

5G Campus networks LTE and 5G-Technology for local company networks

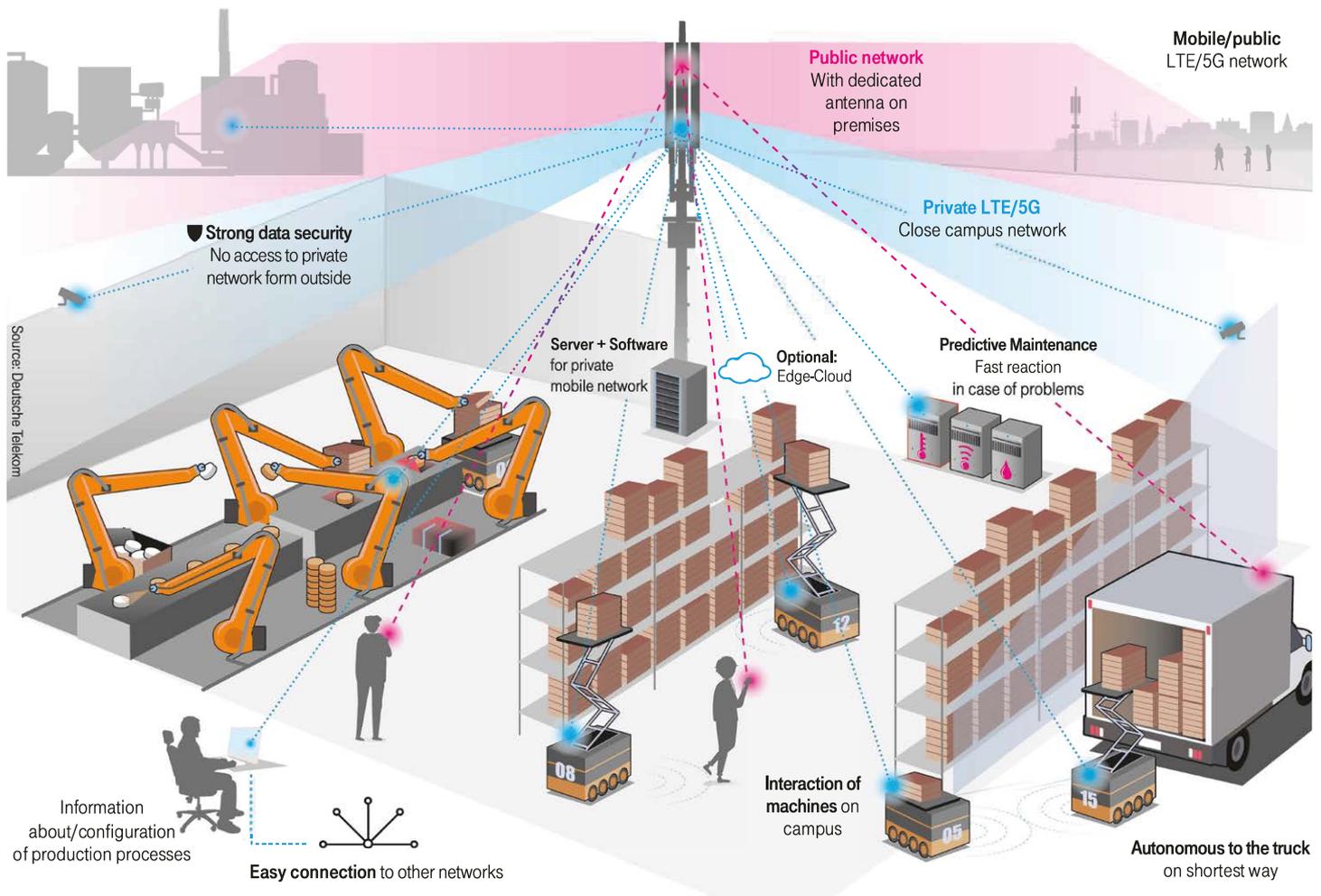


Digitalization makes industrial manufacturing and intralogistics more efficient and flexible: autonomous robots transport parts from station to station, machines report the wear of their components in good time before they fail, service technicians identify defective parts in seconds via “Augmented Reality” (AR). The challenge: Such applications require wireless connectivity that is reliable, quick and secure. Wi-Fi technology is reaching its limits here; laying cables is time-consuming and unsuitable for mobile scenarios. Mobile communications provide significantly higher performance and simple connectivity options. That’s why Deutsche Telekom is making its cellular networks fit for local enterprise networks.

With 5G Campus Networks, enterprises receive a private cellular service with a guaranteed high quality directly on campus. At the

same time, the public cellular network coverage is enhanced in the wider area of activity. This enables companies to control and monitor real-time Internet of Things (IoT) applications, such as centrally controlled industrial robots and driverless transport systems, simply, efficiently and securely via mobile communications. Employees and third parties on the site also benefit: They get significantly better connectivity for voice and data communication.

As part of a “Managed Service,” Telekom will take care of the complete deployment and operation of the local cellular network infrastructure. 5G Campus Networks are the perfect solution for connectivity demands in the smart factory, modern intralogistics and wherever performance, range and security requirements exceed the capabilities of existing (Wi-Fi) networks.



Example of a site network with an improved public and a powerful private mobile network.

ONE INFRASTRUCTURE - TWO MOBILE NETWORKS

5G Campus Networks offer significantly better coverage over the public cellular network (Public Slice). Depending on the customer's wishes, the enhanced public network can then be supplemented with different service variants (M or L) for an additional private cellular network (Private Slice).

PRIVATE SLICE: HIGH QUALITY FOR REAL-TIME SCENARIOS

As part of the 5G Campus Networks, Telekom provides enterprises with a private, local LTE or (in the future) 5G network that is completely isolated from the public cellular network. It is for the enterprise's exclusive use. Depending on the local network coverage, Telekom will install additional radio infrastructure both indoors and outdoors on the company premises. The result: high bandwidth, reliability and security as well as extremely low latencies. Thanks to dedicated spectrum usage and Quality of Service mechanisms, the private network can ensure more reliable and predictable connectivity.

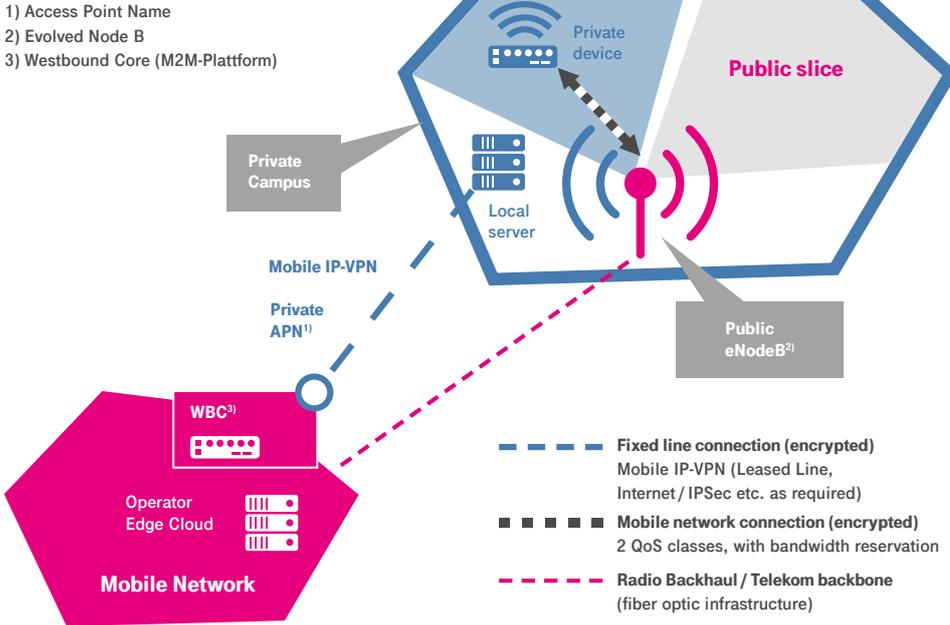
Depending on the selected service variant, the data is routed locally in the private network to a Campus Edge Cloud for very low latency connectivity, or in some cases to the local company network (LAN), otherwise it is transported to a near-site Operator Edge Cloud in the mobile network or sent encrypted to the company's Wide Area Network (WAN). This makes the 5G Campus Networks the perfect solution for demanding mobility scenarios such as autonomous transport and other demanding transmission applications. In addition, 5G Campus Networks make sense if a large number of devices at the site require wireless connectivity in the long term.

PUBLIC SLICE: BETTER COVERAGE WITH THE PUBLIC CELLULAR NETWORK

The enhanced public cellular network coverage can be used at the site by the employees themselves, for example for office communications. On the other hand, external service providers and suppliers are also connected via the public network, for example, to enable maintenance scenarios. If required, this connection can also be secured separately. In addition, the mobile infrastructure at the site has a fiber connection to the Telekom network. This improves the transmission quality for telephony, e-mail and collaboration tools, for example, if they are used via smartphone, tablet or laptop.

THE OPTIMAL NETWORK MIX FOR EVERYONE

5G CAMPUS NETWORK M

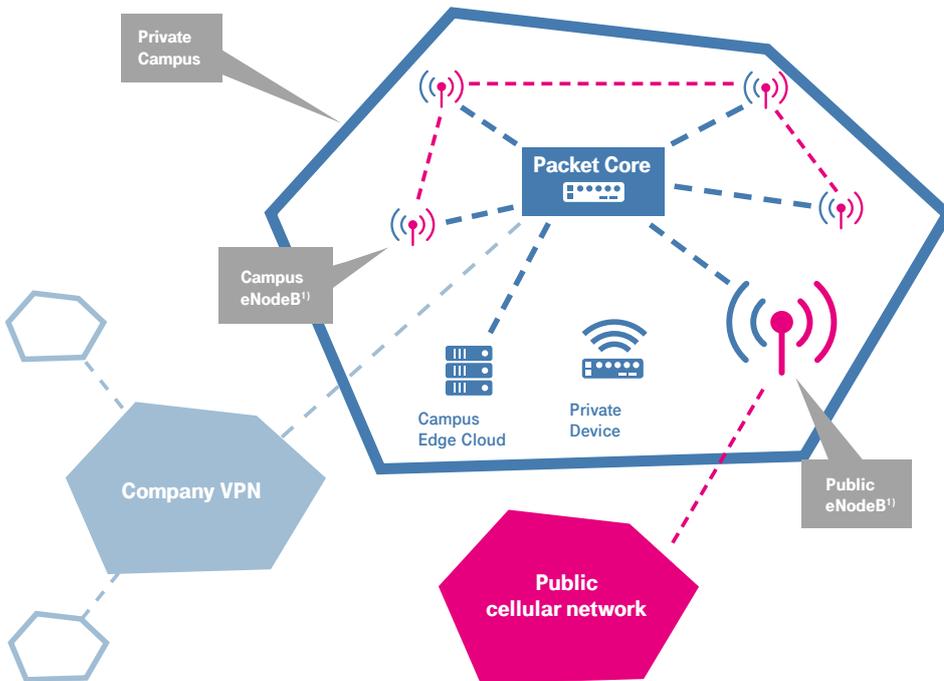


At a glance:

- Private campus network connectivity with Quality of Service (QoS) on dedicated spectrum
- Guaranteed transmission quality for sophisticated IoT services in the Private Slice
- Dedicated private APN (Access Point Name) for the secure transfer of company data between customer site and Telekom's network
- Individually selectable transmission technology between the Telekom network and customer site (e.g. MPLS, Ethernet, IPSec / Internet)
- Optional combination with an Operator Edge Cloud for low latency
- Fiber connection to the site's entire mobile network infrastructure
- Enhanced public cellular network coverage at the company area

In addition to the public network (Public Slice), Telekom also provides a privately usable LTE/5G network (Private Slice), which isolates and encrypts private data and transmits with Quality of Service mechanisms. At the same time, the public mobile network's coverage is enhanced. Employees will also benefit from better connectivity for mobile voice and data services.

5G CAMPUS NETWORK L



At a glance:

- Deployment of a dedicated, publicly and privately usable mobile network with its own network identification (ID)
- Local network interface (NNI) between 5G Campus Network and customer LAN
- Extremely high security and bandwidth as well as low latency
- Fiber connection to the site
- Optional combination with a Campus Edge Cloud to further reduce latency (under 20 milliseconds)
- Enhanced public mobile network coverage at the company location

Telekom deploys and operates additional network infrastructure on the enterprise campus. All data in the Private Slice is routed directly between the campus network and a campus Edge Cloud or the local company network and remains at the company site. As a result, companies benefit from extremely low latency and a high level of IT security of the data transmission, which are particularly necessary for real-time scenarios such as driverless transport systems (DTS), machine control and Augmented Reality (AR).

EDGE CLOUDS – TWO VARIANTS FOR SPECIFIC REQUIREMENTS

To further reduce latency for delay-sensitive applications, enterprises can add an Edge Cloud to 5G Campus Networks. Data is processed locally on the cloud, thus significantly reducing the latency thanks to the short transmission distance. Telekom offers Edge Clouds in two variants:

- **Operator Edge Cloud:** The data is processed in a Telekom Edge Cloud near the company location. Companies achieve latencies of less than 40 milliseconds (5G) or 50 milliseconds (4G).
- **Campus Edge Cloud:** The data is processed in a mini data center directly on the enterprise campus. In combination with the “Campus Network L” service, latency can be limited to around 10 milliseconds (5G) or 20 milliseconds (LTE).

AN OVERVIEW OF THE BENEFITS

- **Flexible:** simple networking for mobility applications such as driverless transport systems and autonomous parts that are difficult to reach by cable
- **Reliable:** defined transmission quality for critical applications
- **Powerful:** high bandwidth and low latency for time-critical and data-intensive applications such as Augmented Reality (AR)
- **Secure:** strong protection by isolating private data traffic from the public mobile network
- **Scalable:** easy networking of the entire company site and a large number of devices as a basis for Industry 4.0 applications
- **Hybrid:** better connectivity also for employees and visitors through the public network’s enhanced coverage
- **Comprehensive:** expandable with a wide range of services for Industry 4.0 such as Campus or Operator Edge Clouds, IoT integration or security solutions

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