Setting wireless broadband free

In UQ's WiMAX network in Japan, any device, any MVNO, and any application is fair game

UQ has established a nationwide WiMAX network in Japan using a very innovative approach to provide wireless broadband services:

- Subscribers are free to select the devices, service providers, applications, and content of their choice, without being tied to long-term contracts or subject to traffic caps
- Instead of developing its own brand, UQ relies on a network of MVNO partners, which includes mobile operator KDDI, ISPs, and retailers
- Leveraging its relationship with its partners, including KDDI, UQ has been able to hit the ground running. Fourteen months after its commercial launch, it already covers 65% of the population and has 337,000 subscribers

SENZA FILI CONSULTING

WiMAX operators have a unique opportunity to innovate when they start out as greenfield operators, with no dependence on legacy technologies, business models, and, perhaps even more importantly, a well-ingrained corporate culture. Some WiMAX operators opt for the safer and better-known models followed by mobile operators and internet service providers (ISPs), and often find it difficult to differentiate their product offerings from their competitors'. The most successful WiMAX operators eagerly take on the challenge, and experiment with new ways to deploy their networks, develop service offerings and structure their business models.

UQ belongs to the second group and is one of the most innovative WiMAX operators worldwide. It has leveraged its relationship with KDDI, a Japanese mobile operator and main investor in UQ, to concentrate on a very aggressive rollout. The focus at UQ is to increase coverage and capacity rapidly, and to create an open platform for wireless broadband services that is open to a wide range of retail devices, applications, mobile virtual network operators (MVNOs), and content providers. As UQ focuses on building and managing the network, marketing efforts fall mainly to its MVNO partners, which have already established well-known brands and sign up the majority of subscribers. Less than 10% of subscribers have a direct service contract with UQ.

This is a unique situation among mobile broadband providers. While most mobile operators live in fear of becoming a dumb pipe, UQ has chosen to be a pipe, although one that is built on advanced network performance and capabilities, and that provides value to its MVNO partners and, ultimately, to its subscribers.

UQ success depends on two main factors. The first is the ability to independently chart its own course and devote all its resources to building a network with cutting-edge performance. The second—and complementary—factor is that it has been able to develop effective relationships with a wide range of partners that support UQ in rolling out and managing the network and in marketing the service to both retail subscribers and vertical customers.

UQ is relatively unknown outside Japan, but we believe that UQ's experience to date provides an interesting blueprint for WiMAX operators and their prospective partners worldwide.

This paper provides an overview of UQ progress so far and its future expectations, as well as an analysis of its business model and go-to-market approach. A UQ case study provides deep insights into how mobile broadband services can be supported using a model that differs fundamentally from the one adopted by cellular operators, and that expands the wireline and Wi-Fi internet model to mobile usage models.

Getting started

The creation of UQ is an interesting example of how regulatory pressure to increase market competition can lead to innovation, even when many of the players involved are long-established companies. In 2007 the Japanese regulator, the Ministry of Internal Affairs and Communications (MIC), offered two 30 MHz spectrum allocations in the 2.5 GHz band for the development of mobile broadband services, and decided to bar incumbent mobile operators from participating directly in the auction. They could participate only as part of a joint venture, with less than 33% equity.

UQ was created as a joint venture led by mobile operator KDDI so that the latter could participate in the auction. KDDI correctly saw the 2.5 GHz spectrum as a valuable opportunity to address growth in data traffic. Even in 2007, before the acceleration in traffic growth had started fueled by fast adoption of smartphones and video applications, KDDI was acutely aware that 3G networks would not be sufficient to accommodate future traffic loads, especially in dense urban areas. The new spectrum allocation was well suited to provide the capacity needed for offloading traffic from existing cellular networks. And because it was time

The Japanese mobile data market

Japan has been at the forefront of mobile data since the introduction of i-mode, the first comprehensive, application-rich mobile data service in 1999. By the end of the current fiscal year, two mobile operators—NTT DOCOMO and Softbank—will see their data average revenue per unit (ARPU) overtake the voice ARPU, a first among mobile operators. By comparison, in Europe and the US, data revenues account for about a third of subscriber ARPU. Japanese subscribers have been using their phones less and less to talk, but they love to use them to keep in touch with family and friends through messaging and other data applications, and increasingly to access video and other bandwidth-intensive content.

As the market has approached saturation, there has been downward pressure on pricing and service models. As a result, Japanese subscribers, used to metered billing (i.e., per minute for voice, and per packet for data), now can choose flat-fee plans and, in some cases, unlimited flat-fee plans. Some mobile operators refer to this change as an "optimization" of service plans. As in other countries, it has spurred a much more intensive use of data services, which has resulted in a steep growth in traffic.

Operators are trying to address the increased traffic load with network expansion plans. NTT DOCOMO is planning to launch a Long Term Evolution (LTE) network by the end of 2010. KDDI is planning to launch an LTE network by the end of 2012 in the 1500 MHz (for hotspots) and 800 MHz (for wide area coverage) bands, expected to cover 96.5% of the population by 2015. Softbank, after acquiring Personal Handy-phone System (PHS) operator Willcom and its 2.5 GHz spectrum assets, would like to deploy a time division (TD) LTE network.

In comparison to other markets, in Japan mobile data services and applications have been heavily branded by operators since the launch of i-mode. Even after the launch of 3G data services, operators have strived to preserve a tight vertical integration model, in which they control most of the value chain, from network and devices to content, applications, financial transactions, and location-based services. Softbank's recent introduction of the iPhone, sold exclusively in Apple stores, marks a departure from the dominant distribution model, but it may well remain an exception in a market where almost all the devices are operator-branded. While the MVNO market is growing, Japanese mobile operators still have a direct-contract relationship with most of the subscribers, as it is in most markets worldwide.

UQ's market positioning is as a network operator primarily focused on building and operating a high-performance network shared by multiple partners, and it eschews a strong role as an application, service, or content provider. That is quite a novelty in the Japanese mobile data market.

division duplex (TDD) spectrum, WiMAX was the technology that offered the best fit.

KDDI partnered with technology companies, such as Intel and Kyocera, that had a strong presence in the WiMAX industry; financial institutions, such as Daiwa and the Bank of Tokyo-Mitsubishi; and a train operator, East Japan Railway (JR East) (Figure 1). All the partners provided an important role in getting UQ off the ground, providing financing, equipment, and market expansion opportunities.

While UQ is a fully independent operator and sets its own strategy, the ties between UQ and KDDI remain very strong. UQ has remained a relatively small entity, with 337 employees as of September 2010. It relies on KDDI and its subcontractors for the network buildout and operations.

UQ's chronology	
August 2007	Company founded
December 2007	30 MHz of spectrum in the 2.5 GHz band awarded for the deployment of a WiMAX network
August 2008	First base station installed
February 2009	Pilot launch Coverage: Tokyo metropolitan area
July 2009	Commercial launch Coverage: Tokyo, Osaka, Nagoya First embedded PC introduced
September 2010	Coverage: more than 500 cities, including 18 big cities (Tokyo, Kawasaki, Yokohama, Kyoto, Osaka, Kobe, Sapporo, Sendai, Hiroshima, Fukuoka) Roaming with Clearwire announced
March 2011	WiMAX 2 trial expected, with 20 MHz channel bandwidth

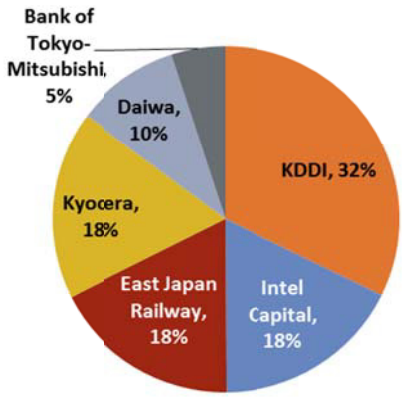

Figure 1. UQ joint venture partners (Source: UQ)

At the same time, the separation from KDDI has created a nimbler, more innovative corporate culture at UQ that is not encumbered by internal pressure to preserve the well-proven business models that are dominant in the cellular industry.

Equally important is UQ's freedom from legacy cellular technologies. That has enabled it to start with a clean slate and build a lean network, without having to worry about backward compatibility from either a network or a device perspective.

Building the WiMAX network

After receiving the allocation of 30 MHz of spectrum at the end of 2007, UQ installed the first base station in August 2008. Samsung was the vendor selected for the rollout. Commercial service started in July 2009, with coverage concentrated in a few urban areas.

By September 2010, only 14 months after its commercial launch, UQ had extended coverage to 65% of the population in 500 cities, including 18 major urban areas, using 11,000 base stations and supporting 337,000 subscribers (Figure 2).

By March 2011, UQ expects to have installed 15,000 base stations, covering 85% of the population, and to serve 800,000 subscribers. The network supports 40 Mbps data rates in the downlink and 10 Mbps in the uplink, using channels with a 10 MHz bandwidth, both for fixed and mobile (up to 120 kmph) access.

In deploying its network, UQ had to face a challenging radio frequency (RF) and usage environment. Japanese cities tend to be very compact, with a high concentration of high-rise buildings. Cities, like Kyoto, that try to preserve their historical heritage impose strict requirements on where base stations can be installed, and on their size.

The RF challenges are compounded by the fact that most of the traffic comes from indoor locations, as is to be expected given that the majority of connected devices are laptops or desktop PCs. Indoor devices typically connect to the base station using a less favorable modulation scheme, and require more network resources than outdoor devices placed within line of sight of the base station.

While these challenges affect all wireless networks similarly, their impact is much lower on voice-based networks, which do not require high bandwidth and in which more traffic is generated from outdoor locations.

To address these challenges, UQ designed its network in collaboration with Samsung to provide high levels of flexibility. To ensure initial coverage, a dense network of base stations was built using primarily rooftop locations. As a result, UQ deployed only base stations with small form factors that did not require ground equipment, for which there is often no room on top of buildings (Figure 3).

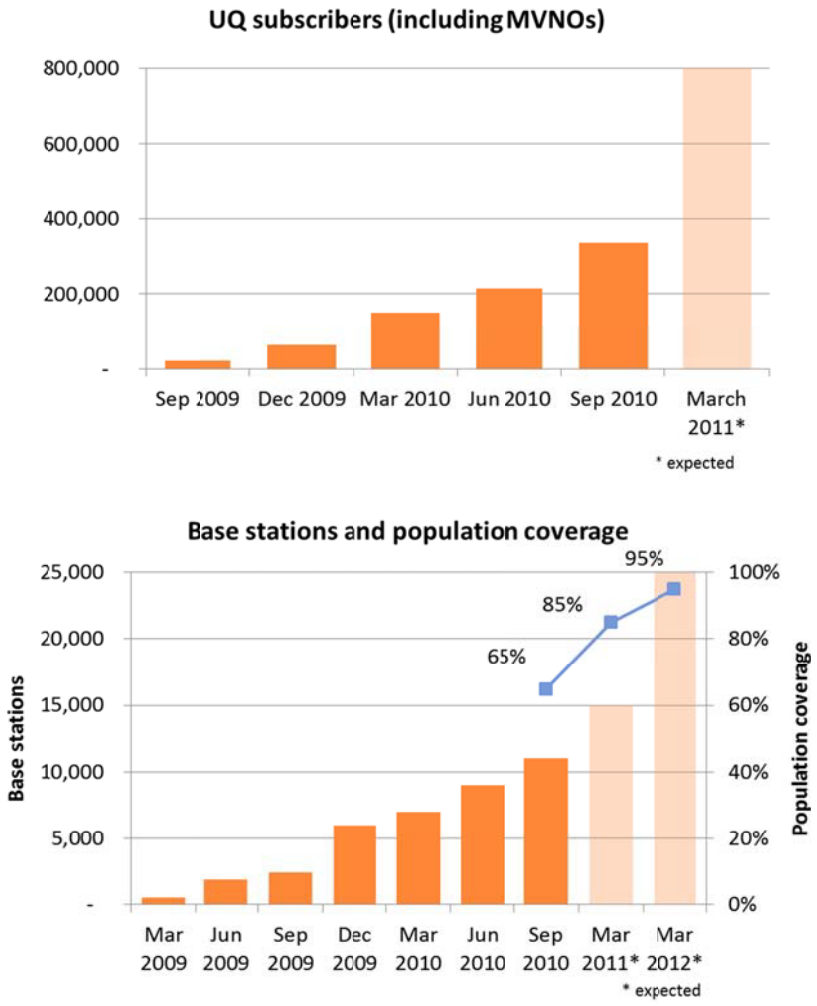

Figure 2. Subscribers, base stations, and population coverage (Source: UQ)

Figure 3. Base stations and antennas for rooftop installation (Source: UQ)

The smaller base station footprint made it easier for UQ to find suitable cell sites, and also accelerated the installation process: each cell site required three to four days for the complete installation and commissioning. Base stations and antennas are mounted quickly. The most time-intensive phase of the installation is the backhaul setup and the commissioning, from the RF survey and testing the base station's coverage and performance, to the fine-tuning of coverage and performance to the specific characteristics of the location.

Access to KDDI's fiber backbone and widespread availability of fiber connectivity in urban areas provide UQ with a reliable, high-capacity backhaul network. Only in a few locations does UQ employ wireless backhaul, which requires additional rooftop space.

From a coverage-driven to a capacity-driven network

While rooftop base stations provide the needed coverage across urban areas, they are not always sufficient to meet the capacity-density requirements, which keep growing as the number of subscribers increases. On average, UQ subscribers generate 7 GB per month of traffic, which is similar to the data traffic generated by Clearwire subscribers in the US but it is substantially higher than the traffic levels generated by cellular subscribers (500 Mb per month is common for smartphone users with data plans, and 2 GB for laptop users).

As a result, UQ is gradually increasing its focus on improving indoor coverage and on increasing capacity in those areas where it has established initial coverage. UQ is deploying multiple solutions for different environments and expected traffic loads. As new equipment solutions become available and subscriber usage patterns become better understood, this is an area of intense experimentation and rapid evolution.

UQ uses distributed antenna systems (DASs) where it has good access to buildings and where it can justify the higher cost associated with the installation of the equipment.

Picocells are also used, in both outdoor and indoor locations. Outdoor picocells can be used to improve indoor coverage in high-rise buildings where indoor equipment installations are too difficult to manage or backhaul is not available. In many environments, interference may severely impact the effectiveness of this solution.

Since the initial network rollout, UQ has deployed repeaters to improve coverage where needed. The repeaters extend

the coverage of a base station by transmitting traffic from subscribers who are close to the repeater.

UQ is increasingly interested in using picocells that, similarly to femtocells, use wireline connections for the backhaul. This approach relies on less expensive equipment, but it leaves UQ with little control over the subscriber experience, because the connection is shared, and UQ has no view into the performance of the backhaul link—or any way to manage it. In this solution, interference can be eliminated if picocells use a different spectrum channel. The management of a high number of picocells may, however, create substantial overhead at the access service network (ASN) gateway. To avoid overloading the ASN gateway that serves the macro base stations, UQ plans to manage picocells with a separate ASN gateway.

As it continues to assess the performance of different solutions for indoor coverage, UQ determines what the most effective solution is on a case-by-case basis. It is also working closely with KDDI to provide solutions specifically targeted to the enterprise. On a corporate campus, in offices, or at a warehouse, KDDI is typically the client-facing party that understands the specific performance requirements, while UQ is responsible for identifying and deploying the best-suited solution. This is an area with good growth prospects, but multiple equipment form factors and business models need to be explored before large scalable deployments can be rolled out.

Putting interoperability to the test

One of the big promises of WiMAX is interoperability across vendors. Because they want to offer a wide choice in subscriber devices, operators realize that interoperability between device and infrastructure vendors is required from commercial launch. There is however another level of interoperability—among network elements—that has not been extensively tested because, in initial WiMAX networks, operators have preferred to keep the number of equipment vendors to a minimum.

UQ has chosen since the beginning to work with Samsung as the main equipment vendor, but it has also integrated other base station equipment into the network. For the ASN gateway and the core network elements, UQ has worked with Samsung and other partners. The majority of large WiMAX operators choose multiple base station vendors, but they typically pick one vendor for each market. As a result, within each city or urban area all the handoffs are between base stations from a single vendor. UQ has pursued a different approach and installed some base stations from a variety of vendors within the markets deployed by Samsung, thereby having to support interoperability in handoffs between base stations.

According to Fumio Watanabe, CTO at UQ, “interoperability among vendors is not problematic if the network management functions are well implemented, and the interfaces between network elements are well defined.” To this end, UQ further defined the R6 interface that links base stations to the ASN gateway, to improve handoffs when base stations from different vendors are installed at contiguous locations.

Hyungwon Suh, President at Samsung Telecommunications in Japan, who has led the UQ project from its inception, took on this challenge as an in-depth test of the interoperability of WiMAX infrastructure outside the lab, in a commercial network. “UQ and Samsung had established a very close working relationship from the initial pilot to the commercial launch, and this enabled us to coordinate effectively our efforts to create a robust and fully interoperable multi-vendor network,” Suh said.

Unlocking the wireless internet

UQ presents a clear proposition to subscribers: free and unencumbered internet access, wherever they are. They can choose the devices they want, buy them in their favorite store, activate their plan and cancel it when they want, add another device to their plan, and access all the contents and application they want.

No longer do prospective subscribers have to go the operator's store. They can subscribe to the service online or through an MVNO partner. UQ has no retail stores, nor is it channeling precious financial resources into building a brand. Instead, it relies on partners with well-recognized brands to sell the service on its behalf. There are some UQ-branded devices, but subscribers are under no pressure to use them instead of devices they can easily buy in one of the major electronics stores. And in most cases, subscribers are not tied to the service provider for the long term, as UQ does not impose long-term contracts on its subscribers. If a subscriber uses the network only rarely, a pre-paid option is available for a one-day period.

To capture both heavy and light users, UQ has two plans. The flat plan provides unlimited access for a fixed price to users who want the freedom to use the network as they want.

Lighter users are better off with the step plan, with a very low, fixed monthly fee that provides a very limited traffic allowance (1.1 MB) but allows the subscriber to pay for additional use. The monthly fees are capped, so that regardless of traffic generated, the subscriber knows that the fees will not exceed the ¥4,980 (US$61) threshold on any billing cycle.

International roaming is the latest feature that UQ has introduced to its subscribers. The service is currently limited to the Clearwire network in the US, and to embedded laptops. But UQ is committed to expanding the roaming agreements to other operators, such as KT in Korea. Initially the roaming agreement simply allows the visiting subscriber to connect to the host network and to pay for access by credit card. Eventually, WiMAX operators expect to establish more streamlined roaming relationships that will allow visiting subscribers to be billed for host network access directly by the home operator (e.g., UQ subscribers visiting the US would be billed by UQ for accessing the Clearwire network).

Regardless of the plan they choose, all subscribers are treated equally. UQ has so far chosen not to manage network traffic with quality of service (QoS) or deep packet inspection (DPI), or by throttling heavy users, because it sees such interventions as they conflict with its stated goal to provide access to an open network. While steep increases in network load may require some traffic prioritization in the future, UQ prefers to increase network capacity to accommodate the additional traffic, rather than manage it in ways that could alienate its customer base.

This is perceived as an important market position for UQ, because most subscribers choose UQ for its superior performance to 3G cellular networks. Subscribers may see traffic management in a negative light, as a way for the network operator to impair subscriber experience and limit available resources.

Beyond the laptop

UQ has a bold device strategy for the long term. It envisions that subscribers will increasingly want to use multiple devices, many of which will be tied to very specific usage models (e.g., digital readers or game consoles). Most of these devices will have Wi-Fi, but the addition of WiMAX connectivity will increase the convenience of use, as WiMAX has broader wide-area coverage. Today, subscribers still predominantly use laptops, and this is reflected in the device lineup currently supported by UQ. To encourage the proliferation of connected devices, UQ has adopted a three-pronged approach.

First, UQ adopted a retail model for devices, which encourages subscribers to choose and buy the devices they want, and then register them on the network. At the same time, this approach entices manufacturers to develop a wide range of devices for the Japanese market, as they do not need to have distribution deals with UQ and its MVNOs to sell their devices.

Today, subscribers can choose from over 40 WiMAX-embedded laptops, multiple data cards and dongles, and Wi-Fi gateways, from ten manufacturers. While a few devices are UQ branded, the majority are directly sold by retailers. To ensure interoperability, all devices are required to have passed the WiMAX Forum certification process as well as the UQ WiMAX Certification Program, which tests specific functionality tied to the UQ network.

A second initiative was launched to accelerate device adoption. For a small (US$2) fee, UQ subscribers can add devices to their plan and log in to the network using the same authentication credentials. Only one device at a time can be connected. This prevents subscribers from sharing a plan with other people in an unfair way.

So far, few subscribers have selected this option, because in most cases they use the WiMAX connection for their laptop (UQ and its partners do not yet offer WiMAX smartphones)

Service plans	
UQ Flat	¥4,480 (US$55) per month for flat-rate service, with no contract requirements.
UQ Step	Subscribers pay a minimum of ¥380 (US$5) per month and receive an allowance of 1.1 MB. For additional traffic they pay ¥344 per MB (US$4), up to a maximum of ¥4,980 (US$61) for 14 MB. Any further traffic during the billing cycle is free to the subscriber.
UQ 1 Day	For ¥600 (US$7), occasional users can use the UQ WiMAX and Wi-Fi network for a period of 24 hours.
Options	
UQ Multi Device	Subscribers can use their connection on multiple devices, but only one device at a time can be connected. The subscriber pays ¥200 (US$2) per month per device, with a maximum of two devices allowed.
WiMAX Speed Wi-Fi	Subscribers with a Wi-Fi mobile router can connect multiple devices with Wi-Fi and use WiMAX for backhaul, at no additional cost.
UQ Wi-Fi	Free Wi-Fi access at UQ's Wi-Fi hotspots, which include railway stations, trains, airports, and subway stations.
World WiMAX	Roaming arrangement to use WiMAX outside Japan. Subscribers can connect to the local network and pay for access by credit card. Currently the roaming arrangement is limited to Clearwire, and it is free during the initial trial period.
Try WiMAX	Prospective subscribers can try WiMAX for free for 15 days. They receive a USB dongle or a Wi-Fi router from a retail store such as Yamada or Nojima.

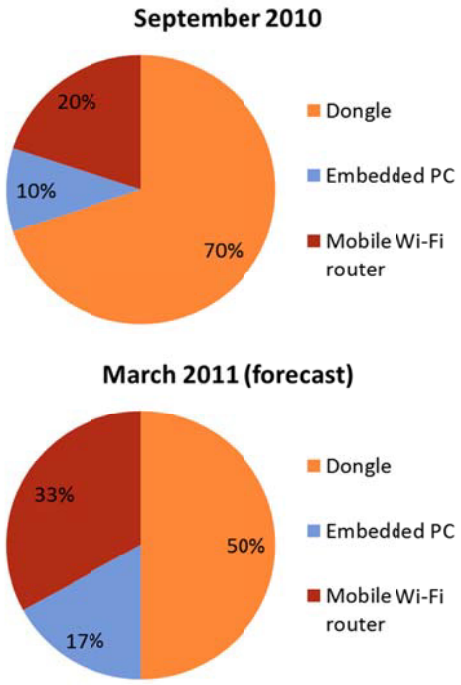

Figure 4. Device mix in September 2010 and March 2011 (forecast) (Source: UQ)

and they typically have only one. In the long term, however, this is likely to become a valuable option as non-laptop devices (e.g., tablets, e-readers, game consoles, or cameras) with WiMAX modules become available and subscribers wish to use them occasionally, but would not be willing to pay for a separate full service monthly fee for them.

The third initiative was to extend WiMAX coverage to multiple devices by offering WiMAX modems with built-in Wi-Fi routers, with the same service plans and pricing used for other devices. Effectively the Wi-Fi router creates a Wi-Fi hotspot to which all devices that support Wi-Fi can connect—e.g., smartphones, digital players, tablets, or e-readers—and connectivity to these additional devices comes for free under all service plans.

Due to the ubiquity of Wi-Fi connectivity in an increasing number of electronic devices, the Wi-Fi router has proved to be a huge success at UQ. By September 2010, 20% of subscribers have chosen a Wi-Fi router. By March 2011, UQ expects that 30% of subscribers will use a Wi-Fi router (Figure 4).

Who are the subscribers?

The initial expectation among WiMAX operators is that their core addressable market includes two main segments: those who lack good access to wireline broadband, and those who need a reliable mobile broadband connection—for instance real estate agents or people with long work commutes.

In Japan, high-speed wireline connectivity is widely available, so the first market segment is virtually nonexistent.

To its surprise, UQ found that while many subscribers belong to the second segment—subscribers who spend substantial time outside the home or the office—the strongest driver for subscribers is convenience of access.

While they value mobility, most of these subscribers use the service from a relatively small number of locations, suggesting that they use it most frequently from home or work. UQ estimates that up to 70% of its subscribers belong to this group. "These are likely to be the same subscribers that have cut off their fixed phone line and only have a mobile phone. WiMAX allows them to cut off another wireline connection," says Watanabe.

Many of these subscribers are students or young people who move frequently, or who spend substantial time outside their home and want to have a broadband connection that they can take with them.

Other subscribers may have home and office wireline connectivity, but find it convenient to keep using the wireless connection on their mobile devices throughout the day, regardless of location, simply because it does not require them to switch to the local wireline network.

Sharing the network with MVNO partners

Establishing a brand and building a retail distribution network are two major challenges for greenfield operators. These are very expensive efforts, especially in developed markets like Japan where broadband and cellular adoption is reaching the saturation level.

UQ took a unique approach. While it markets the service directly to prospective subscribers, it has decided to sell the service primarily through a wide range of MVNOs. Only a small number of subscribers—less than 10%—have a direct contract relationship with UQ. Most subscribers sign up with one of UQ's MVNOs.

The MVNO approach has enabled UQ to minimize the effort and cost of developing a brand, and to refrain from opening retail stores or launching an aggressive advertisement campaign. Instead UQ's message was spread by community-based contributions (Figure 5) that have been quite successful in generating awareness of the WiMAX service.

Figure 5. UQ ads featuring cats and dogs were created by pet owners and have been posted on YouTube (Source: UQ)

For a greenfield operator, the cost per gross subscriber addition (CPGA) can reach US$400–500. UQ was able to keep a very low CPGA and to contain its overall operating costs. Of course, service revenues to UQ are lower in the MVNO business model, because they have to be shared with the wholesale partners.

The decision to anchor the business model on MVNO relationships is a sharp departure from the approach, prevalent among both cellular and WiMAX operators, of focusing primarily on their own brand. Wholesale relationships with MVNOs are increasingly nurtured as a way to reach additional market segments, but for most operators, they account for a limited percentage of customers and revenues.

Interestingly, a similar change is under way at Clearwire in the US. In October 2010, the number of MVNO subscribers for the first time surpassed the number of Clearwire retail subscribers, who now account for only 36% of subscribers. The operator is also cutting back on its retail marketing and sales expenses. In the case of Clearwire, many wholesale subscribers appear to have signed up with Sprint, which has a relationship to Clearwire similar to that of KDDI to UQ.

UQ has lined up a wide set of MVNOs, which in addition to KDDI include electronics retailers and internet service providers.

UQ's publicly announced MVNOs	
Cellular operators	KDDI
ISPs	@nifty @T COM Bigloble So-Net
WiMAX operators	DIS Mobile
Retailers	Bic Edion Nojima Yamad Yodobashi

Figure 6. WiMAX subscriber devices at the Bic electronics store in Tokyo (Source: Senza Fili)

Electronics retailers sell the service in their stores (Figure 6) under their own brand, while usually acknowledging that they use UQ's network. In Japan, large retailers offer store-branded broadband services, and a WiMAX offering fits well within their business model.

ISPs similarly have added WiMAX to the range of wireless and wireline broadband services they offer. Prospective subscribers can choose from among multiple technologies the solution that best meets their performance requirements and budget.

In addition to the WiMAX-only plans, KDDI offers a combined WiMAX and 3G data plan involving a multimode dongle. This allows subscribers to use WiMAX where available and 3G elsewhere under the same contract.

While the MVNO is the client-facing entity, UQ is responsible for all the back office and customer support functions. As a result, the plans offered by MVNOs are the same ones offered by UQ, although each MVNO is free to set its own retail prices and offer promotions. In practice, however, the prices vary very little across service providers. This is not surprising, as significant differences in prices would likely trigger a price war that would not benefit any service provider.

According to its open-network policy, UQ is willing to establish an MVNO relationship with any service provider, and it is committed to treating them all equally and to applying the same per-subscriber charges. "A transparent and open policy for all MVNOs is crucial to establish strong relationships with service providers and provide the right incentives for them to sell the service," said Watanabe.

Moving to conquer vertical markets

At launch, PC-based subscribers were UQ's primary target. With the introduction of Wi-Fi routers, the scope has widened to include multiple Wi-Fi–enabled devices that share the WiMAX connection. UQ ambitions, however, go much further. By 2012, it expects that almost half of the connections will not be mediated by a PC device like a laptop or tablet, but instead will connect to application-specific consumer electronics devices (e.g., cameras, digital players and readers, or game consoles), vehicles, and machine-to-machine (M2M) devices (e.g., smart meters, home security and remote management, surveillance, or digital signage) (Figure 7).

WiMAX networks are ideally suited for vertical applications and M2M devices, as they support both high-bandwidth applications and a large number of end-point devices. For instance, WiMAX can connect embedded devices without the need for a subscriber identity module (SIM) card, thus lowering the cost of managing vertical applications in comparison to a Global System for Mobile Communications (GSM) cellular network.

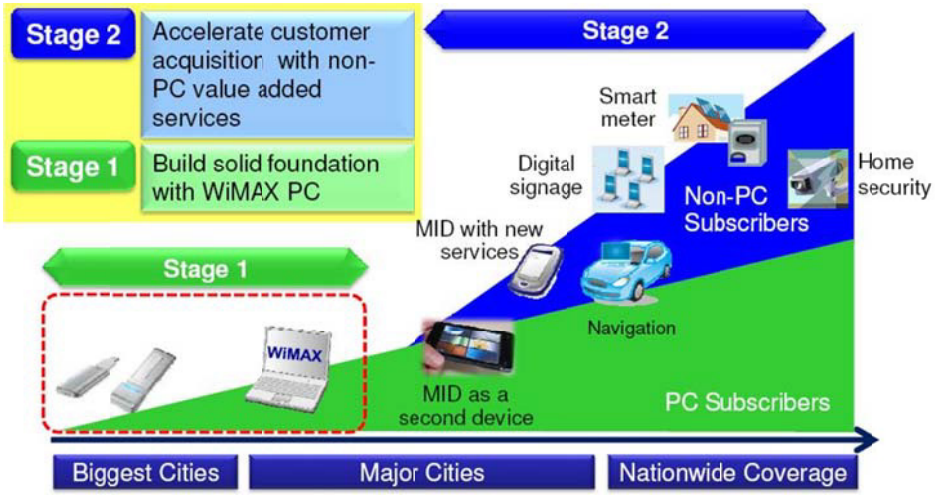

Figure 7. Expanding the market to include non-PC devices at UQ (Source: UQ)

UQ plans to capitalize on this opportunity and is working toward enabling vertical applications within its network. Direct wholesale relationships with utilities, public agencies, transportation operators, or content distributors are likely to be crucial to establishing large projects. In addition, the MVNO model used for retail subscribers could be effectively extended to other vertical applications where industry-specific partners can accelerate market penetration.

The partnership with JR East, a train operator, has provided UQ the opportunity to get involved in vertical applications—and in the public transportation segment in particular—from the beginning. In a country where public transportation is such an integral part of daily life for most people, this is a valuable expertise to have.

Figure 8. Narita Express train and digital signage in cars traveling to the airport (Source: Senza Fili)

Not only does UQ provide Wi-Fi coverage at many JR East stations, the Narita airport, and some subway stations, it also provides passenger access and digital signage on the Narita Express (Figure 8), which connects Narita airport to Tokyo. Train cars are equipped with Wi-Fi access points and WiMAX picocells to give passengers access. The backhaul connection from the train to the trackside uses a WiMAX modem that transmits to WiMAX base stations mounted along the tracks. For the train network, JR East was responsible for the installation and provides maintenance, while UQ manages and operates the network.

Since October 2009, UQ subscribers have had free access to the onboard network using either Wi-Fi or WiMAX. The broadband connection to the train also provides data feeds for the digital signage displays in passenger cars. Currently, the screens provide mostly travel-related information, but the broadband connection to the train makes it possible for the screens to display travel or other information that can be streamed in real time and depend on location, time, weather, or other criteria.

At stations UQ has worked with JR East to provide digital signage (Figure 9). A WiMAX modem is located behind each screen and is used to download the content to be displayed. As in the train, the information can be provided in real time.

WiMAX connections are also used in vending machines to provide buying advice based on the appearance of the customer (Figure 10). As the customer looks at the vending machine, a camera takes a photo and uploads it to an application that generates buying suggestions. The information is sent to the vending machine, which then displays the recommendation.

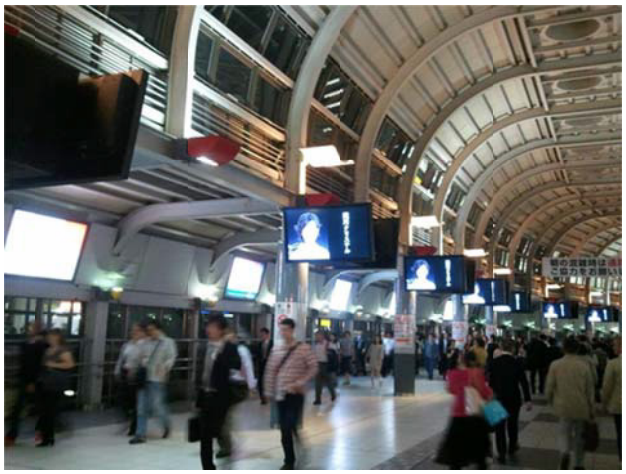

Figure 9. Digital signage at Shinagawa train station in Tokyo (Source: Senza Fili)

Figure 10. Screen of a vending machine with recommendations about beverages (the red heart icon indicates recommended drinks) based on customer photos transmitted over a WiMAX connection. (Source: Senza Fili)

Moving ahead

UQ operates in one of the most competitive wireless data markets—the first to see data ARPUs surpass voice revenues. UQ has been able to carve out a unique market position by focusing on network development and operators, and leaving the retail marketing and sales function largely in the hands of a wide network of MVNO partners, which include the mobile operator and shareholder KDDI, ISPs, and retail vendors.

UQ has also avoided following the mobile operator business model that is based on a tight vertical integration and offering highly branded services. Subscribers can buy the devices they want at the retail store of their choice, and are free to use the applications they prefer and to access the content they prefer. They are also able to use multiple Wi-Fi-enabled devices concurrently at no additional charge, as long as they have the WiMAX modem with the built-in Wi-Fi router.

As the number of subscribers and the amount of traffic they generate grows, UQ will have to expand capacity, especially if it wants to retain the unlimited flat-fee plans which set it apart from most cellular data plans. UQ is working toward obtaining additional spectrum to deploy WiMAX 2, the upcoming version of WiMAX based on IEEE 802.16m that operates in up to 40 MHz–wide channels and provides higher data rates. UQ and Samsung demoed the new technology in October 2010 and demonstrated downlink speeds of up to 330 Mbps using a 40 MHz channel (Figure 11). A trial with Samsung is planned for the first quarter of 2011. The network upgrade to WiMAX 2 is contingent on the availability of additional spectrum that makes it possible to use the 20 MHz channels, which provide a lower cost per bit than the currently used 10 MHz channels.

To fuel further growth, UQ will need to expand the network of MVNOs and deepen their commitment to selling the service. KDDI will be a crucial partner in gaining market share, as its service offering is highly complementary to UQ, and it could offload traffic from its heavy data subscribers to the higher-capacity WiMAX network. The multimode devices that KDDI has recently introduced will also be instrumental in widening the appeal of WiMAX—and of 3G as well. We expect UQ to take a more aggressive approach in the vertical application market. The smart power grid and, more generally, applications for utilities are areas that UQ has started to investigate actively. Further opportunities are available in the public transportation market in which UQ has been particularly active thanks to its relationship to JR East.

Figure 11. WiMAX 2 demonstration in Tokyo showing multiple concurrent high-definition video streams (Source: Samsung)

UQ efforts to bring the internet experience to the mobile world and to create a truly open network infrastructure have begun to bear fruit, and have established UQ as one of the mobile broadband operators most receptive to subscribers' needs and most supportive of innovative business models.

About Senza Fili

Senza Fili provides advisory support on wireless data technologies and services. At Senza Fili we have in-depth expertise in financial modeling, market forecasts and research, white paper preparation, business plan support, RFP preparation and management, due diligence, and training. Our client base is international and spans the entire value chain: clients include wireline, fixed wireless and mobile operators, enterprises and other vertical players, vendors, system integrators, investors, regulators, and industry associations.

We provide a bridge between technologies and services, helping our clients assess established and emerging technologies, leverage these technologies to support new or existing services, and build solid, profitable business models. Independent advice, a strong quantitative orientation, and an international perspective are the hallmarks of our work. For additional information, visit www.senzafiliconsulting.com or contact us at info@senzafiliconsulting.com or +1 425 657 4991.

About the author

Monica Paolini, PhD, is the founder and president of Senza Fili. She is an expert in wireless technologies and has helped clients worldwide to understand technology and customer requirements, evaluate business plan opportunities, market their services and products, and estimate the market size and revenue opportunity of new and established wireless technologies. She has frequently been invited to give presentations at conferences and has written several reports and articles on wireless broadband technologies. She has a PhD in cognitive science from the University of California, San Diego (US), an MBA from the University of Oxford (UK), and a BA/MA in philosophy from the University of Bologna (Italy). She can be contacted at monica.paolini@senzafiliconsulting.com.