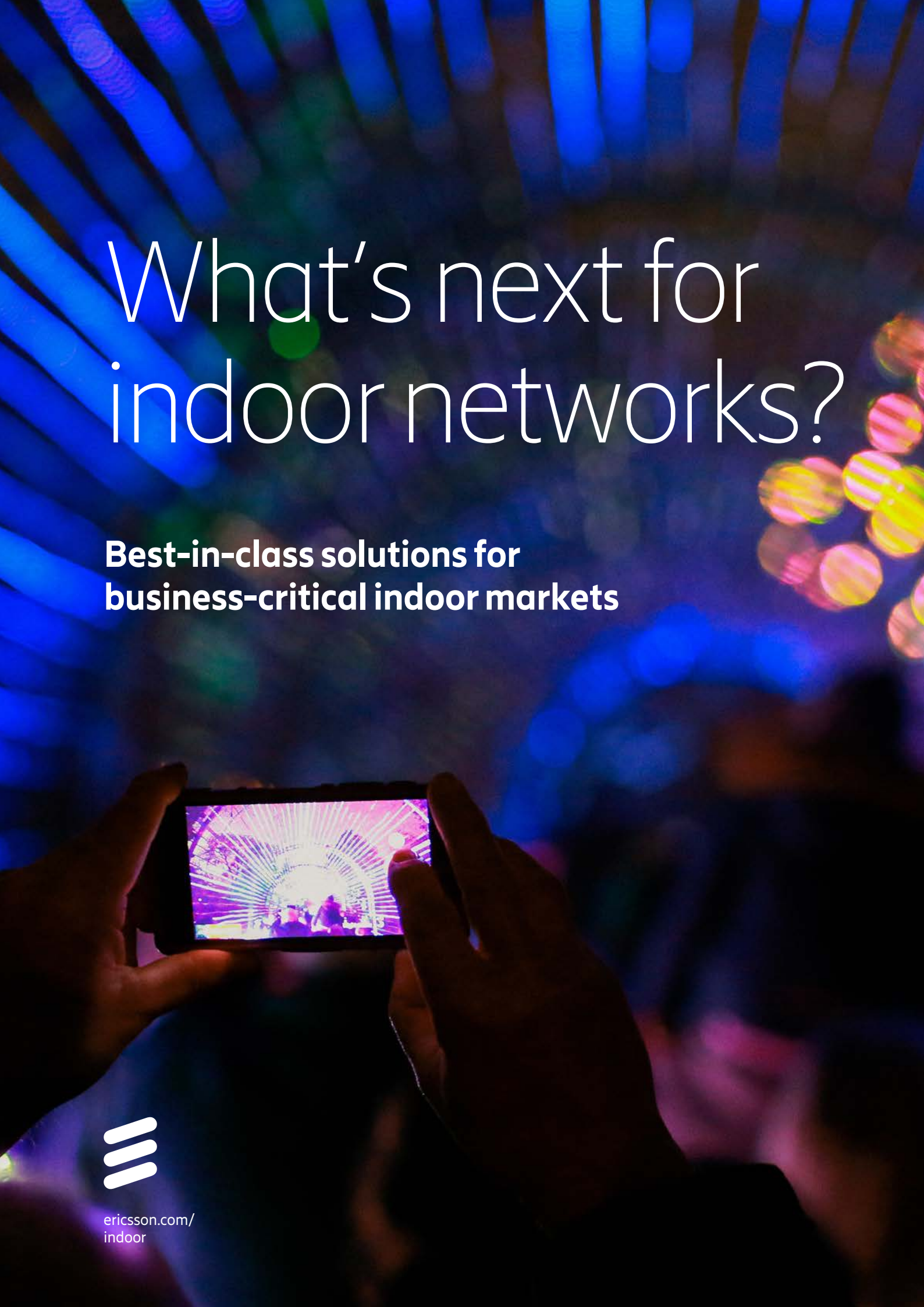
What's next for indoor networks?

Best-in-class solutions for business-critical indoor markets



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indoor

Step inside a market of possibilities

5G mobile technologies are radically transforming the value of indoor connectivity, creating a data deluge that is reshaping indoor revenue opportunities. The only way to truly serve tomorrow's indoor mobile use cases is with agile, scalable, sustainable, resilient, and innovation-centric indoor networks.

This paper aims to guide communication service providers (CSPs) interested in evolving indoor network capabilities to address emerging and expected revenue possibilities within consumer and enterprise markets.

Today, 5G rollouts are well underway and, according to Ericsson Mobility Report forecasts, are expected to cover ~75 percent of the world's population by 2027. In the same year, average mobile data traffic per smartphone is expected to reach as much as 52 GB per month.

While macro networks will provide the mainstay of urban and suburban outdoor coverage, as with earlier mobile generations carried on lower radio frequencies, the ascent into mid- and high-band 5G radio frequencies and the subsequent increased instances of signal path loss has led to greater coverage and capacity gaps – in high-rise buildings, shopping malls, transport hubs and many other indoor spaces.

In earlier generations, cellular indoor connectivity – which accounts for an estimated 80 percent of all mobile data traffic worldwide – has been supplemented through additional dedicated coverage and capacity layers to ensure a guaranteed level of service. Traditionally this has been delivered through two primary incumbent technologies: passive distributed antenna systems (DAS) – optimal as a cost-efficient coverage-oriented layer; and distributed radio systems (DRS) – optimal as a high-performance capacity-oriented layer in high-value zones.

The value offered by passive DAS is today becoming limited with the introduction of 5G mid-band and high-band. While active DAS – which does offer 5G mid-band and high-band support – faces other deployment challenges such as higher capital expenditure (CAPEX), operating expenditure (OPEX), energy consumption, footprint, and latency compared to small cell market alternatives such as the DRS.

Today, CSPs must take a new approach to designing, deploying and managing indoor networks, not only to address more complex indoor coverage and capacity requirements, but also to ensure network-wide activation of future cognitive network intelligence and cloud strategies.

The cloudification of networks through Cloud RAN will open new pathways for CSPs to accelerate service creation across revenue streams, as well as enable, monetize and manage new connectivity services such as dynamic network slicing.

In a world where increasingly diverse and stringent demands will be placed on indoor networks, Ericsson's small cell Radio Dot System remains the only future-proof solution on the market today that can deliver the performance, scale, sustainability, and innovative services demanded by tomorrow's consumers and enterprises.

However, indoor environments will continue to be served by a mesh of solutions depending on the performance and service requirements of each scenario. Navigating the different alternatives and deciding which technology is fit for purpose is a balancing act. This paper will serve as a guide to find the right balance in those deployments.

Across all indoor scenarios, the race to capture the 5G market is happening now, and early-mover advantage will likely be decisive in ensuring a competitive offering in these business-critical markets for years to come.

Perceived 5G availability has a stronger impact on consumer satisfaction than 5G population coverage, with an increase in 5G network availability projected to lead to 4x the level of customer satisfaction.

Ericsson ConsumerLab 2022

Raising the roof on indoor revenue streams

The increasing market saturation of 5G devices and applications will raise the data stakes on indoor in coming years. Innovative service models such as dynamic network slicing will be integral to serving and monetizing the full value of new consumer, enterprise and public-safety markets over the long term.

5G-powered technologies and features form the focal point of emerging disruptive consumer and enterprise use cases and connectivity models, and will be key to leveraging the full value potential of indoor market segments in coming years. This includes use cases such as:

- enhanced mobile broadband (eMBB)
- massive machine type communication (mMTC)
- ultra-reliable ultra-low-latency communication (URLLC)

This is in addition to features such as cellular-enabled 5G positioning technologies (replacing traditional GPS, Bluetooth, and Wi-Fi positioning technologies), intelligent automation and dynamic network slice selection.

New indoor technology use cases

Across industries, the introduction of 5G-enabled technologies will have a transformative effect on productivity and growth, realized through technologies such as:

- AI
- video recognition and analytics
- remote control of machinery
- automated guided vehicles and autonomous mobile robots
- extended reality
- digital twins

According to Ericsson IndustryLab, all of these technologies are expected to be deployed across at least two-thirds of production facilities worldwide by 2027.

In consumer markets, advances within XR and mobile cloud gaming segments will propel new demands on indoor network services, with low latency, speed and high uplink becoming key network differentiators. Already by 2025, 5G users say they expect to increase media consumption through mixed-reality glasses by as much as 1.5 hours a week, according to Ericsson Consumer Lab.

Dynamic network slicing for outdoor/indoor

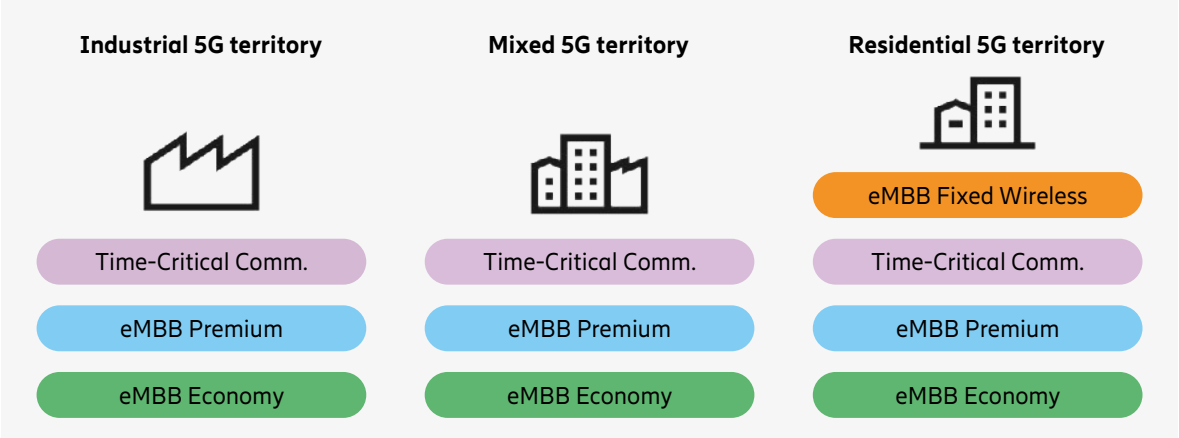
The takeoff of new technologies will also raise consumer demands for more differentiated connectivity service models.

Dynamic network slicing introduces a deterministic-based virtual connectivity model that enables CSPs to slice and serve connectivity in a way that is more flexible, can be managed more intelligently at scale, and can offer dynamic quality of service support for a wider mix of heterogeneous services, including higher resilience, lower latency, extreme performance and more.

For CSPs, this will lead into possibilities to realize multiple-sided business models, delivering increased value through flexible pricing models and driving top-line growth by connecting new consumer and enterprise segments across public, private and hybrid network deployments. According to Ericsson Consumer Lab, as many as 6 in 10 consumers already say they want more tailored network performance and experiential offerings.

The revenue possibilities generated by such models will be significant. According to research by Ericsson and Arthur D. Little, network slicing-enabled revenues are expected to reach around USD 200 billion by 2030 – with healthcare, manufacturing, retail, broadcasting and media consumption, and stadium use cases offering the most value add. For example, in a stadium setting network performance could be sliced and differentiated for fans, VIPs, broadcasters, and public safety personnel – all receiving the right quality of service from the same network as and when they need it.

For CSPs, a scenario-based deployment strategy – based on the demands and characteristics of each use case – will be key to network differentiation and business success in the long term.



Dynamic network slicing will be crucial in monetizing new indoor revenue streams.


Information

Remaining agile indoors

The evolution of 5G is changing the roadmap for indoor deployments. Emerging use cases place a range of different performance demands on the network. And with the technology landscape evolving fast, remaining agile will be key to capturing future indoor possibilities. From public, private and hybrid network deployments, to a new range of spectral possibilities – how you choose to build your deployment strategy will define market impact in the upcoming 5G era.

Public networks

Provide wide area service and traditionally offer the same levels of performance and security to all subscribers, however dynamic network slicing and edge computing are introducing new levels of service differentiation.

Private networks

Dedicated network infrastructures can be deployed in one or more specific locations, delivering higher security, reliability and targeted performance capabilities to an exclusive device ecosystem.

Hybrid networks

Hybrid deployments enable seamless interoperability of private network device ecosystems also across broader public network deployments, leveraging the strengths of both deployment models.

CSP-operated networks

CSP deployments on single- or multi-vendor RAN networks. RAN network sharing models on independent frequency bands, known as multi-operator radio access networks (MORAN), will gain traction in coming years, delivering clear CAPEX and OPEX benefits.

Enterprise-operated networks

Dedicated private network deployments operated by enterprises, industries and public agencies across one or many locations worldwide.

Neutral host

Neutral host models enabling multiple CSPs to gain faster access to high-traffic indoor markets will be vital to scaling indoor 5G deployments, as well as delivering energy-, cost- and aesthetical benefits through the deployment of shared infrastructure.

Purpose-built RAN

Powers the vast majority of today's RAN deployments, comprising tightly integrated deployment of radio, baseband hardware and software that are optimized for performance, energy efficiency and size.

Cloud RAN

Separates RAN baseband software and hardware meaning RAN software can run on any capable commercial hardware – on-site, in a CSP-owned data center, or even on a hyperscale public cloud.

5G mid band (1-2.6GHz FDD, 2.3-7GHz TDD)

Mid bands are ideal for massive MIMO deployments, and can help to extend 5G coverage beyond urban and suburban to rural communities.

5G high band (mmWave)

5G millimeter wave deployments are suited for targeted high-capacity areas and services, and can also use massive MIMO to expand capacity and extend coverage.

3G, 4G and 5G low band (sub-1Ghz FDD)

Low-band frequency division duplex radio frequencies offer good propagation properties that provide good macro nationwide coverage and indoor penetration.

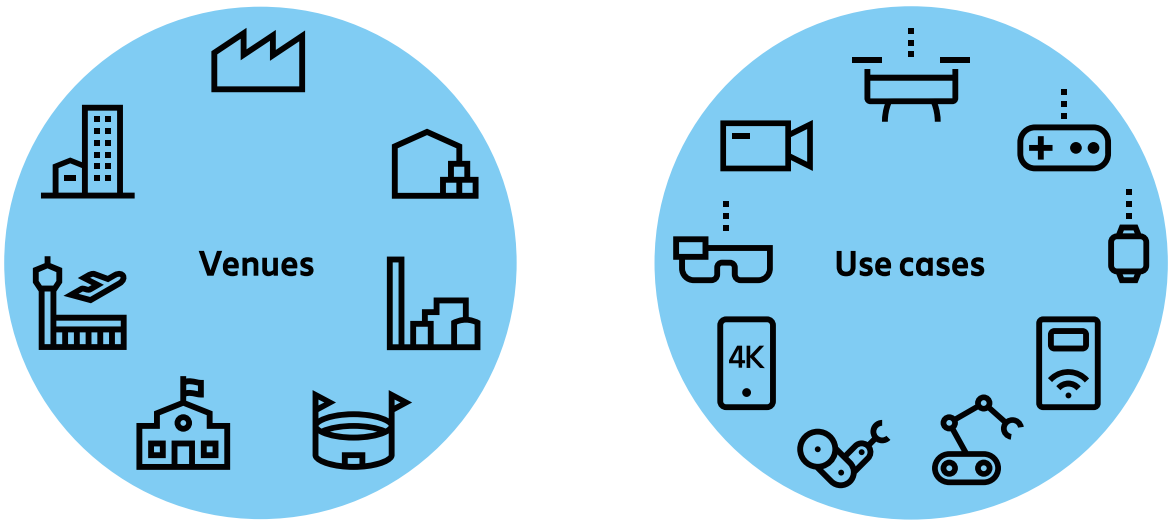
Unlicensed spectrum

The primary frequency channels for Wi-Fi deployments – easy to deploy and maintain, however without the same level of resilience, security, privacy and performance as cellular 5G operating in licensed spectrum.

Citizen broadband radio service (CBRS)

Affordable and agile spectrum that simplifies the process of installation and deployment – however shared access via a tiered spectrum access system can lead to interference.

Indoor coverage and capacity demands



High-performance solutions will be key to going the distance indoors

To build an indoor network that meets the demands of tomorrow's consumers and enterprises, CSPs must look beyond fundamental coverage and capacity differentiators and towards evolution friendliness, investment return and value-added network enrichment services.

Small cells, big impact

Agile and flexible deployment models will be key to gaining an early competitive edge across indoor connectivity markets, ensuring capacity and coverage needs are both addressed and monetized in the near term. However, long-term market leadership in the indoor space will require a strong commitment to continuous network innovation, as well as a strategy that promotes resilient, open, sustainable, intelligent and minimally disruptive network deployments.

Ericsson's small cell Radio Dot System is the leading market choice to deliver on both near-term and long-term objectives, ensuring flexible and scalable support for the future evolution of spectral assets, cloud architectures, features such as distributed MIMO, and virtualized network services such as dynamic network slicing. With plug-and-play functionality, the Radio Dot System offers IT-like deployment with single CAT6 cables. Through extended fiber reach up to 10km, service providers can benefit from the flexibility to serve a broader range of indoor venues with a low equipment footprint.

		Ericsson Radio Dot System	Outside-In	Passive DAS	Active DAS	Uncoordi-nated Small Cells	Wi-Fi
Use scenarios	Public network, single operator	🟢	🟠	🟡	🟡	🟡	🟠
	Public network, multi operator	🟢	🟠	🟢	🟢	🔴	🟠
	Private network, enterprise	🟡	🟡	🟠	🟠	🟢	🟢
Network architecture	Purpose-built RAN	🟢	🟢	🟢	🟢	🟠	🟠
	Cloud RAN	🟡	🟡	🟠	🟠	🔴	🟠
Performance	Frequency, Sub-1GHz	🟠	🟢	🟢	🟠	🔴	🔴
	Frequency, 1-3GH	🟢	🟠	🟢	🟡	🟢	🟢
	Frequency, 3-7GHz	🟢	🔴	🔴	🟡	🟢	🟠
	Frequency, 24-39GHz	🟠	🔴	🔴	🔴	🟢	🔴
	2x2 MIMO	🟢	🟢	🟢	🟢	🟢	🟢
	4x4 MIMO	🟢	🟠	🔴	🟡	🟡	🟢
	100MHz TDD BW + FDD full band	🟢	🟠	🟡	🟡	🟡	🔴
	200MHz TDD BW	🟢	🔴	🟠	🟡	🟠	🟢
	400MHz TDD BW	🟡	🔴	🔴	🟠	🔴	🟢
	RAN feature richness	🟢	🟢	🟡	🟡	🟠	🔴
	Outdoor-indoor mobility and coordination	🟢	🟢	🟡	🟡	🟠	🔴
Sustainability	Power consumption	🟢	🟠	🟠	🟠	🟢	🟢
	Aesthetical footprint	🟢	🟢	🟠	🟠	🟢	🟠
Serviceability	Plug and play	🟠	🔴	🔴	🔴	🟢	🟢
	OAM	🟢	🟢	🟢	🟢	🔴	🔴
	Automation	🟢	🟢	🟢	🟢	🟠	🟠
Total cost of ownership	CAPEX	🟡	🟡	🟢	🟡	🟡	🟢
	OPEX	🟢	🟡	🟠	🟠	🟢	🟢
Recommended deployment scenarios*		Medium to extra-large venues with use cases that require superior outdoor-in mobility, performance, and quality of service.	Very small to small venues with use cases requiring high speed and best-effort traffic (Wi-Fi 6).	Medium to large venues with basic performance requirements (e.g. MBB, voice, SMS).	Medium to large venues with basic performance requirements (e.g. MBB, voice, SMS).	Small venues with basic performance requirements (e.g. MBB, voice, SMS).	Very small to small venues with use cases requiring high speed and best-effort traffic (Wi-Fi 6).

🟢 Key feature 🟡 Moderate support 🟠 Limited support 🔴 No support

* Very small venues can include small retail stores and residential (single house).
Small venues can include retail, small offices, and restaurants.
Medium venues can include schools, larger retail stores, hospitals, hotels, apartment complexes, and convention centers.
Large venues can include stadiums, campuses, airports, malls, high rises, hotels, hospitals, and transport hubs.
Extra-large venues can include airports, large manufacturing plants and warehouses, and government deployments.