Trends in the U.S. Communications Equipment Market: A Wall Street Perspective

Paul A. Bonenfant and Simon M. Leopold, Morgan Keegan & Co., Inc.

ABSTRACT

After years of decline, we exit 2005 predicting that U.S. telco capital expenditures (capex) spending could approach double-digit year-over-year growth in 2005 with spending into 2006 focused on broadband access, wireless, and (later) carrier-grade Ethernet initiatives. This article provides a Wall Street analyst's perspective on select trends in the communications equipment market, with a view toward what the future might hold for the telecommunications industry.

INTRODUCTION

After years of decline we exited 2005 predicting that U.S. telco capital expenditures (capex) spending could see double digit year-over-year growth in 2005 with expectations for spending into 2006 focused on broadband access/fiber to the x (FTTx), wireless, and later on carrier-grade Ethernet initiatives. In this article we provide a Wall Street perspective on current trends in the communications equipment market, with a view toward what the future might hold for the telecommunications industry. As sell-side analysts, we provide equity research to institutional and individual investors, with a coverage universe (stocks we cover) that emphasizes North American telco equipment vendors. The recent (some may say long-awaited) improvement in U.S. carrier spending is driven by intensifying competition for subscribers. To remain competitive, carriers need to broaden services, which requires network upgrades, and offer compelling product pricing, which dictates the need for a lower-cost network infrastructure. Furthermore, carriers strive to converge various overlay networks. Carrier spending (and hence communications-equipment vendor health) is materially influenced by these requirements, and we focus on two key trends:

- The evolution of broadband access and the battle between incumbent telco carriers, primarily the RBOCs — BellSouth, Qwest, AT&T (formerly SBC), and Verizon — and cable television providers or multiple systems operators (MSOs, e.g., Comcast, Time Warner, Cablevision) to offer "triple play" services
- The emergence of carrier-grade Ethernet as a service interface to Enterprise customers, augmenting and eventually supplanting traditional private line technology, and as a low-cost infrastructure alternative for access interconnection and transport

Other factors, including wireless subscriber growth and the ever-increasing expansion of wireless service offerings via second- and third-generation wireless network technologies, also materially affect carrier spending, but this represents a steady network evolution in our view relative to the sea change inherent in the trends mentioned above.

Although we focus on North America, global markets are evolving, and are often ahead of the United States. For example, high-speed data penetration in many nations, including Japan and Korea, exceed that of the United States, and carrier-grade Ethernet deployment is happening faster in Europe than in the United States. The influences of geography, regulations, legacy networks, and the telco–cable battle for broadband subscribers, make the U.S. market unique, yet in other ways indicative of broader, worldwide trends.

As Wall Street analysts and industry veterans, we attempt to identify investment opportunities within the communications equipment sector. While we do not make specific stock recommendations in this article, we hope to shed light on the data that we and others in the investment community consider. Competition among carriers, network evolution, and service-provider-spending growth create opportunities for vendors. While the vendor community has shrunk as measured by employment, market capitalization, and sales, many vendors now generate profits and are poised to grow, albeit at a more modest pace than in the telecom bubble. This allows investors to consider the actual earnings and cash flow of a prospective stock relative to its price, rather than simply consider total sales versus market capitalization and comparable values, as was often done during the telecom bubble at the beginning of the decade.

Paul Bonenfant has no financial interest in any of the companies mentioned in this article.

Simon Leopold has no financial interest in any of the companies mentioned in this article except for his ownership of shares of Verizon.

0163-6804/06/$20.00 © 2006 IEEE

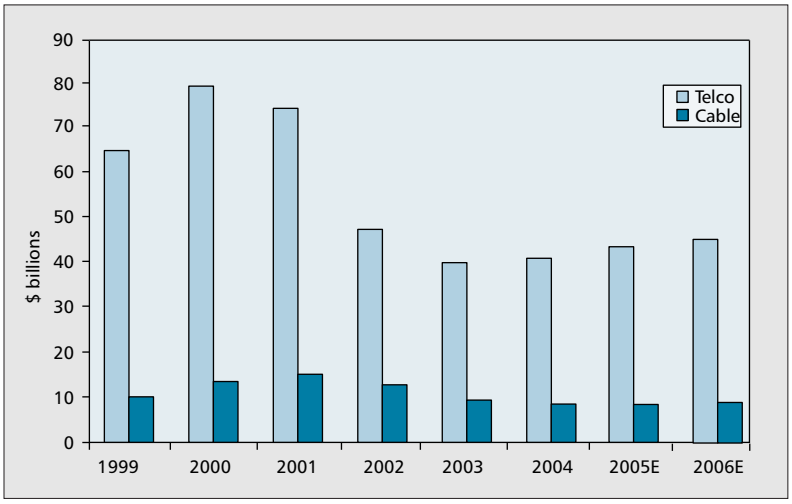

Figure 1. *U.S. telco and cable capex [1].*

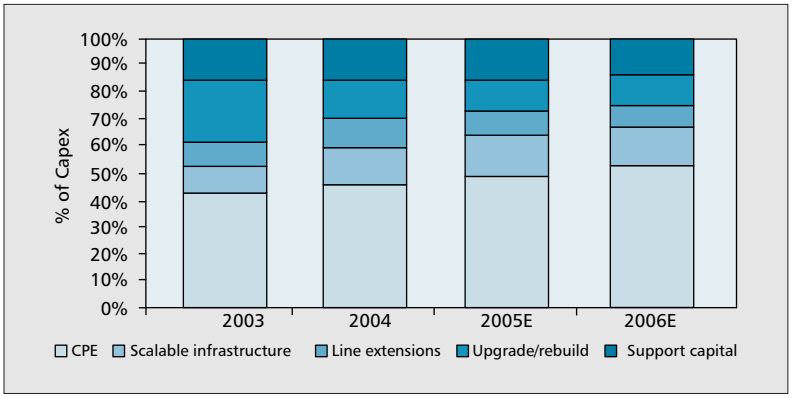

Figure 2. *Cable capex shift [1].*

Telco and Cable Capital Expenditures

We monitor capex as an indicator of the communications equipment industry's health. After years of decline following the spike from the "Optical Bubble" we see signs of improvement (Fig. 1). For example, in the first three quarters of 2005, U.S. carrier spending rose 14 percent, 15 percent, and 7 percent year-over-year, respectively, providing a positive indication for the industry. Carrier comments regarding future spending also contributed to a positive bias. During 2005 Verizon raised year-over-year capex guidance from 10 percent to 15 percent, with a focus on wireless infrastructure and FiOS (Verizon's FTTx initiative), while AT&T indicated that the second half of 2005 would see increased spending on network infrastructure and outside plant upgrades in support of Project Lightspeed (AT&T's FTTx initiative).

As a result, our outlook for 2005 improved and we exited the year predicting that carrier capex could grow 9 percent over 2004, up from a 5 percent estimate formulated during 1Q:05, with expectations for 2 percent year on year growth in 2006. We enter 2006 with a bias towards greater growth, yet still expect a slowdown from 2005. Within the investment community, upward estimate revisions are regarded positively. Our model reflects the seven largest wireline and six largest wireless carriers in the United States. This group represents the vast majority of U.S. equipment spending and provides a good indication of the overall trends. The communications equipment industry appears stable; in fact, exiting 2005, our models for twelve vendors with high US exposure reflected that equipment vendor revenue could grow 13 percent year-over-year in 2005 and a further 6 percent in 2006. Although carrier capex and vendor revenue are loosely correlated on a quarterly basis, the two tend to align on an annual level. Factors that cloud quarterly comparisons include non-equipment spending (e.g., real estate) and accounting issues related to the timing of revenue versus expense recognition. Spending on network equipment represents 30 percent to 40 percent of capex, and other items include outside plant components, real estate, capitalized software, and capitalized labor. Furthermore, the vendors in the model derive varying sales percentages from non-U.S. customers.

Cable operators also spend material capital, although still much less than the telcos (Fig. 1). Our models, based on the six largest MSOs in the United States, suggested that cable capital spending could see a 1 percent year-over-year increase in 2005 driven by a 3 percent drop from the largest cable carrier, Comcast, followed by a 5 percent increase in 2006.

The changes to aggregate cable capex could be deceptive, though, as the spending mix shifts (Fig. 2). Cable carriers report capex in five categories: customer premises equipment (CPE), scaleable infrastructure (head-end equipment in serving offices), line extensions (fiber/coaxial cable, electronic equipment), upgrade/rebuild (costs to modify or replace existing fiber/coaxial cable networks), and support capital (costs associated with non-network equipment, land, buildings and vehicles). Cable carriers are likely to increase spending on CPE to grow digital video recorders (DVR), add voice over IP (VoIP), improve digital penetration, and support high-definition TV (HDTV) services. Scaleable infrastructure grows in our estimates, too, from networking equipment to support new "triple play" (voice, video, and data) services and increased bandwidth per subscriber. Spending on line extensions and upgrade/rebuild could slow, while support capital tends to hold steady in our models.

Cable carrier investment has gone through three stages, and peaked in 2000–2001:

1. Hybrid fiber/coax (HFC) infrastructure upgrade (complete): This "field of dreams" network build was a huge investment (e.g., Comcast, the largest U.S. MSO spent $39 billion since 1996) and it offers MSOs a near-term competitive advantage with a broadband pipe into the home for advanced service offerings.
2. Digital set-top boxes in the home (ongoing): The conversion from analog to digital cable TV service is an evolutionary process, as an increasing percentage of cable subscribers are migrating to digital.
3. Core network upgrades (ongoing): MSOs

continue to upgrade to high-bandwidth transport in the backbone network in order to support emerging bandwidth intensive services such as 100+ Mb/s high-speed data and high definition TV (HDTV), and migrate to an all-IP infrastructure.

THE TELCO–CABLE BATTLE FOR SUBSCRIBERS

In the United States, cable and telco service providers are locked in a battle for survival from which the vendors can benefit. Pundits speak about the triple play of voice, video, and data, and often discussion focuses on technology, but from the consumer's perspective the battle is centered on offering a "better bundle" of services. The better bundle includes four services: voice, a rich video service, high-speed data, and mobile service. The bundles may vary based on the degree providers blend services (e.g., a single mobile and wireline voicemail box). Some carriers may embrace a blending concept called Internet multimedia subsystem (IMS) that provides an architecture-to-service integration. Studies have shown that customers become "stickier" with bundles (i.e., customers become less likely to alter service providers for an element of a bundle than if service subscriptions come from multiple providers). Service providers will compete for greater share by bundling services at lower prices, creating a potentially deflationary trend as consumers pay less for more services. This puts pressure on carriers to lower network infrastructure costs (in order to reduce cost per bit to provide service) and has a rippling effect, forcing communications equipment vendors and their suppliers to lower prices — signaling that vendor earnings will continue to be squeezed as the battle for subscribers intensifies.

Having invested heavily in HFC network upgrades over the last 10 years, MSOs appear well-positioned in the broadband battle, with a fat pipe into the home that they are leveraging to offer triple play services. For the MSOs, the service enhancements are evolutionary and not revolutionary from a basic network perspective.

The growth of cable MSO phone service concerns telcos. MSOs are rapidly taking voice-subscriber share from telcos. While some MSOs have offered voice services via circuit-switched technologies for years, Q2:05 may have represented an inflection point for cable voice services via VoIP, as discussed below. Telcos appear to be playing catch-up with recently launched upgrade initiatives. Losing voice customers to MSOs at an alarming rate is an effective motivator, and we expect continued spending on telco access upgrades, including investment in existing DSL infrastructures, FTTx (x: node, curb, premises, home, etc.) initiatives, migration to an all-IP network, and related backbone upgrades. Wireless keeps telcos competitive because they can leverage the service to turn triple play into a "better bundle" with this fourth service. Telcos have gained ground in high-speed data, yet hold only 44 percent of the market share in the U.S versus the global DSL market share of nearly 70 percent in 2005, in our models. Debate continues about the rate that telcos can enter the video market. We note that telcos have received regulatory relief in Texas that allows them to receive a single statewide video franchise rather than a town-by-town approach (as cable TV operators were required to do), and similar votes are expected in New Jersey and other states.

THE CABLE VS. TELCO IMPERATIVE

Cable carriers and telcos view each other as competitors, more so than they do their own peers. The increasingly direct competition creates an incentive for network evolution and investment.

While the HFC network provides MSOs with the broadband pipe to the home, MSOs will still spend on infrastructure as they migrate to an all-IP infrastructure and upgrade their transport backbones to support additional bandwidth and service requirements. Cable networks were originally designed for broadcast video, and the shift to on-demand services, higher bandwidth, and increased service quality stimulates spending. MSOs must continue to free up the traditional analog bandwidth and move to digital in order to support higher data rates, VoIP, HDTV, and (eventually) Internet Protocol-based TV (IPTV).

Cable broadband service and cable modems are built on the data over cable service interface specifications (DOCSIS) platform, which is evolving toward higher data rates with increased upstream/downstream (upload/download) bandwidth symmetry — upwards of 200 Mb/s to the home using the equivalent of four cable channels (via cable channel bonding like DSL) and the new DOCSIS 3.0 specification. For MSOs, this largely entails upgrades to head-ends and CPE, as the capital intensive HFC network (broadband pipe) is already in place.

The telcos, on the other hand, are playing catch-up to establish an equivalent broadband pipe to the home, either via enhancements to DSL, or via FTTx. For example, fiber to the node (FTTN) and fiber to the curb (FTTC) deployments drive fiber closer to the subscriber, relying on enhancements to DSL over existing copper pair(s) to support higher-bandwidth services into the home. DSL enhancements such as ADSL2+ and VDSL2 offer upwards of 40+ Mb/s, but this is an upper limit that is strongly influenced by the loop length (distance between the network electronics and the subscriber) and the quality of the copper plant. Higher bandwidth can be achieved via so-called channel bonding, an option available for homes served by multiple copper pairs. The option of deploying fiber to the premises (FTTP) offers theoretically infinite bandwidth, but also requires the most up-front carrier investment. However, FTTP architectures eliminate outside plant electronics, so that equipment upgrades, when needed, can be done for minimal costs. Further, some studies suggest that carriers can significantly reduce operating expenses with FTTP [2].

The jury is still out as to which approach is best. In the United States, all three variants of FTTx have been adopted by major carriers for their triple play deployments — BellSouth has embraced an FTTC architecture for its IPTV offering, AT&T's Project Lightspeed is built pri-

We note that telcos have received regulatory relief in Texas that allows them to receive a single statewide video franchise rather than a town-by-town approach (as cable TV operators were required to do), and similar votes are expected in New Jersey and other states.

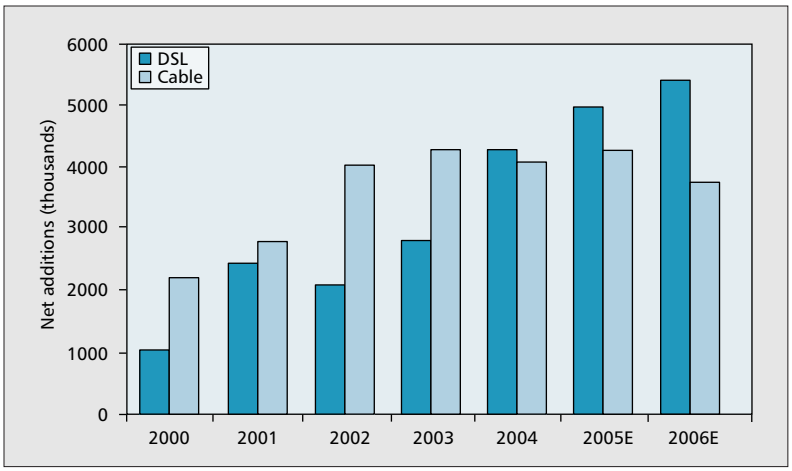

Figure 3. *U.S. broadband net additions [1].*

marily on the goal of FTTN, and Verizon has opted for FTTP for its FiOS service. Our industry contacts suggest that BellSouth and AT&T plan to target 25 Mb/s per home, while Verizon strives for 100 Mb/s. Verizon's higher objective stems from a desire to "future proof" its network. In addition to the more obvious variants for connecting customers, carriers also vary service elements and data networking architectures. BellSouth and AT&T plan to launch IPTV video services, while Verizon now offers video with cable-TV-like analog and digital offerings and will evolve to IPTV. Data networking architectures vary in the placement of layer 2 switches and layer 3 routers. While the use of layer 2 devices near customers may save costs, layer 3 routers may allow for higher service quality in an environment running multiple applications (i.e., triple play). Note that FTTx deployments are in the early stages, and in our view telcos will continue to invest in their "traditional" (existing) DSL infrastructure to stem the tide of high-speed cable modem service competition. Currently, we monitor the debate regarding the architectural alternatives. Key issues include the cost per subscriber, real-world bandwidth available per subscriber, and scalability.

In the following sections we consider trends relative to several metrics — consumer broadband, access lines, and VoIP subscribers — so as to highlight the competition between telcos and MSOs, and provide insights about drivers for communications equipment sales.

U.S. Consumer Broadband Subscribers

Time is of the essence for telcos to win customers as cable MSOs promote bundles that include VoIP, and more aggressive pricing likely helps telcos to win share. In the United States, we think consumer broadband will remain healthy, growing 29 percent in 2005 and 22 percent in 2006. Our models suggest that recent DSL service price decreases (e.g., the lower than $15.00/mo entry-level DSL service offered by AT&T and Verizon) are having the desired effect, and we exit 2005 forecasting that DSL net additions could continue to surpass cable high-speed data (HSD) net additions in 2005, with major telcos adding about 4.9 million new subscribers and MSOs about 4.2 million, reversing the opposite trend that was seen until 2004 when cable grabbed more subscribers (Fig. 3). In 2006, the trend reversal could continue, with MSOs adding 3.9 million new subscribers and telcos another 5.3 million in our models.

In addition to price cuts, carriers are increasing bandwidth with currently available technologies. MSOs have increased customer bandwidth by connecting fewer customers to each cable-modem termination system (CMTS) port. The typical split has dropped from about 800 subscribers per port to 200–400 users per port, which effectively doubles to quadruples the bandwidth available per user. Today several MSOs advertise 6–15 Mb/s service. Telcos have fought back with higher bandwidth by upgrading and offering services via higher speed ADSL2 and ADSL2+ solutions that can greatly increase bandwidth for loop lengths under 12,000 ft.

Despite the high-profile projects (Lightspeed at AT&T, IPTV at BellSouth, and FiOS/FTTP at Verizon), DSL deployment must continue to fend off customer losses to the MSOs; hence, our models reflect healthy growth for vendors with DSL exposure. Vendors with cable HSD exposure, for example, those offering CMTS, DVR, and related equipment including VoIP modems, may also see growth. These trends create a chain reaction with favorable spending on the core network infrastructure — optical systems for transport, and data networking — in order to manage the increase in IP/Ethernet traffic.

FTTx Subscribers

At present, limited disclosures regarding FTTx subscribers make precise modeling a challenge, yet we have developed a proprietary model based on optimistic yet achievable assumptions, and believe that the trends are favorable, with current estimates for well over 3 million FTTx subscribers in the United States by the end of 2006.

AT&T, BellSouth, and Verizon's spending on FTTx projects is not likely to be highly correlated with subscribers for some time, as these initiatives are in the early stages. Time will tell which of the FTTx approaches is the most successful, with the United States serving as a high-profile proving ground since the three major RBOCs have all selected different variants.

RBOC Access Lines vs. VoIP Subscribers

Another indicator of intensifying competition is the trend in telco access (residential and business phone) lines vs. VoIP subscribers. RBOC access lines have been declining since early 2001, and 3Q:05 witnessed the steepest drop yet, falling by 6.0 percent vs. last year (Fig. 4), thus reflecting the worst decline since we began tracking the data in 2000.

To date, most losses have been attributed to wireless substitution and broadband migration from low-speed dial-up connections to high-speed broadband, which hurts secondary lines, but it seems that carriers are now beginning to lose primary lines to VoIP substitution. Verizon stood out in 3Q:05 with 7.5 percent year-over-year declines, which we suspect highlights the

competitive losses to VoIP services from MSOs in Verizon's Northeast markets — Time Warner and Cablevision — that have aggressively marketed VoIP as a component of a compelling voice/data/video services bundle.

VoIP, on the other hand, is still in its early days, and we are just beginning to establish a comprehensive model based on a sample of three MSOs and four other carriers that report VoIP subscribers. However, early indications suggest the market will grow quickly, as shown by the surge in subscribers in the first three quarters of 2005 (Fig. 5).

The earliest VoIP services were offered by the so-called "over the top" (OTP) providers whose VoIP service "rides over" another carrier's broadband connection (dial-up, DSL, or HSD). OTP providers include Vonage, which until recently was the leading U.S. VoIP provider in terms of subscribers by a wide margin. Skype is another example of an OTP, but subscribers are difficult to track — with some 222 million downloads of the software worldwide, we categorize Skype as a service that augments rather than replaces existing voice service — for now. The OTP services have quickly been followed by MSO and telco VoIP offerings, though MSOs, with no existing voice (access line) business to cannibalize, appear to have been more aggressive in marketing the service.

Not surprisingly, while 3Q:05 witnessed the steepest decline in RBOC access lines, it also saw the greatest increase in VoIP subscribers, with cable MSO Time Warner topping OTP Vonage in terms of net VoIP subscriber growth for the first time, in our estimates — and MSOs appear poised to see continued VoIP subscriber growth. While Verizon suffered the worst declines, Comcast, the nation's largest MSO, is in the midst of rolling out its VoIP service in the second half of 2005 and into 2006. We exit 2005 anticipating that Comcast will report 200,000–250,000 VoIP additions by year's end, and another 1 million net additions in 2006, which will likely have a further detrimental effect on AT&T, Verizon, and BellSouth access lines.

Trends and implications for the communications equipment market as the telco–cable battle for broadband subscribers intensifies are:

- Cable TV providers, or MSOs, will increasingly compete with telcos, and we consider this confrontation a positive for equipment vendors. The primary beneficiaries include the equipment vendors that enable service providers to evolve offerings and compete. Both sets of service providers will migrate to a more IP or data-centric network, with the cable MSOs offering VoIP and more flexible switched video, while telcos increase data capacity and work to offer either analog or digital video, or IPTV service.
- The declining access-line trends suggest ongoing challenges for traditional time-division multiplexed (TDM) circuit switches and digital loop carrier (DLC) equipment vendors, while the surge in VoIP subscribers signals growth for IP/packet-based voice infrastructure suppliers.
- MSO feature evolution from analog to digital, DOCSIS 3.0, VoIP, and digital video recorders will fuel set-top box growth and benefit those suppliers, just as wireless feature enhancements benefit handset providers.
- The success or failure of various FTTx approaches will play out as the RBOCs invest heavily to compete. These initiatives require significant up-front capex spending, which varies depending on the architecture — FTTN and FTTC drive fiber increasingly closer to the subscriber but still rely on DSL upgrades for the broadband pipe into the home, whereas FTTP brings fiber to the premise and removes electronics between the carrier serving office and the customer, in effect requiring a network rebuild. Suppliers of FTTx will benefit, but it may be a mixed blessing in the near term as vendor margins are squeezed by the ripple effect of intense carrier service-pricing competition.

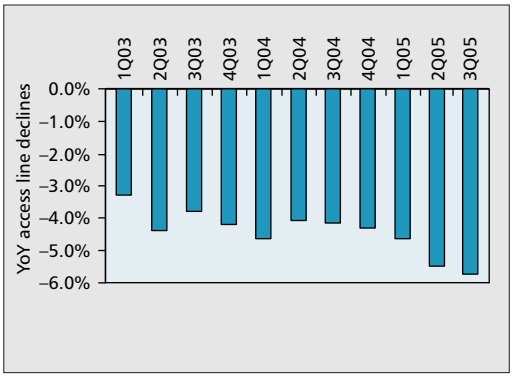

Figure 4. *RBOC access line trends [1].*

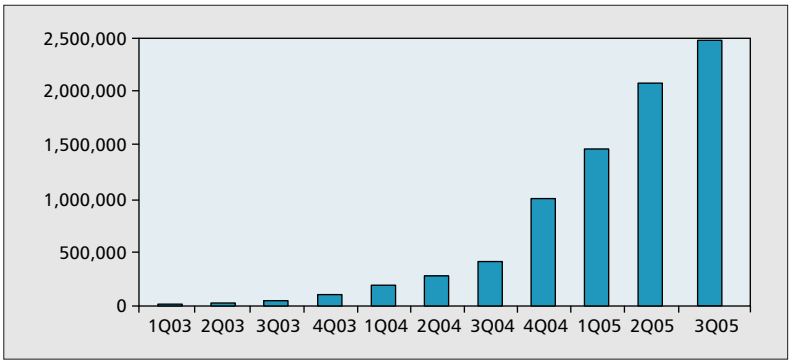

Figure 5. *U.S. VoIP residential subscribers [1].*

Carrier-Grade Ethernet: The Next Wave

The press, analyst, and investment communities have focused on upgrades of carrier access, and may be less aware of a brewing trend toward carrier-grade Ethernet equipment. Carrier-grade Ethernet is playing an increasingly important role in the network infrastructure used to deliver both residential triple play and new Ethernet services for Enterprise (business vs. residential) applications, and will also likely play an increasing role in wireless backhaul replacing private line and ATM. Carrier-grade Ethernet is poised to be a material driver for the communications equipment market — the upsurge of interest in this topic within the industry reminds us of the

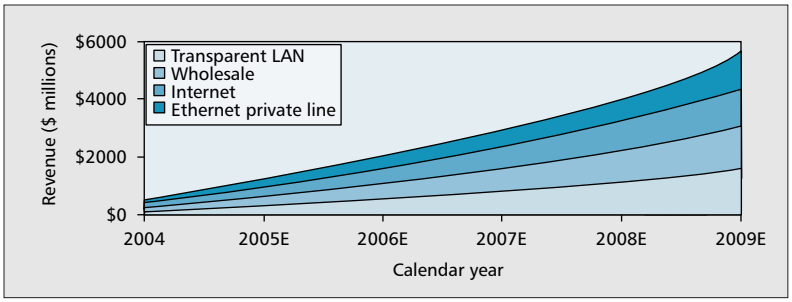

Figure 6. *North America total Ethernet services revenue by type [3].*

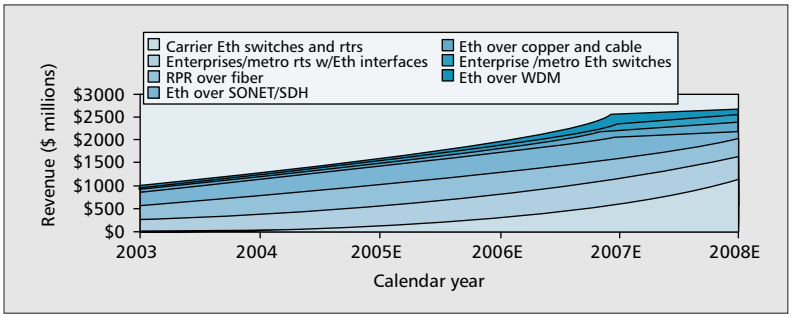

Figure 7. *North American metro Ethernet manufacturer revenue by technology [6].*

brewing interest in access networks that occurred shortly before the telco–cable battle for broadband access took center stage.

An expansion in the number of higher-performance Ethernet services is helping reshape the data services landscape for incumbent carriers including AT&T (including the former SBC and AT&T), MCI, and Verizon, and this trend implies new opportunities for equipment vendors who have strong Ethernet portfolios and strategies. Carrier revenues from traditional private-line data services are eroding 7–10 percent, as quoted by market researcher Heavy Reading [3]. In the Enterprise space this presents an opportunity for IP and Ethernet virtual private networks (VPNs) to pick up the slack.

Recent data from market analyst Infonetics Research suggest that Ethernet services revenue topped $500 million in North America in 2004 and is expected to more than double in 2005, then jump to almost $6 billion between 2005 and 2009, representing a five-year CAGR of 47 percent [4] (Fig. 6). This growth in Ethernet services revenue comes at the expense of traditional private-line service technologies. Recent comments from market researcher Ovum-RHK suggest that the IP services infrastructure market is set to expand from the 2004 level of $6.3 billion to $7 billion in 2010 with legacy multiservice switch (MSS, used for ATM and Frame Relay) spending halving in the same period from $2 billion to $1 billion [5]. Wholesale Ethernet service revenue, much of which comes from point-to-point Gigabit Ethernet links, accounts for about 25 percent of all Ethernet service revenue, while revenue from retail Ethernet services (Internet, Ethernet private line, and transparent LAN services) accounts for about 75 percent of all Ethernet service revenue.

Carrier-grade Ethernet may represent the next wave, in our view, offering a compelling opportunity to serve both as a service interface to Enterprise customers, augmenting and eventually supplanting traditional private line technology, and as a low-cost infrastructure alternative for access interconnection and transport, for example, in FTTx applications. Ethernet will soon become a material driver for the communications equipment market, with the emerging carrier-grade Ethernet segment providing opportunities, and risks — many, though not all, of the existing market leaders have insulated themselves from this evolution by offering Ethernet products.

Vendor implications are far-reaching, as many approach this market with zeal from different fronts, offering either purpose-built products, or adding Ethernet enhancements to existing transport or router platforms. Legacy equipment vendors strive to grow new Ethernet solutions while managing the declining phase of older equipment's life cycle. Newer vendors must establish relationships, build to the carriers' exacting standards, and learn to navigate the procurement processes at the major service providers. The trends create a chain reaction, with carriers upgrading access, transport, and switching elements in order to evolve networks to Ethernet.

This represents an emerging opportunity whose size can be best appreciated by considering market forecasts. Industry analyst Infonetics Research suggests that communications equipment revenue for metro Ethernet products approached $1.5 billion in North America in 2004, is expected to reach almost $1.6 billion in 2005, and increase to almost $3 billion in 2008, representing a five-year CAGR of 19 percent [6]. Note that Ethernet subscriber interfaces — for example, to Enterprise customers — today are roughly 10 percent over fiber and a small percentage wireless (WiFi and WiMax), with the vast majority still over copper (DSL, T1/E1/T3 lines). While the percentage of fiber subscriber-service interfaces is growing, the copper base is significant and will not transition overnight, as evidenced by continued demand for Ethernet over copper and cable (Fig. 7). Ethernet in the transport network — represented by Ethernet over SONET/SDH and Ethernet over WDM — is almost 90 percent over fiber today, but some expect this to migrate to a 50/50 split to fiber/other within a few years, with the other category represented mainly by copper and by wireless interfaces (e.g., based on WiFi and WiMax).

Ethernet will be pervasive in the network, from LAN to core, and leaders in the FR/ATM space face the most risk relative to the transition. Pundits disagree over the speed of the transition — market data suggests that the United States will lag behind other countries in Europe and Asia, for example. Broadband access is increasingly IP/Ethernet (vs. ATM) based; business access is migrating toward IP/Ethernet vs. FR/ATM and TDM, and is an increasing area of focus for carriers, as evidenced by AT&T's acquisition by the former SBC, and Verizon's acquisition of MCI, aimed primarily to increase business/Enterprise customer (not residential customer) base.

SUMMARY

Communications equipment vendors that are best positioned have new or emerging products targeted to the growth applications, while those at risk sell into legacy network technologies and applications, and face challenges in the transition:

- Carriers will follow various strategies to increase bandwidth and services to customers. Product evaluations are underway. Expect continued deployment of DSL with growth in ultra-bandwidth variants and deeper fiber FTTx deployment.
- Different approaches require different tactics and no approach is the clear winner. The United States presents a fertile battleground for the cable model vs. DSL/FTTx, and for the winner among the variants for FTTx. Time will tell, but commonalities exist. At the moment, the more bandwidth, the better it is to offer broadband + SDTV + HDTV to multiple TVs in the home.
- Time is of the essence as carriers scramble to lock-in customers; price competition is fierce, resulting in pressure to reduce network costs. This has resulted in increased interest in carrier-grade Ethernet as a lower-cost alternative to traditional transport infrastructure, and as a service interface to Enterprise customers. We note that Ethernet is following the path of a "disruptive technology" [7] — initially deployed in the LAN, Ethernet is moving up-market to Enterprise applications and access, metropolitan, and core network environments via enhancements that render it sufficient to meet carrier requirements at an attractive price point.

The improving U.S. carrier-spending environment provides incremental encouragement concerning the opportunities for communications equipment vendors. Surprisingly, elements of the industry have returned to double-digit growth. Risks remain, however, because many of the incremental dollars may be success based. Furthermore, incremental spending is often tied to new technologies, and there is inherent risk that the trials and initiatives will take longer than expected. That said, carriers must invest to remain competitive, and in fact have a new religion — evolve or die. Trends in the evolution of carriers' networks — for example, connections to customers via access networks serving residential and business customers, along with a networkwide transformation from circuits to packets in order to offer an increasing variety of services at lower cost — will drive many equipment purchases. Other factors, including the increasing number of wireless subscribers and the ever-increasing expansion of wireless service offerings via second- and third-generation wireless network technologies, also materially affect carrier spending, but in our view this represents a steady network evolution relative to the sea change inherent in the trends mentioned above.

Risks remain because many of the incremental dollars may be success based. Furthermore, incremental spending is often tied to new technologies, and there is inherent risk that the trials and initiatives will take longer than expected.

REFERENCES

[1] Morgan Keegan & Co., *Proprietary Equity Research*, 2005.
[2] "Fiber-to-the-Premises (FTTP): Revolutionizing the Bells' Telecom Networks," *Telcordia Technologies and Bernstein Research*, May 2004.
[3] "Carrier Ethernet Equipment Market Outlook," vol. 3, no. 14, *Heavy Reading*, Aug. 2005.
[4] Infonetics Research, Inc., "Ethernet Services — Annual Worldwide Market Size and Forecasts," Oct. 2005.
[5] "IP Service Infrastructure — Annual Market Forecast: IP Packet Transport to Experience Strong Growth," *Ovum-RHK*, Aug. 2005.
[6] Infonetics Research, Inc., "Metro Ethernet Equipment — Biannual Worldwide Market Size and Forecasts," Sept. 2005.
[7] C. M. Christensen, *The Innovator's Dilemma, Harvard Business School Press*, Cambridge, MA, 1997.

BIOGRAPHIES

PAUL A. BONENFANT [M'89, SM'03] (paul.bonenfant@morgankeegan.com) is associate communications equipment equity analyst and associate vice president at Morgan Keegan & Co., a unit of Regions Bank, and is based in New York City. Prior to his move to Wall Street, he was principal network architect at Mahi Networks, chief architect at Photuris, and a business development manager for mergers and acquisitions in Lucent's Optical Networking Group. Before joining Lucent, he led requirements and standards development for transport systems at Bell Communications Research (Bellcore, now Telcordia Technologies). He received both his B.S. in engineering and applied science, and his M.S. in electrical engineering from the California Institute of Technology

SIMON M. LEOPOLD (simon.leopold@morgankeegan.com) is senior communications equipment equity analyst and senior vice president at Morgan Keegan & Co., a unit of Regions Bank, and is based in New York City. He joined Morgan Keegan, a unit of Regions Bank, in February 2004. Before Morgan Keegan, he worked as a telecom equipment analyst at Merrill Lynch, beginning in January 2000. Priot to his move to Wall Street, he was in the telecom industry at Telcordia Technoligies for nearly 12 years. He received his B.S. in electrical engineering from the University of Michigan, Ann Arbor, his M.E. in electrical engineering from Cornell University, and an M.B.A. from Rutgers University.