Next Generation Access Networks
The future of telecommunications in Europe
Market forces in Europe are driving telecommunications firms to develop higher bandwidth networks that can provide more efficient service to customers. There are many challenges in making this happen, however, and they vary according to each country’s demographic and governmental profile. In light of the challenges, there are also several well-defined solutions that will help European telecom firms and governments work together to advance their network infrastructures.

European countries are evolving toward next generation access networks (NGAN) by employing various technological and business models. Most notable is the increasing number of carriers, municipalities and public utilities involved in fiber to the “x” (FTTx) projects, which replace telecom systems’ copper local loops with fiber optics. Although this has increased the number of European households connected to an FTTx network, more than 75 percent of households still are not linked to these NGAN systems (see figure 1 on page 2).

Even with the technological challenges, it is the business side that presents the biggest challenge to NGAN development. This is most evident in the investment required to connect customers (€1,000 to €2,000 per customer in urban areas, higher elsewhere) versus the average revenue per user (ARPU) the investment might generate (see figure 2 on page 3). Given the uncertainty of future demand in Europe, ARPU is difficult to predict.

The Future of NGANs in Europe
Operators, regulatory bodies and governments are trying to figure out how to move forward with their NGAN efforts. We believe these entities must answer four critical questions if they are to change Europe’s next generation access network landscape: Will there be more than one NGAN in a given geographic area? Exactly where should the push for NGAN occur? What should be government’s contribution to NGAN investment? Should NGANs be fixed or wireless?

The right answer to each of these questions depends on market, competition, geography, industrial policies and government intervention
In particular, return on NGAN investment is tightly linked to population density, potential of fiber take-up (strictly correlated to broadband penetration) and operators’ market share. These factors drive the economies of scale that will provide return on investment, and are keys to answering the four strategic questions.

1. Will there be more than one NGAN in a given geographic area? In areas with dense populations and where the broadband market is well-developed and concentrated, it may be possible to sustain many end-to-end NGANs. Indeed, it could replicate today’s vertically integrated telecom networks and rely on multiple closed infrastructures deployed by incumbents and alternative networks. This model is sustainable only in certain market environments, however, and only if upfront costs are heavily reduced, as in France.

End-to-end NGANs require fair competition throughout, down to networks’ lower levels, and therefore depends on a solid legal and regulatory framework to ensure that investments are minimized and competition is extended geographically. There are four key factors:

Provide infrastructure sharing. It is imperative to have specific regulations that facilitate

*FTTH/B is fiber to the home or building  
**FTTCab is fiber to the cabinet

Sources: Ofcom; IDATE research; A.T. Kearney analysis
Common use of passive infrastructures, and applies both to existing infrastructures and cost sharing among providers for infrastructure upgrades. The objective is to minimize network-deployment costs.

**Ensure equivalent conditions for fair competition.** Anti-discrimination rules are required to ensure that any players wanting to deploy an FTTx network will be able to do so under the same conditions, both in terms of infrastructure access and go-to-market efforts.

**Reinforce legislative framework.** A specific legislation framework for FTTx greatly eases NGAN deployment and minimizes uncertainties among the municipalities involved. Such legislation controls right-of-way costs, regulates time frames within which building permits can be issued, sets standards for buildings’ “FTTx readiness” and imposes rules for access to private premises and certain public environments.

**Motivate demand.** Demand is accomplished through indirect economic incentives for NGAN development (subsidizing initial connection costs through tax benefits, for example). It is important for demand incentives to be technology

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**Figure 2**
Investment requirements of a next generation access network

<table>
<thead>
<tr>
<th>Capex per subscriber (€)</th>
<th>Additional cash flow (€ per customer per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active equipment</td>
<td>Net ARPU improvement³ Other savings (local loop unbundling fees, incumbent costs) Total</td>
</tr>
<tr>
<td>Passive infrastructure</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Population density³</td>
<td>100-200</td>
</tr>
<tr>
<td></td>
<td>200-400</td>
</tr>
<tr>
<td></td>
<td>400-600</td>
</tr>
</tbody>
</table>

Definitions: FTTH is fiber to the house
FTTCab is fiber to the cabinet
VDSL is high speed digital subscriber line
ARPU is average revenue per user
Capex is capital expenditure

Notes: ¹Dense urban area
²Assumes a 70% broadband penetration of households
³Includes additional ARPU for innovative services net of cost of content
⁴Western European country
Sources: Analysys Mason Group; A.T. Kearney analysis
neutral so they do not infringe on European State Aid regulations.

Even if all the enabling factors are in place, however, the business case for the end-to-end NGAN model remains critical for most alternative carriers in Europe.

2. Exactly where should the push for NGAN occur? In recent years, Europe’s telecom industry has moved toward full competition, thus allowing alternative operators to challenge incumbents’ dominance and fostering investment in new technologies and business models. Consumers have benefited by having access to telecom services at a reasonable cost.

This scenario may not apply to developing future telecom infrastructures, however, as the uncertainty of potential revenues may scare off smaller firms’ investment. At the same time, network evolution is causing separation among passive infrastructure, active equipment and service platforms that allow operators to differentiate services without owning the lowest network level.

The industry has responded by deploying single fiber access networks to extend NGAN coverage. These open-access networks employ a single FTTx infrastructure for all providers to use. In these networks, the typical business model has three main roles: the passive infrastructure owner (dark-fiber network, including the optical distribution frame), the active infrastructure owner (optical and transmission equipment), and the service provider (provides connectivity services to end-users). Two of the three can be combined to maximize economies.

Figure 4 illustrates the two main models: infrastructure provider and wholesale provider. The infrastructure provider model offers the most flexibility since it sustains infrastructure competition at the active layer and allows more differentiation of service offerings among operators. This

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**Figure 3**
The “right” next generation access network (NGAN) depends on the local context

<table>
<thead>
<tr>
<th>Population density (inhabitants per square kilometer)</th>
<th>Concentration and broadband penetration</th>
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<td>Low</td>
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</tr>
<tr>
<td>Medium</td>
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</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
</tbody>
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- **1 Many end-to-end NGANs**
  - Market forces drive competition among alternative NGANs

- **2 One shared NGAN**
  - Regulatory model and industrial policy ensures an efficient investment model

- **3 One shared NGAN**
  - State is required to fund partially or totally a single infrastructure

- **4 Wireless**
  - A unique solution

<table>
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<th>Fixed or wireless?</th>
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<td>No state funding</td>
<td>Fixed</td>
</tr>
<tr>
<td>With state funding</td>
<td>Wireless</td>
</tr>
</tbody>
</table>

Source: A.T. Kearney analysis

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3,000 6,000 13,000

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**Concentration and broadband penetration**

**State funding?**

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**Population density (inhabitants per square kilometer)**

- Low: 3,000
- Medium: 6,000
- High: 13,000

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**Concentration and broadband penetration**

**State funding?**

- No state funding
- With state funding

**Fixed or wireless?**

- Fixed
- Wireless
model could potentially attract infrastructure-focused investors, such as private equity funds, which then allows operators to focus on developing active and service networks.

The wholesale provider model combines the passive- and active-infrastructure owner roles. The wholesale provider is responsible for deploying and operating the network, thus giving access to different internet service providers (ISPs) that in turn provide access to consumers. This model operates on higher economies of scale than the infrastructure provider model, and is more attractive for telecom operators as they can leverage their experience in building and managing networks. The potential downside is that relying on wholesale providers could limit long-term competition at the infrastructure level, which may negate incentives for future investments in the active layer.

3. What should be government’s contribution to NGAN investment? Direct state intervention can foster fiber-optic infrastructure development, especially when private entities are reluctant to invest due to uncertainty of returns and other risks. The government not only enforces

**There is no “one-size-fits-all” model for developing next generation access networks.**

Figure 4
One shared next-generation access network presents two different business models
regulations but is also an active participant in NGAN initiatives such as stimulating demand.

A single fiber-optic infrastructure without state funding can be economically viable in densely populated urban areas where the network can capture at least 30 percent of the total broadband connections. That figure rises to 50 percent in less densely populated areas (see figure 5). To extend coverage in this situation, the state could guarantee payback to private investors within 10 to 12 years, through various measures (if necessary and if no other market solutions can be found) by offering subsidies ranging from €200 to €1,200 per connected household, depending on population density and expected fiber take-up.

In designing its financial intervention, governments must make sure they are in compliance with European State Aid regulations (see sidebar: Strategies for Government Intervention).

4. Should NGANs be fixed or wireless? In rural less populated areas where there is limited demand for broadband, the NGAN business case is not viable even with state intervention. In these areas, the only solution is to offer wireless technology, which today relies on lower bandwidth than fiber-optic networks but is rapidly catching up. Several initiatives led by local municipalities have deployed “open access” wireless networks based on WiFi or WiMax technologies, and long-term evolution technologies (LTEs) may well play a relevant role in the future.

No “One Size Fits All” Solution

There is no “one-size-fits-all” model for developing next generation access networks. As we’ve

Strategies for Government Intervention

If financial intervention is deemed necessary, governments in Europe will want to make sure they comply with European State Aid regulations while also considering creative ways to become involved. The following offers several ideas.

State acts as a private investor. In larger cities where the broadband market is well developed, state intervention can simply fill in where private initiatives fall short. The state can act as a market investor, joining private investors in so-called public-private partnerships (PPP) to take on some of the risk. The state typically owns less than 50 percent of these ventures. Already, EU legislation is being reviewed to determine if certain market failures were related to lack of private initiatives for new technology investments. The outcome of this review could enable even large, densely populated areas to receive state aid.

State provides aid. In smaller cities, where no private NGAN investment is readily available, state aid is possible to boost market potential (provided that state regulations are not enough to overcome market problems). There are two options: delegate public service with the state owning 100 percent of the infrastructure; or establish a public-private partnership in which the state owns more than 50 percent of the venture and provides financial aid.

State participates in a NewCo scenario. With regard to public-private partnerships, a spinoff company (NewCo) can be deployed with passive ownership established through a tender to select investors. The state participates in a NewCo scenario, whereby a public-private partnership invests in construction and owns the dark fiber, while the lighting of fiber is offered for bid to providers. In this scenario, the degree of state funding depends on the extent to which the private-sector is involved. For example, the state could intervene directly or by granting the NewCo access to public infrastructures.
discussed, the best solution depends on a variety of factors. To date, in Europe, multiple NGANs are sustainable only in a few highly populated areas where the broadband market is well-developed and concentrated. In all other cases, one shared NGAN seems the only viable solution and, surely, the most efficient choice for a telecom industry that is just starting to mature.

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