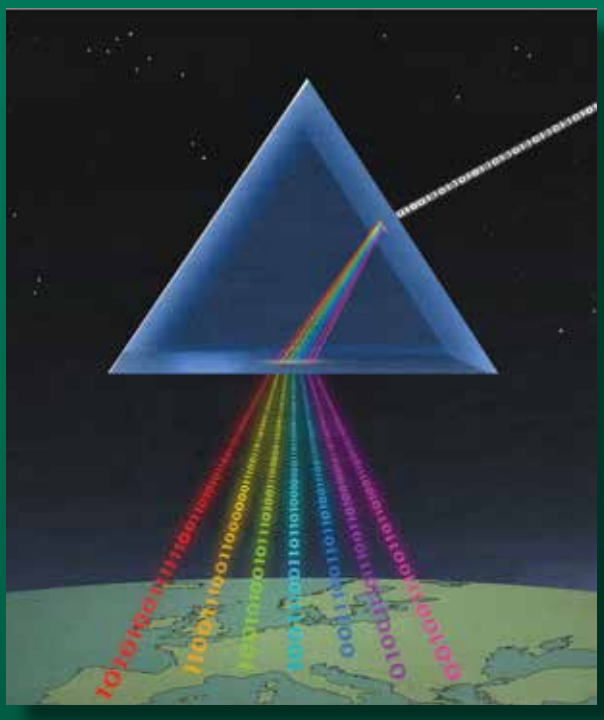
Five Priorities for Achieving Europe's Digital Single Market



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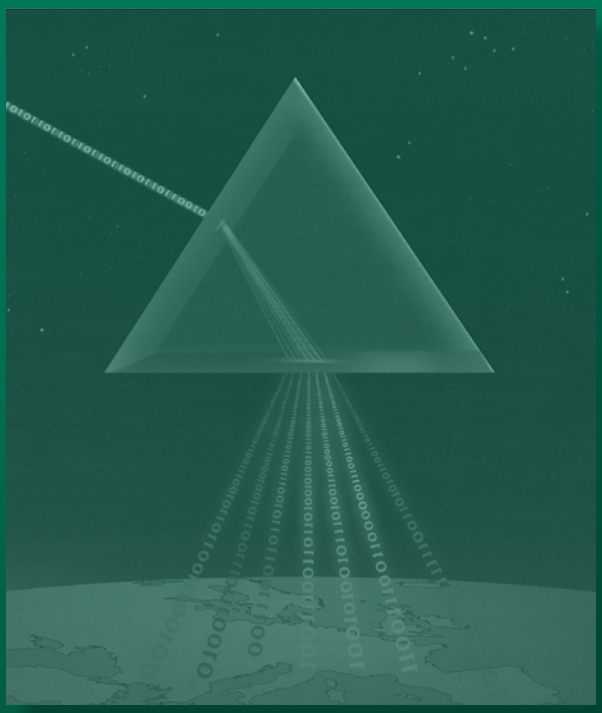

FIVE PRIORITIES FOR ACHIEVING EUROPE'S DIGITAL SINGLE MARKET

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CONTENTS

EXECUTIVE SUMMARY

The European Union has set out ambitious digital goals in its vision for a Digital Single Market (DSM)—and with good reason.

- The EU's Internet economy contributes some €700 billion a year, or 5 percent, to GDP, and the high-tech sector employed almost 8.5 million people in 2013 (almost 4 percent of total employment).
- The potential economic impact is even greater.
- The next wave of growth will be propelled by the Internet of Things (IoT), which is expected to contribute almost €330 billion of new revenues in Europe by 2020.

Europe has come a long way, and the European Commission's strategy for achieving a Digital Single Market is headed in the right direction, but Europe can do more.

- Europe's digital ecosystem trails that of other developed countries in North America and Asia.
- Europe's share of the global consumer-oriented information and communication technology (ICT) market is expected to decline by 2 percentage points by 2019 as other regions grow more quickly.
- Across the four segments of the digital sector—telecommunications, "over-the top" (OTT) content and service providers, TV and other broadcast, and operating systems and devices—Europe's market share is expected to stay flat or fall.

As the marketplace continues to evolve, policymakers and regulators need to account for two big trends in their decision-making.

- The convergence of technologies, services, and companies. Multi-

ple technologies, such as mobile, fixed, cable, and fiber, are increasingly converging and so are the services that run on them. Defining companies by type of technology or service is no longer valid as all kinds of companies are moving into adjacent businesses either on their own or through partnerships.

- Continuous investment is necessary to build and maintain world-class networks that can handle fast-rising and rapidly evolving demand. Some €216 billion of investment is needed to meet the EU's digital goals. We estimate that approximately €110 billion of combined public and private investments are currently planned, leaving a gap of €106 billion.

Five topics should represent digital policymakers' top priorities.

- Ensuring consistent standards across digital services for consumers and companies
- Analyzing the market structure with regard to optimum investment and growth
- Adapting wholesale market regulations to drive investments in next-generation access (NGA)
- Modernizing spectrum policy to cover accelerated demand
- Enabling specialized services with guaranteed network quality needs

Consumers and companies need consistent standards.

- Under the current regulatory framework, consumers today cannot rely on consistent standards, and some companies are faced with higher compliance costs and less flexibility to innovate.
- Regulatory regimes need to be modified to reflect new realities. The EU should consider changes in seven specific areas of regulation: privacy and data security; the commercialization of data; transparency; quality of service; accessing emergency services; any-to-any connectivity; and portability.

Europe needs a market structure that can support its DSM goals.

- European competition policy with respect to the telecommunications ecosystem—especially the criteria for merger review and the focus of merger remedies—needs to be rethought for the digital age.
- Regulators should shift from price as the dominant regulatory objective to a more comprehensive and balanced assessment that includes investment, technical progress, innovation, efficiency, and quality of service (all with reasonable standards of proof).
- Market definitions should take a wider view of shifting demand for

services, including the impact of OTT-based competition in voice and messaging.

The wholesale telecommunications market has undergone radical change; wholesale market policy and regulation need rethinking.

- Homes and businesses today are served by an array of telecommunications technologies that are converging to make high-speed access available through fiber and high-speed copper wires, coaxial cable, and mobile connections.
- There is strong evidence that the existing policy and regulatory framework has not led to the levels of investment needed to advance Europe's digital infrastructure.
- A new, simpler, technology-agnostic, and more market-based approach is called for. It should be based on two principles: segmenting markets according to current competitive dynamics and making light-touch ex-post regulation the rule and ex-ante the exception.

Spectrum policy needs modernizing.

- Policymakers need to allocate more spectrum for mobile.
- Several spectrum-sharing models also offer the potential to increase utilization through approaches that complement long-term, exclusive-use licenses.
- The requirements of the Internet of Things make spectrum release planning—including national spectrum plans—ever more important.
- Advancing HetNet (heterogeneous network) deployment can expand network capacity.
- Policymakers can materially assist the development and rollout of 5G by coordinating spectrum assignment on an international basis.

New applications such as those required by specialized services demand higher quality service than is currently available on a regular basis.

- The EU has recognized the need to allow guaranteed quality of service to foster innovation.
- Allowing different commercially driven models to flourish, in part by ensuring consistency of regulation across countries, can help enable successful rollout of specialized services.

AN AMBITIOUS DIGITAL VISION FOR EUROPE

The European Union has set out ambitious digital goals in its vision for a Digital Single Market (DSM)—and with good reason.

The EU's Internet economy contributes some €700 billion a year, or 5 percent, to GDP (at current prices), the high-tech sector employed almost 8.5 million people in 2013 (almost 4 percent of total employment), and there was more than €80 billion of high-tech M&A and IPO activity in Europe in 2014, representing more than 3 percent of all such transactions. But this is only the tip of the iceberg.

From shopping to sharing to socializing, the digital experience for European consumers is a whole new universe of connectivity that's local (it's always where you are), personal (tailored to your needs and preferences), social (all your friends are there as well)—and always on. Mobile connectivity provides continuous access to information, communication, friends, and entertainment—among myriad other things—and is changing the way billions of people go about their daily lives. It's hardly an exaggeration to say that connectivity has become a twenty-first century necessity as more and more basic services from governments, banks, retailers, media companies, and others are conducted online.

Europeans have been quick to embrace the convenience, fun, and commercial opportunities of 24/7/365 connectivity, and their appetite for more, better, and less expensive digital access, devices, and services shows no signs of being sated. Smart-device penetration in Europe is projected to climb from 33 percent in 2014 to 70 percent in 2019. Total data consumption will more than triple from 12,000 petabytes per month to 38,000 petabytes per month, driven mostly by rising consumer demand. Much of this demand will be for video traffic, which is projected to represent 75 percent of all digital traffic in Europe in 2019, up from 53 percent in 2014.[1]

Research late last year by The Boston Consulting Group shows that the value of the mobile Internet alone (not including desktop or laptop usage) to consumers in the EU5 alone is about €770 billion per year, or about €4,700 on a per capita basis. This surplus is about 13 times what consumers pay for devices, apps, services, and access. (See *The Mobile Internet Economy in Europe*, December 2014.)

The potential economic impact is even greater. We estimate that Europe's Internet economy, or eGDP, will contribute almost €1.1 trillion, or 7.5 percent, to Europe's total GDP in 2020. The Internet economy will grow up to 13 times faster than the economy as a whole, and eGDP growth will represent some 40 percent of overall economic growth for the decade from 2010 to 2020. According to the European Commission, cloud computing and

the app economy will create an additional 3 million jobs in Europe by 2020.

The Internet is creating entirely new businesses as well as transforming traditional industries. All kinds of enterprises are using digital technologies to improve operations, cut costs, and reach new markets and customers. The app economy is flourishing, too. There have been more than 330 billion cumulative downloads from the various app stores since 2009. The rate of growth is mind-boggling: more than 140 billion downloads took place in 2014 alone.[2]

The Impact of the Internet of Things

The next wave of growth—and it's a very big wave—will be propelled by the Internet of Things, which is expected to add some 8.5 billion connected machines, sensors, data collectors, and other devices to the installed base in Europe by 2018 and contribute almost €330 billion of new revenues by 2020. For example, we expect the market for connected cars to reach €8 billion by 2020. The retooling of product design and manufacturing using digital technologies will result in a market of some €50 billion by 2020. The market for smart-city applications such as smart metering, intelligent tolling systems, and remote building management will equal some €45 billion. In Germany alone, we estimate 5 to 8 percent reduction of total manufacturing cost from Industry 4.0. Increases in the machinery sector could reach 15 percent and in food and beverage as much as 10 percent. There are many other areas of impact, including retail, transportation and logistics, and health care. (See Exhibit 1.) And these values represent only the actual sales of goods and services related to the IoT—they don't take into account the add-on benefits that will flow through Europe's economy from, say, the energy savings resulting from smart homes or better truck or bus fleet management, or the better quality and length of life from improved health care.[3]

Plenty of Progress…

Europe has come a long way in the development of its digital market. Network infrastructure, the physical and technological foundation of the Internet economy, has made significant strides as well. (See Exhibit 2.) Basic broadband coverage (including satellite) reached 100 percent of households in 2014. Between 2011 and 2014, NGA coverage, which represents a step-change in the speed and quality of broadband service, increased 22 percentage points to 68 percent of house-

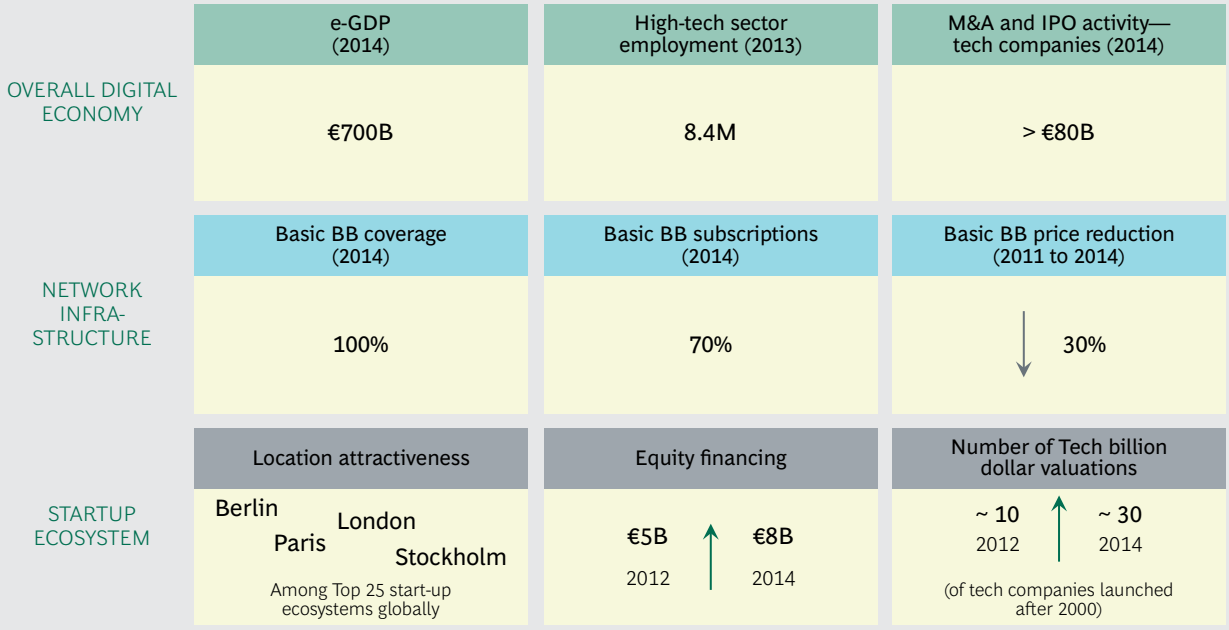
EXHIBIT 1 | Internet of Things Will Have Big Impact Across Multiple Industries in Europe

	Connected car	Smart City	Industry 4.0	Smart home	mHealth	Wearables	Retail	Logistics & transp.
Use-cases (examples)	• Self-driving vehicle • Car sharing • Smart parking	• Intelligent tolling systems • Remote building management	• Virtual product design • Fully automated manufacturing	• Lighting control • Media-sharing and control	• Vital-signs monitoring • Chronic-disease management	• Identity recognition • Environment surveillance	• Smart vending • Connected warehouses (stock management)	• Asset controlling (location and condition) • Traffic and passenger management
Approximated EU Market size in 2020 €B	8	45	50[1]	20	5	5	15[2]	30

Overall value of IoT ~ €330B

Sources: BCG analysis; Gartner; Cisco VNI; SBD; Pike research; IDC; ABI; Euromonitor; Nunatak Group; MarketsandMarkets Analysis, Harbor Research, EIU.
[1]Figure refers to total IoT in manufacturing not Industry 4.0 alone.
[2]Figure refers to overall Retail industry, not one specific application.

Exhibit 2 | Europe's Internet Economy Has Come a Long Way



Sources: GP.Bullhound; Global Startup Ecosystem Ranking 2015, European Commission; Eurostat; Pyramid; tech.eu; BCG analysis.
Note: Basic BB – "xDSL, Cable, FTTX, WiMax, HSPA, LTE", coverage has reached 100% including SatelliteSource: bcg.perspectives, DowJones Venture.

holds, and long-term evolution (LTE) coverage rose by 71 percentage points to 79 percent of households. The number of NGA and LTE subscriptions also increased, while prices dropped. The average cost of a basic broadband subscription fell from about €30 in 2011 to less than €23 in 2014.[4]

Europe is also making progress in building a broader digital ecosystem. In one ranking, four cities—Berlin, Paris, London, and Stockholm—place among the top 25 for startup location attractiveness. The amount of equity financing for European startups increased from €5 billion to €8 billion between 2012 and 2014, and the number of tech companies with billion-dollar valuations tripled from about 10 to about 30 over the same period.[5]

Individual countries are doing their part. Several of the Nordic nations have long been leaders in digital coverage and adoption. The German government has established a goal of bringing 50-megabit-per-second connectivity to every household by 2018 and established a new "network alliance for a digital Germany" to help. Estonia is a recognized trailblazer in digitalization of government services.

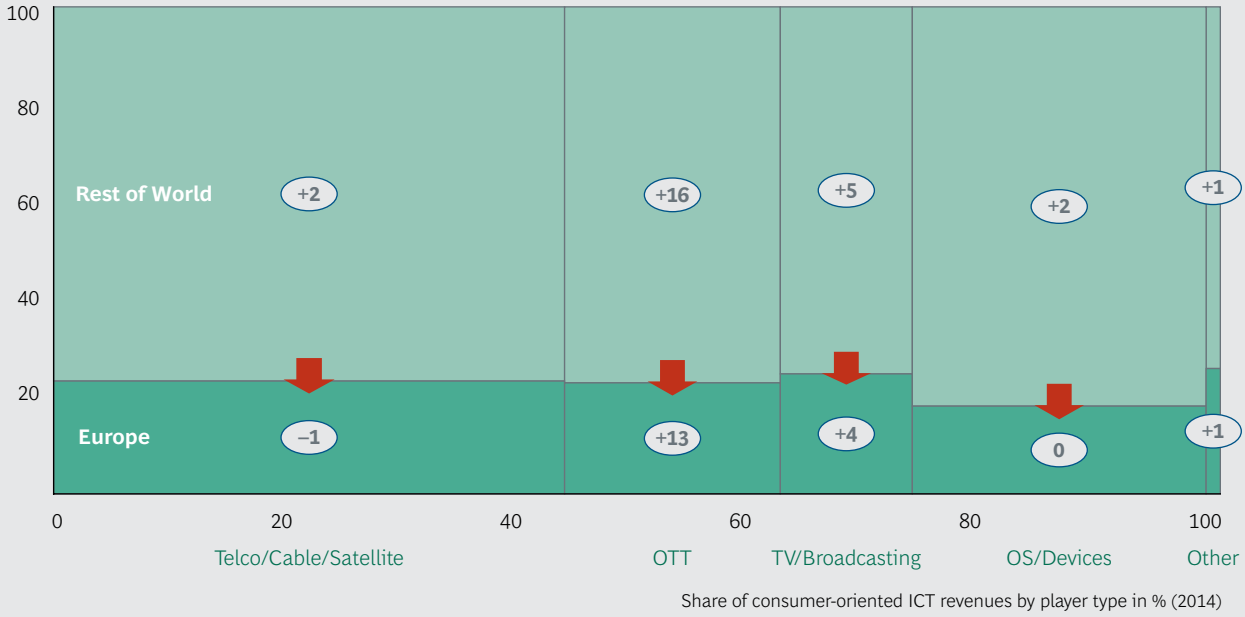
…with a Long Way to Go

Even with all these accomplishments, Europe can do much more. Its digital ecosystem still trails that of other developed countries in North America and Asia, and the rest of the world is not standing still. Global consumer-oriented ICT revenues are projected to grow 5 percent a year from 2014 to 2019, but Europe is growing more slowly and its share is expected to decline by 2 percentage points over this period. Across the four segments of the digital sector—telecommunications, OTT content and service providers, TV and other broadcast, and operating systems and devices—Europe's market share is expected to stay flat or fall. (See Exhibit 3.)[6]

Telecommunications remains a critical link in the digital value chain since all services that travel across the network ultimately depend on fast and secure connectivity. Yet this link faces multiple challenges. There are few big European companies among the top players in the digital segments other than telecoms, none among the top ten players in operating systems and devices, and none in the fast-growing and increasingly important OTT segment—which includes such digital leaders as Google, Facebook, Alibaba, and Amazon. (See Exhibit 4.)

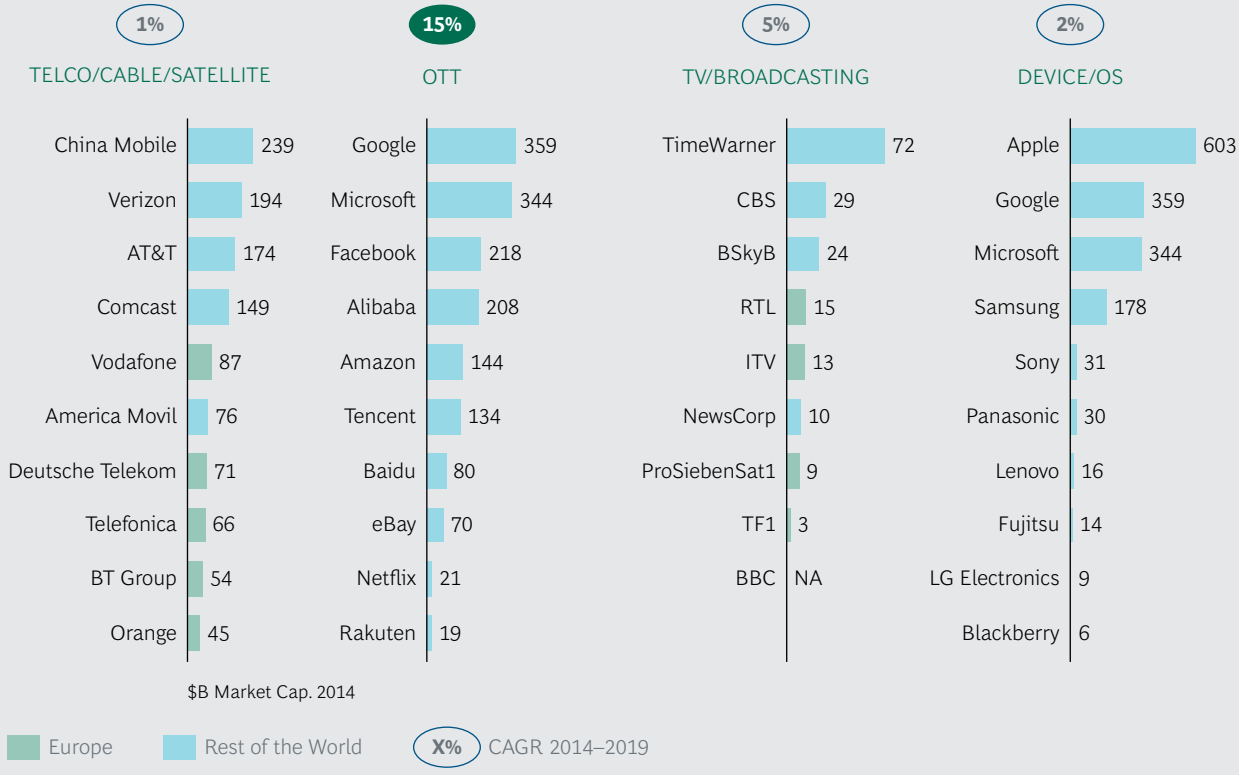
EXHIBIT 3 | Rest of the World Is Growing Faster than Europe in Major Digital Segments

European share of consumer-oriented ICT revenue within player type in % (2014)



Sources: Capital IQ, JP Morgan, Datamonitor, ZenithOptimedia, SNL-Kagan, VSS, ValueScience, BCG analysis.
Note: Europe with differing boundaries in different sources (EU, Europe, EMEA).

EXHIBIT 4 | Few European Companies in Top 10 In Major Digital Segments



Sources: Capital IQ, press search, BCG analysis.

Of equal concern, Europe lags other developed countries in deployment and adoption of next-generation networks, the cornerstone of the Internet economy. While individual countries vary (Sweden has better NGA coverage and higher adoption than the U.S., for example), overall, the EU is far behind nations such as the U.S., Japan, and South Korea in both coverage and penetration of critical technologies such as LTE and especially fiber-to-the-home or -building (FTTH/FTTB).

Out-of-date regulatory policy does not help. The EU points to the many benefits of a Digital Single Market, but it continues to regulate according to a system based on national markets as well as market definitions that no longer apply.

Clearly Europe has more catching up to do.

A Sound Strategy for the Future

The European Commission's strategy for achieving a Digital Single Market is an ambitious plan that points in the right direction. But its achievement depends on the right regulatory actions being taken. These remain open to review and discussion.

The DSM strategy is based on three pillars (in the Commission's words):

- Better access for consumers and businesses to online goods and services across Europe, which requires the rapid removal of key differences between the online and offline worlds to break down barriers to cross-border online activity.
- Creating the right conditions for digital networks and services to flourish, which requires high-speed, secure, and trustworthy infrastructures and content services, supported by the right regulatory conditions for innovation, investment, fair competition, and a level playing field.
- Maximizing the growth potential of our European Digital Economy, which requires investment in ICT infrastructures and technologies, such as cloud computing and big data, and research and innovation to boost industrial competiveness as well as better public services, inclusiveness, and skills.

Beneath each pillar, the Commission has a number of action steps with close-in deadlines attached. We believe that within the second pillar—creating the right conditions for digital networks and services to flourish—five topics should represent digital policymakers' top priorities since success in these areas will have an outsize impact on how far and how fast Europe moves toward its DSM vision.

These five topics are:

- Ensuring consistent standards across digital services for consumers and companies
- Analyzing the market structure with regard to optimum investment and growth
- Adapting wholesale market regulations to drive investments in NGA
- Modernizing spectrum policy to cover accelerated demand
- Enabling high quality networks and specialized services

This report examines the changes taking place in Europe's digital market as a result of rapidly converging technologies, sectors, and services. We then look in detail at each of the five areas and offer specific recommendations that support the EU's DSM vision and strategy and seek to advance their achievement.

Notes
1. Cisco VNI
2. Statista
3. IDC, SBD, Harbor Research
4. European Commission
5. COMPASS, Venturesource, GP Bullhound
6. BCG ICT market model

THE DIGITAL ECOSYSTEM OF THE FUTURE

The fast growth and changing nature of digital usage is leading to major changes in the size, shape, and structure of the marketplace and creating new issues for policymakers and regulators. Consumers are embracing digital convenience and commerce; companies are accessing new customers, markets, and supply chains; and rapid-fire advances in technology and its application are giving rise to whole new industry segments and services. One of these is the rapid rise of cloud computing—a market that is growing at 24 percent a year[1].

As a result of the digitization of both consumer lifestyles and business processes, consumers have a large and growing variety of digital assets tied to them. This digital dependence gives rise to new needs, including the ability of consumers to easily access and use data seamlessly while at the same time protecting privacy and security.

At the same time, a new segment of companies has emerged to play a big (and in some cases, dominant) role in digital service development and delivery: the so-called over-the-top, or OTT, players that include such household names as Facebook, Netflix, Microsoft, Skype (owned by Microsoft), and WhatsApp (owned by Facebook). This segment exemplifies the innovative power of digital technology to create new businesses and revenue streams—in part because it is subject to minimal government oversight or regulation; OTT players answer mainly to the marketplace.

The impact of these trends is evident in companies' financial performance. The combined revenues of Europe's telcos are expected to shrink by 1 percent annually between 2015 and 2019 while the revenue of OTT players will increase at an annual rate of 13 percent. As a result, telcos' share of the overall ecosystem will drop from 41 to 34 percent while OTT's share rises from 19 to 30 percent. Capital markets have already priced-in this shift: OTT's aggregate market cap already exceeds that of telcos, despite the fact that today telcos have the larger share of the overall ecosystem.[2]

This shift raises two important concerns for Europe's policymakers. The digital services that comprise such a big and growing part of the Internet economy still rely on network operators to deliver them. So do the consumers and businesses that use them. As revenues and market share migrate to others, network operators have less money for, and fewer incentives to make, the infrastructure investments that are necessary to keep Europe digitally competitive.

Second, the top-ten global telcos by market cap, which represent 44 percent of the global industry, are a diverse group with no overtly dominant players. They include five Europe-

an companies. The OTT segment is far more concentrated, especially in major sub-segments. Two companies today—Apple and Google— together comprise 94 percent of the global market for mobile operating systems (90 percent in Europe). Google has almost two-thirds of the global search market (92 percent in Europe). Facebook holds more than 65 percent of social media market (excluding QZone in China). Google and Facebook together share about 40 percent of the market for digital advertising. In the U.S., Netflix and YouTube (owned by Google) account for more than half of all primetime digital traffic. All told, the top five OTT companies have 70 percent of the global market for digital services, and there is not a European player among them (four are from the U.S., one from China)—or among the next five largest companies either.[3]

As the marketplace continues to evolve, we see two big trends that policymakers and regulators need to account for in their decision-making. One is the convergence of technologies, services, and companies as the OTT segment grows in size and its influence grows with consumers and businesses. The other is the need for continuous investment to build and maintain world-class networks that can handle fast-rising and rapidly evolving demand for digital services.

Convergence

Markets move fast; regulations often play catch-up. This is especially true in technology-driven industries in which the speed of change can be fierce. Three types of convergence—in technologies, services, and types of player—are having a major impact on the market for fixed-line and mobile voice communications services and for SMS (texting) as well as for Internet and TV access. The new playing fields being created are not necessarily level, and consumers are increasingly choosing among services that operate under different regulatory regimes and provide different packages of service quality and consumer protection, often without disclosure as to precisely what services are being provided and under what conditions. Regulatory policy needs to keep pace and ensure that playing fields are level, rules are applied consistently across services, and transparency reigns—especially in circumstances where different types of services have different features.

Technology Convergence. One of the more popular moves by telcos in recent years has been the offering of three- and four-play bundles of services—Internet access, TV, fixed-line telephony, and increasingly, mobile access (for voice, text, and Internet usage). These "triple play" and "quad play" offers, which are the market's response to consumer demand for seamless consumption, have both simplified service for consumers and brought down prices. Small businesses benefit as well from single billing for communication services and shared data pools, mobile offloading to WiFi networks, and simpler offerings and procurement processes for such functions as sales-force automation and enterprise resource planning. Network operators see fixed and mobile access as increasingly complementary and fixed-mobile convergence as a new competitive growth lever.

Three types of convergence—in technology, services, and types of player—are having a major impact.

The success of fixed-mobile convergence has also led to the development of new business models, such as bilateral virtual network operators, and fiber and cable virtual network operators. Mergers between fixed and mobile operators have increased as operators seek access to both fixed and mobile networks so they can market a converged offering. Overall, this trend has led to increased competition in both fixed and mobile markets through the cross-entry of players from other segments.

Convergence of Services. More and more voice communication is carried over the Internet. Similarly, text messages, a favorite communications vehicle for young people, is fast giving way to alternative Internet-based messaging platforms, which often involve

commercial business models that do not charge customers directly, such as WhatsApp and WeChat. The volume of Internet-based voice services in Europe is growing at more than 20 percent a year and is expected to lead to a €21 billion revenue loss for European telcos, or 7 percent of their total, by 2018. OTT messaging volume is growing even faster—more than 30 percent a year—and is projected to result in a €10 billion revenue loss for telcos by 2018 in eight European countries alone (Germany, France, the UK, Italy, Spain, the Netherlands, Belgium, and Portugal). Part of the growth in OTT voice and messaging stems from consumers substituting these services for traditional telephone calls and text messages and part of the growth represents additional usage. Services such as WhatsApp voice calling and FaceTime audio are expected to accelerate both substitution and new usage.[4]

As services converge, they must be regulated in the same way with the same rules.

At the moment, telcos and OTT voice and messaging services are subject to entirely different regulatory regimes. Regulations for telcos are often quite stringent (such as those governing price, emergency calls, data privacy, and security), while requirements for OTT service provider can be non-existent. This is a legacy of the days of vertical industry silos when services such as voice over Internet protocol (VoIP) did not exist.

Video and data, formerly distinct products, are converging as well. More and more people view video content on demand via the Internet, which constitutes a significant and growing share of all broadband traffic.

As services converge, they must be regulated in the same way with the same rules. The end-user should be able to rely on consistent protection standards across the digital market, which is critical for building consumer trust and confidence in the DSM. When it is not possible owing to technical reasons to apply the same rules to similar services, then consumers need full transparency with respect to any important distinctions so they can make informed choices.

Convergence Among Types of Company. There is significant convergence taking place at the company level as well. All kinds of companies are moving into adjacent spaces either on their own or through partnerships. Device producers have moved into content distribution, for example. Content distribution companies have moved into content creation—as have big e-commerce players. Social networks are claiming central roles in content aggregation, advertising, and commerce. Network operators are offering entertainment platforms (music, video, gaming, and sports, for example) and financial services (such as banking, bill-paying, and insurance). (See Exhibit 5.)

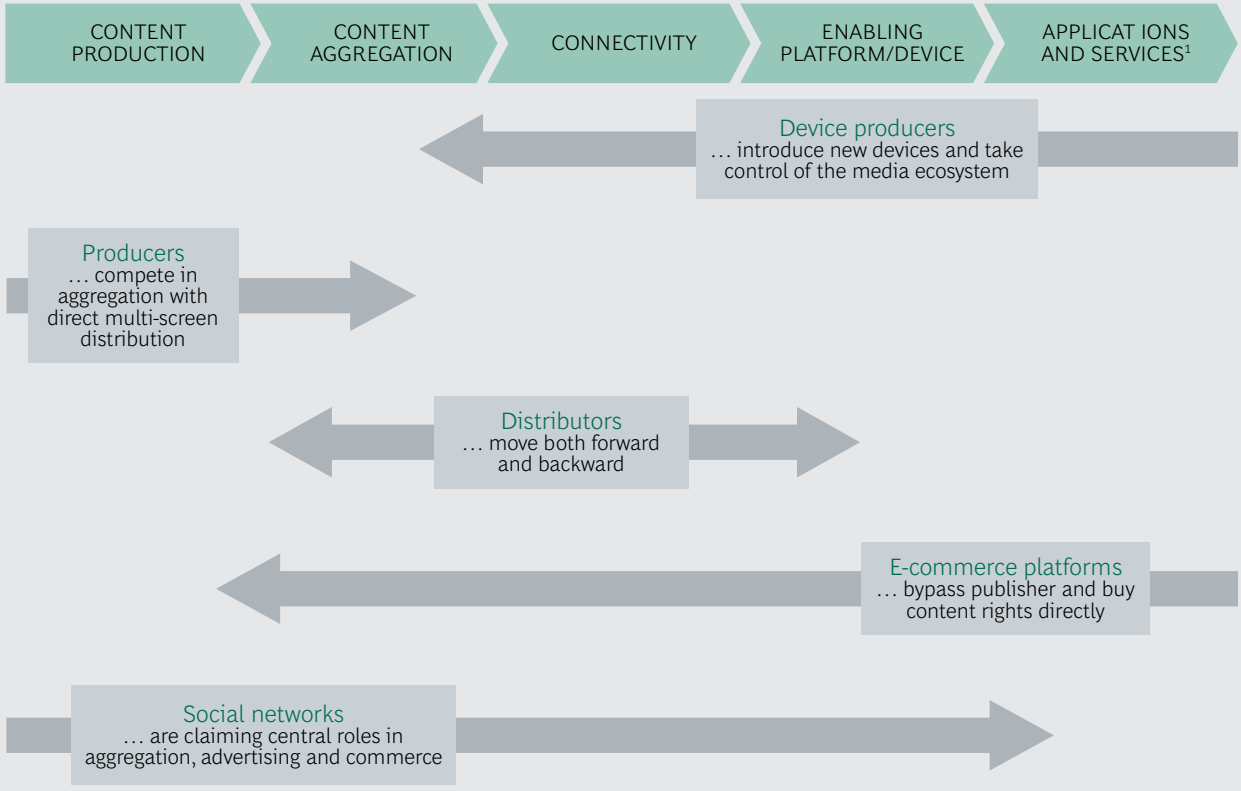
One result of all this convergence is that the terms “network operator” and “OTT player” are not nearly so distinct as they once were. Network operators are offering content and services. Similarly, some OTT players partner with network operators to offer guaranteed quality services, such as guaranteed speed for video, to consumers. A few big OTT companies have gone so far as constructing their own networks and are actively experimenting with new network technologies. Deals between network operators and OTT players are increasingly common as companies recognize the commercial benefit of cooperation. All of which means that regulation based on old roles and old rules is more and more outdated.

The Need for Continuous Investment

There will be approximately 100 million new network users in Europe by 2020. By 2019, 75 percent of network traffic will be video. Another 8.5 billion connected devices will come online by 2019. Multiple improvements in network infrastructure are needed to meet growing and evolving digital demand if Europe is to realize its full digital potential.[5]

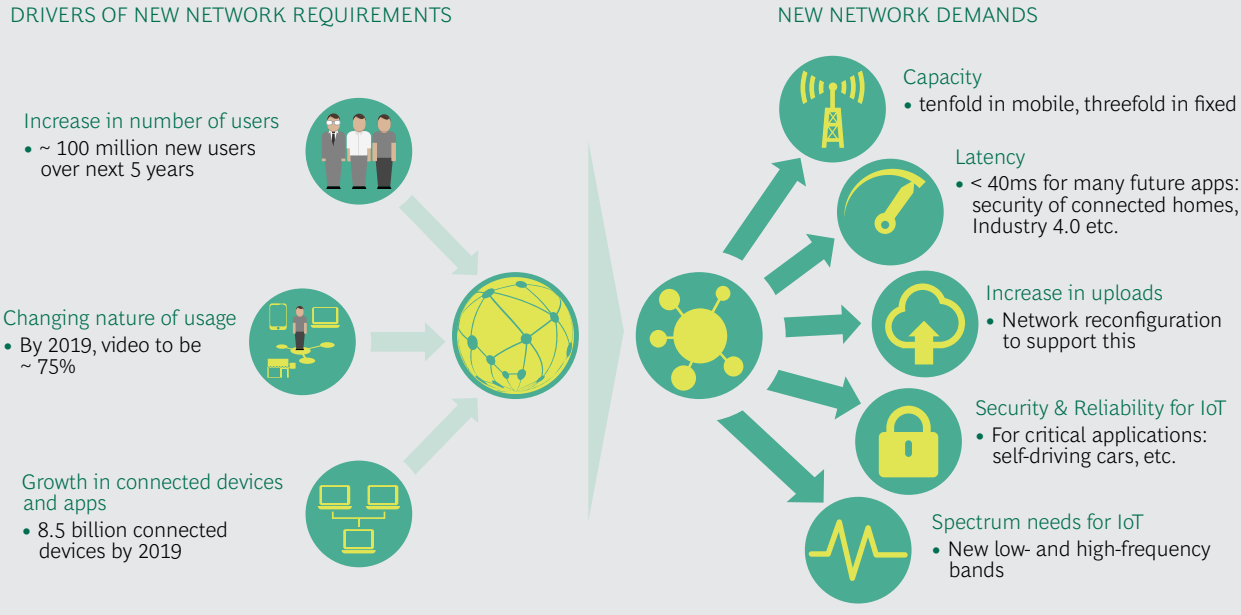
In addition, the rise of the IoT will put its own significant demands on networks. (See Exhibit 6.)

Exhibit 5 | Different Player Types Are Converging



Source: BCG analysis.
[1]Communication services/applications: voice services via PSTN, VoIP, SMS, instant messaging; Other applications: e-commerce, music and video streaming applications, gaming applications; Services: data analytics, tracking and monitoring, reports and dashboards, mobile payments.

Exhibit 6 | Multiple Requirements to be Addressed for Digital Transformation in Europe



Sources: IDC; Cisco; Qualcomm; Goldman Sachs; BCG analysis.
Note: Latency applies to consumer and business traffic and to the internet of things; ms stands for milliseconds.

Rising and evolving demand creates a host of new requirements.

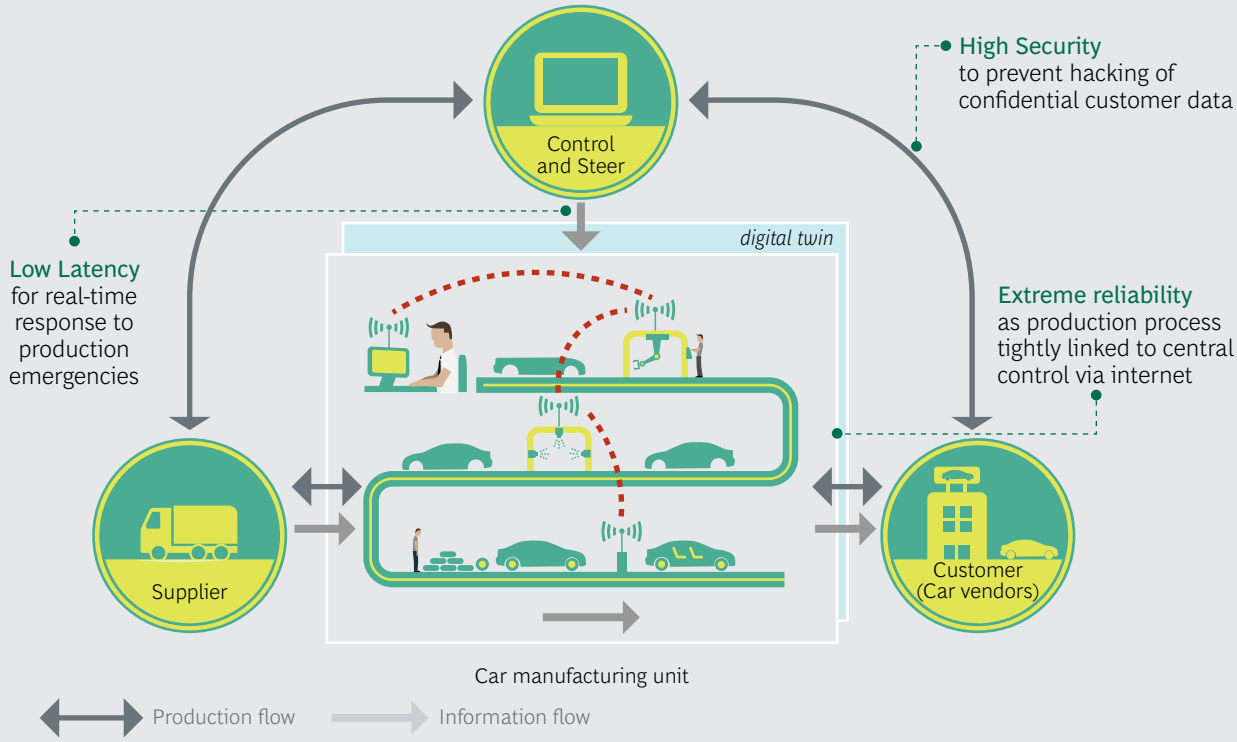
- More capacity—up to 10 times more in mobile and three times more in fixed access
- Improved latency—latency of less than 40 milliseconds is essential for many apps, such as the security of connected homes and VoIP
- The ability to handle more uploads, which requires network reconfiguration in many cases
- Improved security and reliability for the IoT, especially critical applications such as self-driving cars
- New spectrum needs for IoT, including low- and high-frequency bands

One example of these new demands is Industry 4.0, which needs high security, extreme reliability, and low latency, as well as the ability for information to move in multiple ways. (See Exhibit 7.)

The good news is that network technology continues to advance. Three of the most important developments are: HetNets, which boost network capacity; G.fast and Docsis 3.1, which enable ultra-fast copper and cable connections; and 5G, the emerging new mobile broadband standard, which--while still in development--is expected to have a major impact when it reaches the commercial stage.

HetNets. HetNets add to network capacity and increase competition by facilitating shifting of traffic between networks—from a mobile network to WiFi, for example. HetNets employing so-called small cells blur lines between fixed and mobile players. Such networks are being constructed by fixed-line operators that are expanding into mobile. In the U.S., for example, some operators are experimenting with building out dense WiFi grids in urban areas and offering users

EXHIBIT 7 | IoT Applications, such as Industry 4.0, Drive New Network Demands



Illustrative use case — End-to-end supply-chain integration

Source: BCG analysis.

WiFi-only devices that use VoIP for voice calls. Many mobile operators use HetNets to offload traffic from their mobile networks to fixed networks via the WiFi connections.

This is only the beginning; HetNets are becoming big in China and other Asian markets, in which mobile penetration and usage is more advanced. Small cell technology may also apply to 5G rollout and is seen as critical generally for future networks.

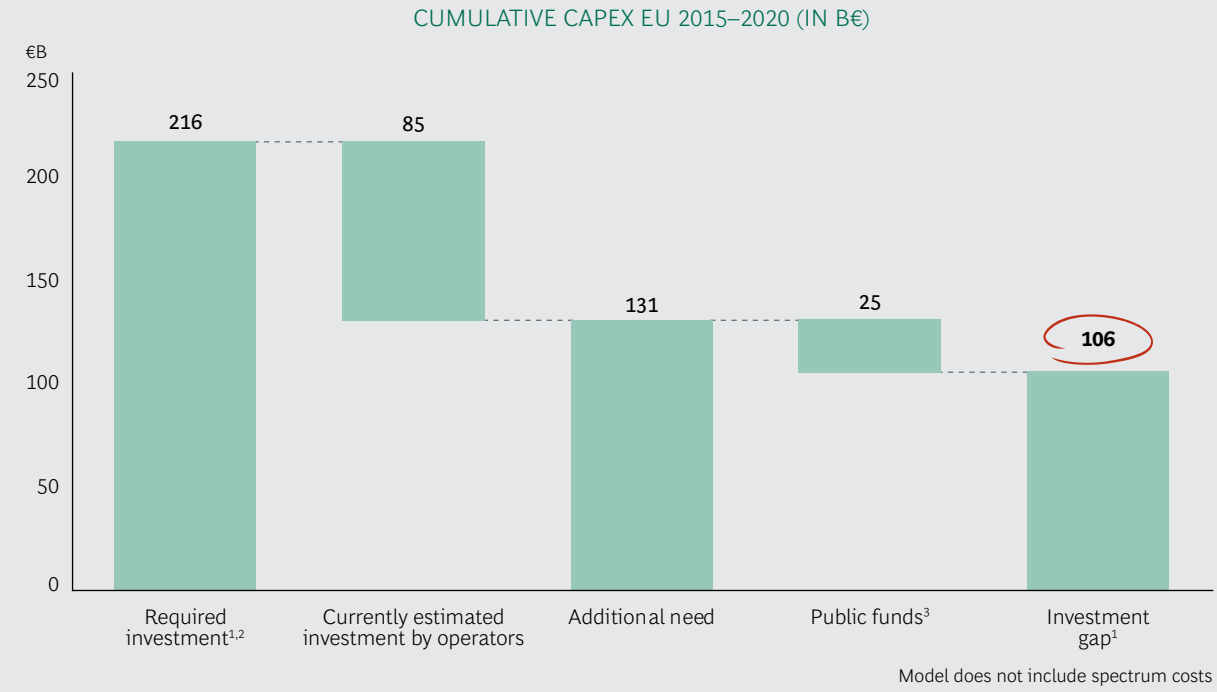
G.fast and Docsis 3.1. These technologies provide cost-efficient complements to fiber by enabling ultra-fast broadband speeds while using existing infrastructure. Hence, they are a useful step before homes or buildings are fully connected via fiber.

5G. No one questions the potential of 5G for such benefits as vastly increased speed and capacity and improved latency compared with LTE, but designing and building the next generation of mobile network is a big challenge. Multiple requirements need to be met to enable 5G deployment, key among them, higher capacity based on leveraging lower and higher frequencies for joint access. This raises complex issues in several critical areas, including 5G spectrum frequencies, spectrum alignment, dedicated antennae technology, and backhaul. New business models for deployment of small cells, which have different economics than traditional cell towers, are also needed. Indoor installation considerations and access to passive infrastructure, among other factors, affect small cell economics. Policy and regulation are important factors in all of these considerations.

Meeting the goals of the EU's Digital Agenda and creating a Digital Single Market is not a technology issue. But it could easily become a funding problem if outdated regulations and uncertainty over future directions continue to impede investment in NGA networks.

All told, some €216 billion of investment is needed to meet the EU's digital goals. We estimate that approximately €110 billion of com-

Exhibit 8 | EU Digital Agenda Targets Require an Additional €106 Billion in Investments



Sources: Ovum, expert interviews, BCG analysis.
[1]Required investment ranging between €160B and €275B due to different investment needs for fixed coverage scenarios. Resulting investment gap ranging from €55B to €155B.
[2]Range of €110-220 B for fixed comparable with €90B required fixed investments estimated by EC, assuming 85.1% 100Mbps+ coverage ratio to reach 50% penetration rate.
[3]€22.5B investments supported by EU funds by 2020 (ESIF, CEF, EIF, EIB).

bined public and private investments are currently planned for new LTE and broadband deployment. This leaves a gap of some €106 billion that has to come from somewhere. (See Exhibit 8.) The most likely source is the private sector—primarily the companies that own networks. But out-of-date rules and lack of clarity over future direction keep these companies and their capital on the sidelines.[6]

Europe needs to establish new rules rooted in current market realities, and to signal a more market-friendly, light-touch approach, if it is to unlock the investment it needs to keep the Internet economy growing. The speed of change, plus the growing complexity and unpredictability of the digital ecosystem, make it more difficult than ever to predict problems in advance. The market itself often resolves emerging issues before regulators can impose their solutions. Europe can make a lot of progress if it bears these facts in mind and if it addresses the five key areas discussed in depth in the balance of this report. We have included specific steps for each topic that policymakers and regulators can take to adapt regulatory regimes to today's market realities and in the process provide necessary incentives for investment in NGA that ensures continued growth of the Internet economy.

Notes
1. Gartner
2. BCG ICT market model
3. NetMarketShare, Business Insider, Statista
4. Ovum, Analysys Mason
5. Cisco VNI, IDC
6. BCG analysis based on Ovum

CONSUMERS AND COMPANIES NEED CONSISTENT STANDARDS

Converging technologies and services throughout the ecosystem are reshaping existing market structures, providing increased competition and consumer choice. Consumers are increasingly substituting application-based services, such as VoIP and Internet-messaging, for telephony and SMS traditionally provided by network operators. Although the consumer use is quite similar (with a couple of important exceptions), these services are subject to entirely different sets of regulations. Consumers cannot rely on consistent standards, and some companies are faced with higher compliance costs and less flexibility to innovate. Consumers should be able to make choices based on the same service standards. If the application of the same service standards is not possible fortechnical reasons, consumers should expect information that provides transparency on any limitations in both services and terms.

Recent statements by EU leaders acknowledge the need to address regulatory inconsistencies. According to Andrus Ansip, Commission vice president for the DSM, "Everybody knows today that with telecom service providers and OTT [players], there are unbalanced relations and we have to find a better balance."

Regulatory regimes need to be modified to reflect new realities. Digital services can be split into two types: network-based services for which traffic is managed on the network level to guarantee certain levels of quality, and application-based services that rely on the Internet. Consistent rules that ensure fair competition, especially in core areas such as consumer protection and privacy, should be applied to all digital services. There must be clear disclosure requirements regarding the availability, or lack, of access to emergency services and any lack of network-grade quality of service for application-based services. There should be no discrimination by player type for either application-based or network-based digital services.

The EU should consider the following actions for seven specific areas of regulation.

Privacy and Data Security

At the moment, privacy and data protection standards differ for application-

and network-based services, with sector-specific regulation and binding EU directives applying only to network-based voice and text services. Users are often unaware of these different data protection standards, and they deserve to be protected regardless of the means of communication they select. The situation is easily rectified by applying the same protection standards to all digital services, specifically voice and text services. European priva-

cy law should apply independently of the telecommunication application used and the provider's country of origin, and EU data protection rules should apply irrespective of physical location of data. In the event of data breaches, the requirement to inform customers about significant loss of personal data has to be mandatory for all service providers.

Commercialization of Data

Various commercialization business models are used today in the digital market for services such as voice, text, and data. In addition to the traditional monetary remuneration model (the direct sale of voice and data plans to consumers), many services are based on the commercial use of personal data. Under this model, customer data function as a kind of new currency—the data are monetized by sale to third parties, usually advertisers. Application-based providers market their services as "free" to consumers but compensate themselves through other revenue sources by trading in data—without necessarily informing consumers of how their data is being used or by whom. Unlike services based on direct monetary remuneration, application-based services that are based on consumers handing over personal data are not subject to most consumer protection rules. Users are potentially unaware that personal data is being monetized.

Consumers should be aware of what they are buying.

In principle, the same rules should apply to both business model types. When this is not possible for technical reasons, end-users—at minimum—should know how services differ and have more control over how their data is used. Unambiguous opt-in decisions, for example, by consumers, should be required for certain types of data usage. Service providers relying on data as a currency should be required to prominently disclose which data is traded, and the commercial usage involved, so that consumers are aware of the value that their data provides and can make informed choices among services with different remuneration models. Similar principles with respect to monetary remuneration and data as a currency should be applied to all business models, and the value of data as a currency must be taken into consideration in any competitive analysis. The watchwords for applying new regulations—and potentially removing out-of-date rules—are that the regulations should be proportionate, consistent, and effective.

Transparency

Network-based service providers are required to follow strict transparency regulations with respect to disclosure of quality of service and any limitations, prices for termination, and dispute resolution measures. Such information requirements help consumers make informed choices, but they also impose higher compliance costs and limit service providers' flexibility to modify services under in-force contracts. Overly prescriptive requirements in contracts limit network operators' flexibility to modify and advance service delivery components. Application-based service providers are subject to no such prescriptive rules.

Similar transparency standards should be enforced across all voice and text services to ensure that consumers have all information they need to make informed decisions in choosing a specific service.

Quality of Service

Network-based services are subject to certain quality-of-service requirements which are important from a customer point of view, such as for high voice quality without interruption, and access to emergency services. This reliability is based on end-to-end quality ensured in the scope of any-to-any connectivity, discussed below. Application-based providers are not required to make such quality guarantees—but neither are they required to disclose how their services may differ.

Consumers should be aware of what they are buying. They can then make an informed choice between network-based services with guaranteed quality and application-based services that offer best-effort quality and may lack important features such as access to emergency services.

Emergency Services

Network-based services are required to provide free access with high reliability and optimal call quality to emergency services and to provide caller location data to the emergency authorities. These features are frequently lacking in application-based services, putting consumers potentially at risk in life threatening situations.

As a general principle, regulation should require that all communication services provide access to emergency services—each provider making the best of its own technical capabilities to deliver access, while acknowledging that reliable end-to-end quality currently can only be delivered by network operators. Regulations should also be adapted as technology evolves. At minimum, in the short term, application-based services should be required to provide full transparency on any inability to offer reliable access to emergency services. There must be much better clarity in particular on the limitations on accessing emergency services using application-based VoIP services to reduce risk of individual harm.

Any-to-Any Connectivity

Network-based operators are required to provide "any-to-any connectivity"—the ability to call or text another individual or a business regardless of the telecommunications service or application used by the recipient. Consumers can therefore choose their provider of telephone services for any number of reasons; the fact their friends use a particular provider is not a significant factor. Application-based providers are under no obligation to provide any-to-any connectivity, thus they require consumers to use their service if they want to communicate with others on that service.

While consumers have plenty of choices within application-based services, switching is easy, and they can use multiple services at the same time, there are also some dominant platforms that are emerging and "locking in" large universes of users. The lack of any-to-any connectivity means that users of one service cannot reach people on another, thus users tend to gravitate toward services with the biggest number of customers, and service providers with small user bases may find it harder to attract new users. Regulators should observe and assess market developments to ensure no misuse of dominant position occurs that restricts consumer choice or ability of others to innovate.

Portability

Network-based voice and text services identify customers by telephone number while application-based services use different identifiers—e-mail addresses, for example—for voice and text services. While network-based services are obligated to enable number portability, the same requirement doesn't apply to other services.

Network-based operators are required to provide free access and optimal call quality to emergency services.

As discussed with respect to any-to-any connectivity, consumers today have ample choice within application-based services. They can use multiple services at the same time and switching from one to another is easy. But, again, emerging dominant platforms could restrict consumer choice and curb innovation, so regulators should closely assess and observe these markets and step in if needed.

If there is regulatory intervention, however, the portability of identifiers will have to be accompanied by any-to-any connectivity among the services that utilize these identifiers as a first step.

Proposed Regulatory Adjustments

These issues can be addressed in the following manner:

- Apply cross-sector regulation across digital services for basic protections such as data security, consumer protection, and consumer privacy.
- Ensure a level playing field within voice and text services, including clear disclo-

sure by application-based services regarding the non-availability of emergency services and lack of network grade quality of service.

- Observe and assess the potential development of network effects that curb consumer choice or innovation within application-based services and step in if necessary.
- Ensure no discrimination by player type for any application- or network-based digital service.

TOWARD A MARKET STRUCTURE THAT SUPPORTS DSM GOALS

Despite substantial progress in next-generation network deployment and adoption, Europe still faces a double-barreled challenge: lagging NGA coverage and penetration compared with other advanced economies, such as the U.S., Japan, and South Korea, and a shortfall of €106 billion between planned infrastructure investments and the full investments necessary to achieve the EU's DSM goals. This €106 billion gap could grow with significant uptake of IoT applications such as mHealth and connected cars, which would require additional investments in network infrastructure.

As the Commission itself observed in June 2015, "…availability of infrastructure is a necessary condition for take-up, but is far from being sufficient. … [Meeting] the 100 Mbps take-up target for 2020 is unlikely to be entirely filled from EU and national public sources–nor was that ever the Commission's intention. The incentives for private operators to do more must therefore be examined afresh."[1]

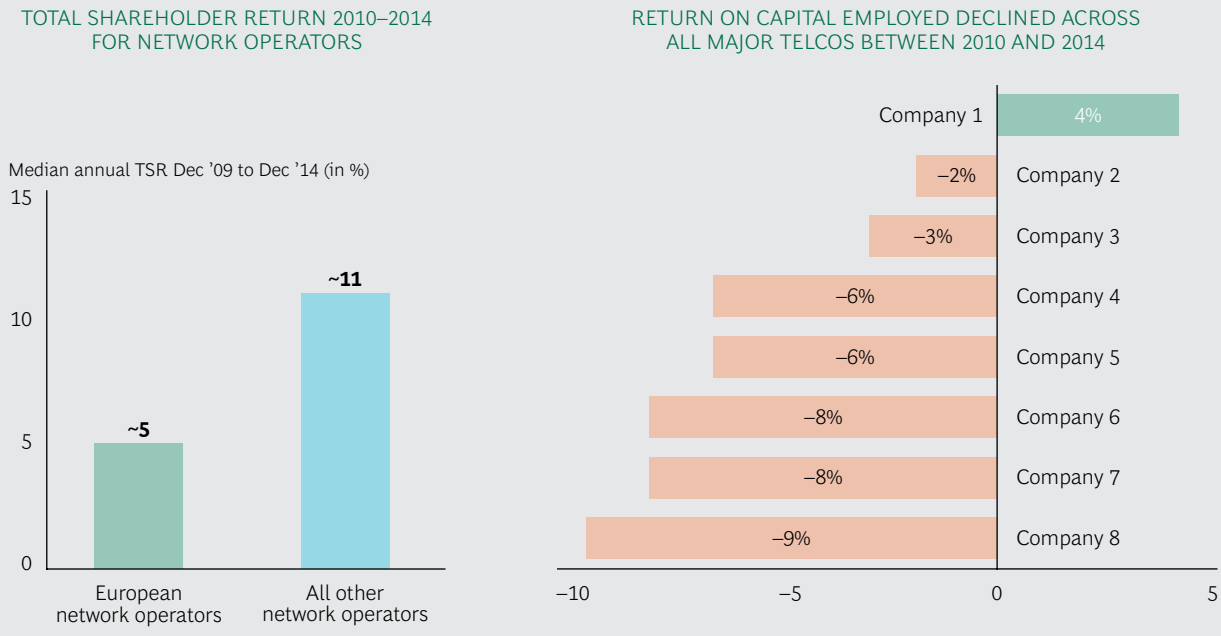
At the same time, recent statements—and actions—by regulators and competition authorities suggest growing concern over consolidation precisely when adding scale across all business functions is one of the key needs of network operators. Two telcos, Telenor and TeliaSonera recently abandoned their full merger in Denmark (beyond their existing network joint venture) because of EU opposition to the proposed deal on competition grounds.

Price Is One Important Consideration…

Regulation and competition enforcement in Europe have focused primarily on reducing the amount paid by customers for telecommunications services. One result, not surprisingly, is that European consumers pay less for voice and data packages than consumers in other developed countries. But they also use less data, on average, and as a result, receive less benefit from digital technologies and services, which impedes the growth of the Internet economy. And Europe lags in NGA deployment and penetration.

Intensive price-based competition has an impact on the financial performance of European network operators. For the five years from December 2009 to December 2014, the median total shareholder return (TSR) for Europe's network operators was 5 percent, while the median TSR for all other network operators was 11 percent. The return on capital employed for most major European network operators showed significant to substantial declines over this period. (See Exhibit 9.) In this kind of market environment, companies have insufficient incentives to invest in new projects because their investors will only

EXHIBIT 9 | Poor Financial Performance of European Telcos Undercuts Ability to Invest in the Future



Sources: BCG Valuescience, NYU Stern, BCG analysis.
Note: TSR derived from fiscal-year data.

punish them for misusing capital and destroying value.

…but Other Factors Are Important Too

Empirical evidence as well as economic theory indicates that a degree of market concentration can help improve network operators' financial performance and their ability to invest. Most recently, a study by the think-tank CERRE points in this direction.[2]

Another recent study by HSBC found correlation between improving margins and higher levels of investment—up to EBITDA margins of 35 to 40 percent (HSBC, April 2015). Since many likely merger candidates are smaller companies with lower margins, further industry consolidation can be expected to lead to improved margins and more investment.

Network operators in Europe continue to operate under substantial margin pressure. We calculate that network operators need an EBITDA margin of at least 25 percent to cover their cost of capital, especially as the capital intensity of the industry increases, and that almost third of mobile operators fail to achieve these levels. Mergers are one important means of reducing cost, improving efficiency, and boosting operating margins. For example, the 2014 merger of O2D and e-plus in Germany is expected to lead to EBITDA margin improvement of about 9 percentage points and capital expenditure savings of about 10 percent. Projected savings from the proposed Orange-Sunrise merger in Switzerland in 2010 included EBITDA margin improvement of about 9 percentage points and capital expenditure savings of 15 percent. (Even though Orange and Sunrise were both much smaller than the market leader, Swisscom, even when combined, the deal failed to receive approval from the Swiss competition authorities. The Swiss telecoms regulator, ComCom, criticized the decision of the competition authorities, calling it a "missed opportunity" and pointing out that competition is not based solely on numbers, but also on the individual power of the players.)[3]

HSBC research indicates that of the three main ways to reduce unit prices for mobile data—investment, operating cost reduction, and competition—by far the largest decreases occur because of network investments, which sometimes account for 90 percent or

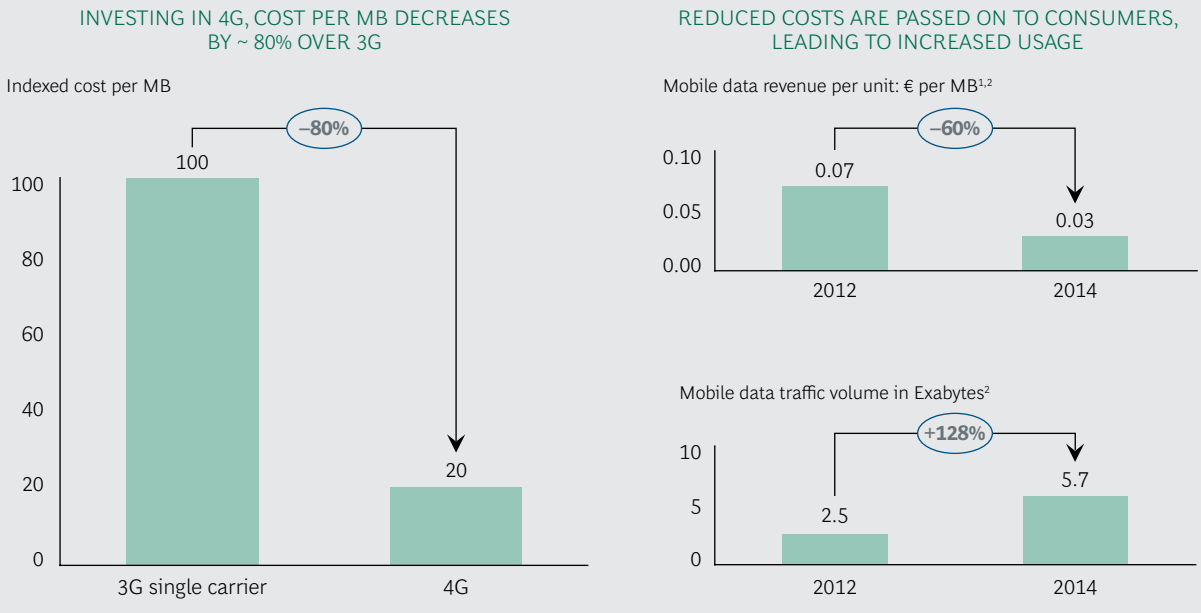
more of total reductions. One reason is that investment in new infrastructure typically leads to big declines in operating expenditures per unit of production which translates into lower prices for consumers. This can be seen in the drop in the unit cost to consumers of 80 percent in the transition from 3G networks to 4G. (See Exhibit 10.) Costs per MB should further decrease with a shift to more advanced technology, such as LTE-Advanced which is being introduced in other markets, the U.S., for example.[4]

Competition experts debate the optimum number of players a market should have in order to achieve the best balance between aggressive price competition and scale, company returns, and other factors. Much of this debate focuses on the difference between three- and four-player markets. The empirical evidence shows a mixed picture, in large part because many other factors come into play—including an individual market's size and density, GDP, smartphone penetration, level of digital literacy, and coverage requirements set by regulatory authorities.

In Europe, average LTE coverage growth since the first spectrum auction in 2010 has been similar in three- and four-player markets, as has been the development of package prices—but with a degree of variance among the markets where consolidation from four to three occurred. In Austria, for example, post-merger per megabyte prices fell and data usage increased. While package prices increased a bit, they are still among the lowest in the EU. (See Exhibit 11.) It is difficult to conclude from package price changes alone that mergers may have an anti-competitive effect; price per megabyte provides a more accurate and complete reflection of pricing trends than package prices in any event.

European competition policy with respect to the investment-intensive telecommunications ecosystem—especially the criteria for merger review—needs to be rethought for the digital age. Convergence of technologies and services leads to new entrants from multiple directions. The relationship among competition, investment, and price remains a critical factor, but other considerations need to be taken into account. For example, merger assessment should encompass all competition and all competitors—including the potential of new competitors—not simply the traditional network operators. And encouraging investment in NGA has to be a key policy goal. In the UK, for instance, following the merger of Orange

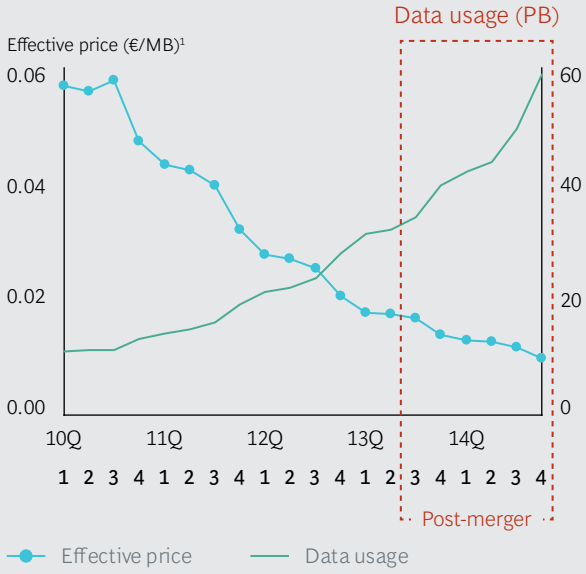
Exhibit 10 | Investment in New Infrastructure Lowers Operating Expenditures—and Prices



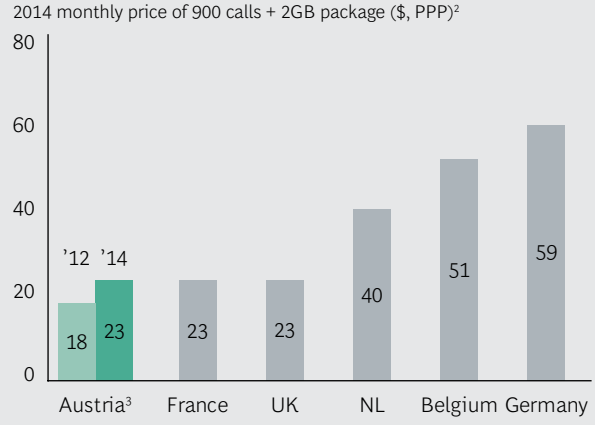
Sources: Regulators; Analysys Mason, HSBC, BCG analysis.
[1]Taking into account data and voice (voice recalculated to data).
[2]European data per unit revenue and traffic

EXHIBIT 11 | Post-Merger Prices per MB in Austria Declinedand Package Prices Remained Low

EFFECTIVE DATA PRICE IN AUSTRIA HAS DECREASED AND PACE IS FOLLOWING PRE-MERGER TRENDS



WHILE PACKAGE PRICES IN AUSTRIA INCREASED POST MERGER, THEY ARE STILL BELOW EU LEVELS



Sources: OECD Digital Economy Outlook 2015, Teligen, RTR, BCG analysis.
[1]Effective price / MB calculated as total mobile revenue / data usage, taking into account voice and SMS by recalculating their values to data.
[2]The OECD compares 5 mobile baskets across countries. 900 calls + 2 GB the basket aimed at the heaviest users.
[3]2013 high auction prices of ~ €2 billion overall LTE spectrum cost for operators also affecting price.

UK and T-Mobile UK, the merged entity was the first to roll out LTE in the UK and one of the first operators to launch LTE in Europe, thanks to improved margins and a better business case for investment after the deal.

Proposed Regulatory Adjustments

In our opinion, the European Commission should consider the following factors relating to market structure as part of its regulatory oversight of the digital ecosystem:

- Regulators should shift from price as the dominant regulatory objective to a more comprehensive and balanced assessment that includes investment, technical progress, innovation, efficiency, and quality of service (all with reasonable standards of proof).
- Price assessment should be based on per-unit prices rather than package costs.
- Infrastructure competition from fixed-line players, through deploying WiFi and acting as an MVNO, needs to be included in regulatory reviews.
- When addressing risk of elimination of an "important competitive force" via merger, the sustainability of this competitive force on its own should be taken into account.
- Market definitions should take a wider view of shifting demand for services, including the impact of OTT-based competition on voice and messaging.
- Regulators should shift the focus of merger remedies from new player entry (usually enforced by reserving spectrum) to encouraging network investment and innovation as well as quality of service commitments from merged entity.

NOTES
1. DSM Staff Working Document 2015
2. CERRE September 2015
3. Telefonica, Orange, ComCom
4. HSBC, Analysys Mason

RETHINKING WHOLESALE MARKET POLICY AND REGULATION

The wholesale telecommunications market has undergone radical change. Today, fixed-line network operators, network renters, mobile network operators, cable companies, and others (including OTT companies such as Google) all compete to provide access to homes and businesses. This is a far cry from the mostly single-operator public switched telephone network (PTSN) markets of a just a few decades ago. Regulatory policy must catch up.

Multiple Technologies Converge

Many homes and businesses today are served by an array of telecommunications technologies that are converging to make high-speed access available through fiber and high-speed copper wires, coaxial cable, and mobile connections. Especially in more densely populated urban and suburban areas, parallel fixed-line coverage (copper or fiber and cable) is high, and speed is increasing exponentially.

A large majority of the European population is also covered by LTE mobile networks, which increasingly offer speeds comparable to fixed-line DSL connections. Estimates put the average LTE connection speed in Europe at 12 to 20 Mbps in June 2015. LTE covers large geographic areas cost-efficiently, including rural areas via the 800 MHz band, with lower costs than fixed-line networks. In some areas, LTE is already a viable alternative for an average Internet user, and it could play a much bigger role in the future.[1]

At the same time, there is strong evidence from multiple studies that the existing policy and regulatory framework has not led to the levels of investment needed to advance Europe's digital infrastructure. A review in 2012 found that 9 out of 13 major empirical studies from 2003 to 2011 failed to find a positive impact from unbundling on broadband penetration, a strong indication that the "ladder of investment" theory does not work and the current regulatory framework does not adequately stimulate investments. (The other four studies relied on older data or allowed for only limited conclusions.) A new study in 2015 determined that the legacy regulatory framework has had negative effects on NGA deployment in the EU. While the current framework has increased competition, the Commission itself has concluded that wholesale access regulation might have reduced incentives for access-seekers to invest.[2]

A New Approach

A new, simpler, technology-agnostic, and more market-based approach is clearly called for. It should be based on two principles: segmenting markets according to current competitive dynamics and making light-touch ex-post regulation the rule and ex-ante the exception, especially refraining from setting prices up front

and from mandating wholesale access products where they are not necessary.

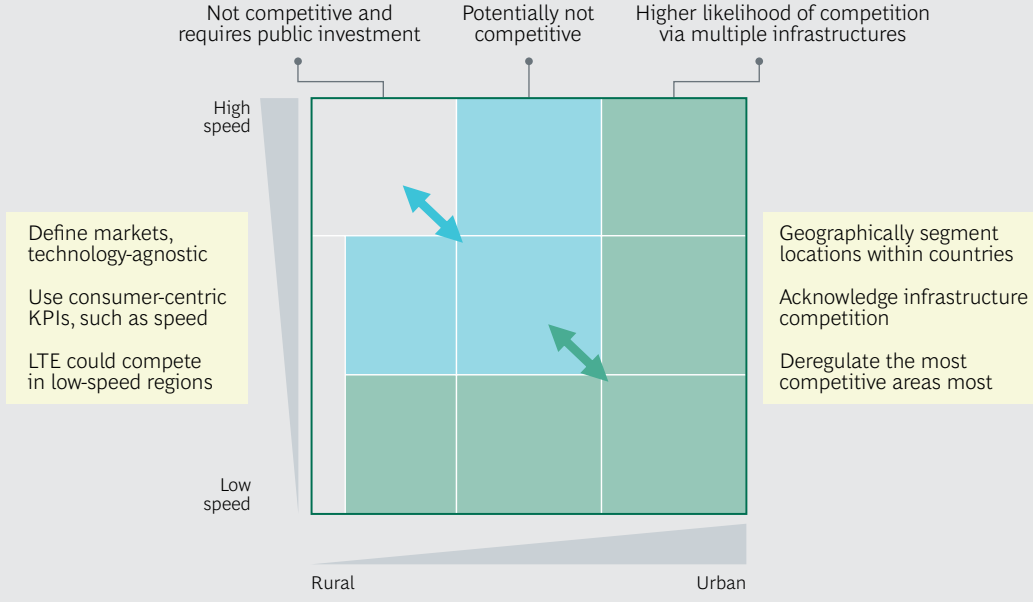
Market Segmentation. Markets, including regional markets within countries, vary considerably in their competitive dynamics. Geography and population density are big differentiators. Regulators should distinguish between markets that are well served by parallel infrastructure and multiple network operators (often of multiple types) and those that are potentially non-competitive. (See Exhibit 12.)

Regulators need to look at markets through a technology-agnostic lens that examines network performance. Customers are not interested in different technologies, but in what each technology provides in terms of access, speed, quality of service, and value. Regulation should be based on measurable outcomes (such as speed) and not favor any particular technologies. Regulatory analysis should include all technologies, whether fiber, copper, cable, or mobile, that can fulfill these KPIs.

Regulatory authorities are already proposing steps in this direction. Several countries, including the UK, Germany, Spain, and Portugal have experimented successfully with flexible approaches to wholesale market regulation, innovative risk-sharing agreements between network builders and renters, and incentivizing concurrent NGA investment while refraining from imposing a full set of wholesale obligations. These are models others should look to while the new framework is not in place. The Body of European Regulators for Electronic Communications (BEREC) has recommended a sub-national analysis of wholesale Internet access markets as defined by the commission's last recommendation in October 2014.

Light-Touch Approach. In a fast-evolving market characterized by converging technologies as well as new advances, the marketplace is far more capable of creating a level playing field and determining winners and losers than outside authorities. Past efforts at regulation, including the mandating of wholesale products and the setting of these products' prices in advance, have not had the desired result. Attempts at making it attractive for new players to enter the wholesale market have resulted in multiple problems. These include unduly low wholesale prices for access-seekers, requirements for various products on multiple levels of the network (which add cost), and countrywide regulations, leading to national obligations on

Exhibit 12 | Different Markets Require Different Approaches



Source: BCG analysis.

incumbents, instead of targeting interventions where truly needed.

A new approach is needed that supports network investment by multiple parties while safeguarding competition. First and foremost, it should allow prices to be set by commercial negotiations between network owners and access seekers. Ex-ante pricing needs to be removed from all access products so builders and access-seekers can negotiate prices as well as co-financing and risk-sharing agreements. For markets with sustainable competition, there should be no mandated access. In other areas, where wholesale access is still mandated, one product at one level should be sufficient. Multiple products today could be phased out with the transition from copper to fiber. Some are little used and offering all of them imposes costs on all parties.

Make ex-post regulation the rule and ex-ante impositions the exception.

Going forward, a goal in all markets should also be to make ex-post regulation the rule and ex-ante impositions the exception. Regulatory policy should encourage investments in next generation networks by establishing certainty over a long investment horizon and enabling network builders to develop viable business cases that offer appropriate returns to investors. Access to passive infrastructure has been legislated through EU Directive 2014/61/EU, to be implemented by July 2016, which sets minimum standards and leaves member states free to innovate.

In markets without sustainable competition, mandating one product, specified by the regulator and agreed upon by access-providers and access-seekers, would reduce costs and provide incentives for network-building by phasing out products for which there is little or no demand. The right product for each market will differ by geography since the network architecture of "last mile" varies substantially—some countries have ducts right to the house, some do not—and technologies are evolving.

Overall, the primary role of regulators should be dispute-resolution between builders and access-seekers (for example, on issues of service quality).

Proposed Regulatory Adjustments

Europe can move toward a wholesale regulatory regime that facilitates competition while incentivizing investment by taking the following steps:

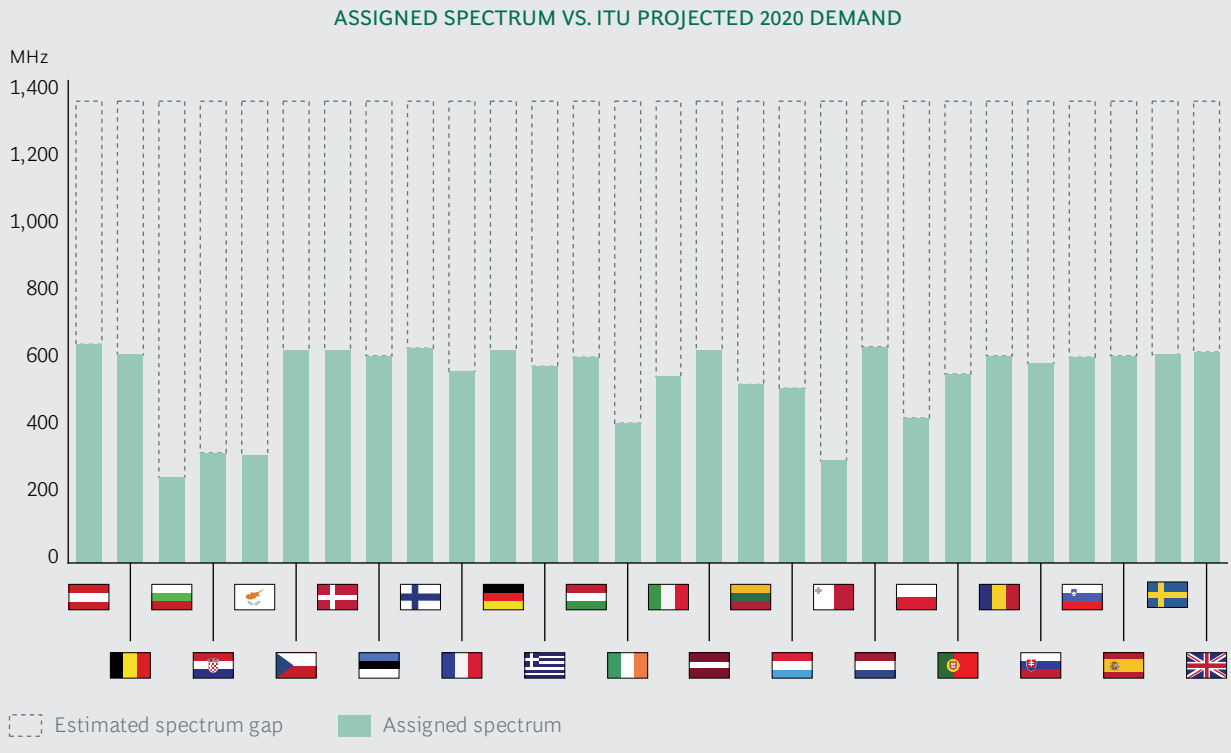
- Geographically segment markets in order to assess competition on a local level.
- Assess competition in a technology-agnostic manner and include all competing technologies—cable and mobile as well as fiber and copper—in the process.
- In non-competitive areas, mandate wholesale access but limit it to one product per geography. Given that general unbundling requirements hinder investments in networks, as they tend to undermine business cases for comprehensive network rollouts, ensure at least that virtual unbundling (VULA) is viewed as an equivalent to the physical unbundling of local access.
- Make ex-post regulation the rule and ex-ante the exception by removing ex-ante pricing and relying on commercial arrangements and prices, with dispute resolution by national regulatory authorities.

Notes
1. Opensignal
2. Crandall et al. 2012, Briglauer 2015, DSM Staff Working Document 2015

MODERNIZING SPECTRUM POLICY

The volume of mobile data traffic in Europe will increase tenfold between 2014 and 2019, from some 600 petabytes to more than 6,000 petabytes a month. Every European country faces a big gap between current spectrum allocations for mobile use and the amount of spectrum required in 2020 to handle this traffic, according to estimates by the International Telecommunication Union. (See Exhibit 13.)[1]

Exhibit 13 | Big Gaps in Current vs. Required Spectrum Need to be Closed



Sources: ECO REPORT 03, THE LICENSING OF 'MOBILE BANDS' IN CEPT, 26 January 2015, European Communications Office (ECO); regulators' web pages; ITU; BCG analysis.
Note: ITU's lower estimate of 1340 MHz (by 2020) refers to lower-density settings and accounts for benefits from effective spectrum utilization e.g. WiFi offloading, densification etc. Analysis does not differentiate required spectrum by country, but assumes similar need across member states.

Policymakers can pull five high-impact levers to help close this shortfall.

Allocate More Spectrum for Mobile

At the EU level, policymakers have pushed for allocation of more spectrum for mobile use. But spectrum release takes place primarily at the national level, and some countries have been much faster than others in planning for and implementing spectrum allocations. For example, the 800 MHz band (790-862 MHz) facilitates delivery of high-speed Internet access to many rural regions (where mobile is the primary way people go online). Yet approximately half of EU member states had failed to meet the original January 2013 goal of allocating, although all have now caught up. (See Exhibit 14.)

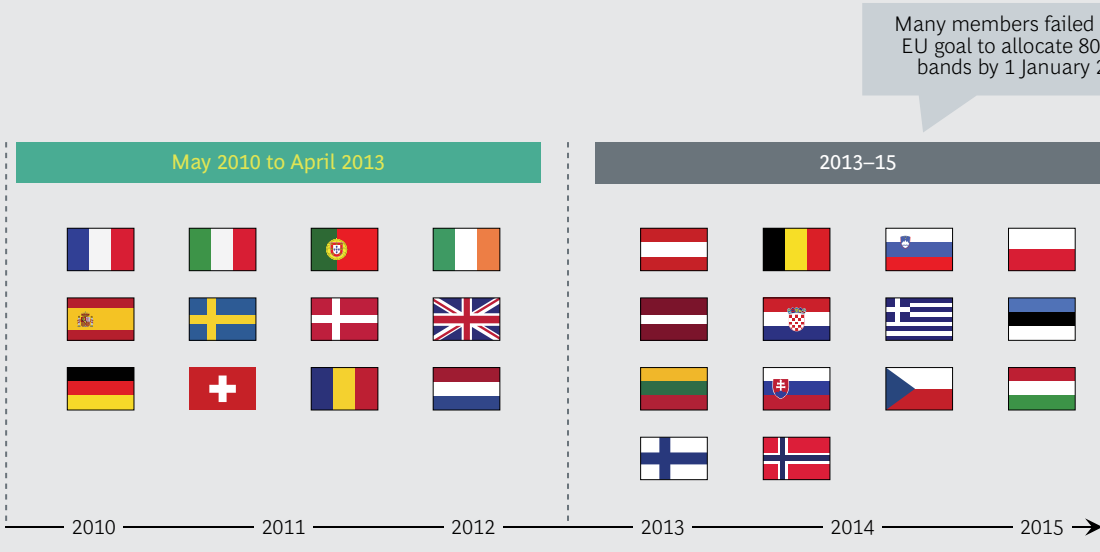
This experience does not bode well for the kind of steps that are needed for the 700 MHz band (694 MHz to 790 MHz) to be made available for mobile by 2020, including reallocating the band from TV to mobile usage. EU policy should recognize that member states will not move forward at the same pace. Policymakers should encourage "leader" states to utilize the 700 MHz band as early as the end of 2017 and look for ways to incentivize other member states to follow within a certain timeframe, such as providing technical support. In addition, the EU can encourage enactment of national spectrum roadmaps to increase transparency and planning security, push for enablement of testing the lower UHF band (470-694 MHz) for mobile, and plan and push for the release of additional bands for high bandwidth mobile usage (such as 2.3, 2.7, 3.4, 3.6 GHz), which will be required for HetNets and 5G.

At the national level, countries need to do two things: modernize auction rules to simplify and speed up the process, and align allocation timetables so that allocations take place under a coherent system that optimizes subsequent network rollouts.

Modernizing Spectrum Allocation. Outcomes of the allocation could improve significantly (primarily by preventing repeating the kind of problems that have occurred in the past) if a few key conditions were met:

- Avoid artificial scarcity, which can lead to artificially high prices and auction "gaming." In the Netherlands auction in December 2012, new entrants were able to

EXHIBIT 14 | Laggards Trailed Leaders in Auctioning First 800 MHz Spectrum Tranches by Five Years



Sources: GSMA, BCG analysis.
Note: Selected auctions displayed. Norway not EU member but EEA member and thus covered by telecommunication regulations. Switzerland not member of the EEA and hence not subject to EU legislation in the telecommunications space; included for comparison.
[1]RSPP, DECISION No 243/2012/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2012, article 6

artificially drive up prices for incumbents by bidding with no intention (or risk) of actually buying because they knew MNOs had to retain the spectrum they currently held at almost any price. In addition, the goal of reserving spectrum to encourage new entrants is seldom achieved. High prices make the business case for the prospective entrant into a mature market unattractive, as was evident in the Czech auction in April 2013 when the spectrum earmarked for new entrants went unsold. Instead, a new entrant (PPF) later acquired an existing player (O2).

Competitive pressure will drive all network owners to invest when they see that others have done so.

- Set realistic reserve prices. In some auctions, such as in Romania in 2012, valuable spectrum was not assigned because reserve prices were set too high and discouraged price-discovery via bidding. National policymakers need to recognize that their primary goal is not to maximize income from the sale of spectrum licenses. Much more value can be generated by the efficient allocation of spectrum that leads to fast network rollouts. High spectrum prices can slow or undermine network construction since acquiring spectrum rights is only one of a series of major capital expenditures companies make in expanding mobile networks.

- Ensure certainty about license terms and license fees. Network operators need to plan their capital expenditures. They must also justify investing billions of euros in spectrum licenses. Longer license terms, particularly with respect to existing mobile spectrum, would encourage more investment, as the European Commission and Parliament have acknowledged. Their proposals for the Telecommunications Single Market regulation called for minimum license terms of 25 years and potentially indefinite usage rights. Licenses should carry balanced coverage and performance obligations for licensees that discourage hoarding while allowing providers to follow their own network rollout schedules. Scheduling payment of license fees close to when an operator has access to the frequencies (instead of directly after auction) will more closely link investments to earning opportunities.

- Put in place rules associated with new spectrum licenses that allow for trading in the secondary market to encourage efficient allocation and incentivize network build-out while preventing hoarding and speculation. The rules should promote usage by enforcing use-it-or-lose-it provisions based on tiered coverage goals. They should also allow trading only after a certain period of time.

- Allow companies to refarm their spectrum in a timely manner to improve efficient use of bands currently allocated to 2G and 3G usage. Going forward, all bands should be allocated on a technology-neutral basis to speed up refarming in the future.

Aligning Auction Timetables. Replacing the current ad hoc auction process with a harmonized schedule of national auctions pegged to one- to three-year time windows will likely produce positive effects for both bidders and countries. Network-builders can reap rollout synergies, including increased scale in equipment purchasing and the continuous, predictable utilization of resources. Consumers in "laggard" member states would benefit from earlier availability of technology. Competitive pressure will drive all network owners to invest when they see that others are doing so, and the availability of advanced networks will produce positive spillover effects for consumers and the economy. With lower personnel churn between auctions, learning by bidders and regulators would be more directly applicable, especially if regulators cooperate closely and deploy similar auction rules. And network builders can better balance rollout goals with financing constraints and thus avoid bottlenecks.

However, harmonization should not be allowed to result in a "smallest common de-

nominator" effect. Countries need to set ambitious deadlines for spectrum release.

Spectrum Sharing

Freeing up and allocating more licensed spectrum for mobile use is the best way to address the spectrum shortage, but as we have stated before, other actions can help as well. Several spectrum-sharing models offer the potential to increase utilization through approaches that complement long-term, exclusive-use licenses. Licensed Shared Access and Authorized Shared Access seek to make broader use of dedicated spectrum that is currently used only at certain times or in particular locations (such as for testing of military equipment, or ship-to-shore radar). These approaches increase efficiency by allowing commercial users to share access on a designated basis, which helps provide the reliability and predictability that operators desire. Licensed spectrum sharing should be permitted by the regulatory framework, but use of spectrum by licensees should be at their own commercial discretion.

Unlicensed spectrum also has an important role to play. The best-known unlicensed technology is WiFi, which is now available on billions of devices, and has emerged as an important resource for operators to offload burgeoning data traffic. This will only increase with LTE-Advanced technology, which can involve aggregating unlicensed and licensed spectrum in the same network with the same wireless technology. This helps operators augment the capacity of their networks by using the unlicensed spectrum more efficiently while providing a tight interworking between the licensed and unlicensed bands. (See *Delivering Digital Infrastructure: Advancing the Internet Economy*, A World Economic Forum report prepared in collaboration with The Boston Consulting Group, April 2013.) Unlicensed dynamic shared-access models can also work through specific technical rules.

Enacting National Spectrum Plans

The Internet of Things comes with specific spectrum requirements that make spectrum release planning ever more important. As the number of M2M Internet connections in Europe soars to 8.5 billion in 2019, the percentage of connections requiring short-range wireless spectrum will rise to almost three-quarters of all M2M devices. This raises new and different spectrum needs for IoT. Governments must plan for the allocation of new spectrum types, including the following:

- Sub-1 GHz spectrum for wide area coverage applications, such as health monitors and distribution sensors
- High frequency spectrum for data-intense, short-distance applications such as video conferencing and cloud uploads
- Dedicated IoT spectrum, including a harmonized licensed spectrum band expressly for IoT connections, to drive down sensor cost
- Experimental spectrum that allows for experiments in all frequency ranges to drive innovation

Allocating more licensed spectrum is the best way to address the mobile spectrum shortage.

One best-practice example comes from the UK, where the government has set a goal of freeing up at least 500 MHz of spectrum by 2020 and has solicited specific suggestions from inside and outside the industry as to which bands to release. It has also reported progress publicly on a continuing basis. An inter-ministerial group, the UK Spectrum Strategic Committee (UKSSC), advised by Ofcom, the national regulatory authority, decides which department must release which bands—and by when. Ofcom has established transparency of current allocations via a Spectrum Information System (SIS) and will eventually allocate newly released spectrum to new users.

The UK approach benefits from several easily replicable attributes:

- Clear goals to create momentum
- A focus on future requirements and support for growing demand and innovation
- Government bodies with appropriate powers to overcome stalemates
- Transparent information and a mid-term timeframe to enable the industry to plan for and use new spectrum releases
- Regular consultations with all stakeholders to ensure fair and fact-based decisions

Advancing HetNet Rollout

Traditional cellular deployment has relied on relatively few high-powered radios usually mounted on cell towers. In densely populated cities, so-called small cells represent a vital, complementary tool for improving efficiency, and they can advance the rollout of HetNets to expand network capacity. Small cells can be placed almost anywhere—on buildings, streetlamps, or bus stop shelters, for example. In large numbers, they can handle a much higher volume of traffic and are adding much-needed density to cellular networks, bringing connections closer to end-users and blurring the distinctions between wired and wireless networks.

Governments (including municipal governments) can facilitate deployment of small cells by making it possible to mount them on public infrastructure at low prices, providing incentives (such as property tax breaks) for private-structure owners who allow mounting of small cells, and monitoring emerging bottlenecks to avoid predatory pricing.

Deployment of small cells will require provision of more backhaul links, which connect the small cell to the backbone network. This requires providing affordable backhaul spectrum (such as extremely high frequency mm waves) and prioritizing spectrum use for wireless backhaul.

In addition, small cells should be approached in the same manner as WiFi hotspots rather than full-scale cell towers, with deployment not requiring bureaucratic registration and approval. Current technology allows for small cells that can be installed indoors (where most wireless activity takes place), maintained by home- or business-owners, and configured remotely by the mobile network operator. Indoor installation is four to six times less expensive than outdoor deployment owing to rent and backhaul costs.

Supporting 5G

The development of the next generation of mobile technology—5G—is still in its early days, and policymakers should engage in the debate to help set clear goals that are based on societal benefit, such as low latency and high security for IoT devices. Technical-standard setting, however, should be left to the bodies currently entrusted with it, as they possess the requisite expertise.

Small cells should be approached in the same manner as WiFi hoptspots rather than as full scale towers.

ts Policymakers can materially assist the development and rollout of 5G by coordinating spectrum assignment on an international—as opposed to country-by-country—basis. Some ideas currently under consideration include releasing spectrum bands above 6 GHz for 5G (as has been suggested by the UK's Ofcom); exploring lower frequencies, such as lower UHF bands (470-694 MHz) to support full territorial coverage; and experimenting with the mmW band (30-300 GHz) which would lead to different design principles, and shorter range (this last, while providing spotty coverage, could also perhaps require low-complexity implementation). Once consensus is reached, policymakers can help enact Europe-wide coordinated plans to free up the agreed bands.

Proposed Regulatory Adjustments

These steps can go a long way toward modernizing spectrum policy:

- Support use of new bands for mobile in a timely manner, especially the allocation of the 700 MHz band by 2020, as well as lower UHF bands (470-694 MHz) and high frequency (such as 3.5 GHz).
- Modernize the allocation process and align auction timetables.
- Enact national spectrum roadmaps to increase predictability.
- Remove roadblocks for deployment and operation of HetNets.
- Support 5G development and deployment.

NOTE
1. Cisco VNI

ENABLING NETWORK QUALITY AND SPECIALIZED SERVICES

New applications, such as mHealth and autonomous cars, demand higher quality service than is currently available on a regular basis. These services have high potential impact—connected cars could save up to 25,000 lives in the EU every year for example, and mHealth could reduce the number of doctor visits in the EU by 330 million a year. But inviolate data security; immediate, continuous, and unbroken availability; and ultra-low latency are all prerequisites. In the not too distant future, networks will have to accommodate multiple service providers with varying requirements on their networks. (See Exhibit 15.)[1]

The European Commission is rightly moving toward allowing guaranteed quality of service

Exhibit 15 | Guaranteed Quality of Service Is Key to New Specialized Services

	HEALTH: REMOTE MONITORING	TRANSPORT: AUTONOMOUS CARS	ENERGY: SMART GRID
			
Role of network	• Remote **health checks** performed via algorithms that run in the cloud • Anytime patient **monitoring** and automated **notifications** to doctor	• Communication **between vehicles** to make local driving decisions • **Road info** like traffic jams, accidents, weather or construction	• **Grid status measurement** (smart buildings, virtual power plants, etc.) • Optimal production mix for plants based on data from **control centers**
Key network needs	**Security of data** must be guaranteed (sensitivity); **Availability** for reliable monitoring and **Latency** for life-critical monitoring crucial	**Security important** to avoid break-ins **Availability increases user experience** (avoid traffic jams) **Latency** for sensor monitoring	Security **of data** from smart buildings and power plants; **Availability & latency important** to avoid blackouts

Sources: Industry reports, BCG analysis.

to foster innovation. In a recent press release, the Commission noted that "the possibility to provide innovative services with enhanced quality of service is crucial for European start-ups and will boost online innovation in Europe." It has acknowledged that the need for technical requirements for some end-users cannot be ensured on a best-effort Internet, and it has allowed Internet access providers to strike deals with service providers to assure a certain quality of service so long as they invest in developing advanced network infrastructure.

Allowing different commercially driven models to flourish, in part by ensuring consistency of regulation across countries, can help enable successful rollout of specialized services. In this fast-moving market, the development of new specialized services must remain a market-based process.

NOTE
1. Google, Eurostat, Forbes, OECD

FIVE PRIORITIES FOR EUROPE'S DSM

CONCLUSION AND SUMMARY

As the European Commission observed in May 2015:

> When the Digital Agenda for Europe targets were set in 2010, they appeared extremely ambitious to many observers. Now midway to the targets, they are already insufficient and out of date in an increasing number of usage cases, in particular for industrial use by other sectors (for example, for connected cars) but also in telemedicine, cultural and creative industries, etc. The capacity of a 30 Mbps service is stretched by increasing levels of multiple device use at home or at work. Increasing emphasis is not only put on the need for download speed but also on other technical parameters which are key to the quality of experience (e.g. upload for cloud-based services, latency for financial transactions and gaming). Today, while it is difficult to anticipate our connectivity needs in the future, we do know from current trends (e.g. video in all its professional and private uses, multiple uses and connections, wireless and mobile uses by people and connected objects) that those needs will increase significantly. The Internet of Things, the data economy, the abundance of content and increasingly cheaper mobile devices are expected to accelerate this trend, and render the availability of bandwidth and the ease of upgrading networks a key enabler for the vibrant digital economy and society.

Increasing needs put increasing demands on the networks that comprise the Internet. The projected shortfall of €106 billion in the investments needed to secure the goals of the DSM looms large--but not so large that it cannot be overcome. Europe has made long strides in a few short years; it can pick up the pace of progress. Smart policy and regulation can provide much of the needed catalyst for achieving the goals of the DSM.

To recap, European policymakers need to move swiftly and decisively in five areas. Many suggestions, such as geographic segmentation of wholesale access markets and an associated reduction of access regulation, can be undertaken within the current EU regulatory framework.

With respect to applying consistent standards:

- Apply cross-sector regulation across digital services for basic protections such as data security, consumer protection, and consumer privacy.

- Ensure a level playing field within voice and text services, including clear disclosure by application-based services regarding the non-availability of emergency services and lack of network grade quality of service.

- Observe and assess the potential development of network effects that curb consumer choice or innovation within application-based services and step in if necessary.

- Ensure there is no discrimination by player type for any application- or network-based digital service.

With respect to market structure:

- Regulators should shift from price as the dominant regulatory objective to a more comprehensive and balanced assessment that includes investment, technical progress, innovation, efficiency, and quality of service (all with reasonable standards of proof).

- Price assessment should be based on per-unit prices rather than package costs.

- Infrastructure competition from fixed-line players, through deploying WiFi and acting as an MVNO, should be included in regulatory reviews.

- When addressing risk of elimination of an "important competitive force" via merger, the sustainability of this competitive force on its own should be taken into account.

- Market definitions should take a wider view of shifting demand for services, including the impact of OTT-based competition on voice and messaging.

- Regulators should shift the focus of merger remedies from new player entry (usually enforced by reserving spectrum) to encouraging network investment and innovation as well as quality of service commitments from the merged entity.

With respect to wholesale regulation:

- Geographically segment markets in order to assess competition on a local level.

- Assess competition in a technology-

- agnostic manner and include all competing technologies—cable and mobile, as well as fiber and copper—in the process.

- In non-competitive areas, mandate wholesale access, but limit it to one product per geography. Given that general unbundling requirements hinder investments in networks, as they tend to undermine business cases for comprehensive network rollouts, ensure at least that virtual unbundling (VULA) is viewed as an equivalent to the physical unbundling of local access.

- Make ex-post regulatory oversight the rule and eliminate obligations for cost-based pricing, relying on commercial arrangements and prices, with dispute resolution by national regulatory authorities based on non-discrimination.

With respect to spectrum policy:

- Support use of new bands for mobile in a timely manner, especially the allocation of the 700 MHz band by 2020. Lower UHF bands (470-694 MHz) and high frequency (such as 3.5 GHz).

- Modernize the allocation process and align auction timetables.

- Enact national spectrum roadmaps to increase predictability.

- Remove roadblocks for deployment and operation of HetNets.

- Support 5G development and deployment.

With respect to providing for specialized services:

- Allow different commercially driven models to flourish.

- Ensure consistency of regulation across countries, especially with respect to interpretation of the principles laid out by Commission on specialized services.

Addressing these five priorities effectively will go a long way to making the DSM a reality.

NOTE TO THE READER

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This report is a product of BCG's Technology, Media, and Telecommunications practice. If you would like to discuss the insights drawn from this report or learn more about the firm's capabilities in TMT, please contact one of the authors.

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10/15

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