Truths and myths about the new super-technology

Does 5G really exist?
Yes, but we have to distinguish between the 5G standard and future 5G infrastructures. The mobile standard is the successor to 4G/LTE. It is currently in development and will be adopted in several stages starting in 2018. This standard will define the requirements of future communication infrastructures with regard to transmission speed, latency, bandwidth, mobility and resource efficiency, for example. When 5G is deployed in 2020, it should offer the following benefits:

- data rates 100 times higher than today's LTE networks (up to 10,000 MBit/s),
- subscriber and device capacity that is around 1,000 times higher,
- 100 billion mobile devices connected at the same time worldwide,
- extremely low application-specific latency times of under 1 millisecond,
- higher availability in terms of coverage and reliability.

In addition to wireless access technology, 5G will bring about a new network infrastructure that integrates existing networks and applications (mobile communications, fixed fiber-optic and copper-wire networks, WLAN, LTE, etc.). The new 5G infrastructure must be built by device manufacturers and providers in the coming years, which will involve high investments. And individual users will need new devices (smartphones, tablets, or even sensors in cars and houses) to take full advantage of the new 5G wireless network.

5G is just a mobile network, right?
No. 5G combines the latest mobile technologies with fixed access networks in a virtualized – i.e., software-based – network world. Virtualization makes the network more intelligent by enabling it to adapt in a dynamic, differentiated way to the requirements of various applications.

Along with the open Internet, with its free access to content and innovations such as multimedia communication services, there will be special networks with a high quality of service and high data security – for e-health applications, for example. These network types are different manifestations of the same infrastructure, which, thanks to technologies such as network slicing, dedicated core networks and dynamic network management, will be optimized for the applications they support.

But there aren't any applications for 5G!

No one can yet say what the killer apps for 5G might be. But three distinct application clusters are emerging, each of which will lead to different network characteristics. One area is the Internet of Things (IoT). A large number of end devices (sensors, sensor clusters) need simultaneous access to the network for this. Mission-critical and ultra-reliable networks are another area. These are used for disaster control, for example, or for controlling critical infrastructures such as the electricity grid. Networks such as these require high security standards, a high quality of service (QoS) and low latency times. There are different requirements again for massive multimedia (video streaming, virtual and augmented reality). High bandwidths are needed here most of all. Through network intelligence and virtualization, 5G can meet the requirements of every application.

Why do I need 5G as an end user? I can already use LTE for mobile video streaming and web surfing.

Video and music streaming are good examples. This is currently only possible at low speeds. Even in a normal intercity train, the connection is often lost. 5G should make streaming possible even in high-speed trains (up to 500 km/h). Other important applications will almost certainly include mobile video in self-driving cars and augmented reality. The hype surrounding Pokémon GO showed that there is great potential here. Augmented reality, especially in combination with sensor-based information from the real environment, could be one of the killer apps for 5G.

Is Germany lagging behind in the development of 5G infrastructures?
Korea is planning to roll out 5G in connection with the 2018 Winter Olympics (Samsung is the technological driver here), while Japan is looking to the Summer Olympics in 2020. In China, Huawei and ZTE are pushing the development of 5G, while in the USA, AT&T and Verizon are important pioneers. All countries are investing massively in building the 5G infrastructure. Germany could move faster here as part of the 5G Capitals initiative of the EU, for example. Worldwide efforts to establish 5G test regions – such as the Berlin 5G Test Field – point in the right direction. These make it possible to test 5G services and devices before the rollout. Germany is also an important player because we have a lot of application expertise in fields such as automotive and production.

Will we all need new end devices (tablets, smartphones) for 5G to work?
Yes. To take advantage of the full spectrum of new 5G services, we will have to use new access technologies and new network functions. These will generally require new devices which will not differ externally from our current ones. But 5G will play a much larger role in the communication between devices (e.g., cars, robots, smart-home equipment) than in mobile communications. There will be a radical change here, because these systems have a longer life span; many of today's sensors are still using technologies from the early days of cellular mobile communication.

Is it true that 5G will make it possible to control remote devices, such as surgical robots, in real time?
No. 5G specifies extremely low latency times of down to a millisecond, but this will only work across relatively short distances (around 150 km round trip, purely for transport time, without processing the data). The physical limit here is the speed of light (around 300,000 km/s). Even 5G won't be able to transport data faster than light.

To achieve low latency times, edge computing concepts are interesting because they allow time-critical events to be processed locally, so remote resources are

only used for non-time-critical requirements. To make this possible for many applications at once, network structures have to be optimized, something that is being attempted with the introduction of software-defined networks (SDN).

When 5G rolls out, will we finally have self-driving cars?
Communication with extremely low latency is a fundamental technology for automated driving. When a car can continually and securely communicate with the traffic infrastructure, other vehicles and pedestrians, then a multitude of additional sensor information can be taken into account. This information has to be evaluated in real time and available in the vehicle – e.g., "Caution: pedestrian in the road. Brake immediately." 5G will eliminate some of the major technical barriers to capturing mobility information, making it possible to transmit and process a multitude of sensor information in parallel under real-time conditions.

Will 5G replace all previous standards (3G, 4G/LTE)?
No, the earlier technologies will still be available, just as they were when LTE rolled out.
5G is developing in an evolutionary way, so earlier standards such as 3G and 4G/LTE, and less widespread technologies such as WiMAX, TETRA and industrial wireless systems, can be integrated. 5G also does not relate solely to mobile communications; WLAN, fiber-optic and other cable networks (e.g., copper twisted pair) and a variety of sensors and sensor networks (see the Internet of Things) can be integrated as well.

Will telecom providers need new frequencies because of 5G?
Yes, because 5G requires a much larger frequency spectrum than 4G on account of the envisaged capacity growth. Today's mobile communication technologies use bands in the region of up to 3.5 GHz. For 5G, much more room will be needed above and below this. Three ranges are currently being discussed:
Under 1 GHz, under 6 GHz (e.g., around 3 GHz) and above 6 GHz. Efforts are currently being made to harmonize frequency use worldwide. This includes reassigning certain frequencies for specific areas of application

(e.g., mobile communications, industrial communication, high-availability communication). Free frequencies will probably be auctioned off in Germany, which will entail additional investment costs for providers. Additionally, models for dynamic frequency access – where multiple users share a spectrum – are increasingly being explored and even partially implemented worldwide.

Who is responsible for the rollout of 5G?
First, the standardization bodies whose members include the most important manufacturing companies: infrastructure producers, device manufacturers and providers. Vital impetus can also come from other user sectors, e.g., state organizations, the automobile industry and the media. And last but not least, governments have to be involved – with respect to regulation issues, legal conditions and infrastructure expansion.

When will 5G be available throughout Germany? Is there a schedule?
According to the 5G Action Plan of the EU, the first preliminary tests with 5G should take place in 2017. The rollout of the first 5G pilot networks is planned for the end of 2018. Commercial 5G services should be available by the end of 2020. All larger urban environments and major transportation routes should have seamless 5G coverage by 2025. In addition, the Action Plan calls for every country in the EU to identify 5G capitals – and Berlin naturally wants to be one of them.

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