CHAPTER 1.3

Opportunities and Challenges of Next-Generation Networks in Telecommunications

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What has been building for several years is coming to pass: major telecommunications operators are finally rolling out their next-generation networks (NGNs).

For operators, these all–Internet protocol (IP) networks will bring several benefits. First NGNs will reduce the operational costs of multiple services by an estimated 35 percent through their simpler architectures and economies of scale. Second, they will speed the development of new services, including video telephony, white boarding, and multimedia conferencing with file and application sharing. Third, they will help protect operators' businesses from cable and other service providers such as MSN, Skype, Google, and Yahoo!

But for all these advantages, building the NGNs will require huge investments in infrastructure. These will create significant financial risks for their operators. Moreover, NGNs will force changes to the economics of the telecommunications industry through changes in traditional pricing models. These changes could find previous cash cows, such as voice service, drying up.

On top of these challenges, however, is an overriding concern: are the regulatory regimes of most nations ready? Are the regulators looking back to the issues of the 20th century, or are they looking forward to the new era—one that demands a clear head to determine how to regulate this unprecedented convergence of voice, television, and mobile communications—so that all will benefit? Getting regulation wrong can put up to 45 percent of an operator's four-year EBITDA (earnings before interest, taxes, depreciation, and amortization) at risk.[1] Such economic disincentives could limit the full deployment of the NGNs and reduce their chances for success.

What, then, are the costs and benefits of the NGNs? What are the regulatory battles surrounding them? And what actions are required—by both the industry and its stakeholders—to face these critical challenges?

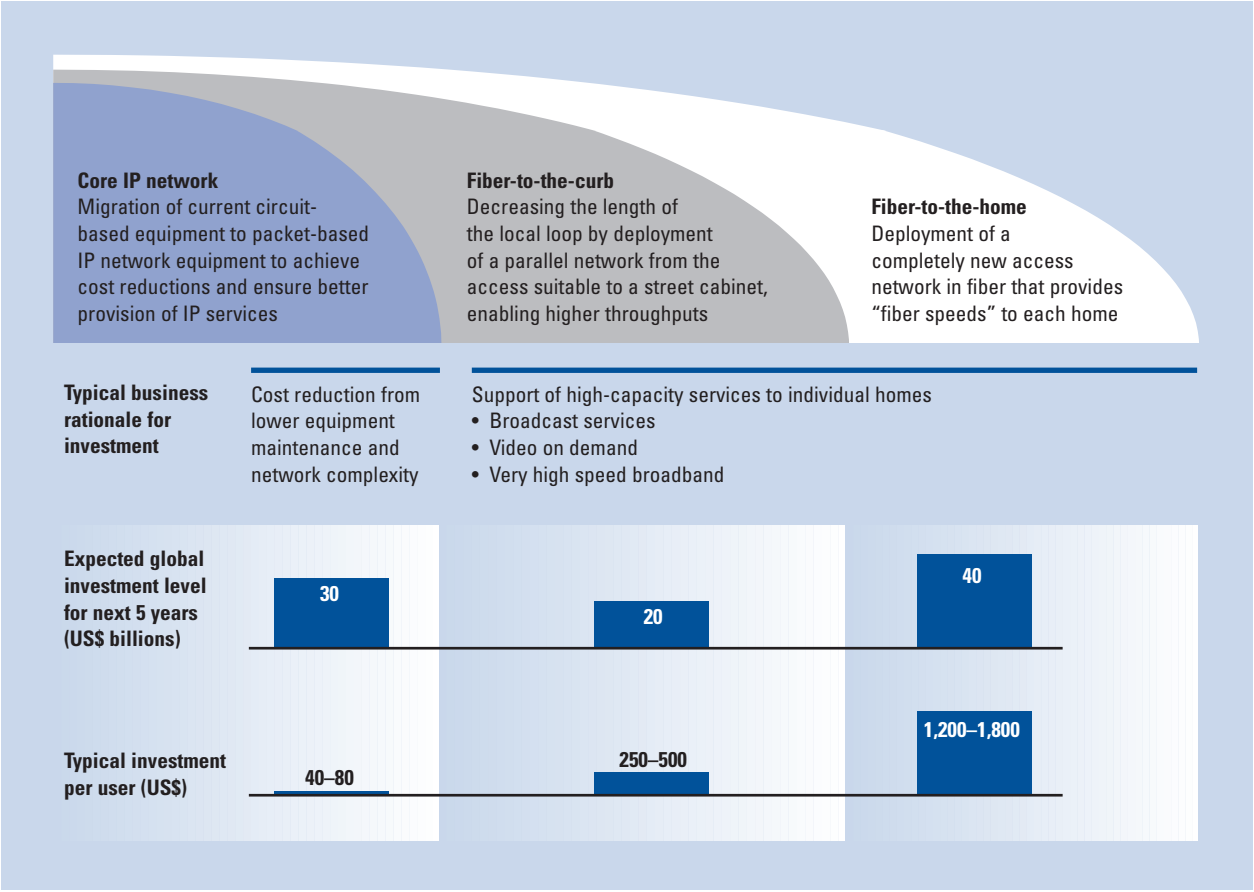
In the discussion that follows, we will explore these issues. But one point is already clear to us: both the policy makers and the industry players must work together. They must manage this transition to NGNs wisely—so that the investors are encouraged to invest, and so that the stakeholders can capture the full benefits of this new era.

Social benefits and new capabilities of next-generation networks

Why are NGNs being built? Because regardless of the size of the investment, the expected benefits are great. These benefits, as we noted earlier, include substantial operational cost savings and a greater ability to deliver high-end multimedia services such as Internet protocol television (IPTV) to consumers.

Although the acronym *NGN* is a simple label, it signifies different levels of service and network upgrades

Figure 1: Next-generation network investments: Three types of upgrades



Source: IDATE, 2005a; OECD, 2005; McKinsey analysis.

to different operators (as shown in Figure 1). NGN upgrades range from the core IP network level (in which operators and manufacturers are pushing for all-IP backbone transport and low-cost distribution solutions) to the local loop (in which fiber-to-the-home [FTTH] solutions can delivery seemingly unlimited bandwidth). The different "flavors" of NGN offer different customer benefits—and imply different costs.

Core network upgrades: Simplification and lower cost

Most major telecommunications operators seeking the new cost curve promised by equipment vendors are either seriously considering or actively deploying new core networks. British Telecom (BT) became a pioneer in this area when it announced a multibillion dollar investment in its 21st Century Network "21CN," and most other operators followed suit. Once its new network is in place in 2009, BT says it expects its operating expenses to fall by 30 percent.[2]

Core IP networks eliminate the multiple networks, layers, and protocols that currently plague the average incumbent. For the industry, this is the long-searched-for "network grail" that asynchronous transfer mode (ATM) technology promised but failed to deliver. For this we can thank the switches that optimize bandwidth and support IP directly over optical fiber, thereby ensuring the enormous flexibility of the IP protocol. The benefits? Less network complexity, reduced needs for specialized engineering and maintenance teams, and improved network reliability. If any more incentive is needed, it comes from the many vendors who have announced that they will progressively discontinue traditional network equipment (along with an affordable investment of around $40 to $80 per user). Thus this transition is a near-certainty, in the near term, for all operators.

During roll-out, operators will compete aggressively on price while rapidly deploying the more "intelligent" of the IP-based services such as TV multicast or network-based personal video recording. This will increase their ability to compete with wireless and cable players.

New higher-speed services through optical fiber solutions

In terms of multiple bandwidth–hungry services to the home, many operators are betting on building optical fiber solutions in the local loop. Fiber, based on traditional copper loops, enables much faster and more reliable speed than current digital subscriber line (xDSL) technologies. The hope of operators deploying this type of solutions is that the high-quality, triple-play services that these investments will deliver will turn the competitive game in their favor.

The first type of solution is fiber-to-the-curb (FTTC) or fiber-to-the-node (FTTN). It consists of deploying fiber in only *a section* of the last mile to deliver faster speeds than other xDSL technologies. Operators building FTTC, such as Deutsche Telekom and South Bell Canada (SBC), are balancing less available bandwidth (and related services) with significant lower investment per user of about $250 to $500. FTTC offers operators considerable savings because it avoids investments in the "last section of the last mile," a distance that is always the most expensive section to connect with fiber.

The second type of fiber solution being deployed is fiber-to-the-home. This solution connects the client and the access switch through a dedicated fiber cable. This enables consumers to enjoy almost unlimited bandwidth, while operators get the lower operating costs associated with its reliable, noise-free technology. The downside is in the investment, however: a whopping $1,200 to $1,800 per client for full FTTH solutions (such as those deployed by Verizon and Nippon Telegraph and Telephone Communications Corporation, or NTT).

What is the business case, then, for optical fiber architectures (FTTx)? Against the growing threat of wireline attackers and increasingly aggressive cable and mobile players, this technology allows operators to retain their large client base. It also allows providers to up-sell the new value-added services provided by these platforms to their customers. However, this benefit is not obvious to most operators; for this reason, optical fiber deployment is still on the drawing board for the majority of them. Verizon's recent announcement of its commitment to FTTH, and the subsequent battering of its shares, is a cautionary tale. Currently, the announced worldwide commitments to FTTx solutions are still at around US$60 billion, only double the amount announced for Core IP Networks despite the 50-fold difference in investment per client.

Huge attention on next-generation networks at a global level, but largest amounts of capital expenditures continue to be day-to-day

The Economist featured a cartoon recently in which a saloon customer is sitting at a bar with bottles labeled "Broad Band," "Telephony," and "TV" before him. The bartender on the other side of the counter, however, is busily shaking a tumbler with all those tasty ingredients mixed within: it's labeled "Info Heaven."

In another *Economist* cartoon, readers see a group of masked men labeled "AT&T," "Verizon," and "other telecom operators," punching and gouging at each other's eyes. The caption reads: "LIVE: All-In Convergence Wrestling."

A third cartoon might have established the final frame of the story: government regulators, wearing the striped uniforms of referees, trying to enforce some rules that will keep everyone on the straight and narrow.

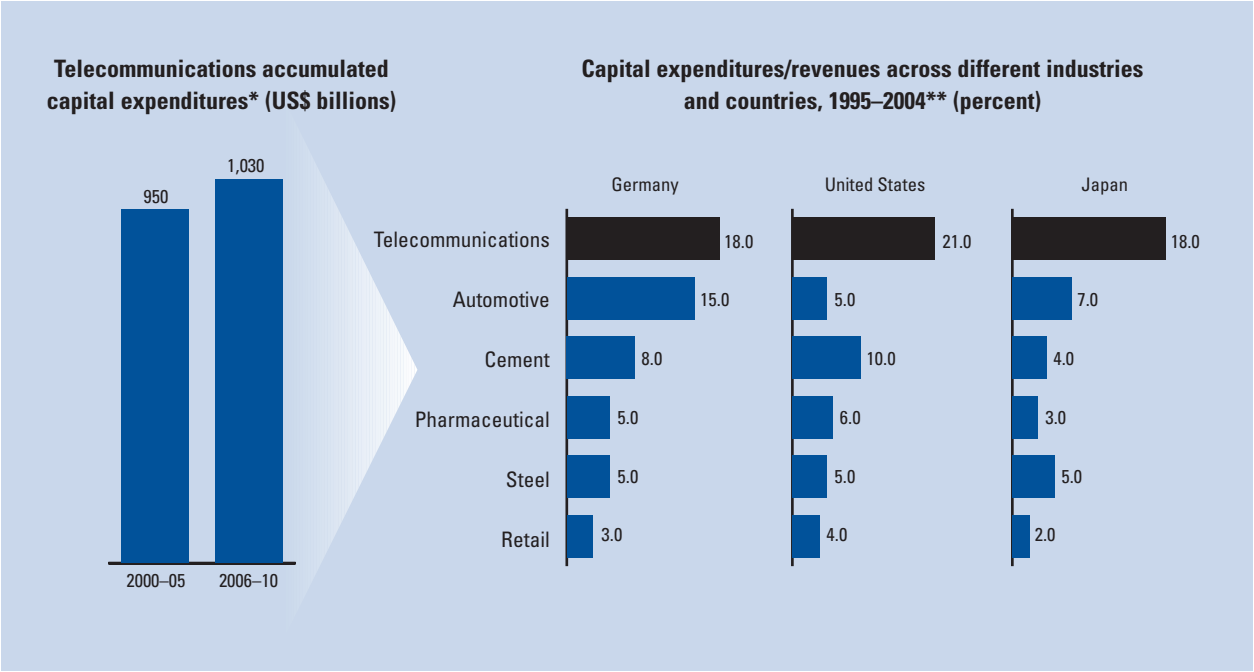
These cartoons capture the essence of today's NGN issues: great opportunity—but also great regulatory and business battles over the conditions in which industry investments will take place. Many telecommunications firms want to capture the benefits from the different types of NGN deployments, which is why they are planning to invest heavily on NGNs. In the United States, Verizon is deploying a network in parts of 18 states (about 400 communities). By 2009, they hope to provide fiber connection to 18 million homes with speeds of 100 megabits. To reach that target, Verizon said it will spend $22 billion.[3]

In Europe, Deutsche Telekom, BT, and KPN have committed $3.8 billion, $19 billion, and $1.9 billion respectively to build networks.[4] Central European operators in Slovakia, Bulgaria, Hungary, Croatia, and the Czech Republic have also announced investments in NGNs.

But investment is not the only news. There is news also in the regulatory battles over the conditions of those and other investments. Telstra, the Australian incumbent operator, for instance, has been seeking a regulatory break for its planned NGN investments. In early 2005, the company warned that state regulators were stepping beyond their authority. "Our investment in a decade-long build-out of a fiber optic network is an issue of national policy first, and accompanying legislation perhaps, and this is the difficulty I have with the regulator," said Telstra's (former) Chief Executive Officer, Ziggy Switkowski. "The regulator is there to ensure compliance with the rules; I don't really look to the regulator to help architect an industry." He added that Telstra's decision to invest in a high-capacity network, that might cost many billions of dollars and would dramatically increase broadband speeds to 4 million homes in the country, is an important decision, one "where we would expect to make above-average returns for making the investment and taking the risk. And the regulator's role, in all that, is secondary."[5]

But Helen Coonan, Australia's minister of communications, disagreed. Referring to Telstra's plan to increase earning margins to 52 percent over five years, she remarked, "With those kinds of margins, Telstra doesn't need regulatory breaks. They should get on with it, and let's see what they can do to turn the company around."[6]

Figure 2: Telecommunications industry as a global investment driver



Source: IDATE, 2005a, 2005b; OECD, 2005; Bloomberg online database; McKinsey analysis.

* Includes enterprise networking equipment investments
** Weighted average for listed companies

In Germany, meanwhile, the government offered a draft of its new telecommunications law that would postpone the policing of Deutsche Telekom's $3.8 billion high-speed network by two to five years. That raised opposition from Viviane Reding, the European Union commissioner for telecommunications. It is "against the European interest and the German interest" she argued recently,[7] adding that the "EU rules do deliberately not provide for regulatory holidays, precisely in order to prevent a re-monopolization of markets."[8] In particular, she said, in network-based economies "effective competition does not prevent, but drives investment."[9]

Indeed, the NGNs have brought a new paradigm to the industry. And with it, operators and regulators alike must grope approach that will deliver the right level of investment and industry competition.

The potential impact of the next-generation network debate on capital expenditure investments

The prominence of these and other regulatory battles has obscured an important fact: overall capital expenditures investment in the telecommunications industry today is significantly higher than NGN investments alone.

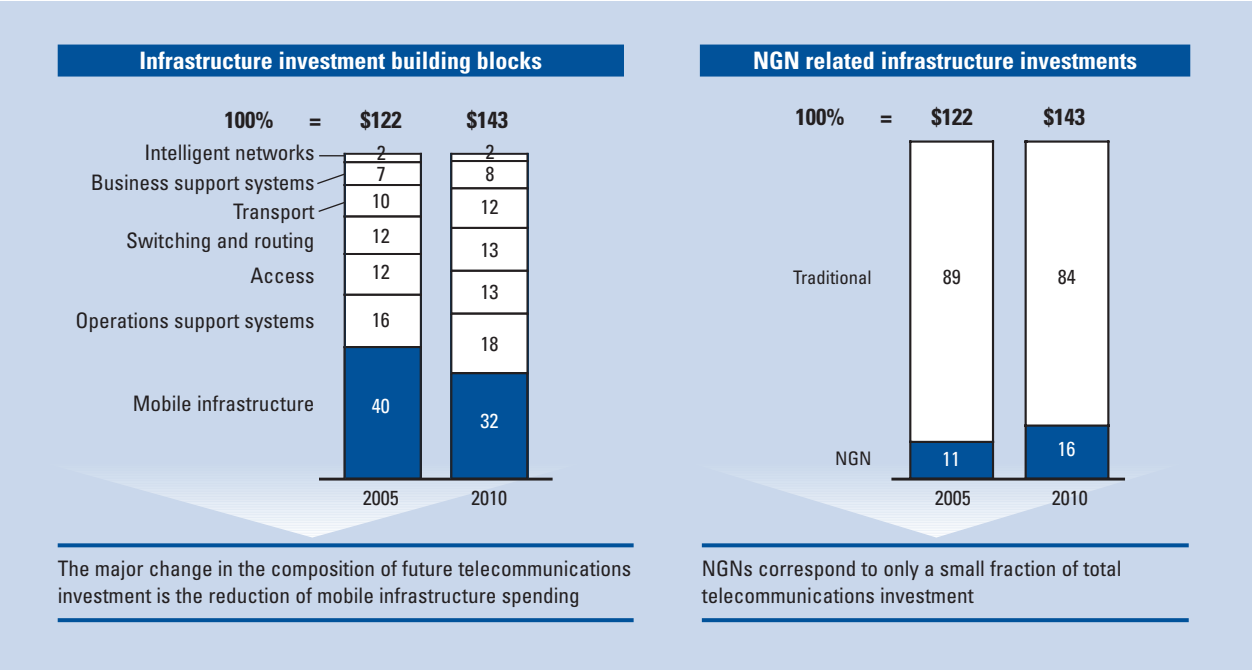
On a global level, in fact, the telecommunications industry is one of the most important drivers of all industry investments. Over the next five years, their capital expenditures will reach the US$1 trillion mark (Figure 2). When compared to the automotive, pharmaceutical, steel, cement, retail, and other investment-heavy industries, telecommunications outstrip them all in terms of capital expenditures–to-revenue ratios. This can be explained by the speed of technological change in the telecommunications industry, which compels operators to investment heavily in order to remain both competitive and innovative.

As shown in Figure 3, the main components of infrastructure investment in the telecommunications industry are mobile infrastructure, operations support systems, access networks, and switching and routing elements, which together account for 80 percent of total spending. The composition of these investments is not expected to change greatly in the next five years with the exception, perhaps, of mobile infrastructure spending.

Figure 3 also puts NGN investment in perspective within the industry as a whole. Today NGN investments account for about 11 percent of total industry investments. This is expected to grow to approximately 16 percent by 2010. NGN investment is therefore only a small fraction of all telecommunications investments and will remain so for the foreseeable future.

The industry needs to consider the relative size of these NGN investments and put them into perspective in view of the level of media attention this topic has recently received. Without such perspective, the increased interest in NGNs and the uncertainty around it may not affect

Figure 3: Infrastructure investment in the telecommunications industry, 2005–10 (US$ billions, percent)



Source: Data from Gartner, 2006b; McKinsey analysis.

only the level of NGN investment but also, and more broadly, overall investments in the industry. This offers a warning to the industry and policymakers alike: there is a lot at stake, and the success, or failure, of NGNs in the next few years could have wide repercussions for the industry.

Next-generation networks: Effects on pricing and revenue models

Operators have traditionally relied on the healthy margins generated from fixed voice telephony. These have enabled the enormous investments in network capital expenditures that we find today. Moving to NGNs could drastically change the current voice-pricing model for both retail and wholesale services, potentially cannibalizing the main revenue source of most operators.

Playing a key role in this shift in technology and pricing will be the world's telecommunications regulatory authorities. Their decisions will not only shape the future returns of new investments, but will largely determine the adoption or not of NGNs.

New pricing structure for voice services

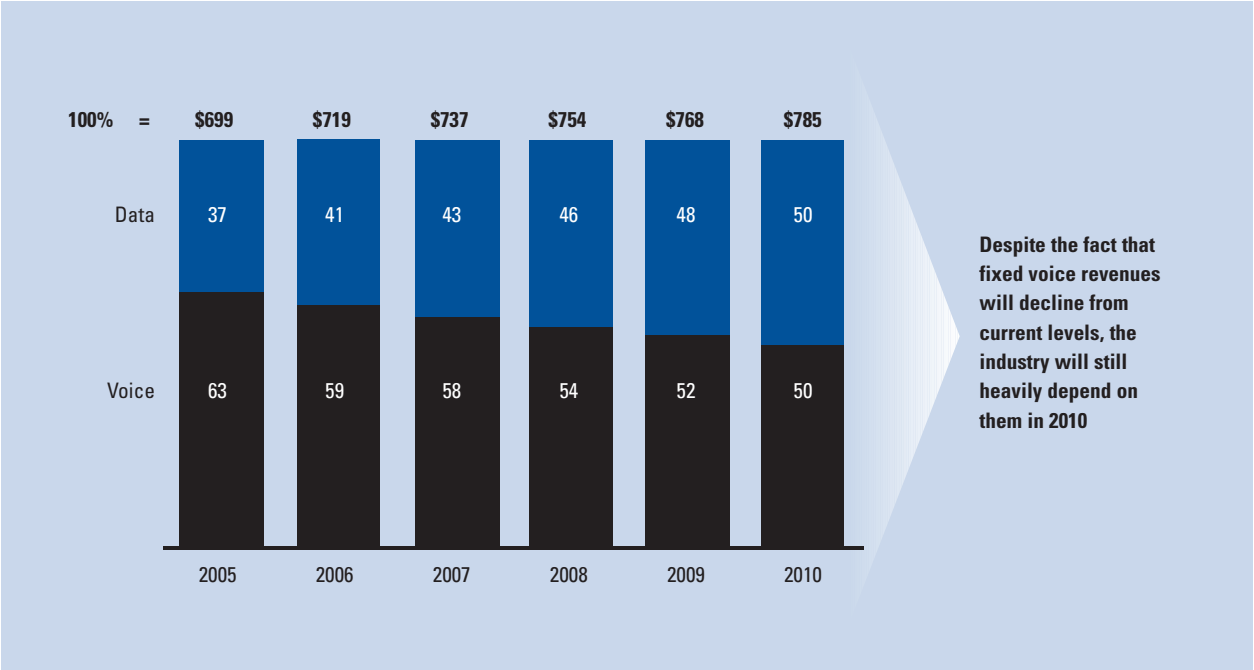
Voice telephony on the fixed network has always been characterized by high margins. These margins have been derived mostly from voice traffic: the per-minute charges that consumers pay for making a call. The monthly rental fees for telephone services, on the other hand, have experienced low and even negative margins (even after numerous countries have repeatedly rebalanced the tariffs).

The high margins on voice calls have largely covered more than the high investment costs of rolling out a telecommunications backbone. They have also covered the losses of access to the network and the costs of Universal Service Obligations. Moreover, these margins have allowed incumbents to invest heavily in upgrades to the existing networks (as well as in such new network infrastructures as mobile networks, broadband infrastructure, television services, and so on). High returns, together with the opportunities brought by the liberalization of the telecommunications markets, are responsible for the vibrant telecommunications industry of today.

Going forward, however, NGNs will significantly change the way voice is priced to consumers and other operators. Historically, voice calls have been priced per minute. Moreover, the longer the distance between the two calling parties, the more expensive the call.

With NGNs, time-based billing will become irrelevant (in a world where costs are driven by bandwidth usage). Also, the distance part of pricing will become obsolete since IP packages do not follow a fixed route. Instead, voice calls will be made over the IP data network. They will share the "pipe" with several bandwidth-intensive services (such as digital television and broadband services), and will utilize only a small fraction of the network. But

Figure 4: Telecommunications industry fixed revenues, 2005–10 (US$ billions, percent)



Source: IDC, 3Q-2006; Gartner, 2006a; Yankee Group, 2006a, 2006b; McKinsey analysis.

considering that, on average, more than 60 percent of an operator's revenues comes from voice, the future profitability of the industry will rest on the pricing for voice (Figure 4). Although projections continue to show voice as an important contributor to revenues, its rate of decline will depend heavily on the impact of new pricing models on voice revenues.

Passing on price reductions: Limited incentives for network operators

As we said earlier, if operators price their retail voice services according to a bandwidth-based, non–distance-related formula, the price for a voice call could collapse, leading to a cannibalization of the bulk of the fixed operator's revenues. This would destroy the incentive for deploying NGNs unless alternative revenue sources were identified, which is not currently the case.

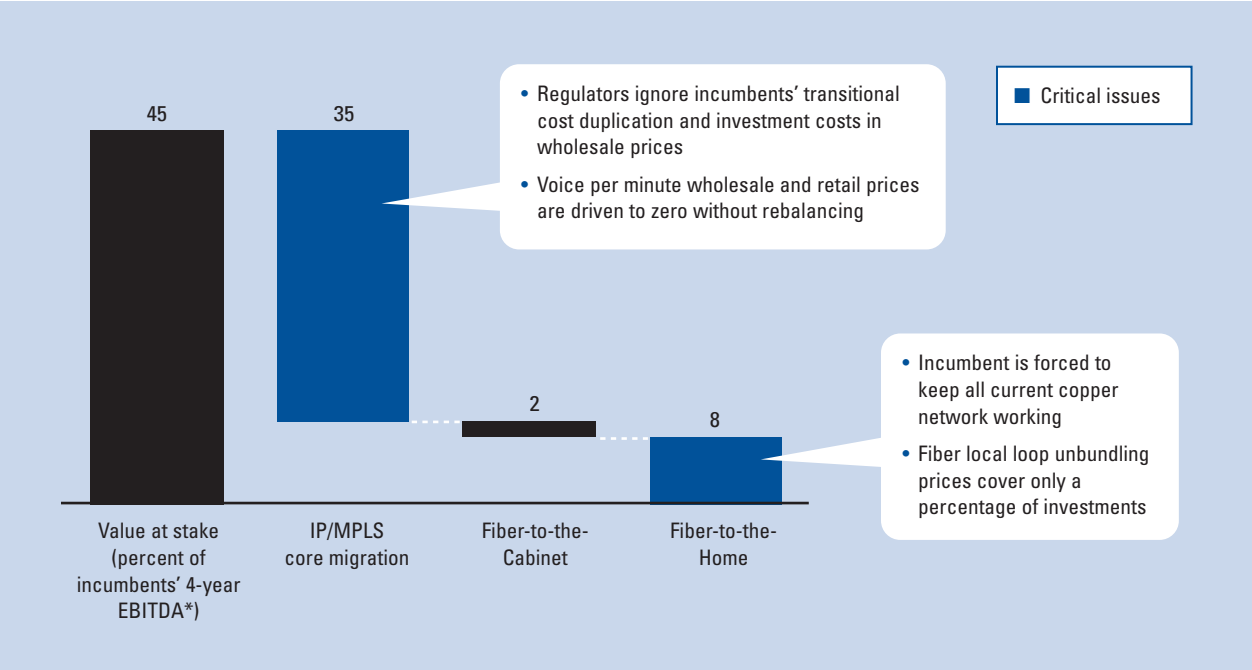
Could telecommunications firms actually destroy their own best source of profits? What makes this unlikely is that incumbents control their own retail prices, and therefore would be careful not to cannibalize their voice revenues (as long as competition does not force prices down). Rather, they would most likely price their NGN voice services at a healthy premium. Most of their competitors would likewise not be eager to instigate a downward price spiral. The danger, as we will explain below, could come from asset-light competitors—those reselling wholesale minutes.

Although incumbent operators control retail prices, they usually do not control wholesale prices (for example, voice interconnection rates, unbundling rates, and so on). Rather, in almost all liberalized countries, wholesale rates have been heavily regulated, either through telecommunications-specific regulation or through the intervention of general competition. These costs are usually set on the basis of the theoretical costs of an "efficient" operator (long-run incremental costing, or LRIC).

Offering wholesale services (priced per bandwidth, non–distance dependant) to competing operators (based on NGN costs), however, will allow asset-light voice providers to drastically undercut the incumbent's voice prices. Why? Because the actual wholesale fee paid to the incumbent still constitutes a large portion of their cost base. These price decreases would result either in large market share losses for the incumbent or an overall reduction of price levels in the market (or both).

At the same time, until a full switchover to NGN is completed, incumbent operators will have to continue to support their old copper networks. During this transition —which may take several years—the incumbents will have to cover both their NGN costs and some of their old public switched telephone network (PSTN) costs. Unless the network operators can quickly find alternative, high-margin revenue streams, this could significantly affect their profitability and potential for financing.

Figure 5: Value at stake for incumbents from NGN transition (percent)



Source: McKinsey analysis.
* Constant prices; 2006 estimated EBITDA

In the absence of new revenue streams (such as increased access fees or new services), McKinsey estimates that declining retail prices, coupled with a period of transitional cost duplication, could reduce incumbents' four-year EBITDA by up to 45 percent (Figure 5).

Revenue declines will jeopardize broader industry investments

Network operators worldwide are assessing the feasibility of NGNs. As discussed above, this presents a double-edged sword. On the one hand, operators are tempted to deploy NGNs in order to offer new services and further reduce costs. On the other, the possibility of a loss in the incumbents' main revenue source (voice) creates a reluctance to invest heavily in the new technologies.

The fall in voice revenues that NGN wholesale pricing could bring, in fact, could seriously affect the future of telecommunications investment both for voice services and broader infrastructure investments. Over the next four years, the amount of investment under threat could be as high as $100 billion.[10] Without the steady revenue streams from the voice business, much of the past investment in broadband infrastructure, digital broadcasting services, and even mobile telephony might never have been made.

The effect of NGN on voice revenues, then, casts a big question mark over the future of the industry: will NGN allow the current levels of telecommunications investment to continue? A reduction in those investments could reduce new benefits for consumers and innovation in the sector as a whole. Funding for NGNs could decline —not only on the part of telecommunications operators, but also on the part of equipment manufacturers, content providers, and related service providers as well.

Current regulatory regimes: Issues of NGN deployment

For all theses reasons, NGN regulation is one of the hottest issues discussed in industry and policy circles. And it should be—considering the size of the investments and the impact of the new pricing models on the industry. This issue will not only shape the revenue streams of the operators, but it will also affect the operating models and the timetable for the roll-out of services.

What is at the heart of the issue? Essentially, the question is whether a mere extension of the current regulatory framework (that of conventional PSTN networks) to the NGNs will allow the NGNs to thrive.

The conventional regulatory framework focuses on cost orientation, price controls, and service quality—with the ultimate objective of creating a functioning and sustainable competitive environment (often in the form of a "service-based" competition model). This framework, however, has evolved in the context of a widely deployed infrastructure—one that already exists and whose costs have been largely recovered. The challenge of NGNs is

Figure 6: Three regulatory models for operators investing in next-generation networks

	EUROPE	JAPAN	UNITED STATES
Current framework	• Strict regulation of wholesale business • LLU, interconnections, WLR, and other wholesale offers being widely used by attackers • Severe regulations on retail business with limitations to aggressive pricing and bundling	• Strict regulation of wholesale business, already extended to FTTH through fiber unbundling • Copper and fiber infrastructure being kept in parallel by NTT to provide both unbundling modes • Wholesale fiber prices already under pressure	• Wholesale regulation (LLU, others) have been dropped as NRA assumes that mobile and cable competitors provide an acceptable level of competition pressure • Ad hoc retail regulation depending on state-specific issues with limited/no impact on incumbent competitiveness • Interconnection tariffs between operators set up as historical base with direct link with costs
Key implications	**NGN networks likely to face regulation similar to current networks**	**FTTH network already regulated**	**Current policy should imply that NGN networks will not face wholesale obligations or any other significant restrictions**

Source: Interviews by McKinsey team, 2006; McKinsey analysis.
Note: LLU = local loop unbundling; WLR = wholesale line rental; FTTH = fiber-to-the-home; NRA = National Regulatory Authority; NTT = Nippon Telegraph and Telephone

that they are still to be deployed. Someone has to pay for the initial investment costs. If NGNs were to be regulated like PSTNs, for example, an investment group might have to assume that upon completion of its NGN investment, it would be required to open its network to competitors (effectively with no margin). Moreover, if this wholesale access were to be priced on a bandwidth basis, voice services offered by competitors could create significant price declines in the investor's retail market. The question, then, is whether incumbents (and new operators) would be willing to take on such a risk.

NGN regulation is already evolving, and three distinctly different regulatory models have emerged in different parts of the world. These regimes reflect differences in regulatory objectives and market structures. The three models are described in Figure 6:

- In Europe, NGNs are likely to face the same kinds of regulations that apply to current PSTN networks. This calls for strict regulation (for example, access, price, and so on) of the wholesale business. Attackers would be using such wholesale offerings as local loop unbundling (LLU), interconnections, wholesale line rental (WLR), and other offerings widely; thus there would be severe regulations on retail business (with limits placed on aggressive pricing and bundling).

- In Japan, NGNs (specifically FTTH) are already regulated. There are strict regulations of wholesale business in place, already extended to FTTH through fiber unbundling. Copper and fiber infrastructure are being kept in parallel by NTT to provide both unbundling modes. As a result, wholesale fiber prices are already under pressure.

- In the United States, current policy trends suggest that NGNs will not face wholesale obligations or any other significant restrictions in the immediate future. Since the US regulator assumes that mobile and cable competitors already provide an acceptable level of competition pressure, wholesale regulation (LLU and others) have been dropped. There is some ad hoc retail regulation, however, on state-specific issues, but this type of regulation has limited or no impact on incumbent competitiveness.

The success of these three different regimes is still to be proven, and the regulatory debate in some of these regions is still very hot. In Europe, for instance, the regulatory framework around NGNs is still in its infancy, and many countries (such as the Netherlands and the United Kingdom) and associations (such as the European Regulatory Group, or ERG) have launched consultations to understand the positions of different stakeholders around regulatory topics such as pricing, functional separation, and wholesale access. Much remains to be done and understood, but one thing is clear: involving industry stakeholders is part of the answer.

Managing the transition: The role of industry and policymakers

As stated in the beginning of this paper, both the industry players and the policymakers must work together. They must manage the transition to NGNs in such a way that investors are encouraged to invest and that stakeholders are able to capture the full benefits of the upgrades to NGN. However, the introduction of NGNs, with new pricing models, can substantially lower prices on core voice services, reducing overall returns to infrastructure. These lower returns can create disincentives to put in new infrastructure. This creates a different type of challenge for policymakers and industry players.

Rethinking the regulatory compact?

At present, the regulators must start managing the tension between creating adequate incentives to deploy infrastructure and ensuring that the telecommunications market remains competitive. The issue of creating adequate incentives for infrastructure cannot be taken lightly; the challenges are real. In the short term, incumbents will indeed invest in NGNs, but how much or at what pace is still not clear. However, the concern over competition is also substantial. In the middle of this debate, regulators will need to manage multiple pressures from operators with and without a network, who will be on opposite sides of the debate. And that raises another concern: will the regulators be tempted to "preserve" the industry as it existed before NGNs? In this context, regulators must:

- **Understand the economic impact of NGNs, not only in terms of specific upgrades but also in terms of their overall impact and that of regulation on the structure of the industry.** This means the policy must be grounded on solid economic analyses. These analyses must take into account not only the costs and potential services of future NGN upgrades, but also how the market dynamics might change both during the transition and in the medium term. Although forecasting must be approached with caution, it is still essential in making decisions about the future of the industry.

- **Approach decisions on pricing and infrastructure openings through a broad lens, one that recognizes that these decisions will affect the market structure beyond the redistribution of rents among industry players and consumers.** Price, in other words, is not just a method for distributing economic value among incumbents, competitors, and consumers. It is also a signaling device. Because of this role, it drives competitive dynamics. Therefore, as the regulators determine pricing and services, they will drive the industry and determine the structure of the market (for instance, in keeping competitors out of some businesses, where regulated prices are set low, and encouraging entry where prices are kept high—and, in fact, in some cases where arbitrage opportunities are created, enabling room for competition). This is a critical role that the regulators and policymakers must play, but in doing so they must be aware that they are also shaping the evolution of this critical sector of the world economy.

- **Avoid focusing on market price as the only measure of industry success.** Since deregulation, the regulatory toolkit has focused on breaking up the infrastructure (usually controlled by a large integrated incumbent) to allow entrants to piggyback on that infrastructure and cut prices. This approach has been phenomenally successful in the past. It has reduced supernormal profits, introduced market competition, improved and enhanced service offerings, and increased consumer welfare. It has worked well because lower prices (driven by competition) have generally put pressure on the incumbents to improve their operations and enhance their service offerings. However, as competition expands from pricing to include consumer loyalty, infrastructure differentiation, technological features, and innovation, the current toolkit comes up short in delivering the right answers. In most telecommunications markets, where price has become only one element of competition, firms are constantly seeking sustainable competitive advantages of other kinds. It is that search to create advantages that drives the innovations in services, technologies, and investments. In telecommunications, policymakers are intervening in this process. While this may be necessary due to the nature of the industry, they must recognize the longer-term impact of their interventions. This will require regulators to withstand political pressures to lower prices (and of course nobody likes higher prices) as well as to

demonstrate a willingness to tolerate temporary but meaningful sources of competitive advantage as part of the normal functioning of a market ("When in doubt, do not regulate.")

Can the industry lead a strategic dialogue with policymakers?

For industry players, the challenge is twofold: first, they must manage the strategic and tactical issues they face from NGNs. These encourage the long-term deployment of the NGN, but at a cost to their existing revenue models. Second, they must convince policymakers to rethink their approach to the regulation of the sector. This is essential to ensure returns to the infrastructure that will enable the transition to the IP-based revenue models. This will not be easy, as the entire regulatory toolkit and the policy debate has centered on how to "open up" the new networks (with some exceptions, such as the regulatory model in place in the United States).

In this context, industry players must:

- **Develop a clear economic and strategic plan around the deployment of NGNs, including the management of the transition process.** This plan would include not only a business plan that maps out the economics of deployment, but also a strategy for migrating users of existing networks to NGNs. It should also consider how to price wholesale and retail products during the transition for both traditional and NGN products.

- **Engage proactively in discussions with policymakers and other stakeholders on the long-term evolution of the industry, including the changes in market structure.** This would entail engaging in meaningful discussions around fact-based scenario analyses that could enlighten the future development of the industry. Understanding the potential impact of today's decisions in tomorrow's market structure is crucial to communicate clearly what is really at stake from the new NGN paradigm.

Conclusion

For the last 20 years and more, regulation and deregulation have transformed the telecommunications industry, making it one of the most vital markets in the world. But now the industry is at the cutting edge of technologies and opportunities that are still beyond our ability to imagine fully.

It is at this time that regulators, policymakers, and the industry must find the wisdom to think beyond what we can even see. They must set rules that will encourage the funding of this vastly expensive infrastructure—and give it time to take wing. Yet they must also find the appropriate level of competition, so that it will remain vital and sensitive to the needs of society and consumers. That is the challenge ahead.

Notes

1 This assessment of risk based on an estimate by McKinsey.

2 See The Economist (2006b).

3 See Reading (2006a).

4 See Deutsche Telekom (2005); British Telecom (2005); KPN (2005, p. 61).

5 *Australian Financial Review* 2005a, p. 11.

6 *Australian Financial Review* 2005b, p. 3.

7 Reuters 2006.

8 Reading 2006b.

9 *Financial Times* 2006, p. 15.

10 See Gartner (2006b).

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