPLS) model. As our network evolves and passes more residential and business sites, this will help reduce the size of the VPLS PE mesh required with a smaller number of LDP adjacencies but also fewer LSPs to be maintained in the core of the network. Similarly, PAS, ADS, and SPE elements can act as VPLS multitenant units (MTUs) and be dual-homed into their respective core switches acting as VPLS hub PEs. HVPLS will also help with broadcast and multicast replication by spreading the replication effort across distribution switches and core switches (RCSs and DCSs).

With VPLS, replication happens at the ingress of the network (i.e., from the RCS to the DCS and then to the ADS in the current topology). With a large amount of broadcast and multicast traffic, core bandwidth is not used in the most efficient way and might induce some undesired latency and jitter. IGMP snooping [7] helps ensure that traffic is only sent toward recipients who request specific multicast streams. Further enhancements to optimize bandwidth usage with the use of point-to-multipoint LSPs [8] will ensure that a single copy of a multicast/broadcast frame will be sent across the MPLS core. They can be used to carry multicast/broadcast traffic across various VPLS instances but can also be defined on a per-VPLS instance [9].

LAGs offer a very efficient way to protect against link failure by dynamically mapping traffic onto the active physical links. However, LAGs are point-to-point and hence need to be terminated by a single element. These LAGs are
The UTOPIA network demonstrates that Ethernet routing in conjunction with MPLS and VPLS is capable of supporting triple-play services. It provides the carrier-grade scalability, reliability, application support, standardization, and future-proofing required for mass-market deployment.

Currently used between access and core switches, as HVPLS is implemented, access nodes, such as the PAS and ADS, will be able to be dual homed into separate core switches with individual LAGs. The ability to seamlessly integrate layer 2 and 3 capabilities into the different elements provides a significant advantage. This typically involves a deep packet inspection into the IP header while making a forwarding decision at layer 2 and snooping control protocols. For instance, instead of relying on 802.1p markings, which might not always be available or trusted and are currently ignored, switching nodes can examine the type of service (ToS)/DiffServ code point (DSCP) and incoming port/VLAN combination to determine the best path toward a destination and mark the MPLS EXP bits accordingly. ACLs can also be configured based on various IP header fields in order to prevent denial-of-service attacks. Finally, snooping IGMP or PIM, acting as an IGMP proxy snooping DHCP, will allow traffic to only be sent to the proper place, avoiding unnecessary control traffic sent through the network.

CONCLUSIONS
The UTOPIA network demonstrates that Ethernet routing in conjunction with MPLS and VPLS is capable of supporting triple play services. It provides the carrier-grade scalability, reliability, application support, standardization, and future-proofing required for mass market deployment. Recent developments supporting IP multicasting, resiliency, and manageability help to make this triple play deployment a reality. For the UTOPIA network, it provides a basis on which a municipality acting as a competitive carrier may cost-effectively deploy an open services infrastructure for multiple application providers with a goal of developing local economies, increasing quality of life, and retaining skilled workers.

REFERENCES

ADDITIONAL READING

BIOGRAPHIES
KEN MORMEAN, chief system engineer, DynamicCity, has over 25 years experience in networking and telecommunications, engineering network architectures from bsci to MPLS while utilizing dedicated 1200 baud analog to OC192 circuits. He has recently designed metropolitan area networks using DWDM enabling fiber-to-the-home (FTTH) networks for various public utility departments and cities across the United States and Mexico. Sample metropolitan network projects range from 2000 to over 150,000 nodes using 100 Mbs, 1 Gbs, and 10 Gbs native Ethernet and MPLS supporting voice, video, and data. Network design customers include private and government entities, including Aerie Networks, AT&T Wireless, Touch America, the U.S. National Security Agency, and Interfibra. Previous to Dynamic City he worked 10 years at Nortel and 3Com in various engineering roles.

JEFF FISHBURN, chief technology officer, DynamicCity, has dedicated the past 15 years to the telecommunications industry, beginning with product development at AT&T Bell Laboratories, business management for Lucent Technologies, and most recently including FTTH network designs for WINfirst and UTOPIA. He has been responsible for topology and network architecture designs covering voice/video/data access architectures over DC/DSL as well as AT/MTEthernet fiber-based infrastructures, dedicated transport over SONET/CWDM/DWDM for local/metro networks along with terrestrial and metropolitan networks over ATM and IP fiber infrastructures. He was previously chief technology officer for WINfirst, an FTTH overbuilder that provided a complete voice, video, and data service package in Sacramento. Prior to and during deployment, he managed the integration of the various voice, video, and data technologies into a cohesive network which currently provides 100 Mbs service to each home and 100 Gbs to individual residential subscribers. He is currently employed by DynamicCity, which brings a team that supports the networking, design, buildout, and operations of OSPNs for municipalities interested in advanced fiber networks.

MARC LASSEER, Chief Scientist, Riverstone Networks, is responsible for standards definition and network architecture. Over the years, Mr. Lasserre has held technology leadership positions at several high-tech companies in Silicon Valley, where he has been active in the design of Ethernet switches, ATM switches, and IP routers. He has worked on system design, protocol design, and implementation for such technologies as IP stacks, IP over ATM, LANE, Frame Relay, PPP, and MPLS-based Ethernet.

DAVID GINSBURG, VP of marketing and product management, Riverstone Networks, brings more than 18 years of marketing and technical networking experience to Riverstone. Prior to his current position, he was vice president of marketing at Allegro Networks. Previously, he was vice president of product marketing at Nortel Networks, prior to which he was a founding member of the Shasta Networks marketing group until its acquisition by Nortel. He also held a variety of management and engineering positions with Cisco Systems, Alcatel, and the U.S. Army. He has also authored several internetworking books including Implementing IP Services and the Network Edge, Implementing IP Services, and Implementing ADSL and ATM: Solutions for Enterprise Internetworking. He is also a former chair of the Broadband Content Delivery Forum (BCDF) and holds an electrical engineering degree from Rensselaer Polytechnic Institute. 