TowerStream's Boston T-1 Party

Second-Generation Fixed Wireless Equipment Gives TowerStream the Edge Against Incumbent Carriers in the Enterprise Market

By Philip Urso and Jeff Thompson

Hundreds of businesses in the Boston-Providence-Newport business corridor have tossed their expensive, ILEC-provided T-1 lines overboard since TowerStream Corp. began offering them a less expensive, yet more robust, alternative.

Based in Waltham, Mass., TowerStream was formed with the sole purpose of providing business customers in the Northeast with high-quality, carrier-class, fixed broadband wireless access (FBWA) T-1 service. Customers who learn of the service through TowerStream's sales force, local advertising, or word of mouth are quick to ask themselves, "Why pay a King's ransom for T-1 service when we don't have to?"

The average price of T-1 Internet access in the Boston market today is more than $1,000 per month. A TowerStream T-1 speed connection costs $500 a month.

We deployed our original network of seven base stations operating in the 5.8 GHz U-NII band spectrum in the spring of 2001. Business

was moving along without a hitch for the first few months. However, we had approximately 100 customers on the network when our first-generation equipment supplier decided to take leave of the FBWA market. We hit the road as soon as we could and began meeting with the six equipment vendors that claimed to be shipping systems operating in that band.

Network Criteria

During our search for a new equipment vendor, we knew what we meant by "carrier-class" equipment. We had already deployed an actual network, and also had the real-world experience of serving real customers. We were not afraid to ask vendors the tough questions.

We had a very good sense of what we needed in a successful business model. For instance, to enable sustainable base expansion, we wanted equipment that would address the following needs:

• A tight focus on a regional market;

• An ability to incrementally scale costs only after successful proof of concept;

• An ability to leverage the latest technologies; and

• Multiple, value-priced feature sets to drive subscriber growth (quality of service, rapid upgrade program, etc.).

After spending two and half months evaluating the candidates, Aperto Networks' PacketWave system stood out above all other competitors' broadband wireless systems. Aperto appealed to us most because the company was commercially shipping its complete system. Its RF and IP engineering teams and end product were superior, and the company was solidly managed.

TowerStream signed a contract and began deploying Aperto's PacketWave system in January 2002. It took six weeks to install the new base stations and convert our point-to-multipoint customers to the new system. Today, TowerStream, with a staff of 25 people, is serving several hundred customers with a cellular network of 14 base stations.

Although we designed our network to maximize line-of-sight coverage, Aperto's base stations offer non-line-of-sight and obstructed-line-of-sight coverage. The base stations provide TowerStream with nearly 90 percent penetration in each area. We are achieving our subscriber acquisition targets, as well as subscriber retention goals.

Our average customer consumes 2.3 Mbps of bandwidth. The majority use their FBWA link as their primary connection to the Internet. Our customers include large and small firms, such as MIT Lincoln Labs, Bentley College, Bechtel, numerous professional engineer-

ing services, pharmaceutical research and software development companies, financial services firms, and state and local government agencies. For them, the wireless link is mission critical to their day-to-day operations.

Robust Rings

For reliability, the backbone connecting the base stations in each metro area is deployed in a ring configuration. Each ring connects to two separate backbone egress points and two Internet network access point providers. The path redundancy TowerStream provides is superior to that provided by the incumbent local exchange carrier or other landline-based ISPs we compete against.

As it turns out, installing second-generation equipment has been a big benefit to Tower-Stream and our customers. The capability and flexibility of the new gear is enabling us to build business aggressively within our existing footprint. This is important, as tight capital markets are hindering expansion into new markets for all FBWA providers.

PacketWave's feature-rich functionality surpasses that delivered by our first-generation system. For example, with the first-generation network, in order to provide service to a single customer located far away from the base station, we had to decrease the overall power and throughput to every customer serviced by that

Mbps, which uses a smaller frame size plus more robust forward error correction coding. Meanwhile, customers located closer to the base station and in the same sector receive a 16 QAM (quadrature amplitude modulation) signal at a rate of 20 Mbps, which may use a large frame size.
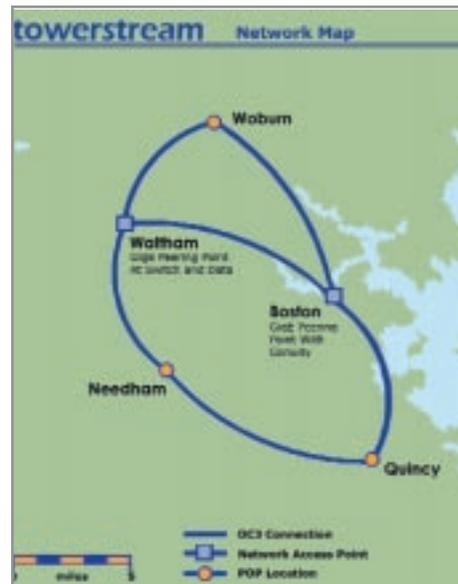
TowerStream's fault-tolerant wireless backbone features redundant links and dual peering points for maximum network availability.

The base stations carve up the 100 MHz of spectrum available in the U-NII-band into 16 narrow, 6-MHz channels. Other systems typically require 20-MHz or 33-MHz channels, causing their operators to run out of spectrum very quickly as they scale their networks to accommodate growth. This is not a winning business model. To ensure profitability, FBWA service providers need to architect networks that are easy to scale and therefore offer optimum opportunity for growth.

Narrow channel spacing, embedded quality of service (QoS) capabilities and the system's inherent ability to dynamically adjust individual subscribers' links enable TowerStream to double the capacity of the network and use and reuse spectrum as efficiently as possible. Growth is not a problem for us — it's our business model. These capabilities also enable us to package the performance and value-priced features we know we need for this market.

We are also able to keep our CapEx and OpEx costs low. In large part, that is because PacketWave provides integrated routing and DHCP (Dynamic Host Configuration Protocol) functionality on both the base station and subscriber units, which would otherwise have to be supported by external systems.

The system also enables us to have a faster return on our investment. It supports three QoS levels and delivers up to 16 flows per cus-

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base station. All parties suffered for the sake of one or two customers.

PacketWave's OptimaLink technology enables each base station to optimize the link to each individual subscriber it serves. Intelligence in each base station enables every upstream or downstream burst of bandwidth to be scheduled and controlled as it is transmitted. The system adjusts up to 10 signal parameters, including power, modulation, coding, frame size, automatic repeat request and forward error correction.

For example, a subscriber located five miles away from the base station with an obstruction may get a signal modulated in QPSK (quaternary phase shift keying) at a rate of 10

Traffic Management

In addition to the flexibility described above, PacketWave enables us to adjust upstream and downstream bandwidth allocations according to customers' actual traffic patterns. Although the majority of TowerStream's customers download nine times as much traffic as they upload, there are a few sectors in which the ratio is closer to 50/50 between the upstream and downstream traffic. We watch customers' traffic patterns and set the system accordingly.

PacketWave also enables us to use our allotted chunk of unlicensed spectrum very efficiently, scaling the network more profitably.

tomer, which means we can classify traffic by application or by one or more fields in the packet header.

This is extremely important to TowerStream's customers because they require predictable QoS for specific applications, and it allows us to offer multitiered services. Our customers are eager to sign service level agreements (SLAs) to ensure that we have an incentive to deliver on our promise to provide them with 99.99 percent availability. We are happy to offer them a higher SLA than what is offered by the regional Bell operating company because we know our system has the intelligence and ability to deliver the QoS and SLA they desire.

Because the Prudential Center is the second tallest building in Boston, line-of-sight is the primary mode of coverage. However, Aperto Networks augments transmission to include some obstructed-line-of-sight and non-line-of-sight coverage.

A Good Deal

In addition to enabling TowerStream to scale its network costs effectively, our network enables our customers to do the same almost instantly. As their Internet usage increases, they can add additional bandwidth as they need it. There's no need to order another T-1 line well in advance of carefully calculated growth or add or change subscriber equipment when upgrades are executed. We can deliver additional bandwidth to any subscriber at a cost of $325 per megabit in less than 19 seconds' time. Customers do not buy our service with this benefit in mind, but they are quick to grasp its significance once they've made a no-hassle, no-additional-cost upgrade or two.

In addition to meeting the varied needs of our existing customers, TowerStream is attracting new subscribers through our recently introduced Rapid Installation Program (RIP). Offered at a premium, RIP guarantees new customers that service will be up and running within 48 hours. Customers that take advantage of RIP are often those who have ordered a T-1 from the incumbent local exchange carrier for a new office, only to be told on moving day that they will have to wait another six weeks for service due to some kind of problem with the network or their paperwork. Although RIP guarantees service in 48 hours, we are often able to bring new customers up in a few hours' time.

To date, the new generation of FBWA technology has been very good for TowerStream and its customers. Despite all of the failures in the telecom industry, demand for service is growing. The need for carrier-class broadband connectivity is increasing every day. In TowerStream's service area, customers have an alternative access method that provides them with an affordable, flexible means of growing their businesses.

A sweet spot is the T-1 market. Even though business customers are demanding, they are much more willing than consumer subscribers to pay higher monthly charges for premium services, which helps the ROI. By practicing a focused, incrementally scalable business model, we are successfully serving a growing need, winning a sustainable place in the market and achieving per-cell profitability.

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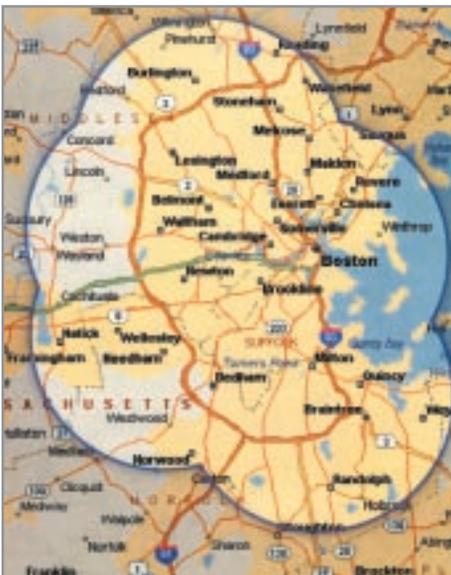
TowerStream's Boston Service Area

The P-to-P Option

Although TowerStream's point-to-multipoint customers are far greater in number, we are serving a growing number of customers that require more than 6 Mbps of symmetric bandwidth and very long reach with our point-to-point network.

To date, our backbone network operates in the 18 GHz and 23 GHz bands and is based on point-to-point equipment provided by Ceragon Networks.

Aperto Networks has introduced a complementary point-to-point access product that leverages the same technology used in Aperto's PacketWave system. The point-to-point product delivers up to 12 Mbps of throughput for enterprise customers as far as 10 miles away from the base station. We are deploying this new system, as well as DS-3 point-to-point units from Proxim, and estimate that they add at least 5 percent in additional subscriber reach to our overall servable base.

Fast Facts

Company

Name: TowerStream Corporation

Headquarters: Waltham, Mass.; Middletown, RI

Founded: October 2000

Number of Employees: 25

Service Markets: Boston; Providence-Newport, RI

Customers: Several hundred businesses

Services: T-1 and above; multipoint and point-to-point Cost of T-1: $500

Network

Spectrum: Multipoint - 5.8 GHz;

point-to-point - 18 GHz and 23 GHz

Line-of-sight/non-line-of-sight: Both

Base stations deployed: 15

Equipment suppliers: Aperto Networks, Ceragon Networks, Proxim Corp., Cisco Systems