

5G MOBILE COMMUNICATIONS IN ENTERPRISE NETWORKS



In the B2B environment, 5G has evolved from a purely mobile access technology into an integral part of modern enterprise networks. High bandwidth, low latency, and flexible deployment make 5G a powerful complement or alternative to traditional wired WAN connections. At the same time, requirements for security, availability, and the centralized management of distributed networks are increasing. The key question is therefore: “How can 5G be integrated into the enterprise architecture in a practical, secure, and cost-effective way?”

What sets 5G apart technologically

5G is the fifth generation of mobile communications and uses the 5G New Radio (NR) air interface standardized by 3GPP. Compared with LTE, mobile communications technology has been fundamentally enhanced to enable higher data rates and capacity as well as shorter response times.

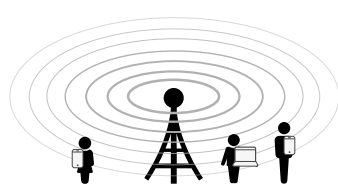
Wider radio channels and carrier aggregation

5G NR supports significantly wider radio channels than LTE. Carrier aggregation also allows multiple frequency blocks to be combined. However, the data rates actually achievable depend on factors including frequency, signal quality, network load, and the end device. For enterprises, what matters most is therefore stable performance under real-world conditions.

Massive MIMO and Beamforming

Multiple Input Multiple Output (MIMO) enables multiple antenna elements to transmit and receive in parallel. Beamforming directs radio signals more precisely toward individual end devices. This enables more efficient use of radio resources and can improve both capacity and connection quality.

Previous standards

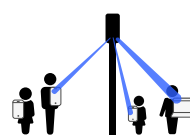


Side view

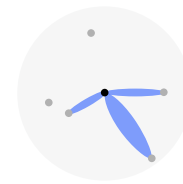


Top view

5G



Side view



Top view

Figure 1:
Signal coverage of former standards and 5G

Flexible 5G NR air interface

5G NR can adapt radio transmission more flexibly to different requirements. Different subcarrier spacings and shorter transmission intervals contribute, among other things, to lower latency. For time-critical applications, however, the air interface alone is not what matters. The entire end-to-end path must be considered, from the end device through the radio access and core network to the application.

► **Technology deep dive:** For more background information on 5G and how it works, visit the [“What is 5G?” technology page](#).

Frequency matters

The frequency spectrum used is a key factor in determining the coverage and capacity of a 5G network. As a general rule, lower frequencies typically provide greater range and better building penetration. Higher frequencies and greater available channel bandwidths, on the other hand, enable higher capacities, but over shorter distances. 5G therefore combines different frequency ranges.

Low frequencies



High frequencies

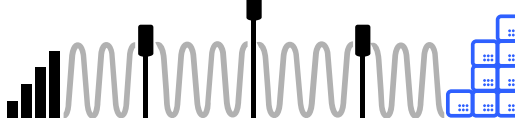


Figure 2:
Comparison of range and the data throughput for low and high frequencies

- ▶ **Low band** is particularly suitable for wide-area coverage.
- ▶ **Mid band** offers a good balance between coverage and capacity and also plays an important role in private campus networks.
- ▶ **High band/millimeter wave** enables very high capacities over smaller areas but requires correspondingly denser radio network planning.

For enterprises, this leads to an important conclusion: **Simply saying that “5G is available” reveals little about the performance that can actually be achieved.** What matters is which frequency spectrum is used at the specific location, how much bandwidth is available, and what level of radio quality can actually be achieved.

Architecture matters

From 5G NSA to 5G Standalone

The underlying network architecture also influences what 5G can actually deliver. With 5G Non-Standalone (NSA), 5G NR is combined with existing LTE infrastructure. This approach enabled the rapid rollout of 5G. Technologies such as Dynamic Spectrum Sharing (DSS) also allow frequency spectrum to be dynamically shared between LTE and 5G.



Figure 3:
Example of bandwidth allocation with Dynamic Spectrum Sharing (DSS)

5G Standalone (SA), by contrast, operates with a dedicated 5G Core. This enables additional capabilities such as advanced quality-of-service mechanisms, network slicing, and optimized communication paths. For enterprises, the relevant question is therefore not only whether 5G is available, but also **which architecture and capabilities the respective network supports.**

Network slicing and Quality of Service

Not every application has the same network requirements. A video system requires high bandwidth, a sensor transmits only small amounts of data, and an industrial control application may have particularly demanding reliability and latency requirements. 5G addresses these different communication profiles through three fundamental service categories, among other mechanisms:

1. eMBB – Enhanced Mobile Broadband

High data rates for broadband applications, such as video streaming, augmented reality, and virtual reality.

2. mMTC – Massive Machine Type Communications

Communication for large numbers of connected devices, for example in IoT, logistics, and industrial applications.

3. URLLC – Ultra-Reliable and Low-Latency Communications

Highly reliable, low-latency communication, for example for industrial control systems and other time-critical applications.

Where supported by the respective 5G infrastructure, network slicing enables logically separated network segments with different characteristics to be provided on a shared physical infrastructure. This allows communication resources to be aligned more closely with the respective requirements.

5G use cases

The technical characteristics of 5G enable a wide range of use cases. For enterprises, it is particularly important to distinguish between the use of public mobile networks and private 5G networks.

Public 5G: Flexible and resilient site connectivity

Public 5G networks can complement wired WAN connections or replace them in suitable scenarios. Typical use cases include:

- ▶ **Backup:** 5G provides an independent access path if the fixed-line connection fails.
- ▶ **Active/Active:** Fixed-line and 5G connections can be used in parallel, with traffic intelligently distributed between them.
- ▶ **Primary access:** Where a suitable fixed-line connection is unavailable or not economically viable, 5G can serve as the primary access technology.
- ▶ **Day-1 Connectivity:** New or temporary sites such as branches, construction sites, or pop-up stores can be connected at short notice.

With [Secure SD-WAN](#), different internet connections can be integrated into a common WAN architecture and centrally utilized based on availability, connection quality, and application requirements.

Private 5G: Connectivity for campus and industrial environments

Where enterprises need greater control over radio coverage, connected devices, capacity, and network quality, a private 5G network can be a suitable option. In Germany, local frequencies in the 3.7 to 3.8 GHz range are available for this purpose, among others.

Typical use cases include AGVs (Automated Guided Vehicles) and AMRs (Autonomous Mobile Robots), machinery and production systems, video and image analysis, as well as sensors and IoT. Particularly for mobile devices and flexible production environments, private 5G can complement wired communications and Wi-Fi in a targeted manner.

For time-critical applications, the location of data processing also plays an important role. [Secure Edge Computing](#) enables data to be processed directly on the campus. This can shorten transmission paths, reduce the load on central networks, and keep sensitive data local.

Private 5G should therefore not be viewed in isolation: the radio network, core, edge infrastructure, and application together form the end-to-end architecture.

Integrating 5G securely

5G expands connectivity options – and, with them, the network architecture that needs to be secured. The security mechanisms of the mobile network must therefore be embedded in the enterprise's overarching security architecture. A holistic architecture should take into account authentication, segmentation, VPN and encryption, firewalling, and monitoring. Office, production, IoT, and guest networks should be logically separated, communication relationships controlled, and relevant network and security events made centrally visible.

The key is not to add security as an afterthought, but to design it as an integral part of the 5G and connectivity architecture from the outset.

Five questions to ask before deploying 5G

For enterprises, theoretical maximum speeds are less important than the specific value 5G can provide within their own connectivity strategy. These five questions can help guide the decision:

- 1. Which use case needs to be addressed?**
WAN backup, Day-1 Connectivity, and industrial applications have different requirements.
- 2. What level of performance and availability is required?**
Bandwidth, latency, and resilience should be derived from the specific use case.
- 3. Public or private 5G?**
Public 5G is often suitable for site connectivity, while campus and industrial applications may require a private 5G network.
- 4. How does 5G fit into the existing infrastructure?**
5G should be considered in conjunction with fixed-line connectivity, Wi-Fi, SD-WAN, and, where applicable, edge computing.
- 5. How will security and operations be implemented?**
Segmentation, [VPN](#), [network encryption](#), [firewalling](#), [monitoring, and centralized management](#) should be part of the architecture from the outset.

Outlook: 5G continues to evolve

5G is not a static mobile communications standard. **5G-Advanced** continues to enhance areas including efficiency, network coverage, and support for different device classes. Technologies such as **Reduced Capability (RedCap)** expand the range of potential applications, for example by enabling simpler and more energy-efficient 5G devices for IoT and industrial use cases. As a result, the scope of 5G continues to grow beyond traditional mobile broadband access.

Conclusion

5G opens up new opportunities for enterprises to connect sites more resiliently, provide connectivity flexibly, and integrate mobile and industrial applications. Its potential use cases range from an additional WAN access path over a public mobile network to private 5G networks for campus and industrial environments.

What matters, however, is not 5G alone, but its integration into the existing network and security architecture. Combined with fixed-line connectivity, Wi-Fi, SD-WAN, security, and centralized management, 5G becomes part of a holistic connectivity strategy.

Where can 5G deliver the greatest value within your network architecture?

Our experts can help you identify suitable use cases and securely integrate 5G into your network architecture. Talk to us about your requirements and potential solutions. Feel free to use our [contact form](#) to ensure that your inquiry reaches the right experts directly.

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