

CITY OF SANDY

# TELECOMMUNICATIONS MASTER PLAN

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POSSIBLE FUTURES FOR SANDYNET

FEBRUARY 2009  
CITY OF SANDY, OREGON

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## POSSIBLE FUTURES FOR SANDYNET

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### INTRODUCTION

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Many cities have become municipal Internet service providers *after* they have already installed telecommunications infrastructure. For example, the City of Sherwood invested in a fiber connection to the Internet to serve the city and other local governments, and then explored the use of that resource by businesses and residences. Monmouth and Independence acquired fiber access for the two city governments and Western Oregon University, and then decided to extend fiber to all homes and businesses.

Sandy's path was different: the city's investment in telecommunications infrastructure was first motivated by a need to bring broadband service to local businesses and residents, who at the beginning of the decade had no other access to broadband service. Ordinance 2001-07 created SandyNet as a municipal utility. The ordinance states:

Services provided by this utility may include, but are not limited to, high speed Internet services, including the transmission of any digital information such as data, audio, and video information. This service will be available to residents and businesses in and near the Sandy City Limits. It is not the intent of this utility to provide analog telephone services or analog video services; the emphasis of the Sandy Telecommunications Utility is on information that is conveyed digitally.

SandyNet began by offering DSL service, and later supplemented it with wireless service. The 900MHz WaveRider equipment continues to offer advantages in overcoming our challenging terrain and tree coverage (especially in the rural area west of Sandy). The more recent Wi-Fi service has smaller coverage areas, but offers higher speeds and the advantages of widely-available 802.11 equipment. An upgrade to DSL equipment in January 2008 allowed that service to continue to be a fast and reliable option for many residents.

Since SandyNet began offering service, the telephone company (GTE, which became Verizon) began to offer DSL service. Cable modem service is still not available, but in the past year, Wave Broadband purchased Charter Cable and is in the final stages of upgrading its facilities in order to offer both phone and data service. Verizon has not stated any plans to offer FIOS (fiber to the home) service in Sandy, but the company offers the service in nearby Gresham.

At the same time, SandyNet has become a key asset for municipal operations and for other government agencies. SandyNet provides ISP service for both city operations and for the Sandy Fire District. The city has entered into facility sharing agreements with the US Forest Service and the Oregon Trail School District. The new downtown fiber will provide service to Clackamas County's Mental Health office, and provide connections from the

police station and library to the county networks. Many of these connections benefit from cooperative service agreements with the Clackamas County ESD.

The Wi-Fi network has been used by Sandy Police and County Sheriff officers when submitting reports. A Wi-Fi network security camera in Meinig Park led to a conviction on a vandalism crime. The new Operations Center uses a voice-over-IP (VOIP) phone system. The city continues to add e-government applications, most recently live streaming video of Council and Planning Commission meetings, and on-line utility bill services. The web-based archive of city documents (now including large-format building and planning drawings) is one of the most complete of any local government, let alone a city of only 8,000 people.

Finally, the mere presence of the SandyNet ISP has been a powerful marketing tool in the city's economic development efforts. Prospective businesses recognize the importance of broadband service, and the existence of a municipal ISP indicates that the city is innovative and supportive of business.

While initial capitalization was assisted by other city funds, SandyNet is operating on a break-even basis. It is only able to do so, though, because it is operating on a shoestring budget; there was never an expectation that a municipal ISP would be a "profit center," and that expectation has been met.

The SandyNet Advisory Board and the City Council have periodically reviewed the mission and goals of SandyNet. With rapid changes in technology and uses of the Internet, this is healthy and necessary. As we enter the second decade of the 21<sup>st</sup> century, a review of SandyNet's future is once again in order.

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## **MUNICIPAL USE OF SANDYNET INFRASTRUCTURE: AN OPPORTUNITY FOR SYNERGY**

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Current and future SandyNet facilities could be significant assets in areas such as VOIP service, automated (water) meter reading, water/sewer system telemetry, public safety communications, security cameras in public areas and city buildings, webcams for traffic monitoring and tourism, and web-conferencing.

### **PHONE SERVICE**

City Hall, the Library/Police Station, and the Community Center all have their own standard phone switch equipment and standard phone trunk lines (provided by Integra at the Library/Police building and by Verizon at the others). The annual phone bill at these three locations is over \$19,000. The new VOIP equipment at the Operations Center was designed to be expanded to serve all city facilities. Because of limited (wireless) data access to the Operations Center (via backhaul links at the Forest Service HQ, Suburban Auto, and the Fire Station), the connection to the phone system is through an Integra T-1 line at a cost of \$700/month.

Our goal is to connect all city facilities through an IP (Internet Protocol) network, with a single VOIP switch, and a single phone service connection (at the server room in city hall).

This will provide a significant savings in phone utility costs, and provide better management of our phone system.

The downtown fiber will allow us to reach this goal for City Hall, Library/Police, and Community Center. A fiber connection to the Operations Center would allow us to include the phones for public works and transit into an integrated system.

#### **DATA MANAGEMENT**

Maintaining separate data servers in each building leads to several problems: maintaining operating and security systems, backups, and access to common files, among others. It is less of a problem for the police and library operations, since their primary servers (for the LEADS law enforcement system and the LINUS library catalog system) are operated by the county. But those departments also face challenges backing up local working files and getting access to shared files such as the ordinance and resolution indexes. As with the phone system, our goal here is to manage one or more servers locally, with centralized backup and maintenance of the operating system.

Doing this will allow our IT staff to concentrate on maintaining the data network (the basic SandyNet infrastructure), rather than on managing five separate servers and local networks. As with the phone system, the key to including all city facilities is a fiber connection to the Operations Center.

#### **SECURITY OF PUBLIC PLACES AND CITY FACILITIES**

Our security camera in the Meinig Park gazebo has already proved its usefulness (although the camera itself was also vandalized, and needs to be replaced). A Homeland Security grant has provided the capability to manage and record security video from a server in the Police Department. Our Cisco Wi-Fi radios, mounted on street lights, have a Power Over Ethernet (POE) port that allows us to power security cameras and transmit the video signal through the SandyNet IP infrastructure.

This is only possible, however, in the areas that are served by our Wi-Fi system. Many of our parks, for example, are not covered by Wi-Fi service (Hamilton Ridge, Tupper, Tickle Creek, Skatepark, Jonsrud Viewpoint). Citywide Wi-Fi coverage would enable permanent security cameras as well as temporary cameras to respond to patterns of vandalism or other crimes.

#### **AUTOMATED METER READING**

For at least the past decade, our water utility has used “Badger” meters that can be quickly and cheaply upgraded to radio-based automated meter reading (the dial face is simply twisted off and replaced with a new dial face connected to a small transmitter). A separate analysis considers the costs and benefits of automated meter reading. Using automated meter reading for *future* subdivisions appears to be an easy decision. When and whether to convert existing neighborhoods is a more difficult decision.

The automated meter reading system uses a low frequency (long wavelength) signal that is able to penetrate trees and buildings, and cover significantly larger distances than the high frequency Wi-Fi signals. The system works best if the receivers are fairly high. The existing

Bornstedt tower is an obvious location. We are exploring two new 120' towers at the Vista Loop reservoir site and the Operations Center. Even with conservative assumptions on future growth, the cost of these towers and receivers could be recovered through meter reading savings within nine years, with a rate of return of 15%.

These towers could also provide a wireless alternative to leased phone lines for water and sewer system telemetry. They would be able to reach most facilities in or near the city, including the Vista Loop reservoirs, sewer lift stations, and probably Sandercock Reservoir, Brownell Springs, and the sewer plant. The current utility bill for these leased lines is approximately \$4,200/year, paid indirectly through our contract with OMI.

#### **MOBILE DATA ACCESS**

A citywide Wi-Fi mesh would enable access to data for city staff who work in the field. Applications could include police reporting and access to law enforcement data, building inspections, water and sewer system as-built drawings, street condition surveys, code enforcement access to sign permit data, property records, and dog license data, and others. The City of Corvallis uses hand-held PDAs to record geographically-based data, such as the location of potholes and park equipment in need of repair.

#### **FUTURE APPLICATIONS**

A recent (December 2008) issue of *Public Works* magazine described Quebec City's implementation of a "smart" street lighting system, using IP-addressable street light circuits. It allows substantial savings in electricity by reducing the intensity (or even turning off) of street lighting after a given time, and allows light intensity to be dialed in by area (e.g., higher intensity at a parking lot that is experiencing vandalism problems). Quebec City invested \$70 million in the system, with an expected payback of five to seven years. European cities have installed similar systems.

With the upcoming addition of traffic signals near Strauss Avenue and a future signal at Vista Loop, Sandy will have eight traffic signals on Highway 26. As traffic volumes grow, either ODOT or Sandy will need to manage the signals more actively. Loop sensors and cameras could use SandyNet infrastructure to feed traffic data to the traffic manager, and relay signal timing changes back to the signals. SandyNet's connection to the Internet could allow the signal system to be managed centrally by ODOT from any location in the state (or under contract to a company in Bangalore, for that matter).

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### **RESIDENT AND BUSINESS NEEDS**

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With upgraded Verizon DSL capacity, and with the future availability of cable modems from Wave Broadband, residents have more options than they did at the beginning of the decade. These services do not meet all residents' needs, though:

- Limitations in DSL coverage. Some phone lines, due to technical limitations, cannot be used for DSL. Neighborhoods far from the CO (Central Office,

located on Scenic Street) have slow or no service. While Verizon's service is reliable, introductory pricing usually jumps after a customer is committed, and when there are problems, residents often experience problems with customer service. Higher speeds (comparable to typical SandyNet speeds) are relatively expensive. There are no local customer service or support contacts.

- Lack of phone lines ("land lines"). Households are increasingly using cell phones, and don't need a land line. Leasing a land line simply for Internet access is expensive. It is theoretically possible to lease a "dry line" (with no phone dial tone) at a lower cost, residents have had difficulty doing this through Verizon, and Verizon has made it impossible to do it through SandyNet (probably in violation of federal access requirements).
- Transition to satellite TV service. Many households use satellite service and have no interest in subscribing to cable service. Cable Internet service is fairly expensive if it is not bundled with TV service.
- Few or no options for rural residents. DSL service is not available in most of the rural area surrounding Sandy. Cable modem service may become available, but for more remote locations, the line extension costs may be prohibitive.
- The digital divide. SandyNet is working on ways to provide free or reduced cost Internet service to low income residents in housing developments such as Sandy Vista (farmworkers) and Cedar Park Gardens (senior citizens). The private providers have no interest in or incentive to bridge the digital divide.

On the other hand, privately-provided wireless services may become available in the future. These could include upgraded cell phone technology, or Wi-Max such as the Clearwire service now offered in Portland.

SandyNet's residential niche appears to be in the Wi-Fi service area: it provides high speeds, it frees customers from the need for phone or TV lines, and it uses very inexpensive off-the-shelf customer equipment. But this service is currently available to less than a third of the city's residents.

SandyNet service to businesses has been an increasingly significant economic development tool. Since its beginning, SandyNet has provided service to the Best Western Sandy Inn. More recently, very high bandwidth service has been provided to the Resort at the Mountain (via a leased line connection provided by the cable company); this has allowed it to attract conferences with high bandwidth needs (e.g., IT professionals). Major business customers include AEC, Suburban Auto, and soon, Clackamas County Bank. Many small businesses downtown take advantage of SandyNet's \$19.95/month Wi-Fi service, a tremendous value for them.

For many businesses, Wi-Fi service is sufficient. For others, SandyNet has provided point-to-point microwave service (with higher, dedicated bandwidth). But radio signals are susceptible to interference (we are fortunate to be in a lull in sunspot activity now, but that won't continue for more than a few years), and the weather takes a toll on outdoor

equipment. A fiber connection to west end commercial and industrial businesses would provide a major improvement in bandwidth and reliability. In the future, a connection to east side commercial area (including the future Vista Loop village commercial) would be helpful. It would be especially important if we are able to entice a destination hotel/conference center to the east side view property.

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## POSSIBLE FUTURES

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SandyNet could take one of three future paths. One path would be the private path. Another would be a municipal-use (institutional) path. The third would be an integrated city/ residential/business ISP, most similar to the current direction that SandyNet has been taking. A fourth option—municipal fiber to the home—is probably not viable for Sandy, for several reasons. First, cities that offer this service (Monmouth/Independence with fiber, Ashland with a hybrid fiber/coax network) offer a “triple play” of data, phone and TV service. Sandy has a track record as an ISP, but there has been less need to fill a gap in available phone and TV service. Second, fiber to the premises requires a very large up-front investment. Cities that have done this typically operate an electric utility (Ashland), or have a significant partner (e.g., Western Oregon University). Third, installing fiber in existing neighborhoods would require trenching streets and yards—not a popular activity.

Private Path. Under this scenario, SandyNet would continue to support existing customers, but would not add to the system, and would discontinue marketing it. Residents and business would instead be directed to the private provider(s). City operations would use the existing (downtown) fiber, but more remote locations would lease data and phone service from private companies. The city would, however, extend institutional fiber capacity (to connect city facilities) as opportunities arise with major water or sewer line projects.

This scenario would allow the city to, over time, discontinue managing and maintaining a wireless network (which is high-maintenance compared to fiber networks). It would reduce financial risk due to new technologies, private providers, or federal and state preemptions of municipal service. It would probably, however, increase long term city costs for Internet and phone service and for managing our internal data network. Mobile data services for staff in the field might, in the future, be provided by cell phone companies, also at relatively high cost.

Institutional Path. Under this scenario, SandyNet would continue to support existing customers, but would not add to the system, and would discontinue marketing it. Residents and business would instead be directed to the private provider(s). The city would, however, continue to expand its fiber and Wi-Fi facilities to serve city operations, as described above. This would free staff from the time and cost of interacting with private customers and providing customer equipment. System outages would affect internal operations, but have less effect on the public.

Citywide Wi-Fi coverage under this scenario might be hard to justify financially. While residential customers do place a time burden on customer service staff, the marginal cost to

serve them is very low (they pay for their own equipment). Total customer revenue is now over \$150,000/year, and the bulk of this is from wireless customers.

Business customers would experience large increases in cost. Small businesses would be affected most.

Integrated Government/Resident/Business ISP. Under this scenario, the city would continue to provide residential and business ISP service, with Wi-Fi service extended citywide, and fiber service extended to the Westside business centers and eventually to the east gateway businesses. The city and other governments would take advantage of the SandyNet infrastructure for governmental operations as described above.

The City of Portland, in its aborted experiment with municipal Wi-Fi, paid a private provider for city use of the Wi-Fi infrastructure, and service to residents was provided for free. In the model proposed here, the residents and businesses would pay for ISP service, allowing the city to spread the cost of the infrastructure over both the private and public sectors.

### SUMMARY OF POSSIBLE FUTURE PATHS

	<b>Private Path</b>	<b>Institutional Path</b>	<b>Integrated ISP</b>
Cost of city operations	Higher	Higher	Lower
Broadband options for residents & business	Limited	Limited	More choices
Economic Development Opportunities	Similar to other small rural cities.	Similar to other small rural cities.	Gives Sandy an edge in business recruiting. Supports home based businesses and telecommuting.
Financial risk to city	Low	Moderate—fiber investment good for the long term; Wi-Fi more susceptible to technology change.	Higher—possible competition and technological change might reduce future residential and business demand. Wi-Fi investment is, however, relatively modest.
Other considerations	Allows city to concentrate on “core” water and sewer utilities.	Reduces administrative overhead in customer support.	Keeps competitive pressure on private phone and cable monopolies.



			Strengthens Sandy's reputation as an innovative city.
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**STRATEGIC PLAN**

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Under the “Private Path,” the city would make little or no further investment in telecommunications facilities. For telemetry purposes, a fiber line could be extended to the Vista Loop reservoirs if and when a sidewalk is constructed in the east end of Highway 26. Even without the cost of trenching, however, this would probably not be cost-effective. A fiber connection could be extended to the current and future high schools when the Bull Run water connection is made. There are, however, no current plans for a water line between downtown and 362<sup>nd</sup> Avenue, so the city would need to lease lines to connect the Operations Center to the rest of the city network. Moving to web-based applications might, in the future, reduce the need for a local network.

The “Institutional” path would be similar to the “Integrated ISP” path (in terms of facilities), with a few important differences. First, the City could not justify using Urban Renewal funds for an extension of fiber to the Operations Center if the fiber is not used to provide ISP service to businesses. That investment would need to be made from other funds, and the cost might not justify it.

The strategic plan, below, assumes the “integrated ISP” path.

**SANDYNET “INTEGRATED ISP” STRATEGIC PLAN**

**SERVICE TO RESIDENTS**

- Extend Wi-Fi service citywide. Due to radio limitations, there will probably be a few homes that can't receive a signal, even if service is available in every neighborhood. Use existing towers and antennas, plus new towers at Vista Loop and Operations Center, for backhaul.
- Cap DSL service at 120 customers (there are currently around 90 customers). In the future, reserve DSL capacity for business customers, and encourage new residents to use wireless service.
- Once Wi-Fi service is available in all neighborhoods, expand citywide marketing efforts.
- Upgrade backhaul radios as necessary to accommodate increased bandwidth.
- (Long range) Relocate Bornstedt tower to city property or to a site with a permanent easement. As an alternative, consider use of Wave Broadband institutional network to provide backhaul.

**SERVICE TO BUSINESSES**

- Extend fiber to the Pioneer Corporate Park. Provide service drops to (at least) Suburban Auto, Oregon Trail Admin offices, Forest Service HQ, and Operations

Center. Use those points for Wi-Fi and microwave point-to-point service to surrounding businesses. Provide conduit for sufficient fiber strands for future connections (recent downtown conduit can accept up to 576 fibers).

- In conjunction with east side sidewalk project, extend fiber to Vista Loop. Use it as a marketing tool for a future destination hotel/conference center.
- Encourage downtown businesses, particularly banks and real estate offices, to take advantage of downtown fiber.
- Offer rack space for off-site backup servers for local businesses. This would require a more secure location for this equipment. It would allow businesses to take advantage of the large bandwidth of SandyNet's local fiber service, without the limitations (and costs) of the Internet.
- Consider offering free low-speed Wi-Fi access downtown as a service to visitors and tourists.
- Pursue connection to LS Networks (BPA fiber made available to local governments) as a redundant path to the Internet. SandyNet is currently dependent on a single 100mbps fiber connection leased from Wave Broadband and Comcast.
- Obtain SandyNet's own IP space (block of public IP addresses "owned" by SandyNet).

#### INSTITUTIONAL SERVICE

- Adopt AMR (Automated Meter Reading) technology for new and partially built subdivisions; convert existing subdivisions in a phased approach (over 10 years). For receiver locations, use existing SandyNet infrastructure (Bornstedt tower, Fire Station) plus new towers at Vista Loop reservoirs and Operations Center. Use SandyNet for backhaul to server in city hall.
- Consider use of Wave Broadband institutional network in place of leased phone lines for telemetry at sewer lift stations and reservoirs (cable franchise agreement will be re-negotiated in late 2009). Where this is not feasible, replace leased lines wherever possible with SandyNet wireless connections.
- Centralize phone switching to a VOIP system in city hall.
- Centralize data network to server(s) in city hall.
- Relocate current backup server off-site (preferably at Operations Center).
- Add an IT professional position to focus on the city's own data and network needs, and to serve as backup when our Network Administrator is on leave.

#### RURAL SERVICE

- Pursue federal grant funding (possibly as part of President Obama's economic stimulus package) to do the following:
  - Purchase an easement for a tower site at the top of "Waybill Hill" (near the location of our existing WaveRider access point northwest of Sandy).
  - Upgrade WaveRider equipment to 8mbps service (including replacement of customer premises equipment (CPE). As an alternative, consider switching to Motorola's 900MHz "Canopy" technology.

- A new (higher) antenna site would allow broader coverage, including coverage to the southeast section of Gresham. This would make broadband service available to many rural residents who currently have no access to local service. It would also allow for a high-bandwidth wireless connection to the Internet, to serve as backup to our current fiber connection.

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**TELECOMMUNICATIONS FACILITIES PLAN**

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<b>2009-10</b>		
Extend fiber to west side commercial areas	Urban Renewal	\$150,000
Install Automated Meter Reading receivers and towers	Water & Sewer Funds	\$80,000
Phase 2 (of 3) of Wi-Fi mesh (2/3 of city served)	SandyNet	\$38,000*
Acquire easement and construct tower for rural service (Waybill Hill)	Federal rural telecom grant/loan	\$150,000
Expand VOIP switch and centralize city phone service	General fund	
Centralize servers; move backup offsite	Staff time only	\$0
<b>2010-11</b>		
Phase 3 of Wi-Fi mesh (citywide coverage)	SandyNet	\$19,000**
Replace telemetry leased lines with SandyNet service	Water & Sewer Funds	\$10,000

(\*) Lease purchase, biennial cost

(\*\*) Lease purchase, one year

SandyNet Facilities Plan 2009-11

