Network Neutrality: An Opportunity to Create a Sustainable Industry Model

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Network neutrality is the principle that inhibits telecommunications network operators from discriminating among different kinds of Internet content, applications, and services traveling across their networks. Advocates of network neutrality argue that the principle underpins the Internet's explosive growth: if any and every kind of content, service, and application can be distributed over the Internet, then there is no limit to the innovations that Internet companies will invent for consumers to choose from. But network neutrality has, arguably, become the victim of its own success. Internet traffic has grown faster than network operators' related revenues, and they are now struggling to invest in the new network infrastructure needed to support more Internet traffic.

Not surprisingly, network operators are also trying to manage traffic volumes. Some are even deploying sophisticated network management technologies, such as *deep packet inspection,* which examine the nature and content of the traffic to identify possible sources of harm to network performance and also to protect the networks and consumers from increasingly sophisticated attacks and abuse. But as soon as network operators start scrutinizing the content of Internet traffic, edge players—providers of content, applications, and services as well as aggregators—worry that network neutrality may be infringed, limiting their will to innovate. Both consumers and regulators also worry about maintaining the confidentiality of consumer data.

At the same time, major edge players are building their own Internet traffic "pipes" or using the dedicated content distribution networks (CDNs) of companies to preempt possible network capacity constraints and avoid the performance limitations related to the speed of transmission and delay if their traffic traverses the traditional backbone of the public Internet. By by-passing the backbone of the public Internet, the edge players ensure that the immense volume of traffic they generate reaches consumers' Internet service providers (ISPs) at top speeds. In fact, the majority of the traffic destined for residential end users from edge players now flows over these specialized backbone networks. This situation can be seen as putting a different kind of strain on net neutrality: smaller edge players, unable to make similar investments, may not be able to match the larger players' performance, though whether this represents discrimination or simply a competitive disadvantage is open to debate. Policymakers can argue that even though small edge players may not be disadvantaged, network neutrality regulations need not extend to the backbone providers, including the CDNs, because backbone transport in almost all countries operates in a competitive

market. Moreover, the development of CDNs and private backbone transport has greatly benefitted the evolution of the Internet by the flow of new private capital that has greatly increased both performance and capacity.

However, the evolution of the backbone of the Internet from traditional Internet protocol (IP) interconnections to specialized networks to provide higher performance foreshadows the critical net neutrality issues vis-á-vis access networks with which policymakers must wrestle. The edge players that offer services demanding high performance or capacity such as video-rich content, gaming, and two-way multimedia conferencing will increasingly want differentiated service from where their traffic enters the access network to the end user in order to provide high-quality service. Unlike the competitive backbone market between edge providers and Internet access providers, access providers are positioned in the network where they do have unique market power since each end user typically is connected to only one access provider. Access providers need to invest capital to provide the differentiated services and increased capacity needed by edge players and end users. But the access providers will not invest this capital if they cannot earn reasonable returns. However, offering such differentiated services between edge players and end customers may be a departure from the pure "best effort" open-access principles of the Internet.

This is definitely a very complex picture for the telecommunications industry, and involves multiple angles. From an economic perspective, it is a debate on how to finance the new wave of infrastructure investments and who would incur the costs—for example, should edge players contribute? From a regulatory perspective, it involves complex regulatory issues covering both traffic and access management. Although network neutrality appears mainly as a discussion of traffic regulation, since it is closely related to capital expenditure funding decisions, there is also a strong link to access regulation. Thus, one cannot assess the network neutrality rules in any given country without understanding the status of that country's access regulation. Despite all these complexities, we believe, as we show in this chapter, there are some key industry messages that are starting to become clearer:

- Network neutrality is not an immediate major issue in the fixed-line industry. Despite decreasing numbers of fixed lines and revenues, the fixed-line sector has managed to successfully increase average revenues per line from its conventional, mainly copper-based access network in the past few years by successfully rebalancing in spite of the impact of applications such as voice over Internet protocol (VoIP). The issue in the fixed-line sector, however, is how to increase investments in fiber optic networks—particularly access—that are under current regulatory constraints. Once these networks are in place, capacity constraints will not have as great an effect on the content going through them.

- Network neutrality does matter for the mobile industry. Increasing capacity demands caused by new and heavy applications and an inability to re-price its services have meant that the industry will be under great pressure to deliver the future investments that are required for growth. We believe this industry, unlike the fixed-line industry, will constantly require network upgrades to keep up with capacity. Over-the-top (OTT) players (e.g., Skype, Netflix) also offer a fundamental challenge to mobile players because VoIP- and IP-based messaging applications have cannibalized traditional revenues.

- Traffic management issues will affect small edge players that leverage the "public Internet" to provide their services more than large edge players that more and more frequently use the competitive CDNs networks to provision their services.

- Network neutrality poses large risks for telecommunications operators, consumer privacy, and even—potentially—national security in general in the form of disclosure, adjudication, and discrimination.

- Regulators are caught in the middle of these complex and quickly evolving developments, and have largely been opting for a cautious approach.

This chapter sets out the background of the current issues affecting network operators' revenue and capacity as well as measures taken thus far by the industry to address those issues, and discusses current regulatory positions on network neutrality. It then proposes a set of aims that all industry players—network operators, companies offering Internet services and applications, and regulators—can pursue that will balance growing industry revenues to fund infrastructure investment with safeguarding network neutrality, and so release the next wave of services and applications over the Internet, with all the economic and societal benefits they promise.

THE INTERNET'S SUCCESS IS STRETCHING NETWORKS' CAPACITY AND REVENUES

The principles of an open Internet based on network neutrality developed at a time when facility-based Internet service providers could meet the demands of Internet traffic without straining their capital expenditure budgets. Similarly, Internet services and applications did not challenge the core revenue streams of the companies providing the Internet's physical transport infrastructure. Today the industry is quite different: explosive growth in Internet traffic has put operators under intense pressure to increase communications network capacity. This is expensive: estimates for upgrading fixed infrastructure to next-generation network in the EU-15 countries range between €200 billion and €250 billion. At the same time, operators are facing downward pressure on their revenues and profits, particularly from services offered "over-the-top" of the Internet by edge players,

making further investment at current levels of price and cash flow both difficult and unattractive.

Internet traffic has grown by 13,000 percent, or 63 percent a year, in the Organisation for Economic Co-operation and Development (OECD) countries over the past decade. It now dominates traffic on wireline networks, where it continues to grow at a compound annual growth rate of 40 percent.[1] Internet traffic will soon dominate wireless networks too: wireless Internet traffic is expanding in developed countries by 100 percent a year or more. Recent proliferation in movie-streaming services and connected home gaming systems is accelerating consumer demand for more bandwidth. These video-oriented applications represented more than 37 percent of total global consumer Internet traffic in 2010.

However, at the same time, some OTT Internet applications—such as VoIP—are eroding operators' existing revenue streams and cash flows. Although content providers continue to grow their businesses quite rapidly, McKinsey analysis in North America suggests that traditional telecommunications industry players, both mobile and fixed, lost around US$30 billion of revenue between 2005 and 2010 to OTT applications that substitute for existing revenue streams.

REGULATORY RESPONSES CONCERNING NETWORK NEUTRALITY

So far, we have seen how rapid and profound changes in the Internet landscape appear to be straining the principle of network neutrality. Telecommunications regulators around the world take a variety of approaches to the issue, which is appropriate given the variety of interests at stake. These stakeholders include the content providers and aggregators, who fiercely support the open Internet; telecommunications executives, who argue that more beneficiaries of an expanding Internet—such as Internet search engines, video content providers, and social networks—must share more of the heavy burden of network capacity expansion; and consumer advocates, who call for more privacy protection and transparency.

Examining the main regulatory approaches to network neutrality followed in the United States, the European Union, and Asia reveals some positions that will need to be refined to enable the successful co-existence of telecommunications operators and content providers. Current regulations tend to equate protecting network neutrality on its own as the best means of promoting competition in the provision of Internet infrastructure and services. But this approach bears the risk of some unfortunate unintended consequences.

The US approach

The US regulator, the Federal Communications Commission (FCC), has cautiously promulgated the following network neutrality principles:

- **Transparency:** Telecommunications operators must disclose their network management practices, performance characteristics, and terms and conditions in a clear way so that consumers and edge providers can make appropriate informed decisions.

- **No blocking:** Fixed operators may not block lawful content, applications, services, or non-harmful devices. In the same manner, mobile broadband providers may not block lawful websites or block applications that compete with their voice or video telephony services.

- **No unreasonable discrimination:** Fixed broadband providers may not unreasonably discriminate in transmitting network traffic as long as it is lawful.

The US approach recognizes that translating these principles into practice is challenging, to say the least, for the rapidly evolving Internet industry. Therefore the FCC encourages the industry to follow these principles while inviting potential aggrieved parties to file complaints, allowing a "case law" to develop that will inform more detailed regulations in the future. Despite their caution, the rules are already being challenged in the courts by Verizon and other service providers. The challengers argue that market forces are working fine on the Internet: there is no need for more regulation since existing antitrust laws provide sufficient protections.

While assessing the status of regulations in the United States, one should keep in mind that the country has two competing fixed-infrastructure operators and the US regulatory authorities relieved network operators of the obligation to unbundle their networks. Together these give some immunity to operators, especially to fixed-line players, against the potential side effects of network neutrality regulation.

The EU approach

The European Union (EU) follows a "flexible in principle yet cautious" approach in its initial policies regarding network neutrality, which were adopted in April 2011. These policies enshrine the following principles:

- **Reasonable network management allowed:** Both fixed-line and mobile operators are allowed to manage traffic on their networks.

- **Transparency:** Consumers and content providers should be notified of network management policies.

- **Minimum quality requirements:** National regulatory authorities can impose "minimum quality requirements" for network transmission services concerning both performance and content to ensure that end users have access to comprehensive, comparable, and user-friendly information.

- **Close scrutiny:** The European Commission will keep a close eye on the behavior of operators to see whether they are complying with these principles. The Body of European Regulators (BEREC) is currently finalizing a report on their compliance so far,

which will inform further EU policies, if necessary, on network neutrality.

Individual countries in the European Union are interpreting the principles in different ways. For instance, the Netherlands has recently passed a law strictly enforcing network neutrality and forbidding any blocking of Internet services, the use of deep packet inspection to track customer behavior, and any other filtering or manipulation of network traffic. Italy, in contrast, takes a more laissez-faire approach. Its government has set up a regulatory roundtable including industry executives to review the topic in greater detail, from which no firm conclusions have yet emerged.

At the EU level, however, current thinking tends toward using network neutrality as a tool to promote competition among Internet providers. The EU Commissioner for the Digital Agenda, Neelie Kroes, stated recently that "If measures to enhance competition are not enough to bring Internet providers to offer real consumer choice, I'm ready to prohibit the blocking of lawful services or applications."[2]

The Asian approach

In Asia, some regulators take the view that network neutrality should be maintained by market power and anti-competition rules, allowing more flexibility in Internet markets.

For example, in Hong Kong, the Office of the Telecommunications Authority (OFTA) issued a discussion paper on net neutrality in April 2009 setting out its view that net neutrality mainly concerns anti-competitive and discriminatory conduct. OFTA believes that its existing regulations addressing market power issues and discriminatory activities are adequate to safeguard against anti-competitive and discriminatory actions that threaten net neutrality.

Implications of imposing net neutrality

Implementing policies to protect net neutrality, without making any other changes in the current Internet environment, risks triggering a number of unintended consequences concerning disclosure, adjudication, and discrimination.

- **Disclosure:** Will carriers that disclose their network management practices to satisfy transparency rules enable "the bad guys" to hack into their network, jeopardizing privacy of information or even national security? If so, who will be liable—the regulator, the carriers, or someone else? And will disclosing performance characteristics entail disclosing sensitive competitive information?

- **Adjudication:** First, who will determine what is a non-harmful device and how? To illustrate, a "chatty" wireless device that powers down frequently to save battery life can cause heavy signaling congestion on a 3G network, denying other users access. Can a carrier prohibit such a device for being

"harmful"? And will a carrier be allowed to require device manufacturers to test devices for compliance in the carrier's own laboratories, to protect its network from harm? Second, who determines what is lawful concerning content and network practice and performance?

- **Discrimination:** Will a policy of no unreasonable discrimination inhibit investment in additional capacity and/or services and/or applications? Consider the extreme case, promoted by some consumer advocates, in which operators are allowed no price discrimination between different types of content and no usage-based pricing. For operators to meet the likely volume of demand for new services or applications fostered by such a non-discriminatory business model would require massive new capital investment with a high risk of no or negative return on investment, which rational operators would be unlikely to make.

THE INDUSTRY RESPONSE

Pressures on the physical capacity of the public Internet have prompted operators to look for ways to prioritize traffic. They have also prompted some larger edge providers to invest in their own high-speed Internet infrastructure or use content distribution networks. Both responses raise questions concerning network neutrality.

To make further capacity investments, telecommunications operators and edge providers alike need robust income streams and manageable investment costs. One priority for the industry therefore must be to enable both mobile and fixed-line operators to migrate to more sustainable business models. In this shifting competitive context, fixed-line players have made some progress on re-pricing, while mobile players are still behind, particularly in the European Union. Both fixed-line and mobile players need to work with regulators to develop policy that balances the need for growing revenues to fund investment with network neutrality. In particular, given the current dynamics of the industry, policy concerning revenue must recognize the critical need to stimulate investment in the network infrastructure.

Different types of capacity investment for different parts of the Internet

Physically, the Internet today comprises a network of IP-enabled networks in three parts that require different types of investment to increase capacity: backbone networks interconnecting all the Internet access networks; fixed high-speed Internet access links—using digital subscriber line (DSL), fiber, cable coax, or fixed-wireless technology—connecting individual residential or business customers to the backbone networks; and mobile access links that do the same for customers—via a second-, third-, or fourth-generation (2G, 3G, or 4G) cellular infrastructure.

Fixed-line operators need to make a major capital investment to add each new customer—the fixed access

line. However, once in place, this line needs no further investment whatever the customer's level of usage, unless the customer wants much higher speeds. A mobile operator's principal capital investment is its radio access network. But as mobile customers increase their usage, the operator must invest in extending the radio access network's capacity, both in radio frequency (RF) interface and backhaul, in order to maintain performance.

Both fixed and mobile access links are supported by backbone networks. But using the public IP network of networks' backbone can impede edge players' performance and add extra costs. Major edge players—the content providers and the service and applications providers—need to achieve higher levels of performance more cost effectively than public IP backbone networks can support. So they either build their own high-speed fiber networks to connect directly to fixed and mobile Internet access providers or use CDNs, whose specialty is providing backbone pipes.

Progress toward sustainable business models

Huge increases in consumers' bandwidth requirements coupled with the loss of traditional voice revenues to VoIP services have prompted both fixed-line and mobile operators to protect revenues by re-pricing services. Although fixed-line players have so far done a better job of maintaining average-revenue-per-user metrics, among mobile operators a structural mismatch has emerged between mobile broadband pricing and bandwidth consumption (Figure 1). Some regulators around the world are also adopting measures encouraging operators to invest in network capacity, for instance, by allowing pricing flexibility or offering direct subsidies. Meanwhile, edge players are advancing in building their own Internet backbones, trying to by-pass network capacity constraints and increase quality of service. However, this creates challenges for the business models of smaller edge players.

Re-pricing to increase resilience

Fixed-line players are generally doing better than mobile access providers at charging more for faster connections. In Sweden, for example, the whole market has succeeded in migrating customers from slower-speed asymmetric digital subscriber line (ADSL) packages to higher-speed connections over time. Sweden's telecommunications operators even managed to increase prices from 2009 to 2010, because consumers are recognizing the advantages of faster connections and will pay for them (Figure 2).

Re-pricing in fixed-line operators: However, fixed-line operators following the kind of re-pricing approach adopted in Sweden will not generate the amount of money they need to upgrade their telecommunications networks to meet future demand. Pressure to invest in fiber optic lines is rising: our analysis of current bandwidth usage patterns across Europe indicates that average households are on course to push the limits of bandwidth that can be delivered by copper wires by 2015. We estimate that upgrading the fixed-line telecommunications networks to fiber across the EU-15 is likely to cost between €200 billion and €250 billion, as noted above. Fixed-line network operators are unlikely to make this long-term investment with no expectation of meeting or exceeding their cost of capital. They need to cultivate a supportive regulatory environment, just as regulators need to develop careful strategies promoting infrastructure investment by operators, to enable the next wave of Internet use.
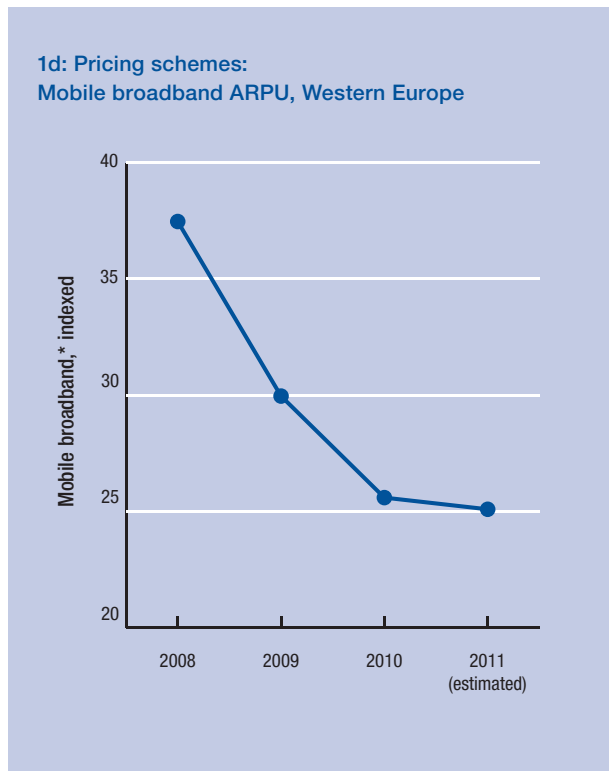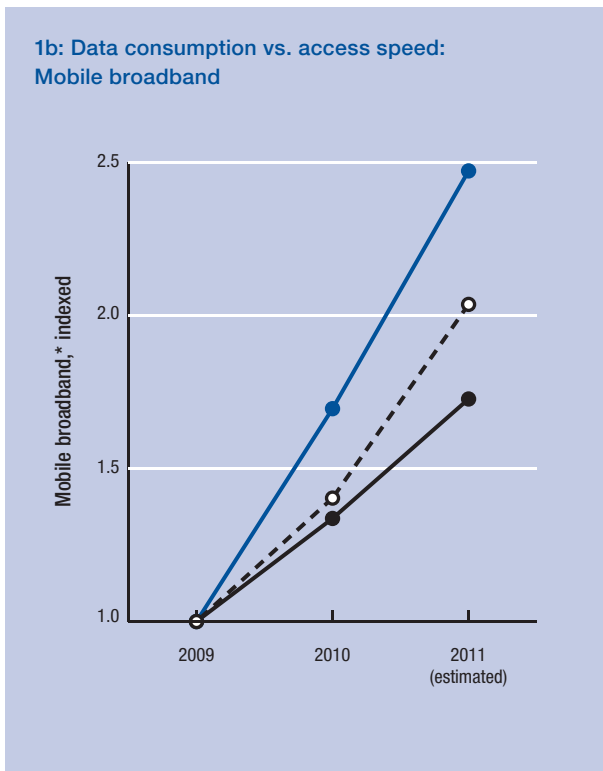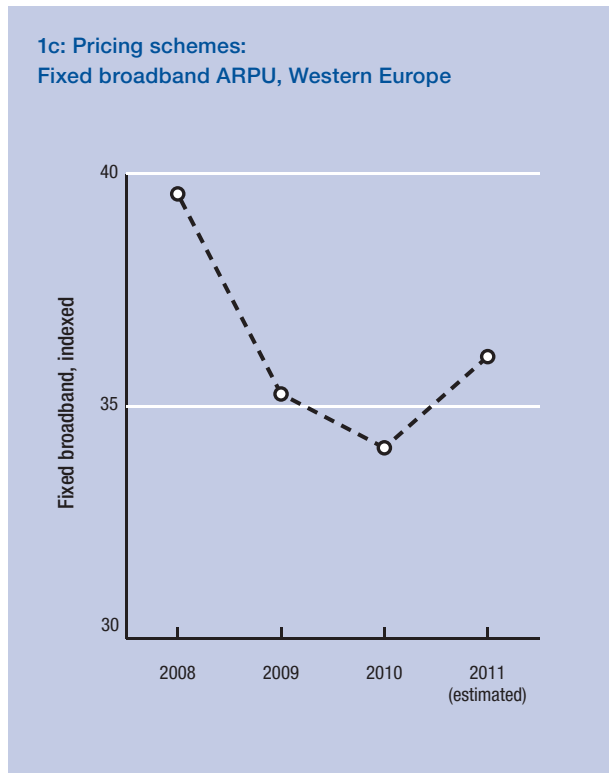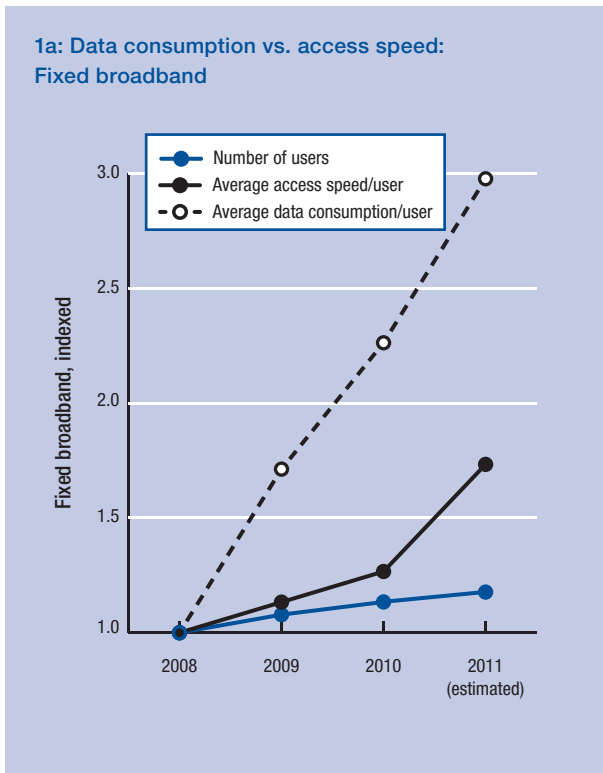
Re-pricing in mobile operators: Over the past four years, as people have used more mobile data services and therefore greater bandwidth, the unlimited data plans offered by some mobile carriers have begun to erode customer value. Unlimited data plans are effective tools for acquiring customers but unsustainable in the long term, since the performance of radio access networks, which account for the vast bulk of mobile operators' capital expenditure, is very sensitive to increased demand. In many mobile markets, data traffic is growing at a compound annual growth rate of 80–150 percent with the explosion of smart phones, tablets, dongles, and new video applications.

Mobile operators in some markets are managing to re-price. For example, in the United States operators have introduced tiered pricing for mobile data and moved to fixed monthly voice plans. Customers who use more bandwidth pay for the privilege. In Russia, one company offers pricing bands for data dongles, with users paying a fee proportional to usage. In Germany, an operator sells data plans as bolt-ons (or add-ons) to voice services, allowing customers to purchase blocks of mobile bandwidth each month. There are other models mobile operators can follow to rebalance their prices as a competitive reaction toward the shifting of their traditional services to IP. One option is for operators to bundle mobile voice service with different mobile data packages that, if priced correctly, can preserve their mobile average revenue per user (ARPU) levels and offset the risk of losing existing voice and short message service (SMS) revenues. Another more familiar option could be to mimic most fixed-line players and introduce access fees while significantly reducing pricing based on usage. This method worked well for fixed-line players, where prices of fixed-line calls converged to termination rates, or zero in the case of a full VoIP call, a trend that may easily occur with mobile pricing as well.

Financing the new wave of infrastructure investments

The new wave of infrastructure will require different types of investment incentives for fixed-line and mobile operators.

Figure 1: Fixed-line vs. mobile: ARPU levels and consumption growth

1a: Data consumption vs. access speed:
Fixed broadband

Legend:
- Number of users
- Average access speed/user
- Average data consumption/user

Y-axis: Fixed broadband, indexed (1.0 to 3.0)
X-axis: 2008, 2009, 2010, 2011 (estimated)

1c: Pricing schemes:
Fixed broadband ARPU, Western Europe

Y-axis: Fixed broadband, indexed (30 to 40)
X-axis: 2008, 2009, 2010, 2011 (estimated)

1b: Data consumption vs. access speed:
Mobile broadband

Y-axis: Mobile broadband,* indexed (1.0 to 2.5)
X-axis: 2009, 2010, 2011 (estimated)

1d: Pricing schemes:
Mobile broadband ARPU, Western Europe

Y-axis: Mobile broadband,* indexed (20 to 40)
X-axis: 2008, 2009, 2010, 2011 (estimated)

Source: McKinsey & Company analysis.
Notes: ARPU = Average revenue per user. The vertical axes used indexed units, which means that different metrics are converted to a common scale starting at one.
* Small and big screen users

Figure 2: Access-speed pricing and the fixed-investment case: The shift of fixed customers from low-speed packages to higher-priced high-speed packages
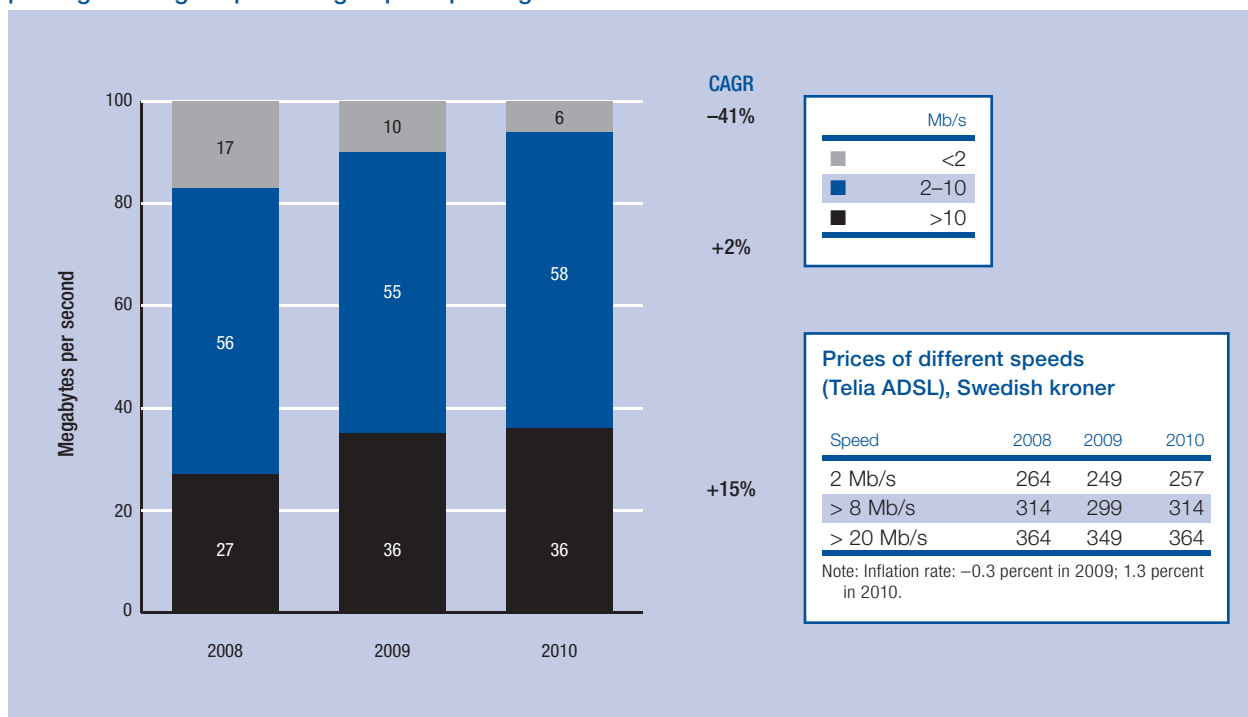
Source: McKinsey & Company analysis.
Notes: Data in this figure are from Sweden. These prices do not include inflation, but that is so low that the effect can be dismissed.

Fixed investment incentives: Studying markets that have already invested in fiber networks on a significant scale reveals two regulatory models that seem successful: one laissez-faire and one based on subsidies.

- **Laissez-faire model:** This model, followed in the United States, encourages operators' infrastructure investments by guaranteeing them attractive financial returns by relieving them of the obligation to unbundle their networks. In essence, this model provides regulatory certainty that benefits from investing in fiber infrastructure can be captured by those making the investment. This seems to be one reason why Verizon has invested more than US$18 billion in the last five years in a fiber-to-the-home network that currently covers 14.5 million residences in the United States. However, the model does not incentivize operators to roll out infrastructure in unprofitable areas and may need in future to be complemented by some sort of subsidy model. Moreover, the United States is unusual in that the majority of fixed-line Internet access is provided by cable operators that can increase capacity at a small fraction of the investment needed by telecommunications operators, which use DSL infrastructure, to do the same.

- **Subsidy model:** This is used mostly in Asian countries such as Singapore, Malaysia, and, to some extent, Japan, to promote broadband access for all. It offers network operators either indirect subsidies, through tax incentives, or direct subsidies for deploying fiber networks. Some countries—for example, Australia and New Ze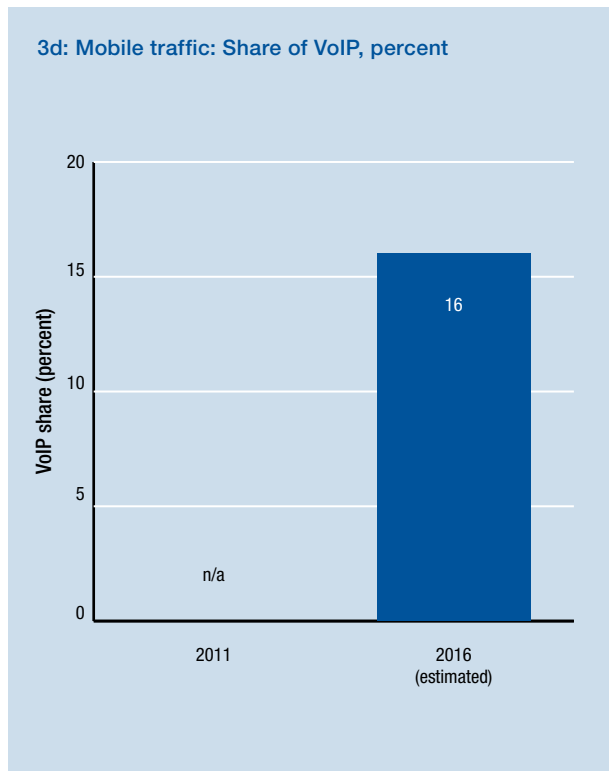aland—have gone further and se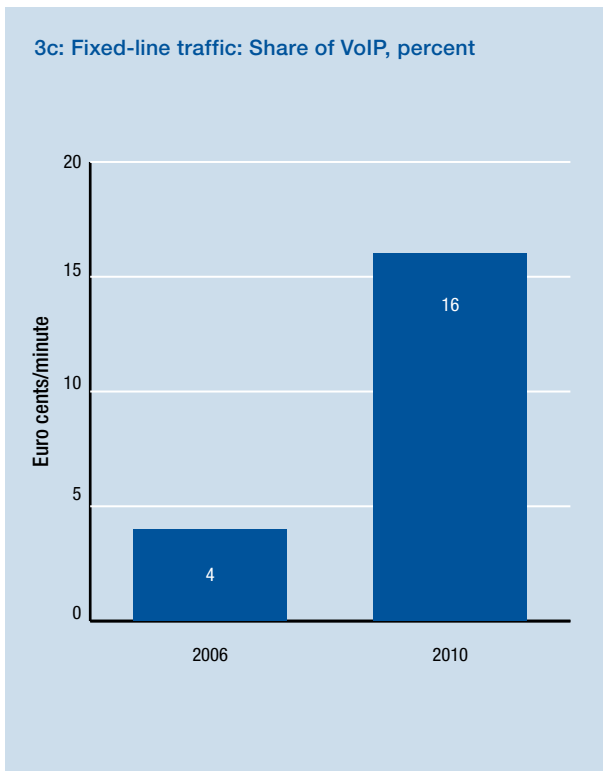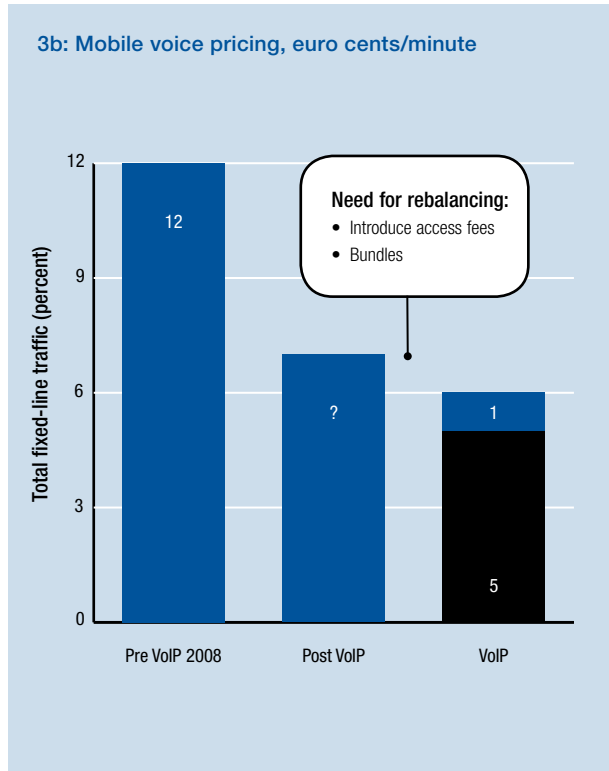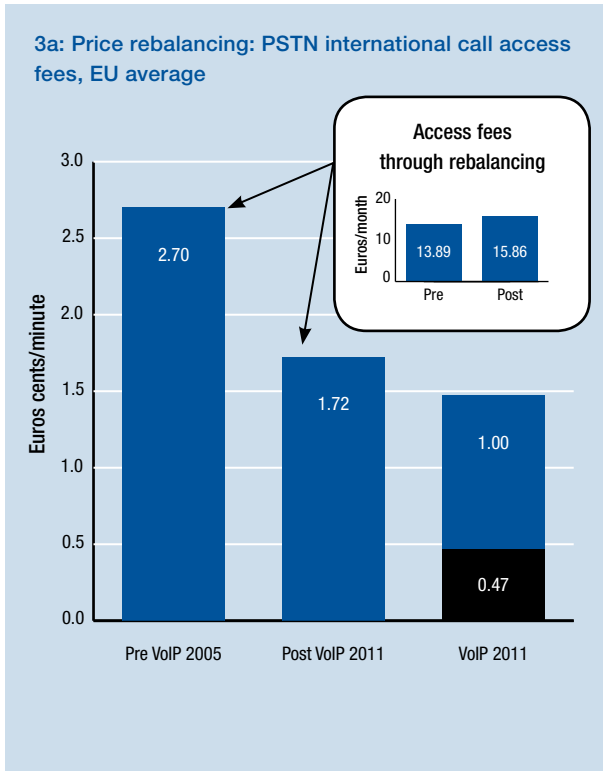parated out a neutral (government-owned) entity from the incumbent's network through which to channel the public infrastructure investments. This entity then provides wholesale Internet access pipes at regulated prices to retail Internet service providers, and functions like any other regulated utility.

Mobile investment incentives: Regulators control many aspects of mobile networks that affect costs and returns from their network investments, and can therefore make investment more attractive. For example, regulators can allow operators to share parts of their networks and so lower their costs. They can also set economically viable network coverage requirements, make more spectrum available at an affordable cost, and maintain a reasonable degree of competition in the mobile arena through licensing and access regulations. The appropriateness of such measures will vary from market to market. At a minimum, regulations need to give mobile operators the freedom to re-price (Figure 3).

Contribution from edge players

The continued explosive growth in Internet applications and services and the traffic they generate has forced important changes in the architecture of the Internet. Major edge players today, as noted above, are already addressing physical Internet capacity constraints and performance limitations by investing in private backbone networks or by using CDNs, which transport content from the edge to the destination Internet access providers. As a result, consumers are enjoying better performance and lower costs for many Internet applications

Figure 3: Re-pricing: Fixed-line industry after VoIP and mobile industry

3a: Price rebalancing: PSTN international call access fees, EU average

Access fees through rebalancing

Pre 13.89   Post 15.86

Euros/month

2.70 (Pre VoIP 2005)
1.72 (Post VoIP 2011)
1.00 / 0.47 (VoIP 2011)

Euros cents/minute

3b: Mobile voice pricing, euro cents/minute

Need for rebalancing:
• Introduce access fees
• Bundles

12 (Pre VoIP 2008)
? (Post VoIP)
1 / 5 (VoIP)

Total fixed-line traffic (percent)

3c: Fixed-line traffic: Share of VoIP, percent

Euro cents/minute

4 (2006)
16 (2010)

3d: Mobile traffic: Share of VoIP, percent

VoIP share (percent)

n/a (2011)
16 (2016 (estimated))

Source: McKinsey & Company analysis.
Note: PSTN = Public switched telephone network; black bars indicate the cost of VoIP (termination fee).

and services. Some consumer advocacy groups believe this development may skew net neutrality and harm smaller edge players, but it could also simply reflect a legitimate scale advantage achieved by larger players, which ultimately benefits consumers.

The complexity of the network neutrality pricing issues among Internet access and backbone providers and the edge players that generate the traffic is illustrated by recent discussions about the peering and transit agreement that determines the pricing of Internet traffic exchanged between the companies. Internet peering and transit agreements are signed between ISPs—both access and backbone providers—and determine payments for Internet traffic exchange. Traditionally, smaller players pay larger players to transport their traffic, and players of equal size exchange traffic without charging each other fees. However, the recent increase in video downloads is creating an asymmetric flow of traffic between backbone companies using CDN technology and Internet access providers, and creating new disputes with requests for regulators to intervene. Whether this development undermines principles of net neutrality is the subject of much industry discussion. Thus far, however, the FCC, for example, has not regulated peering and transit agreements: it considers these to be business contracts between private parties and has declined to get involved in commercial disputes.

We believe the way to resolve such debates is to foster collaboration between edge players and access providers and thus create a win-win solution.

A COLLABORATIVE SOLUTION?

To prevent regulators from implementing policies that could discourage investment or have other unintended consequences, we believe that network operators; the major content, service, and application providers; and regulators need to come together to develop mutually beneficial solutions on net neutrality. If operators are allowed to manage traffic transparently while at the same time all industry actors collaborate to create conditions enabling further investment in network infrastructure, then the Internet can move into its next wave of growth. Principles that could assist in this endeavor include:

- **Allow operators to manage traffic with high levels of transparency toward customers.** First, network owners should be allowed to manage traffic on their networks so as to protect networks from harm and handle congestion effectively, but they must be more transparent about network management, service levels, and all relevant terms and conditions for consumers. Operators' policies concerning data collection, retention, and privacy should also be transparent. Future innovation and growth in Internet services and applications depend on preserving both openness and support for privacy on the Internet.

- **Incentivize investments by lowering input costs and/or providing favorable regulatory environment:**
  - **Make more inputs available at lower cost.** Given the need for increased massive expansion of the Internet, regulators should consider implementing approaches that lower the cost of inputs controlled by government policies, such as the cost of spectrum and rights of way. In addition, regulators should exercise their power to make more of these critical inputs available. For example, governments could ensure that construction companies dig trenches for installing fiber cables when they build or restore highways, or that government-owned roofs can be used for cell towers. Allowing site sharing is another means of increasing network capacity. Such measures will allow operators to expand their networks faster and at lower cost. The appropriateness of these measures will vary from market to market.

  - **Allow operators pricing flexibility.** Operators need to price services flexibly to achieve the levels of cash flow that will allow them to make the infrastructure investments required to meet surging demand. Regulators should create a favorable environment supporting infrastructure investments, such as granting regulatory holidays to fiber investments.

  - **Allow operators to provide differentiated services to edge players that share the same physical infrastructure.** These services will provide edge players with additional higher performance to support new innovation. Operators will be able to recoup their investment in improved performance and capacity from both traditional Internet access revenues and new differentiated services, thus being able to earn a return on investment that justifies continued investment. Operators must offer these services in a transparent, non-discriminatory manner.

- **Require operators to provide a high-quality best-effort service with minimal speeds.** This service is the baseline service that provides global interconnectivity and open access. This baseline provides for the continued innovation that has fueled the spectacular growth in Internet services and applications.

A formal net neutrality policy with these principles in place would be a win-win outcome: operators would be encouraged to invest in their networks, Internet players would be free to innovate and deliver services to a global user base, and governments would benefit from the impact of upgraded networks on the economy and society in general. Negotiating rules based on these principles will not be easy, however. For instance, achieving transparency without triggering any of the unintended consequences outlined above will take thoughtful discussion among all the parties involved. But countries that succeed will foster a continued virtuous cycle of investment,

innovation, and demand for new services and applications that will bring benefits to their consumers and across their information and communications sectors.

NOTES

1 Global Internet Traffic database; OECD – Cisco – 1984–2009.

2 Kroes 2011.

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