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CASE STUDY

# Hong Kong Broadband Implements IPTV Solution on Cisco IP NGN Converged Infrastructure

Sponsored by: Cisco

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## INTRODUCTION

Hong Kong Broadband Network Limited (HKBN), a wholly owned subsidiary of City Telecom (H.K.) Limited (CTI), is a fixed telecommunications network services (FTNS) carrier operating in Hong Kong. Today, HKBN is the largest alternative residential provider of voice and broadband services in Hong Kong. HKBN's "Everything over IP" (EoIP) network is the basis for its successful multiplay strategy of offering 10,100, and 1000Mbps broadband Internet access, telephony, and digital/IPTV services to high-density, high-population areas in Hong Kong. In 2000, HKBN was granted a local wireless FTNS license, which it upgraded to a wireline-based FTNS license in 2002. HKBN also invested in Cisco Systems Metro Ethernet IP networking solution in 2000, with the carrier subsequently implementing the Cisco optical networking solution in 2002 to offer multiple services over a single, all-IP network to mass-market residential and small and medium-sized enterprise (SME) customers.

Currently, HKBN has 3,800 employees, with more than half (2,000) based in its call centers in Guangzhou, China. In early 2005, HKBN was funded to expand its network from 1.2 million to 1.8 million (roughly 80%) of Hong Kong's 2.2 million homes. By the end of 2005, HKBN expects to connect approximately 90% of its homes passed with self-owned fiber. According to cofounder and Chairman Ricky Wong, HKBN has "created a 'Reverse Digital Gap' whereby the mass residential market on City Telecom's network coverage now enjoys superior value and choice for broadband services."

Now, HKBN is tapping into the opportunities presented by IPTV — multichannel pay TV services delivered via Internet Protocol over broadband. IPTV is an emerging segment of the pay TV market that is poised to deliver a competitive shock to incumbent cable and satellite TV operators throughout the world. Major telcos across North America, Europe, and Asia have begun, or are planning, IPTV rollouts, with IDC forecasting subscribers to exceed 30 million worldwide by the end of 2009. IPTV is now a cornerstone of HKBN's suite of service offerings, enabled by its metro Ethernet network built with Cisco equipment.

## OPERATOR PROFILE

### Services Offered

HKBN offers fully integrated facilities-based telecommunications services, including unlimited broadband access, unlimited local voice, and more than 60 channels of pay TV, targeted to mass-market residential and SME customers in Hong Kong. According to HKBN, as of October 2005, it has more than 600,000 subscriptions across its data, voice, and video services and now is the largest alternative residential voice and broadband carrier in Hong Kong. HKBN is branching into corporate services, including carriers-carrier services for mobile operators and IP VPN for enterprise customers.

#### *Broadband*

Broadband penetration has reached 65% of households in Hong Kong, where many residents view broadband as a necessity for work, education, and entertainment. Hoping to capitalize on this belief, HKBN launched Ethernet-based broadband Internet access in 2000 with 10Mbps service, offering it at a price point below that of existing dial-up services. By year-end 2004, HKBN had successfully penetrated the Hong Kong market, with 201,000 broadband subscribers and a 14.5% market share.

In 2005, HKBN launched two new Ethernet-based symmetrical broadband services: 100Mbps and 1Gbps. The 100Mbps service is targeted to the mass-market consumer and retails for US$27 per month, whereas the 1Gbps service, which retails for US$172 per month, is a showpiece service intended primarily to illustrate the capabilities of HKBN's fiber network. As such, it is the first global offering of its kind and is a prime example of the advanced nature of Hong Kong's Internet access market. As part of the 1Gbps service launch, HKBN initiated a brand enhancement program designed to "crystallize [HKBN's] bandwidth advantage into revenue."

HKBN's broadband mantra is "Build it cheaper and better than DSL and they will come!" Thus, HKBN is positioning the 100Mbps as a premium commodity that provides productivity gains over legacy DSL services and enables subscribers to utilize their broadband connections for multimedia and other bandwidth-intensive applications. By pricing the entry-level 10Mbps service below dial-up and the 100Mbps service commensurate with legacy DSL offerings, HKBN is able to approach the mass market with price-competitive offerings. The majority of HKBN's recent subscriber additions have been 100Mbps users switching from competitors' DSL offerings or existing HKBN subscribers migrating from 10Mbps to 100Mbps.

#### *Local Voice*

HKBN launched its second service, residential local VoIP, in mid-2002 and today has more than 250,000 lines installed. HKBN's voice service includes a full suite of value-added services (VAS), such as call waiting, call conferencing, and voicemail as well as on-net and off-net VoIP services on other operators' networks, similar to offerings by Vonage and Skype. HKBN's local voice strategy is "value for money," with the service priced at between US$6 and US$16 per month. To prevent customer churn, the company requires local voice service subscribers to sign a 12–36-month contract.

HKBN is using VoIP as an entry point to up-sell customers on other “triple-play” (data, voice, and video) services. With this strategy in mind, HKBN launched its second-generation software-based VoIP phone service — 2b Broadband Phone — in October 2005. Once users install the broadband phone software overseas, they can make unmetered outgoing calls to and take incoming calls from any Hong Kong phone or 2b Broadband Phone user via their Hong Kong local number for a fixed monthly fee of US$6 without incurring international direct dial or roaming charges.

### *IPTV*

HKBN launched IPTV, the third prong of its triple-play offering, in 2003. Today, IPTV is the fastest-growing segment of HKBN's triple-play services portfolio. HKBN offers more than 60 pay TV channels with an emphasis on the Chinese language market. HKBN is targeting the lower end of the Hong Kong consumer market, with the foundation of its IPTV strategy based on upgrading consumers from terrestrial free-to-air services rather than from traditional pay TV services such as cable and satellite. Currently, the incumbent pay TV operator iCable has a strong presence in the market with 685,000 active video subscribers paying US$39 per month. In comparison, HKBN has 120,000 IPTV subscribers but charges US$16 per month for its service. HKBN continues to enhance its IPTV pay TV services with the mid-September 2005 launch of near video on demand (NVOD) programming.

## Market Strategy

HKBN has established itself as a significant market leader in Hong Kong. Even though it trails its competitors in terms of subscribers, HKBN has crafted a market strategy, enabled by its fiber network, that leaves it well suited to gain share in the years ahead. As it moves to compete against incumbents, HKBN understands that it cannot compete simply by being a "me-too" carrier. This approach has led to impressive subscriber growth and an even more impressive array of services.

### *Leadership and Innovation*

HKBN's most innovative approach has been to abandon legacy technologies and focus squarely on the potential of metro Ethernet. Unlike the incumbent telcos, HKBN was not tied to a legacy infrastructure. Therefore, HKBN did not have to justify the business case for a DSL-to-metro Ethernet migration strategy, making metro Ethernet the most cost-effective and service-efficient way for it to enter the hypercompetitive Hong Kong market. By utilizing metro Ethernet technology and equipment from Cisco, HKBN has been able to achieve an efficient cost structure and deliver multiple services over a single network for the low cost of about US$130 per home passed. The bandwidth enabled by the network has allowed HKBN to be innovative in its service offerings and, perhaps more interestingly, leaves it poised to be future-proofed against network enhancements conducted by core competitors. These efforts bode well for the future as HKBN attempts to leverage its strengths to capture share in the competitive Hong Kong communications services market.

### *Go-to-Market Strategy*

The underlying keys to HKBN's success range well beyond technical factors. The carrier espouses the view that although the right network enables competitive services, more important, the right business model is critical for sustainability. In much the same way that HKBN seeks to use its network as a competitive advantage, it also views a carefully crafted go-to-market strategy as a means to grow its subscriber base.

The guiding principle of HKBN's market strategy is its "50% cheaper or 10x faster" philosophy. HKBN is targeting the price-sensitive mass-market residential sector, traditionally underserved by other carriers, by undercutting its competition on price. Thus, its all-IP network, built with Cisco technology, provides HKBN with a huge competitive advantage, enabling it to focus exclusively on value pricing rather than penetration pricing and effectively target the mass market.

HKBN's near-term explicit goal is to commoditize broadband by making the 100Mbps service the de facto mass-market standard broadband offering in Hong Kong. Because of its investments in an all-IP network, HKBN is well positioned to achieve this goal by forcing a bandwidth explosion that DSL competitors are unable to match given their legacy networks. HKBN's first practical step toward commoditizing broadband was the initial launch of its service for free, with the goal of eventually converting broadband households into paid subscriptions — after the first year (2000) of offering free broadband, HKBN had successfully converted 87% of its free users to paying subscription-based services. Today, HKBN's focus is on up-selling rather than bundling, even though bundling is a part of the company's long-term strategy; HKBN believes the potential for near-term revenue and subscriber growth is greater by emphasizing each multiplay service individually rather than by bundling and locking subscribers into a package of multiple services from the same carrier.

## Network Architecture Overview

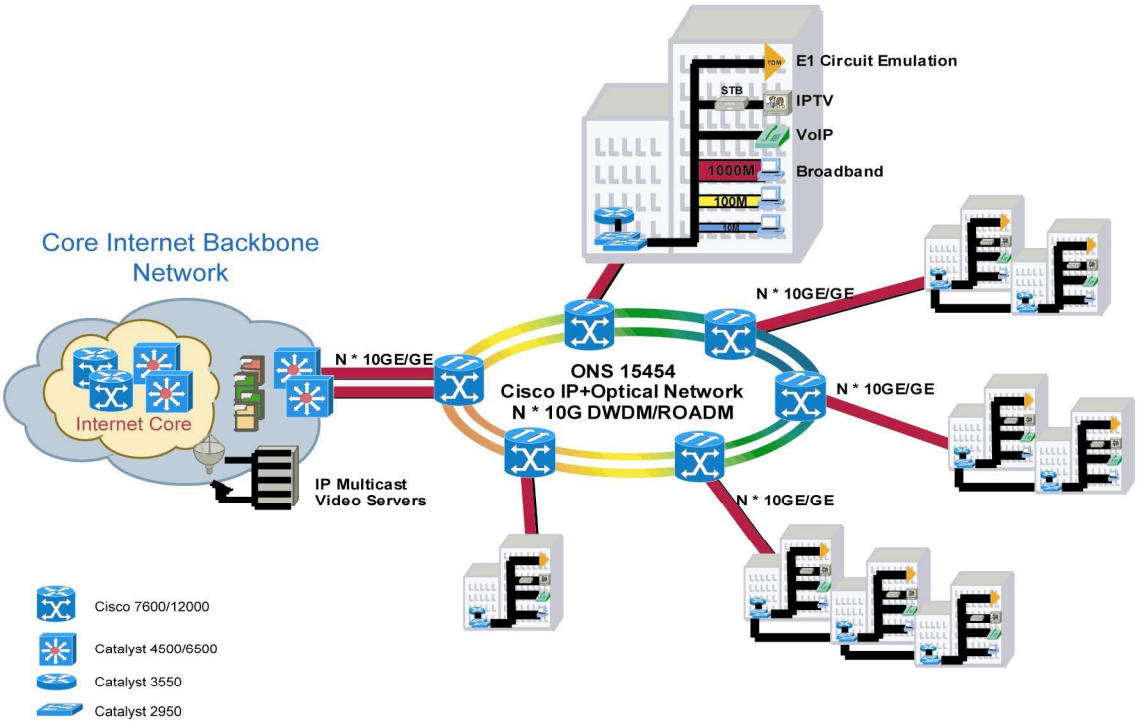
HKBN chose Cisco as the end-to-end network equipment supplier to build its metro Ethernet network; installation began in September 2001. Figure 1 depicts the HKBN metro Ethernet network and the different Cisco network elements that are used.

The HKBN metro core network is built around the carrier-class Cisco ONS 15454 SDH Multiservice Provisioning Platform (MSPP) with 10Gbps metro core transport infrastructure. The ONS 15454 MSPP combines multiservice transport, (i.e., SDH-based optical transport and DWDM transport) as well as support for data traffic, including various speeds of Ethernet. Key to HKBN's selection of Cisco as its MSPP supplier was the ONS 15454 support for resilient packet ring (RPR), the IEEE 802.17 standard. RPR takes the bandwidth of an SDH circuit and adapts it to handle packet (Ethernet) traffic more efficiently, at the same time preserving the sub-50-millisecond protection scheme of the SDH ring. The SDH level of resiliency is critical for HKBN because it is offering voice, IPTV, and business services with service level agreements (SLAs), all of which require protection above and beyond that of "best-effort" data connections.

**FIGURE 1**

HKBN Metro Ethernet Network Architecture Overview




Source: Cisco, 2005

Also part of the core is the MPLS network backbone, which was built using Cisco 7600 and Cisco 12000 series routers. IETF MPLS-standard technology is key for traffic engineering and quality of service (QoS) in an IP network. High backbone throughput was needed for the more than 60 IPTV channels offered to customers.

From the core, optical fibers connect from Cisco ONS 15454s to Cisco Catalyst 4500 Series Ethernet switches at aggregation nodes, or "mini POPs," located at HKBN's network edge. These mini POPs are essentially distribution sites from which traffic can be fanned out to groups of multitenant units (MTUs) in neighborhoods. Connections from the core to the mini POPs are at n x 1Gbps Ethernet, depending on the density of the neighborhood. Within the MTUs, HKBN uses Cisco Catalyst 3550 Series products as distribution switches in the buildings' basements that are optically connected at n x 1Gbps to the mini POPs as well as connected to Cisco Catalyst 2950 Series products used as access switches on riser floors using 1Gbps fiber or copper connections. Throughout the MTUs, HKBN has wired Category 5 copper cabling from access switches for connections to end customers with bidirectional 10/100Mbps bandwidth. Currently, more than 30,000 access switches are in the network.

Because of the complexity of building out a network for triple-play services and the requirements for strict, end-to-end QoS for clear service differentiation as well as

consistent services behavior across the network, HKBN wanted a single supplier for its network infrastructure. After a thorough evaluation, HKBN selected Cisco Systems because the vendor had all of the necessary pieces, from CPE switches through MPLS core, and was already a long-time supplier to HKBN's parent, CTI. In addition, Cisco supported key industry standards, such as the IEEE's RPR (discussed above) and 802.1q QinQ tunneling, which extends VLAN boundaries for business transparent LAN (TLAN) services and greater scalability in switched Ethernet networks. Cisco also offered value-added features, such as multicast VLAN registration (MVR) along with IGMP snooping and filtering, which uniquely optimizes the multicast distribution network. This functionality increases the scalability and reduces the multicast replication and also treats and protects video traffic separately from data traffic on the network — another key feature for reliable IPTV services.

## BUSINESS CHALLENGES

### Local Market Profile

Hong Kong is a densely populated city, home to more than 7 million people and 2.2 million households. Six active facilities-based telecom carriers operate in Hong Kong, and they are all backed by large financial shareholders. Additionally, several local alternative carriers are aggressively launching their own next-generation services, making Hong Kong one of the most competitive and open markets in the world today.

Hong Kong is also one of the most advanced global Internet markets, with broadband household penetration levels reaching 65% at the end of 2004. The most formidable competitor — PCCW — is a large private entity currently delivering a minimum of 6Mbps broadband access via DSL to 95% of Hong Kong's population. Hong Kong's residents already have a wide choice of broadband services based on pricing, technology, and content from multiple carriers.

### IPTV Services

#### *Competitive Situation*

Pay TV service enabled by the emergence of IPTV is a new frontier for broadband and voice carriers. Although IPTV is a worldwide phenomenon, it is particularly well suited to Hong Kong because it features an urban population highly concentrated in large high-rise apartment buildings. Hong Kong is already a major IPTV market because of PCCW's success in growing its subscriber base to nearly half a million.

Although the Hong Kong pay TV market is competitive, it has some unique characteristics that are key to HKBN's video strategy. Unlike the population in countries where the pay TV market is saturated, more than half the population in Hong Kong does not subscribe to pay TV services. As a result, a huge untapped market opportunity exists, particularly for an innovative carrier such as HKBN seeking to attract unattached terrestrial TV viewers rather than compete with incumbents for existing pay TV subscribers.

### *HKBN Strategic Objectives*

For HKBN, the decision to launch IPTV was simple and logical — doing so enabled HKBN to leverage the capabilities of its next-generation metro Ethernet network and fill up the pipe to the home with bandwidth-intensive applications. Moreover, IPTV presented HKBN with an effective present-day strategy for growth and a longer-term means of creating further network-enabled differentiation.

Because of the existing combination of limited free-to-air Chinese channels, low entrenched pay TV penetration, and an abundance of alternative sources for Chinese language content, Hong Kong is a unique video market. Given these conditions, HKBN has positioned its IPTV solution as a free-to-air supplement rather than as a direct competitor to iCable and PCCW, which have almost exclusively targeted their offerings to premium subscribers. HKBN sees no near-term need to offer more costly premium content, such as HBO and CNN, to its subscriber base because its video customers either have not been interested in premium programming or cannot afford these services. Instead, HKBN is pursuing local content and programming, including self-produced educational content, local interest programming such as politics and sports, and specialty programming such as J-League Soccer from Japan and Chinese opera and tourism.

HKBN's IPTV strategic objective is to attract new subscribers, change their video consumption habits (i.e., get them hooked on pay TV services), and eventually convert them into paying customers. Consequently, HKBN has replicated its broadband strategy of seeding the market with free service by offering a one-year IPTV trial to new customers. HKBN's unique value proposition is its ability to deliver more value at an aggressively lower price point than its competitors offering free-to-air or premium services. As a result, HKBN believes that it can be profitable at a fraction of its competitors' current pay TV services ARPU precisely because of its content choices and comparatively low network operation costs.

## HKBN AND CISCO STRATEGIC PARTNERSHIP

### Technology Selection

As a relative newcomer to the highly competitive Hong Kong communications market, HKBN was not burdened with a legacy switched voice and data network. Consequently, HKBN's technology decisions have driven its innovative service offerings and go-to-market strategy. HKBN's ultimate goal was to drive subscriber usage and ARPU toward long-term profitability. As such, it required a highly scalable and robust network that would enable it to offer feature-rich content such as IPTV on top of basic broadband. However, HKBN was limited to either leasing connections from a wholesale carrier or investing in building out its own “greenfield” network.

Initially, HKBN chose to lease circuits from other carriers to supplement its own network, which utilized cable modems over in-building HFC supported by wireless local multipoint distribution service (LMDS) to form a trunk network. Although LMDS is a line-of-sight technology that purportedly provides access services to subscribers within a five-mile range, HKBN experienced numerous implementation issues, network congestion, and network quality issues related to its LMDS network. These issues, coupled with HKBN's desire to not rely on other operators for basic transport

access, eventually drove its decision to partner with Cisco and build its own IP backbone based on an optical metro Ethernet network.

## Vendor Selection

For a fast-growing company such as HKBN, "total investment protection" was critical. HKBN wanted a vendor that could provide technology and R&D that would lead to new commercial opportunities. Moreover, given Hong Kong's extremely competitive telecom market, a "me-too" network was not an option. Therefore, vendor selection was not about which vendor could help HKBN build the cheapest network but rather which vendor presented the best business case. Cisco successfully met and continues to meet that challenge.

After HKBN's initial HFC network deployment failed to deliver the competitive advantage necessary for a successful and competitive market entry, Cisco, also HKBN's HFC partner, recommended that HKBN move to an all-IP Ethernet-based network. Cisco's brand was an important consideration for HKBN, particularly for a new entrant to a highly competitive telecom market with a well-established incumbent. Even more important, though, was that Cisco, at the time, was one of the few vendors offering integrated IP solutions for data, voice, and video. This critical factor, which helps reduce both points of contact and time to market, further tipped the scales in Cisco's favor.

For HKBN, the benefits of the Cisco partnership are multifaceted. Cisco's market leadership and metro Ethernet solutions expertise have enabled HKBN to make effective network buildout decisions. Yet, Cisco's role has not ended with the completion of the network design and construction. Rather, the company’s recently implemented and innovative Cisco Powered Network QoS Certification further augments HKBN's ability to drive new business and enhance existing service delivery. Membership in the Cisco Powered Network Program and one of the first recipients of the new QoS certification mean that HKBN's network is constructed over an end-to-end Cisco infrastructure, that a third party has conducted an onsite assessment, and that the network meets Cisco's best practices and standards for QoS. This includes interconnect requirements for the delivery of real-time video or voice packets from customer edge to customer edge. Carriers such as HKBN, which is one of four global carriers that have so far received the Cisco Powered Network QoS Certification, can use the Cisco certification as a means to establish credibility and network reliability as well as craft SLAs with a greater degree of confidence.

Cisco Powered Network QoS Certification is valuable for HKBN on several fronts: It enables HKBN to differentiate itself even further from its DSL competitors. Moreover, it puts HKBN in position to expand its customer base and enter the commercial managed services market by targeting the enterprise sector in Hong Kong. Equally important, Cisco Powered Network QoS Certification assists HKBN in gaining valuable market mindshare for its willingness to invest in the latest technology and a state-of-the-art network, which Cisco refers to as an IP Next-Generation Network (NGN).

### Network and Business Strategy Synergy

HKBN's state-of-the-art IP NGN converged network is a critical competitive differentiator for the operator vis-à-vis its DSL competitors. Even though HKBN's primary focus today is the mass-market consumer, its network architecture decisions leave it well positioned to be flexible and aggressive with its video strategy in the future. Rival IPTV deployments have considerable bandwidth constraints, limiting the number of streams that can be delivered to a given home at one time and severely impacting the carrier's ability to migrate to high-definition video services in the future — a 6Mbps DSL-based service simply does not have the necessary bandwidth for HDTV.

HKBN has bandwidth to spare, without the need for additional capital expenditures and network enhancements. By opting for an IP NGN converged infrastructure, HKBN has future-proofed itself as it moves beyond basic IPTV services and toward bandwidth-intensive multichannel HDTV. In addition, incumbents ultimately will be on the defensive because they will require infrastructure rebuilds simply to be able to compete. HKBN's strategy of commoditizing 100Mbps broadband achieves precisely the same goal.

Looking forward, HKBN's IP NGN infrastructure will enable it to expand beyond the mass market and into the market for carriers-carrier for mobile operators. HKBN also plans to penetrate more deeply into the enterprise market through the delivery of multinational corporate-style services such as IP VPN to the SME segment. Over the next three years, HKBN expects to expand its corporate network coverage from 600 to 1,500 buildings.

## FUTURE OUTLOOK

Although HKBN has yet to capture international IPTV mindshare as PCCW has, HKBN is still very much on the cutting edge of IPTV deployments; with roughly 120,000 IPTV subscribers today, HKBN is in the process of proving the soundness of both its technology and subscriber acquisition strategies. However, HKBN faces the challenges associated with convincing consumers who have not previously subscribed to pay TV to sign up for its IPTV service.

HKBN continues to focus on building out its Ethernet network to extend the reach of its services and increase subscriber growth in existing homes passed. Still, with much of its IP NGN converged infrastructure already in place, it will be more interesting to watch how HKBN leverages its network investments over the next several years to increase ARPU as its "Everything over IP" strategy leaves the door wide open for numerous future initiatives.

At the most basic level, HKBN could opt to offer more channels because the IP NGN architecture avoids the spectrum limitations inherent in current cable HFC pay TV implementations. More channels would enable HKBN to offer several tiers of service to further up-sell to new and existing subscribers. HKBN could also opt to expand its on demand offerings by building upon its recently launched NVOD service. Although this option would be reasonably simple from a technical perspective, a compelling business case would be required to justify the investment in both equipment and content. Appealing to a mass-market audience might preclude a VOD offering from

being commercially viable in the short term. Nevertheless, the option exists for the future: VOD may not be viable today, but it could allow HKBN to compete effectively for premium subscribers in the future, particularly as these subscribers migrate to HKBN for high-bandwidth broadband access. Essentially, with a IP NGN converged network in place, HKBN can treat these issues simply as business decisions and not as technology-related roadblocks.

Going forward, the ability to deliver high-definition content will be perhaps the most advantageous feature of HKBN's network. Already on HKBN's forward-looking strategic plan, HDTV is poised to be a means for the carrier to create significant competitive differentiation. With legacy DSL carriers likely unable to offer high-quality, high-definition content in advance of a network rebuild, HKBN will be better positioned to serve existing subscribers and in fact may have something approaching a “killer application” to attract customers from other carriers.

## ESSENTIAL GUIDANCE

### Lessons Learned

Network carriers and equipment vendors worldwide would be wise to learn from HKBN's experience. Even though much of HKBN's success has been aided by the unique characteristics of the Hong Kong market, such as high population density, which facilitates a reasonably quick and inexpensive metro Ethernet network buildout, HKBN effectively illustrates how a carrier can start from scratch yet compete in a highly complex and competitive market. Moreover, with no legacy network in place, HKBN has been able to focus almost exclusively on rolling out new services without the need to maintain support for an existing subscriber base on an outdated technology platform. As such, HKBN is a model multiplay carrier.

The important role played by a network solutions vendor in enabling a carrier to perform effectively in a highly competitive and fast-moving market is one of the key lessons others can learn from HKBN's achievements. To date, HKBN has achieved phenomenal success largely because of its partnership with Cisco, an industry-leading solutions vendor that has helped HKBN design and execute an IP NGN converged network architecture. Consequently, HKBN's all-IP network allows the carrier to offer triple-play services at affordable prices because its network costs are so low, activate new subscribers in a relatively short time frame, and ultimately lead the market with a strong technology foundation that enables innovation.

As HKBN moves beyond consumer services and toward expanding into the business sector, the carrier also benefits from its ability to leverage its partnership with Cisco to gain validation in the marketplace for its converged multiplay services portfolio and its role as an emerging alternative carrier. This is achieved through ongoing assessments, network enhancements, and QoS certification.

### Recommendations

Going forward, HKBN has much to consider. Although still an upstart challenger to well-established incumbents, HKBN is poised to gain share across the multiplay segments of broadband, voice, and video. HKBN's broadband experiment of "giving away" service to

attract subscribers is now being applied to the video segment and seems well on its way to generating growth. Moreover, the carrier's strategy of commoditizing 100Mbps broadband service — speeds in excess of those associated with competitors' offerings and current capabilities — both drives subscriber growth and undercuts the competition's ability to respond. Pursuing parallel strategies of growing each business segment individually further paves the way for up-selling additional services to subscribers.

However, challenges and threats remain. HKBN trails its competitors despite aggressive growth plans, and although capital and operational expenditures may be manageable, subscriber growth is ultimately the key to long-term viability. As such, HKBN's mass-market approach is fraught with risk — appealing to dial-up customers with 10–100Mbps broadband and to terrestrial TV viewers with more than 60 channels of pay TV is a means to grow the overall market rather than create churn within the incumbents' subscriber bases. Yet, the incumbents' customers are the ones demonstrating an inclination for advanced services and a willingness to pay for them. Thus, in advance of consumers' desire or need for ultrafast bandwidth, the pricing game might be HKBN's most realistic marketing strategy and one that may be required to drive ARPU and attract advanced users, including those interested in premium television content and VOD. Nevertheless, these are strategic decisions for the future and can evolve as HKBN focuses on its primary growth objectives through current tactics.

HKBN's greatest strength remains its Cisco IP NGN converged infrastructure, which enables the carrier to stay flexible with its business strategies. When bandwidth is plentiful, as it is with HKBN's all-IP network, a migration to HDTV, support for real-time online multiplayer gaming, the launch of integrated voice and video communications solutions, or value-added broadband services is a natural service evolution. Therein lies HKBN's long-term advantage over its competitors, even though this advantage might eventually be neutralized by another carrier's metro Ethernet buildout. As such, advanced ARPU-driving services should be on HKBN's road map. At a minimum, these services can help HKBN achieve parity with emerging competitors. At best, they can help HKBN differentiate itself from such competitors.