Who wins in a 5G world?

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Next-generation mobile networks promise lower latency and higher speeds. Whether telcos can capture the value is less clear.

In this episode of the *McKinsey Podcast*, Simon London speaks with McKinsey senior partners Ferry Grijpink and Philipp Nattermann—ahead of the headline telecommunications conference Mobile World Congress (MWC)—about how telcos can prepare to be winners in the fifth-generation (5G) race.

Podcast transcript

Simon London: Hello, and welcome to this edition of the *McKinsey Podcast*, with me, Simon London. Mobile-phone networks are among the technological marvels of our age. Yes, we might complain from time to time about dropped calls, but let's be honest: the ability to browse, stream, upload, navigate, and even shop from our phones is nothing short of remarkable. And there's more to come in the form of 5G networks, which promise to open up whole new sets of applications. But who makes money from this abundance of innovation and investment? The answer, as we'll hear, is complicated. Suffice it to say that the winner is not always the telco to which you pay your monthly bill. To discuss the economics of this fascinating industry, I sat down in London with Philipp Nattermann and Ferry Grijpink, two McKinsey partners who work extensively with clients across the telecom sector. Philipp and Ferry, thanks for being here, and welcome to the podcast.

Philipp Nattermann: Great to be here.

Ferry Grijpink: Happy to be here.

Simon London: So from a consumer perspective, clearly we're in a bit of a golden age for mobile. We're streaming. We're navigating. We're doing a lot of things from our cell phones we just couldn't do before. Step back, if you don't mind, Philipp. Give a sense of the growth of the industry. How fast is data consumption over mobile growing?

Philipp Nattermann: It is growing enormously. If you look at some of the numbers in Europe, data consumption has grown sixfold between 2010 and 2017. I think it's actually growing even

faster if you look at different forecasts. A key reason for that is the ubiquitous availability of 4G, both handsets and networks.

With the new services like you mentioned—of streaming applications, et cetera—telcos cover more people than electricity today. It is a truly ubiquitous product. The forecasts really are that it will only continue to grow. Depending on whose numbers you believe, something like north of 75 percent of all the mobile traffic today is already video.

That is also the fastest growing both in terms of how much video gets uploaded to the YouTubes and so on of the world on a daily basis and in consumption. My expectation is that the growth we have seen will only accelerate over the next three to five years.

Ferry Grijpink: If you look at growth, [you see] the availability of very cheap devices in many, many markets. I work a lot in Africa, where you suddenly have phones that are $50 or even $20, which enables many people to have phones, and you create so many interesting applications on top of it. The value generated by mobile phones for society and for people is so big that we're really living in a golden age of these opportunities. The better the network becomes, the more it's feasible. That also makes it more exciting.

With a 2G phone, you could do SMS. But now, suddenly, you can do taxi booking. You can manage your bank account. You can even look at your crop. Is my crop doing well? Can I get advice? Get some medical advice. The value of cheap smartphones in emerging markets is phenomenal, and the value created for the individual and for society is tremendous.

Simon London: From a company perspective and from an industry perspective, the interesting question is: Who's capturing the value? Give us a sense of where the value is flowing today.

Philipp Nattermann: I think "it depends" is the answer. As Ferry mentioned earlier, there is still unbelievable growth in the pure telco industry. On a regional level, if you look at free cash flow as a proxy for that, it increased by about 100 percent in North America between 2007 and 2017 and at a similar rate in Korea and in Japan, for example.[1] There's been growth.

There are some markets, like Europe, that are shrinking. That's probably due to competitive market structure more than anything else. But that's only part of what I as a consumer spend and you as a consumer spend, which is your monthly phone bill.

The second bit, which is, if you look at devices, particularly at the high end in the mature market, some phones cost north of $1,000 at this point. There has been a huge amount of value creation and value shift toward the technology players that create these devices.

The third pool, which is probably the biggest opportunity, is the services and applications on top of that, be that the streaming, be that the entertaining, or any other types of services, which require both the ubiquitous networks and the smartphones, be they low end or high end. Those are the three different types of players in the industry that are seeing quite different value flows and quite different trajectories at this point.

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[1] Based on a sample of companies across regions, looking at the differences between earnings before interest, tax, depreciation, and amortization and capital expenditure.

Simon London: So telcos have done well, Europe aside, but maybe not quite as well as some of the device manufacturers, naming no names, and some of the technology companies. They've probably done even better out of 4G and this growth.

Ferry Grijpink: If you take a step backward, Philipp described these three buckets of value. You see that the equipment manufacturers who deliver the network, they've consolidated. When I graduated there were 15 or so. We're now at four or five left. If you look at the device manufacturers, there may be five or six globally, but only one or two make money. But they're global industries.

The telcos are largely a local industry, so they compete locally. And they've done relatively well in their local markets, but once they start to compete on the global scale—for example, for services—it becomes more difficult. That triggered a bit of an identity crisis. Because before, they did everything from calling to SMS, and they provided a lot of tech services and connectivity.

Now, suddenly, they're boxed into this connectivity area. If you try to compete with global players without the R&D, without the developers, and without the ten-year horizon, profitability is very difficult. Therefore a lot of telcos outside of Europe have done really well but not as well as the big global services providers and internet companies. And there's a realization of, "What is my business? And how can I be successful in this game?"

Simon London: It's funny from a layperson's perspective to think of mobile operators almost like utilities because the technology is pretty amazing.

Ferry Grijpink: The technology is fascinating. Indeed, I was in Myanmar, and you can literally have a FaceTime call with your parents in the Netherlands. It's just phenomenal. At the same time, of course, only a small part of that is the telco. You've got the equipment manufacturing, the R&D chipset people, which are all needed to make it happen. [The telco is] an orchestrator of the chain more than an innovator in the chain.

That orchestration's really important because you need to run base stations. You need to fuel them. You need to make sure they work. That is not easy business. But at the same time, they're an important part of but not the total value chain.

Philipp Nattermann: I think you're absolutely right. If you think about it, as a telco, I buy all the equipment. I buy the phones. It has, thanks to GSMA[2] and others, been standardized. If you're a telco, it's also quite hard to really differentiate yourself because we can all buy the same phones. We can all buy the same equipment.

Yes, some are larger, so you have more money. You can build a better network. But it's very different than most other industries where I run my own R&D. Telcos have outsourced it. That's one of the key issues where when you do have a slightly less favorable industry structure, like we have in Europe for example, then it's very, very hard for the players to overcome that.

That's one of the things that, if you think back over the last 20 years, has changed quite significantly. I remember there were players who tried to have their own smartphones, who tried to have their own early versions of a walled garden. We all remember NTT Docomo's examples 15 years ago or so.

Simon London: Just double-click on the industry-structure point. By that, basically, we mean how many players are competing for market share in any given market?

Philipp Nattermann: It is that and more. So, yes, of course. Look at a market like the US, where I have four players or four scale players, in effect, in mobile, for example, maybe even going down now to three. Compare it to a market like the UK, which is, from a population standpoint, something like a quarter or a fifth of that [market]? But, again, I have four players. Now, I have a smaller landmass that I need to cover with my cells. But I lack scale economies. And I think Europe, as Ferry mentioned earlier, is particularly separated. I need a local operating license. [The European Union] has 26, 27 countries? Roughly it's the size of the US in aggregate. But I have 26 to 27 times as many local operators as the US has. That, by definition, puts Europe at a scale disadvantage.

Ferry Grijpink: I work with a lot of regulators in Asia and Africa to look at regulatory regimes. If you take the two opposite perspectives, there is a perspective around, "How do I protect the consumer?" Because do you need a local operating license, or is consumer protection needed? At the same time, you want to make sure there is investment and there is basically good infrastructure. And it's a balancing act.

By far and large the European Union did a pretty good job in making sure that the consumers have low cost for connectivity. Now we're on the verge of a large rollout of new infrastructure like 5G. Then the question is a bit, "Is there enough money, and is there enough value in the pool for an operator to roll out faster?" Getting that balance right between consumer protection and investment protection is difficult. At different times and in different markets, governments played differently and therefore you see different outcomes.

Simon London: So that's a really nice segue into 5G. Ferry, for a nonspecialist like me, what is 5G, when's it coming, and what's it going to enable?

Ferry Grijpink: 5G is just the next evolution of the mobile network. We started out with 2G, then 3G, 4G. Now we have 5G. 5G does three big things. One is it enables much faster speed. We're talking about gigabits a second that you can deliver. The second is it cuts down latency. So it'll go faster. Between setting up the connection and receiving something, things go faster. And that's quite important: if you want to steer a robot, that robot reacts very quickly in what you do. A third one is it enables a lot of IoT [Internet of Things] use cases. Much lower power. Those are the three big things 5G is enabling.

We predicted it would launch after 2020 [Exhibit 1]. Right now we see many players planning to launch commercially in 2019. And, of course, in the US, there are a lot of very advanced trials already going on this year.

Exhibit 1

Large-scale deployment of 5G is around the corner, with approximately 92 percent of respondents planning deployment by 2022.

5G large-scale deployment timeline,[1] % of respondents
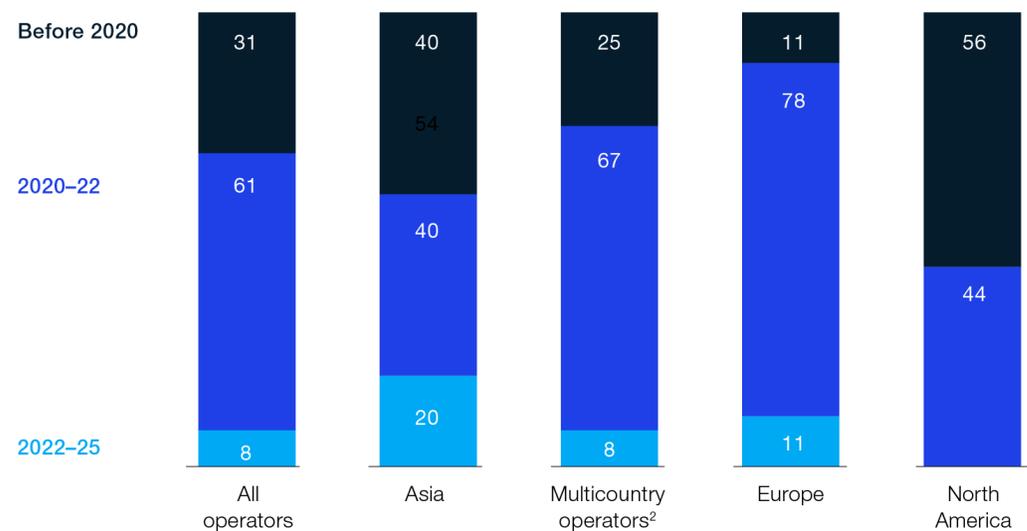
[1]100% = 46 operators.
[2]Multicountry-operator responses reflect perspective of group chief technology officer.

McKinsey&Company | **Source:** McKinsey 5G Survey 2018

Simon London: I was going to say I see quite a lot of headlines that mention 5G as if it's literally just going to hit me as a consumer.

Ferry Grijpink: Well, we expect handsets to be available at the end of 2019. So in the end, you will be able to buy a handset then. Maybe not from the big brand one but from smaller brands. At the same time, as a consumer, will you notice faster speed on your phone? Most likely not. Will you see a lot of the latency benefits for yourself? No.

For 5G, we are looking for different use cases. Things like Industry 4.0. We talk about cars. We talk other applications. And in that respect, 5G resembles a lot 3G. When the operators in Europe were rolling out 3G in 2003 and 2004, they built a beautiful, shiny network that could do a lot of high-speed data. Nobody had any idea what to do with it at that point of time.

It took them until 2007, when the iPhone came, to realize that is the application. Smartphone is the thing. It's not going to be wireless broadband. It's really that as a use case. What we see

now is we're rolling out a network with a much better capability. And the question is: Who can innovate on that capability to really offset demand?

We see a lot of trials in factories. I was in a refinery to look at how robots can connect faster. But the big thing, that iPhone moment, hasn't happened for 5G yet.

Philipp Nattermann: The game changer, if it comes, will come from IoT applications, Industry 4.0 applications.

How do I connect a car? Take that as an example. Clearly you have the car manufacturers. You have the existing map producers and all these things, the OEMs, the service providers. They will create a lot of use cases. They largely will retain the information.

Take your car, in terms of predictive maintenance. If you drive—whatever it is, a Fiat, a BMW— the car manufacturer will own a lot of this. Clearly I will use a mobile operator's network to transmit that. If I want to do autonomous vehicles, I need the low latency. To get to this eureka moment, I believe, it will be very important for the operators to collaborate with these different vertical players, be that automotive, be that robotics, be that logistics, be that financial services.

If you're honest, the one thing the telco industry has not been particularly good at is effectively collaborating with third parties. We're very good within the industry in terms of finding standards. That's very impressive. But if you're really honest, how well have you worked with financial services? How well have you worked with the medical-device industry, the automotive industry? Not that well. But that's where the value will come from.

One of the things that the operators really need to start thinking about is: How do we avoid the mistakes of the past to enable the industry to capture its fair share of the value that will undoubtedly be created by 5G?

Simon London: Yes, that's the big takeaway for me. As I started researching this, I, as a layperson, hadn't realized to what extent the industry had failed—and maybe "failed" is too strong a word—but failed to capture a lot of the value created out of 3G and 4G. That has to be the really interesting strategic question for telcos now.

We know there's going to be a lot of value created through 5G. We don't know exactly what yet, but there's going to be stuff created. There's going to be value created out of 5G. How do you have a real seat at the table? How do you partner? What are the business models? What are the alliances, the ecosystems to actually capture value? Is that a fair summation?

Ferry Grijpink: MGI [the McKinsey Global Institute], our think tank, thinks it will be about $4 trillion to $11 trillion of value created by IoT. It's unclear if that's going to be captured by the industry or it's going to be consumer surplus. But it's a large number to look at. When we looked at this for a lot of our clients, around 10 to 30 percent of that requires advanced network capabilities. Things like low latency, very high reliability, very high speeds, that give the telcos some right to play because they bring that capability sometimes earlier and more integrated than other players.

At the same time, a right to play is not the same as a right to win. A right to win, to Philipp's point, means that you need to understand the vertical. You need to be able to partner with device manufacturers, with people who operate refineries, people who understand pumps, who build the solution. The question is, as a regional player or a local player, how do you inject yourself in that ecosystem to generate value?

Some local use cases, like smart cities, healthcare-related stuff, are easier for telcos to capture because there's a local regulatory aspect. They need to be reinvented at a local-market scale. While things like Industry 4.0 will be more difficult because some of that will be more global.

Simon London: And, of course, the other thing about 5G, like any of these technology transitions, is the cost of the build-out of the new network. I know 5G has some particular wrinkles in it. For example, you need denser towers to make it work. Philipp, what is it going to cost? Who's going to come up with the money? Are they going to make a return?
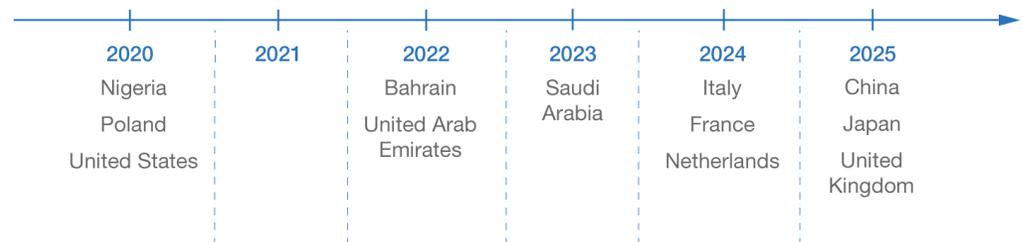
Philipp Nattermann: I think, yes, it's absolutely right that, especially for the higher-frequency bands, the density of the network is significantly higher, probably an order of magnitude higher, than it was for 4G or 3G, particularly in urban areas.

Simon London: So literally more towers per square kilometer in these areas.

Philipp Nattermann: Yes. For the high frequency, which is really what gives you the high capacity, particularly in urban areas, as Ferry had mentioned earlier, 4G is starting to run out of capacity [Exhibit 2]. A big part of the business case for many operators is the increased capacity you get from your networks. Forget about the IoT stuff. But that's the very first stuff.

Exhibit 2

The point when operators begin running out of capacity in at least 50 percent of sites will vary by country.

2020	2021	2022	2023	2024	2025
Nigeria		Bahrain	Saudi Arabia	Italy	China
Poland		United Arab Emirates		France	Japan
United States				Netherlands	United Kingdom

Note: Includes examples of select countries. Assumes current spectrum ownership. The years shown represent the point when at least one operator in a country runs out of capacity.

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The equipment prices are already starting to come down. The key challenge really is what I would call the civil-engineering cost for each of the new cell sites. It won't necessarily be a

massive, big tower, it might be a microsite. But you still need to build the site, get planning permission for the site, have fiber backhaul because the whole idea is: I have much higher capacity in my cells. Well, I need to somehow bring it back to my core network. Players who have an existing fiber network will actually have a greater advantage relative to other players.

Part two is, in a number of markets, you are not allowed to build incremental cell sites in urban areas either because of the radio-emissions constraints, or because of building constraints, for example.
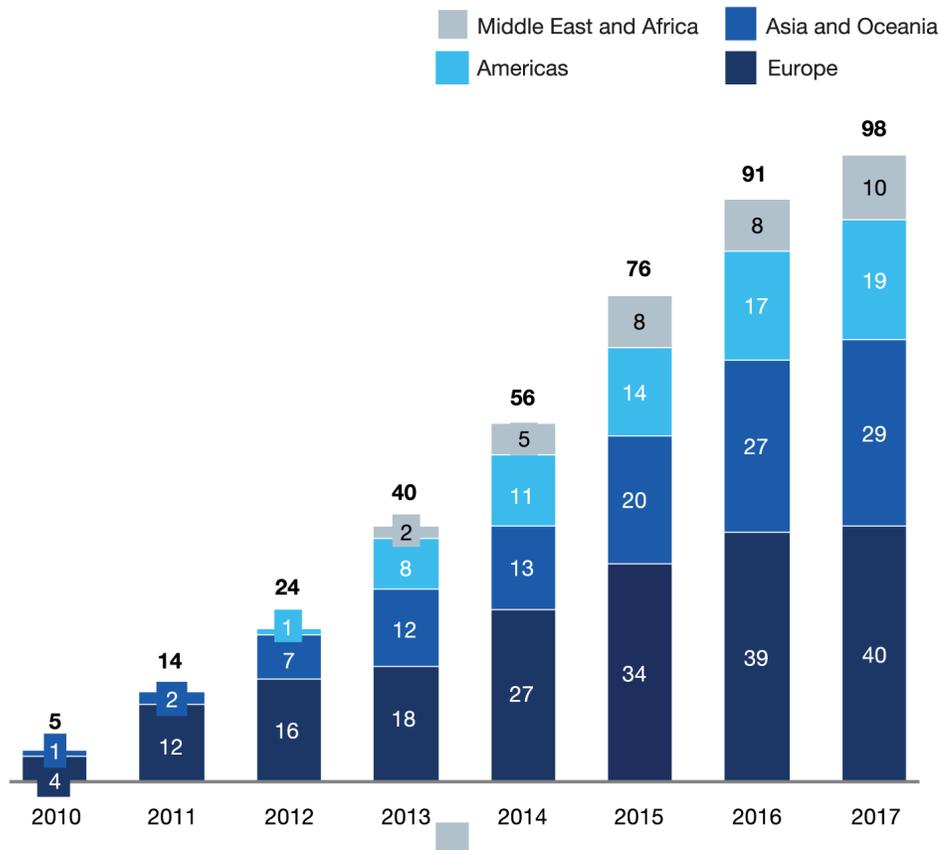
So there are real questions about, especially in European metropolitan areas, whether it will be physically feasible under the current regulatory regime to build the density of the networks that you would need for 5G to work.

What we are starting to see already is different players thinking about network sharing [Exhibit 3]—pooling their networks together, either what we call the passive, or the sort of infrastructure part, or the active part—and that will very likely continue. It is clearly a cost element, but it is also a sheer, "I need access to a larger number of sites. You have some sites. I have some sites. If we combine them, it gets us both a long way down the road."

Exhibit 3

Active network sharing has become more common worldwide.

Cumulative number of active network-sharing agreements announced 2010–2017

Legend: Middle East and Africa | Asia and Oceania | Americas | Europe

Year	Europe	Asia and Oceania	Americas	Middle East and Africa	Total
2010	4	1	1		5
2011	12	2			14
2012	16	7	1		24
2013	18	12	8	2	40
2014	27	13	11	5	56
2015	34	20	14	8	76
2016	39	27	17	8	91
2017	40	29	19	10	98

| **Source:** GSMA Intelligence; Ovum; McKinsey analysis

Simon London: So, Philipp, you said "orders of magnitude." How many base stations are we going to need in an urban area? Give us a sense of what that means in practice.

Philipp Nattermann: It really depends on the topography. But typically, in an urban area, [you can have up to 30 to 45 sites] per square kilometer.

Simon London: And these are towers today.

Philipp Nattermann: These are towers or smaller cell sites that you see on the side of buildings. On 5G, again, it depends on the take-up. It depends how much spectrum you get as an operator, et cetera. But we could talk an order of magnitude, so [up to] hundreds per square kilometer of cell sites.

What that means is, on street furniture, on lampposts. One of the operators in Europe developed a method to put a cell in the underside of a manhole cover. This gives you a sense of the sheer number of cell sites they will need in big urban areas but also in the length to which operators are being forced to think about, "Well, where do I actually attach this cell site?" Be that in street furniture, be that elsewhere, [they will need] to be able to place potentially hundreds of cells in a single square kilometer.

Simon London: And when you talk about the civil-engineering challenge, that's what we're talking about. It's not like building a big bridge, but the complexity of rolling out 5G, particularly in urban areas, is significant. [See Exhibit 4 for a look at increasing network density.]

Philipp Nattermann: Yes. It's the distributed nature of it. Most European cities or North American or Asian cities were not built for 5G. They were built for very different purposes. So, yes, I think it will be a huge challenge. And I think you might very easily see a greater bifurcation of operators.

If I'm a well-financed operator, maybe even the incumbent, I have a fixed infrastructure in place, that's one thing. If I'm a relatively small mobile-only player with significantly fewer resources, this challenge becomes significantly more daunting. We could very well see that 5G might lead to some changes in industry structure.

Simon London: This is why you said it may not make sense to have multiple networks. It may make sense just to have a single network, just like you have a single set of water pipes and a single set of electricity cables. Because the civil-engineering challenge becomes such that you just need a single layer of these base stations?

Ferry Grijpink: One of the analysts always jokes that telcos are specialized real-estate companies because, frankly, rent you need to pay for all these hundreds of towers is pretty high. It's like being a real-estate developer. What you see in 5G, there are certain regulators who are willing to give out licenses for a region. You get a neutral host.
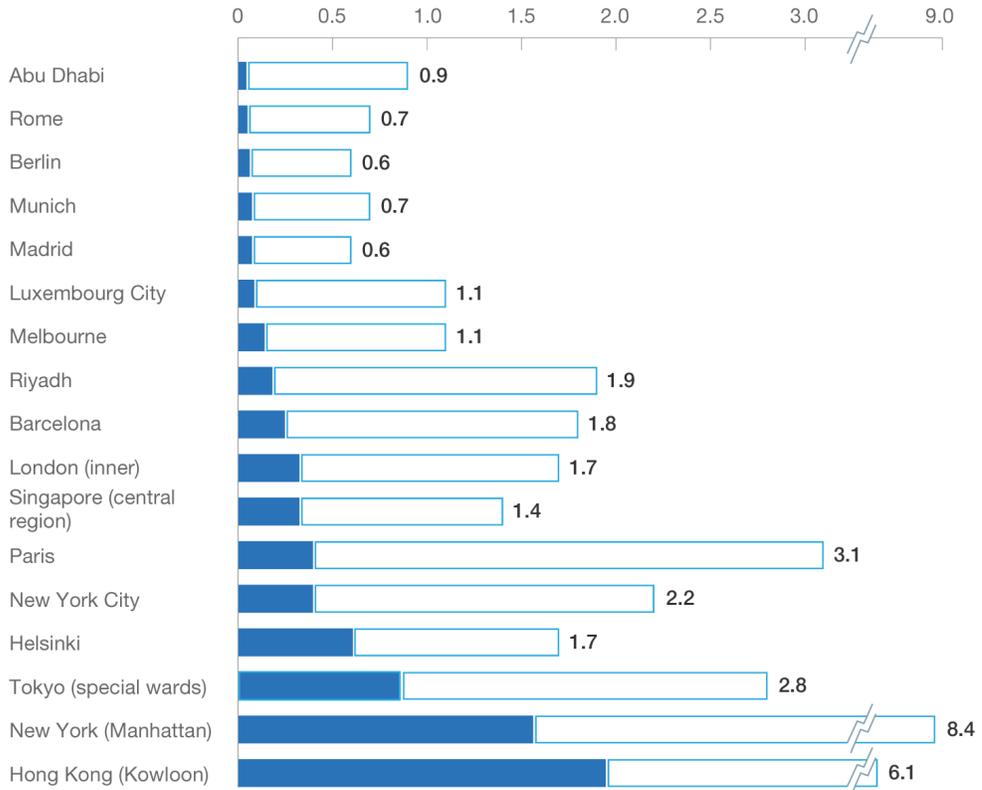
So instead of five players trying to cover this area, only one covers it and people roam on it. It's very controversial in the industry. How do you create enough competition? How do you not create certain rent extraction? But in the licensing regime of 5G, certain markets are going that way.

Exhibit 4

Network traffic density is growing in urban locations.

Traffic density in city area,[1]
petabyte per square kilometer

■ 2017   □ 2025

City	Value
Abu Dhabi	0.9
Rome	0.7
Berlin	0.6
Munich	0.7
Madrid	0.6
Luxembourg City	1.1
Melbourne	1.1
Riyadh	1.9
Barcelona	1.8
London (inner)	1.7
Singapore (central region)	1.4
Paris	3.1
New York City	2.2
Helsinki	1.7
Tokyo (special wards)	2.8
New York (Manhattan)	8.4
Hong Kong (Kowloon)	6.1

[1]Unless specified, excludes areas outside the smallest definition of "city," that is, "metropolitan" or "urban" areas.

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Simon London: And then you really get to a model that begins to look more like a utility, don't you? And this is one of the issues for the industry. You only have one set of water pipes, and there's a utility, basically. And there are certain regulatory regimes that allow a degree of competition. You can choose your electricity provider, for example, in many places. But they're all going across a single transmission network. Doesn't the industry begin, again, to look more like a utility?

Ferry Grijpink: I think regulators would like to prevent that happening. Because what we see in the industry, in places where you had cable and fixed, you saw much more innovation. Fixed players were much more incentivized to upgrade their networks to VDSL,[3] to fiber. And cables were running faster to provide upgrades to DOCSIS.[4]

So a situation of one network I think would be counterproductive toward innovation and rolling out things fast. At the same time, do you want to have five base stations crammed in historic city centers in Europe? No. So there's most likely an optimum, which is somewhere between two and four depending on the scale of the economy, depending on the size.

[3] Very-high-bit-rate digital subscriber line.

[4] Data-over-cable service interface specifications.

Simon London: OK. So different solutions for different geographic areas. And there are good reasons for competition. There are good competition reasons why we might not want to see the industry develop into too much of this utility model.

Philipp Nattermann: I agree. I think, to be honest, again, this is primarily a European issue, which you talked about before. If you compare prices of telcos—so what does the average consumer pay, let's call it a price—and you look at it over ten years, for telcos this has come down even though we use way, way, way more data today than we ever did before. All other utilities have increased their prices even though people tend to use less electricity today because we've become more energy efficient, and probably use about as much water as you did, and so on.

So I'm not sure that the telcos would necessarily mind being treated like utilities if you look at that in terms of being able to raise prices, to have a regulatory-protected environment. Utility might be a bit of a dirty word, but in reality, it may not be such a bad thing.

Simon London: That's right. A good regulator would make sure they could at least earn their cost of capital, which in Europe, I gather, is not the case if you take the industry aggregate.

Philipp Nattermann: Absolutely. We've looked at this across a range of European countries. Clearly there will always be players that do. But across the core seven large European markets, the industry not only does not meet its cost of capital, the return on capital is lower than its cost of capital. In pure economic terms, this is value destructive and has been for the last three or four years. And I think that is a real concern for the industry. It goes back to a point we discussed earlier, which is, in Europe, regulators have been very good at lowering end-consumer prices, which has an impact on the revenue and on the returns that these players have had.

The flip side of this is, if my cost of capital is higher than the return I generate, that, among rational economic players, will have an impact in terms of reducing the investments I will make. There is a real risk that Europe might fall behind. I think we can claim that it definitely was leading in 2G. No question about that. Maybe even early 3G.

But if you look at network density, if you look at the speed of 5G rollout, you could claim that certain markets in Asia, for example, maybe even the US, are on par, if not ahead of, Europe. One of the key reasons for that is the different economic climate. That is one of the concerns I would have, at least, that if this continues and the industry continues to fail to generate a return that at least meets its cost of capital, forget about exceeding it, we might see slower investments. We might see headline rollouts of 5G in London, Paris, or Milan. That's all great. But who will actually have it? How much will it be available, at what cost relative to some of the other markets out there?

Ferry Grijpink: And, Philipp, this is not just a European phenomenon. If you look at what happened in India, on one hand, there are grateful consumers because data prices went down and there was massive adoption. But at the same time, the industry is starved of profits. And

the question is: What will that mean going forward? There are other markets, like Indonesia, that are also very similar. Very competitive. And the question is: If all the players are experiencing losses at the moment, will that generate enough cash to keep innovating and keep building new infrastructure?

Simon London: As we're recording this, everybody's preparing for MWC at the end of February in Europe, in Barcelona. As you mentioned, Philipp, the industry in Europe faces particular challenges around industry structure and profitability. What needs to change? How can that be fixed? And how do we make sure that Europe doesn't fall behind, doesn't end up with a tech deficit in this area?

Philipp Nattermann: European regulators have been very good at keeping end-customer prices low. They have been less good at creating an environment where the return on capital is sufficient to cover the cost of capital. What that means is we need to start thinking about how we allow more in-market consolidation because we clearly see that the number of players has a very clear inverse correlation to profitability. European operators are significantly less profitable than their North American, their Korean, or their Japanese counterparts.

Simon London: And consolidation, in practical terms, means M&A.

Philipp Nattermann: It means M&A. Or, alternatively, you allow for moving away from what is a sort of accident of history, that these relatively small countries in Europe each has its own licensing requirements, and instead saying, "I allow you to run a network across the whole Benelux region," for example, or the DACH region or whatever it is, so that you help operators get more economies of scale. Because, obviously, a large market is able to support a larger number of competitors than a small market. So I think there is clearly something around that. And I think the commission and the regulators really need to think about, what is the long-term vision? Because, yes, of course, they can keep continuing to just focus on low-end customer pricing. But that will over the long term [have an impact].

There's a second element, if you look at what we talked about before: the other players, the newer players in the value chain that have captured most of the value, particularly on the OTT, which is "over the top," the service providers that sit on top of the telcos. This is the Netflixes, the Googles, all your applications that you run. Very few people still talk on their phone much. It's mostly all the applications. If I look at those, they're almost exclusively North American. At the same time, you have, which is less visible to us, maybe, but you have a similar ecosystem being created in China. The question is, what are the things we can do in Europe—and that we *should* do—to ensure that we have an equally rich pipeline of these innovative companies?

Because my thought is, as we look at the value migration, more and more of the value will migrate to the application—and the simple reason being that the number of applications you can provide is limitless and the number of networks I can have is, by definition, limited. This goes from taxation to risk capital to setting up the environment where we don't just grow start-ups—and anybody who goes to MWC sees a huge number of very small start-ups—but

actually create tech companies that can play on the same level as the big players in either the US or in China. And I think that's almost the bigger concern in all of this.

Ferry Grijpink: Philipp, if I may build on the point you're making but take a slightly different lens, I think there are three other elements we need to consider for Europe telcos. Number one is the consumer. In the transition from being the integrated service provider to being more connectivity providers, we lost the consumer.

If you ask a consumer, "Who would you rather deal with? Do you want to give your information to one of the service providers like Google or Facebook?" They would rather give their information to them than to [telcos]. One element to focus on as an operator, to stay relevant and play in the application space, is to win back the minds and heart of the consumers.

Second, if you look at where we are in the development of connectivity and applications, we're moving from virtualized goods like social networks and content into the hard physical space with IoT. And there, of course, Europe has a lot of advantages. We know how to run industries. We're a manufacturing hub like in Germany. We produce a lot of goods. So once applications move from the virtual space to the physical space, the question is: Do we have an advantage in Europe?

The third thing is we also have a little bit of an advantage given the fact that we don't have one of the large players here. Things like GDPR [General Data Protection Regulation], privacy, how we are going to create these new platforms that are more focused on what consumers want now—I think we saw all the problems with decentralized platforms. Given that we have none of them in Europe, we have the opportunity to win one.

Those are some positives to look at where we can build on. But it requires the industry to make real bets and to go after one thing, not a hundred things at the same time, and really focus. If we try as every individual nation and every individual operator to go after the same thing, we will fail.

Simon London: So I think we're out of time today, but Philipp, Ferry, thank you very much for a fascinating conversation.

Philipp Nattermann: Thank you.

Ferry Grijpink: Thank you.

Simon London: And thanks as always to you, our listeners, for tuning in. To learn more about our work in telecom, technology, and beyond, please visit McKinsey.com. ☐

Ferry Grijpink is a senior partner in McKinsey's Amsterdam office, and **Philipp Nattermann** is a senior partner in the London office. **Simon London,** a member of McKinsey Publishing, is based in the Silicon Valley office.