5G Advanced: commercialisation will depend on mapping performance improvements to key use cases

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In partnership with 3GPP, vendors and operators are beginning to define standards and conduct research for the next evolution of cellular networks: 5G Advanced. 5G Advanced promises to improve the coverage, capacity, capabilities and intelligence of mobile networks, while laying the foundation for 6G. However, as operators have struggled to monetise 5G performance improvements so far, it is imperative that stakeholders ensure new 5G Advanced capabilities are clearly mapped to emerging use cases that can enable new revenue streams.

5G Advanced will improve network performance and provide enhanced support for emerging use cases

5G Advanced is the label applied to the next three releases of 3GPP standards, Releases 18–20. These will introduce specifications for new technologies that will improve network performance and support emerging use cases. Release 18 (Rel-18) is expected to be finalised in 2024 and the first commercial launch of 5G Advanced networks is expected in 2025.

5G Advanced will build on 5G standalone (SA) and lay the foundation for 6G by:

- improving network **coverage, capacity, latency and intelligence** to ensure the 5G network delivers optimal performance, while also being sustainable
- supporting **emerging use cases** through new and improved **network capabilities** and improvements in general network performance.

Stakeholders must consider both of these factors if they are to maximise cost savings, performance gains and new monetisation opportunities on the path to 6G.

5G Advanced will enable a wide range of RAN performance enhancements including embedded AI

The improvements to network performance that 5G Advanced promises will be driven by enhancements in existing technologies, as well as by the deeper integration of artificial intelligence and machine learning (AI/ML) throughout 5G networks.

Key performance-related improvements that are expected in 5G Advanced include the following.

- **AI/ML**. As well as reducing cost and energy consumption, vendors claim that AI could be used at every layer of the network to optimise and improve performance. 5G Advanced will probably signify the beginning of AI/ML integration as standard, which will enable it to be increasingly embedded in 5G networks.

- **Improved massive MIMO.** Rel-18 and 5G Advanced will focus on massive MIMO improvements, particularly relating to uplink. Enhancements will also support wider coverage, improved power efficiency and an increased number of antennas per MIMO array. The MIMO beamforming framework will also be improved in Rel-18 to facilitate switching between different beamforming techniques depending on a device's requirements.

- **Enhanced signalling.** Improvements to network signalling are expected to be important in 5G Advanced standards, potentially allowing for improved traffic management and support for enhanced low-latency capabilities.

- **Improved mobility.** 5G Advanced will bring a new layer 1/layer 2 triggered mobility (LTM) handover procedure, which will aim to shorten handover interruption time and enable greater mobility and service continuity for devices.

Although these standardised improvements are expected to improve performance and reduce costs, operators and vendors need to consider which emerging use cases will be central to their new revenue opportunities over the coming years. Network-wide performance gains will address emerging use cases from a bandwidth, latency and reliability perspective, but it is vital that operators and vendors also consider 5G Advanced capabilities that further support use cases or address new customers.

Operators and vendors should pursue 5G Advanced capabilities that directly support use cases and generate revenue

5G Advanced also aims to standardise or improve a range of new technologies that will directly support new use cases. Although these capabilities currently have a niche commercial impact, they will be vital in driving new revenue streams for operators and supporting new monetisation opportunities on the path to 6G.

It is important that stakeholders consider these unique capabilities and how they map to new use cases that can support new services and revenue. Some examples include the following.

- **Reduced Capability (RedCap).** First standardised in Rel-17, RedCap enables low-functioning IoT devices with reduced capabilities to connect to 5G without unnecessarily overloading the network. In 5G Advanced, RedCap devices can feature enhanced-sleep modes, low-power modes, on-chip power amplifiers and scaled-down bandwidth. RedCap devices will support emerging **industrial use cases** by providing low-cost solutions for process monitoring and asset tracking. Additional use cases include **smart grids** and IoT devices such as **smart watches, AR/VR glasses** and **medical devices**.

- **Enhanced sidelink**. First standardised in Rel-16, sidelink enables communication from one user device to another, even without cellular network coverage. 5G Advanced will enable sidelink to operate in new frequencies, and new relay technology will extend coverage and support new use cases. These include **self-driving cars,** with sidelink potentially enabling constant communication from vehicle-to-vehicle and vehicle-to-everything (V2X). New sidelink relay technology could also support applications for emergency services, which require coverage in all locations.

- **Positioning enhancements.** Positioning was first standardised in Rel-15. In 5G Advanced, improved bandwidth aggregation, carrier phase measurement and non-line-of-sight paths is expected to offer enhanced positioning with centimetre-level accuracy in both indoor and outdoor locations. Enhanced positioning will support **industrial use cases** including asset tracking and sensing capabilities, as well as **VR, XR** and **AR**.

- **Non-terrestrial networks (NTNs).** NTN integration was first standardised in Rel-17. NTNs use aerial technologies, such as satellites and high-altitude platform stations (HAPS), to provide improved coverage, mobility and service continuity. 5G Advanced is expected to offer full integration for NTNs, enabling support for direct-to-device connectivity for smartphones and roaming devices. This could allow operators to serve new customers, improve network resilience and support new IoT use cases in **transport, agriculture, public services** and **logistics**.

- **Resilient timing.** 5G Advanced is expected to provide more resilient timing capabilities, allowing 5G networks to time-stamp network events accurately. Vendors claim this could become an alternative to global navigation satellite systems (GNSSs) and the Global Positioning System (GPS), and support a range of applications, including **industrial automation**, **energy grids, network synchronisation** and **regulatory compliance** in the **financial sector.**

Emerging use cases will be a key source of network monetisation on the path to 6G in addition to network-wide performance gains and cost savings. Vendors and operators should view these use cases, and the capabilities that support them, as vital areas of network innovation in 5G Advanced.