**Comments to the County and City of San Francisco's
Request for Information and Comment
"San Francisco TechConnect - Community Wireless Broadband Initiative"
Issued August 16th 2005**

Executive Summary:

The City is in a critical position of owning much of the infrastructure in deploying bandwidth to the residents and businesses of San Francisco. Handing over these resources to one entity that holds a monopoly of this resource to prevent competition does not benefit the city. It has been demonstrated that broadband costs to the consumer are artificially high due to the fact that there, at the most, two broadband providers for an area. This high cost for bandwidth is keeping the digital divide wide open and limiting new enterprises from starting.

There is a multi-prong approach to solving this:

1. A municipal broadband network will need to use a mix of different technologies such as 802.11 (WiFI), 802.16 (WiMax), copper and fiber to address the different needs of deployment such as geography, rights-of-way, etc.

2. The City should require that the network comply with open standards established by recognized standards committees (ie. IEEE, IETF, etc.). The network should not be dependent on proprietary protocols or APIs.

3. The City should provide a Level1/2 (see below) high-speed network (ie. Fiber) as a backbone for paid access to ISPs and clients in San Francisco.

4. The City should work directly with business and community groups to identify broadband needs.

Who we are:

Tim Pozar is a network engineer specializing in microwave engineering for government and commercial applications.

He was an early entrepreneur and developer in the Internet startup area, by co-founding a number of companies such as TLGnet (San Francisco's first ISP), Brightmail (first commercial anti-spam company) and Omniva (digital rights management). Previous to this for 25 years, Pozar was a radio broadcast engineer for commercial and non-commercial radio stations in the states of Washington and California.

Pozar is active in community wireless networking. As such he is a co-founder of the Bay Area Wireless User Group. Pozar is also leading an effort, called Bay Area Research Wireless Network (BARWN), to study the issues (such as scaling, sustainability, etc) of deploying wireless high speed Internet access for urban and rural settings to address digital divide issues. The BARWN network is currently

being built out through the San Francisco Bay area. The infrastructure is based on very low-cost unlicensed equipment.

Pozar has also published a number of papers covering the regulatory issues in the United States and engineering of high-speed wireless networks.

David S. Holub has more than 17 years experience in computing and telecommunications. He launched one of the first successful commercial ISPs in the Bay Area in 1994, and served nearly 20,000 subscribers. Holub also led the way for ISPs to become CLEC's and IXC's earning those certifications for the company in 1996. He is recognized both locally and nationally as a strong proponent for independent ISPs and non-discriminatory interconnection, having battled over interconnect issues with the incumbent Telcos before regulatory bodies both here in California and in Washington DC. He was instrumental in developing sophisticated Internet infrastructure and broadband connectivity in "state of the art" provider neutral data centers in Hong Kong, Seoul and Taipei and currently owns and manages a consultancy focused on CLEC's, and various large application service providers.

Introduction:

Why should the City of San Francisco do this?

Access to broadband is critical not only for the operation of most businesses today, but for individuals and families trying to get ahead in today's society. Social services, hospitals, job listing services (among others) are pushing and requiring clients to use the "web" to interact and use their services. This is fine if one has access to a computer and a connection to the Internet. Organizations have streamlined, reduced the cost and sped up customer support. Unfortunately, there is still about 4%[1] of the City that can't get broadband access.   This area is not just some random area of San Francisco. It is the area that they have identified as population areas that they will not be able to recover their investment in deployment. This is exactly the area that San Francisco should be concerned about. They can hardly afford a connection to the Internet let alone a computer to connect with. The longer this population is without broadband access the more stratified they will be from the rest of the population. Of course this 4% is not the only area in San Francisco that can benefit with high speed broadband access owned by the City.   The "Digital Divide" population is scattered all over San Francisco.

The incumbents have not demonstrated their concern to this population nor have they tried to provide the bandwidth that users currently require and will be requiring in the future. Applications that use the Internet are becoming more bandwidth hungry. Multimedia files are becoming larger, the media incumbents are understanding that their audience is moving the getting their content on the Internet. Voice over Internet Protocol (VoIP) requires symmetrical broadband access, unlike the broadband offerings that the cable and DSL providers offer now. SBC's residential offering is limited to 1.5Mb/s down and (up to recently) 128Kb/s up. Comcast's offering is also asymmetrical. This restricts many peer-to-peer applications such as VoIP, gaming and user publishing of content. Peer-to-peer

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[1] Comcast's presentation to the Telecommunication Commission on broadband coverage (February 23rd 2004)

applications are just starting to be developed. Demand for symmetrical high-speed bandwidth will be ramping up at an exponential rate.

Our vision for the San Francisco's broadband deployment:

We would like to respectfully suggest that the City becomes a Layer 1 and 2 network provider within its borders. The problems with the current broadband providers could be addressed by having a low cost, non-obsolete and carrier-neutral network that broadband providers can use to provide last mile access to the Internet.

The City investment in optical fiber cable plant is the enabling ingredient in this project for two key reasons:

1. The Government Authority it is uniquely positioned to leverage its physical plant and facilities and exercise its 'right-of-way' access, necessary to providing high bandwidth to the core of this network

2. Because of both the high cost of deployment and the essential nature of a required optical fiber core, that core it should be utilized/leveraged by the greatest number of paying and non-paying users. To do that the City is uniquely positioned to encourage both competitive private and public use.

Attaining a Confluence of Goals

The RFI/C mentions a wide range of goals that it wishes to accomplish by virtue of deploying a City wide broadband service. This proposal attempts to achieve as many of those goals as possible while limiting the City of San Francisco exposure to undo criticism or resistance to this network due to perceived governmental overreaching of its authority, financial resources or operational capabilities. We feel that by arriving at the right structural balance at the onset of this project, San Francisco can be a fantastic example of what is possible with inexpensive increased broadband availability without exposing itself to undo financial obstacles, legal challenges and operational risks.

The essence of this idea is to have the City of San Francisco be primarily responsible for maintenance and construction of the lowest physical level of the network. The City will contribute the essential 'Physical Layer-1' optical fiber and access to poles, conduits, rights-of-way and public infrastructure to be utilized as 'root nodes' in the network. This optical infrastructure and the access rights will constitute a backbone -lowest level- of a network necessary to allow for interconnection, aggregation and wireless distribution to the endpoints. On top of that 'physical layer' will ride a 'Network Layer-2' operated by an independent authority composed of members of a cooperative. This 'membership group/cooperative' may include government and 'outside' management but will be primarily composed of representatives of various service providers that are allowed –by virtue of their participation, contributions to the City and management of this entity- to sell services across the network. As a participating member any new or existing ISP or Telecommunication service provider who participates in the 'management group' can sell their services across this Layer 1 plus Layer 2 network.

The group can set qualifying standards however an essential governing principle must be that service providers receive an equal and non-discriminatory opportunity to join and offer services on the Layer 1 & 2 network. This model can even accommodate the incumbent provider SBC provided care is taken not to allow SBC to dominate management of this cooperative group. To achieve the City's goals with a minimum of public investment various providers must have market-based incentives to compete for broadband customers. Ashland Oregon has been successful with a similar model. The structure will promote a 'positive feedback loop' that will organically grow and fund itself. In effect, much of the revenue collected by the service providers customers will be paid back to the management group for operations and to the City to reimburse it for building and maintaining Layers 1 & 2 of this 'openly competitive self-funding' network.

With this operating structure the City will be facilitating a competitive marketplace for broadband services which helps attain the other stated goals including job creation, private investment in the network, economic development, the attraction of high-technology businesses interested in taking advantage of the network to deliver new and enhanced services requiring broadband access, universal and affordable broadband access, better communications and interoperability as well as efficient delivery of various governmental and private information services.

The technical elegance of this operational structure is that it appropriately leverages the known and proven networking attributes of wireless, wired and optical media and the role that they are best utilized in such a network deployment. To be sure, WiFi/Wireless technology is not well suited for backbone aggregation; rather it is best suited for the last few hundred feet -residential and common area distribution. 802.3x 10/100/1000 copper/wired Ethernet is best utilized to connect the Wireless distribution nodes/access points to the switches and routers necessary to power, connect and aggregate those distribution nodes/access points. All of which to function in a scalable and sustainable fashion needs to ride upon a backbone comprised of fiber optic cables interconnected via a switching fabric with existing public and private networks. The City is best positioned to deploy and maintain an infrastructure for the fiber network the service provider industry is best suited to cooperatively maintain the access points/nodes and deliver their services across them.

With the opportunity of the trenching needed for San Francisco's upgrade of water and sewer systems, San Francisco can install fiber for a much lower cost than doing this later. Fiber has the ability to be non-obsolete in that bandwidth that one fiber pair can support all of the bandwidth that the City and its citizen's would require today.   Technology is advancing at a rate to insure that fiber will be able to support higher bandwidth rates in the future by adding multiple wavelengths to the same fiber pair or different modulation methods. For example, the incumbents have a copper infrastructure that is much more restricted in bandwidth. The best return on investment for all parties concerned will be cooperate in such a manner as to maximize the use of these fiber optic facilities while simultaneously contributing to the reimbursement of their cost.

We see the city treating this network as multiple layers[2]:

The Physical Layer (Layer 1)

City builds and maintains fiber infrastructure. The initial trial can focus on existing city fiber, strands already exposed, terminated, but not lit up. This layer would be managed by the city with input from Layer 2 and Layer 3 customers.

The Data Link layer (Layer 2)

This layer would be managed by non-profit of network stakeholders. This model needs to allow equal playing field for incumbents such as SBC and Comcast and for the ISPs that are currently locked out of competition, as they don't own the current "copper". This structure will also provide access to smaller community networks to the city's backbone. Similar to current Internet Exchanges' (IX) such as the Seattle Internet eXchange[3] or the London Internet eXchange[4] among others[5], all stakeholders have a goal to keep the fabric economical and reliable.

This organization will be responsible for sustaining the Layer 2 infrastructure. This would include the Layer 2 switches and other software and hardware to support this infrastructure such as monitoring, etc.

The Network Layer (ISO-OSI Layer 3)

Private and public do whatever they want, sell IP, VPNs, or anything that can support either dark fiber or lit fiber using Ethernet over fiber protocols like 802.3ae. Once a municipal network is deployed, a significant amount of the traffic will actually stay within the network as consumers will need to access local services such hospitals, city services such as transit schedules and shopping. Access to the Internet will not be required for these customers to use the network. Of course much of the City's government would stay within this network. Applications such as conference video between buildings, multi-media between the main library and its branches, etc.

We envision that the Layer 3 users will be the primary financial supporters of the continual upkeep and new installations of the network. Likely a majority of the incoming will go back into the costs of supporting the Layer 1 infrastructure. A smaller portion of the incoming would go to support the Layer 2 infrastructure.

The most likely outcome of this economic structure is Layer 3 and above providers will be able to access customers far cheaper than they can now and with the competition, will be able to serve a larger audience as service prices will be lower.

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[2] For convenience and understanding we are using the ISO Layers and Protocols. http://en.wikipedia.org/wiki/OSI_model#Description_of_layers The ISO-OSI 7 layer Reference Model (officially known as ISO Standard 7498, 1984, 7498-1:1994. and CCITT standard X.200) was developed by the Internet Architecture Board and drafted by the IETF.
[3] http://www.seattleix.net/
[4] http://www.linx.net/
[5] There are numerous cities around the globe hosting Internet Exchanges (IXs). For a comprehensive list, please see the web page: http://www.ep.net/ep-main.html

As Internet bandwidth is very cheap[6] any additional profit can go into servicing non-profit community centers for broadband.

Conclusion:

We encourage the City and County of San Francisco to study and develop RFPs for deployment of Fiber throughout San Francisco.   We encourage that this network be carrier-neutral and be self-sufficient to the point that it subsidizes areas of San Francisco that are in need of broadband access and technology.

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[6] Pricing is anywhere from $8 to $30 a Megabit per month depending on the commit level