T-Mobile and Nokia reach new heights with 5G 5CC and 6CC Carrier Aggregation

- Outstanding 5G performance by maximizing the use of spectrum assets
- Cementing the lead as Best Mobile Network in the US (1H/2025)
- More capacity for high-priority network slices, enabling enhanced 5G monetization

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"T-Mobile is leading the industry in pushing the boundaries of 5G.

Our close collaboration with Nokia reflects our drive to keep delivering the very best that the industry has to offer to our customers.

Nokia's 5CC and 6CC Carrier Aggregation solutions enable us to reach unparalleled 5G performance, accelerating the evolution to Advanced 5G and beyond.

They also help us enhance network monetization with 5G slicing."

John Saw

Executive Vice President and
Chief Technology Officer
T-Mobile

T-Mobile runs the best-performing 5G network in the United States and is the only operator with blanket nationwide 5G Standalone coverage.

Nokia is a key partner for T-Mobile's 5G Radio Access Network (RAN) through our comprehensive AirScale base station portfolio. We collaborate on many initiatives, including AI-RAN and 6G.

Q2/2025 marks 19 consecutive quarters that T-Mobile has been recognized by Ookla as the Fastest Mobile Network in the United States. In the most recent assessment, it also won the new category, Best Mobile Network.*

5G Carrier Aggregation (CA) is a key area that reflects our partnership to further T-Mobile's lead in 5G.

In this case study, we show how 5CC and 6CC CA helped T-Mobile elevate 5G performance and enhance network slicing to power 5G monetization.

Enhancing network performance, 5G monetization and user experience

Enhanced network efficiency and performance

Working with Nokia to push the boundaries of Carrier Aggregation, T-Mobile enhances network efficiency and performance by maximizing the use of its 5G spectrum layer cake.

On the next page, we illustrate field measurements from the commercial 5G Standalone network with 4CC, 5CC and 6CC CA.

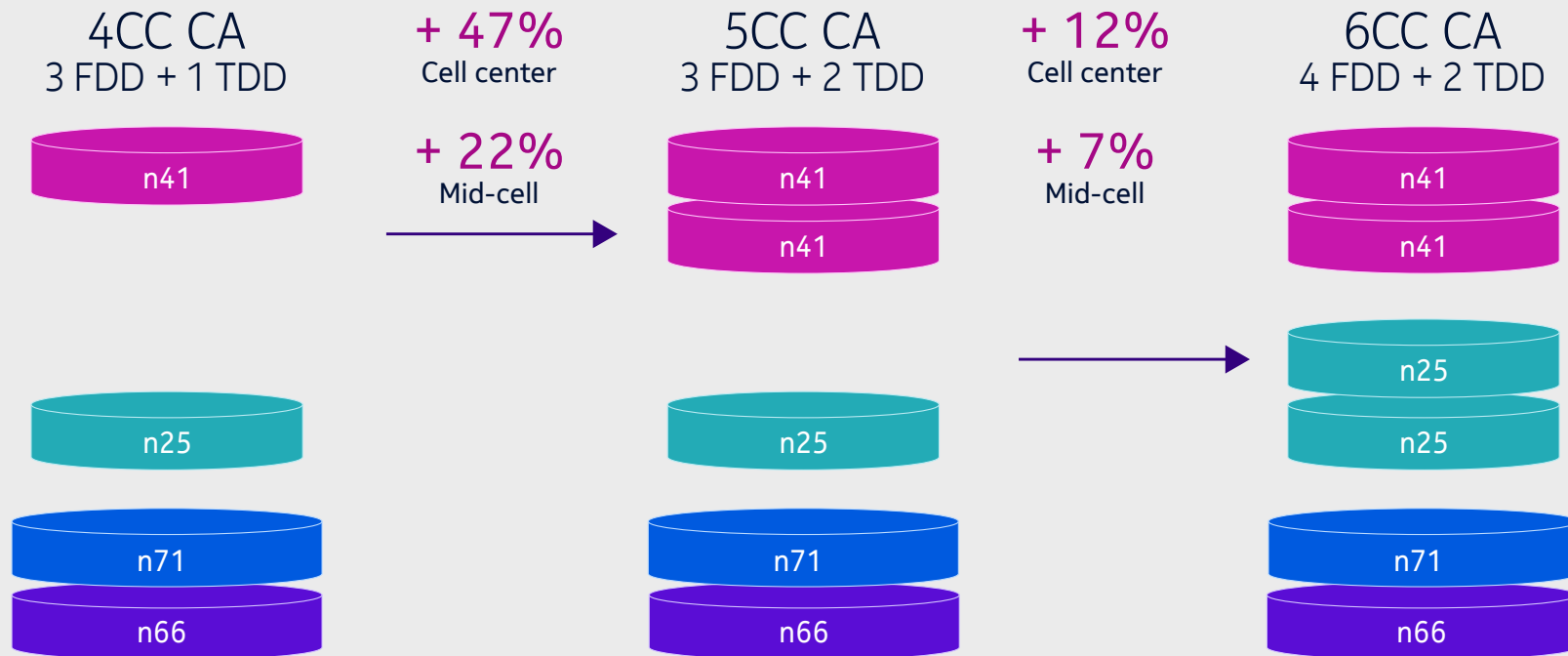## More capacity for network slices

By aggregating multiple carriers, the total spectrum available in the scheduling pool increases, enabling dynamic and efficient resource allocation. This allows T-Mobile to support a higher number of users accessing dedicated slices for high-priority services, unlocking more opportunities for 5G monetization.

Exceptional 5G user experience

Consistently high performance and network availability are the foundation of an exceptional 5G user experience. High-order Carrier Aggregation and intelligently designed network slices enable T-Mobile to ensure that users get the expected bandwidth for their applications and services, even during peak demand.

Field performance measured in a commercial 5G Standalone network

4CC CA 3 FDD + 1 TDD	+ 47% Cell center	5CC CA 3 FDD + 2 TDD	+ 12% Cell center	6CC CA 4 FDD + 2 TDD
n41	+ 22% Mid-cell	n41 n41	+ 7% Mid-cell	n41 n41
n25		n25		n25 n25
n71		n71		n71
n66		n66		n66

Performance enhancements in the cell center and mid-cell when comparing 4CC CA, 5CC CA and 6CC CA in T-Mobile's commercial production network. On the next page, we describe the 6CC CA field tests in more detail.

Paving the path to Advanced 5G with 6CC Carrier Aggregation

T-Mobile and Nokia collaborated to validate the potential of 6CC Carrier Aggregation to create the foundation for premium Advanced 5G performance.

We aggregated the bandwidth of six low-band and mid-band spectrum carriers in T-Mobile's commercial 5G network, showcasing the power of 6CC CA in real-world conditions.

No degradation was observed during the 6CC CA field test in other key KPIs measuring network availability, performance and quality.

This field test confirmed that our 6CC CA solution is ready to support Advanced 5G deployments and user devices as soon as they hit the market.

The results were outstanding:

- Peak downlink speeds of 4.3 Gbps using a commercial smartphone
- Peak downlink speeds of 6.3 Gbps using an Advanced 5G capable mobile test device

Read the related press release

4.3 Gbps
Peak DL speeds with a commercial 5G smartphone

6.3 Gbps
Peak DL speeds with an Advanced 5G test device

Carrier Aggregation powering 5G slicing and monetization

Carrier Aggregation is a key building block for making more resources available for scheduling, which enables dynamic slicing. This, in turn, unlocks new network levers and related monetization opportunities. Below are examples of how T-Mobile leverages slicing.

Premium connectivity services

Aggregating multiple carriers expands the resource pool for Physical Resource Blocks (PRB) and Transmission Time Intervals (TTI). This allows greater flexibility to schedule resources for premium slices that T-Mobile offers, such as 5G Fixed Wireless Access (FWA) and cloud gaming.
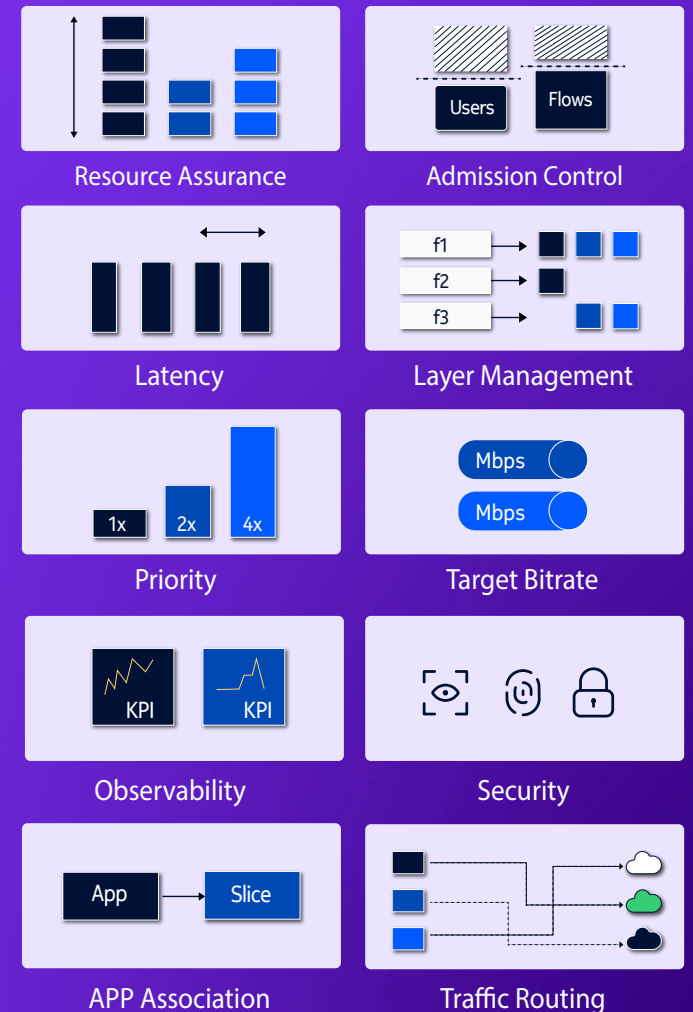
Mission-critical services

When more Scheduling Request (SR) resources are available per user, resource contention is minimized. This is particularly important for T-Mobile's low-latency services, such as mission-critical communications and other high-priority applications.

Payment and streaming services

With more resources available for scheduling, the network is more likely to meet the nominal bit rate requirements defined for each slice. This enables T-Mobile to support services such as point-of-sale transactions and live video streaming, which rely on consistently high throughput.

Network levers unlocked with 5G slicing

Resource Assurance

Admission Control
Users
Flows

Latency

Layer Management
f1
f2
f3

Priority
1x 2x 4x

Target Bitrate
Mbps
Mbps

Observability
KPI   KPI

Security

APP Association
App → Slice

Traffic Routing

Continuously pushing the boundaries of what is possible with 5G Carrier Aggregation

T-Mobile and Nokia have a close, long-standing partnership. Over recent years, we have explored the potential of 5G Carrier Aggregation and collaborated on several achievements:

- In 2021, T-Mobile was able to extend 5G mid-band coverage by 30% with Nokia's 2CC Carrier Aggregation solution. At that time, the global smartphone ecosystem was not yet supporting more than two aggregated component carriers.

- In June 2022, we collaborated on the world's first implementation of 3CC CA in a live production network.

- In February 2023, we were the first in the industry to successfully demonstrate 5CC CA with commercial Nokia AirScale base stations and a mobile test device.

- In March 2023, we achieved the world's first 4CC CA data call on a commercial device, and later that year, T-Mobile rolled out 4CC CA to its customers.

- In May 2023, we reached over 200 Mbps uplink speeds in a 5G data call using uplink Carrier Aggregation in T-Mobile's commercial network.

- In March 2025, we set record-breaking 5G downlink speeds with 6CC CA.

CONCLUSION

High-order Carrier Aggregation has the potential to redefine Advanced 5G experience

Carrier Aggregation is the foundation for today's 5G Standalone experience and one of the key technology building blocks for delivering Advanced 5G performance.

The ability to aggregate multiple carriers within or across the available spectrum bands significantly boosts network capacity and spectral efficiency. It enables faster data transfers and extends the coverage area of higher data rates, which translates into an outstanding experience for 5G users.

This case study is an example of how Nokia's high-order Carrier Aggregation solutions helped T-Mobile achieve impressive downlink speeds that can truly differentiate its 5G customer experience from the competition. It also highlighted the role of Carrier Aggregation in enabling enhanced 5G slicing and monetization.

Leveraging advanced software capabilities, such as Carrier Aggregation, helps operators prepare for and capture the opportunities with Advanced 5G and later 6G.

Read more about 5G Carrier Aggregation

Read more about Advanced 5G

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs, which is celebrating 100 years of innovation.

With truly open architectures that seamlessly integrate into any ecosystem, our high-performance networks create new opportunities for monetization and scale. Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.