# Regional Connect

Issue 8 | Fall/Winter 2023

**Featured articles**

Mobile quality of experience: Network readiness for new services

Expanding the 5G device ecosystem: Ericsson's New Radio (NR) Reduced Capability (RedCap) solution

Ericsson Mobility Report: Meeting evolving network requirements

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# Table of contents



**Do you have a success story you'd like to share? Has your enterprise had an impact in your community?**

Contact your Ericsson account representative to be featured in the next issue of "Regional Connect Magazine."

Customers and partners,

## Welcome to the Fall/Winter 2023 issue of "Regional Connect Magazine."

It was wonderful to see so many of you at the Ericsson Regional Connect Summit and then at CCA this fall. As we enter the holiday season, I'd like to take the opportunity to thank you for your partnership. I look forward to a strong 2024, as we build on our momentum to reach many milestones relating to 5G and beyond!

I hope you enjoy this issue of the magazine, which includes the following highlights and more.

**Connect**

If you weren't able to join us at this year's Regional Connect Summit, see what you missed in our event recap. The event featured 17 sessions covering industry and government updates, innovations in technology and insights from regional carriers, plus networking and socializing. And in this issue's customer spotlight, we learn how Cellular One connects and empowers the tribal and rural communities of the Four Corners region.

**Share**

As the industry prepares for the next wave of 5G applications, learn how to apply new models for rating mobile quality of experience to design networks that support future performance needs. Plus, hear from three Ericsson experts about improving uplink coverage with massive MIMO and securing 5G networks with zero trust architecture.

**Serve**

Learn how Nemont, based in northeast Montana, donated more than $18,000 to local libraries with their award-winning "Connect at the County Fair" initiative. In addition, meet the Ericsson Cycling Team, who ride together in events across North America to raise money for organizations like the National Multiple Sclerosis Society, St. Jude Children's Research Hospital, and Make-a-Wish Foundation of North Texas.

**Eric Boudriau**

Head of Customer Unit Regional Carriers, Ericsson North America

www.linkedin.com/in/ericboudriau/

# Connect

# Meet the team

In this issue of "Regional Connect Magazine," we spoke to **David Green**, Head of UScellular Account, Customer Unit Regional Carriers, Ericsson. David has more than 20 years of experience as a sales leader across multiple network generations and technologies.


To hear more from David, including how he applies his experience in telecom to solve challenges for his customers, watch the video interview at **t.eric.sn/3FJC66m** or by scanning the QR code.

**Q: What excites you most about working with regional carriers?**

A: Regional carriers in general continue to have great scale—good cash flows, good positive business, and ways to keep growing. And there's enough of a structure that they can move quickly. You see an opportunity, you see a problem, you go solve it and get stuff done. To me, I think that's what's super interesting about the difference between the "bigs" and the "not-as-bigs." And that's why I'm so excited to be a part of this group.

**Q: What do you see as the biggest opportunities for 5G?**

A: 5G allows us to solve a lot of problems in the rural and suburban areas, and with mid-band we can do both coverage and capacity. Once that foundation is built, we have the opportunity to grow revenues for the customer. We can now replace what used to be very much wireline-specific solutions. That allows us to solve problems in a more economical fashion and, more importantly, get broadband to people whom operators historically couldn't afford to take it to.

**Regional Connect Summit 2023**
Plano, Texas

# Regional carriers from across the country gather for two days of learning and networking

The Regional Connect Summit is held annually at Ericsson headquarters in Plano, Texas. This year's event brought together 54 attendees from 17 regional carriers to discuss common challenges and opportunities, share best practices and have a little fun.

The summit featured 17 sessions covering industry and government updates, innovations in technology and insights from regional carriers.

The agenda also included deep-dive sessions into government funding opportunities, network evolution study insights and security, among other topics.

The event allowed plenty of time for networking and socializing, such as a welcome dinner with the Ericsson team and the opportunity for friendly competition and fun at Sixes Social Cricket.

# Featured sessions

### Insights from senior leaders panel discussion

Senior leaders from Southern Linc, XtremeLTE, Nex-Tech Wireless and Carolina West Wireless shared the stage and discussed their points of view on shifting technology, the competitive landscape and revenue sources. They also shared what keeps them up at night and future opportunities they see with 5G.

### Benefits of private networks

**David Allen**, Director of Emerging Technologies and Business Development at UScellular, joined Ericsson's **Bob Gessel** and **David Green** to discuss the benefits of private networks and opportunities for enterprises.

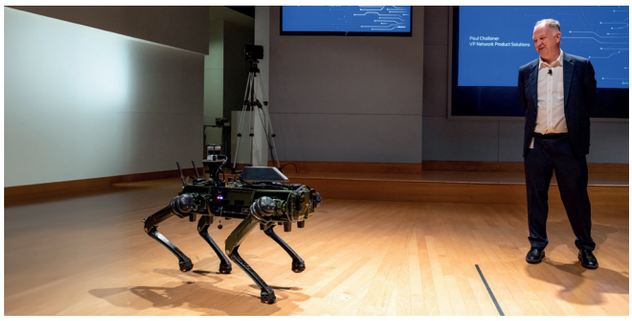
### Market and industry update

**Paul Challoner**, Ericsson's Vice President of Network Product Solutions, presented a market and industry update along with a special guest, Spot the dog , a 5G-enabled quadruped. Paul shared examples of 5G use cases, including how quadrupeds like Spot can assist in cases like guidance or navigation. Paul also covered FWA, indoor, sustainability and Open RAN updates.

### Energy-smart 5G

This session explored how energy-smart 5G sites have the potential to reduce energy consumption and carbon emissions, without sacrificing network coverage. Attendees were even able to see the sustainable site in action at the Ericsson headquarters.









# Connecting and empowering the tribal and rural communities of the Four Corners region

Headquartered in northern Arizona, Cellular One has been serving the Navajo, Hopi, Zuni and White Mountain Apache nations and rural communities throughout the Southwest for nearly 30 years. We spoke to Chief Operating Officer **Guy Turley** to learn more about what makes this regional carrier special.

**Guy Turley**
Chief Operating Officer
of Smith Bagley Inc.
DBA Cellular One of NE Arizona

**Q: What's your origin story?**

A: Before Cellular One arrived in the Four Corners in 1994, telephone penetration for most tribal communities in the region was roughly 27%. Today, in cooperation with the FCC, the U.S. government and tribal councils, Cellular One provides mobile service to more than 90% of these lands.

It all began with our founder, a visionary man named Smith Bagley. Even when mobile technology was in its infancy, Smith could see the incredible ways it would change the world. He also realized that not everyone had equal access to mobile technology—particularly the rural areas and tribal lands of the Southwest. For many, this exciting new technology wasn't just a modern convenience, it could actually be a lifeline. That's why he made it his mission to bring mobile service to tribal lands and other underserved communities—and to make it affordable. He went to Washington, D.C., and personally championed the creation of federally subsidized mobile plans for those needing financial assistance.

**Q: What are your company's core values?**

A: Service: We strive to provide the best customer experience possible—not only through our mobile service plans, but as we continually grow our product lines and expand our network. Innovation: Our team is constantly forecasting ideas while implementing better solutions to meet the daily needs of those we serve. Community: Community at Cellular One stretches far beyond our own walls. As Smith once said, "We do well when we do good."

**Q: How do these values help you serve your community?**

A: Our company continues to evolve to meet changing needs. We have reinvested many millions of dollars in continually upgrading our network—first to 3G technology, and most recently to LTE, with 5G underway. In fact, we currently operate more than 230 cell sites, covering 60,000 square miles throughout rural Arizona, New Mexico and Utah—and we're still growing! Many of the communities, organizations, schools, healthcare, and public safety operators within our coverage area rely heavily on the connectivity we provide, as well as the federally subsidized programs we offer to make this access affordable.

**Q: Tell us more about your communities.**

A: Navajo Nation President Buu Nygren is a strong leader. He understands how important broadband is for the health, safety and education of the Navajo people. Likewise, Chairman Kasey Velasquez of the White Mountain Apache has been instrumental in championing increased coverage and greater access to modern technology that enhances quality of life on tribal lands.

Of course, connecting those who live in remote areas requires more effort than opening stores in cities like Farmington or Gallup, New Mexico. We've put our team—40% of whom are Native American—right in the communities we serve. These stores on tribal lands deliver a level of customer care that people in suburban and urban America often take for granted.

Getting involved with local activities and honoring the unique cultures of our customers is very

important to us. We participate in local festivals and tribal fairs, we support Earth Day clean-up initiatives, and we sponsor camps for indigenous youth, where they participate in artistic projects and outdoor activities that allow them to learn more about their own cultural traditions.

**Q: What's something unique about your company that most people probably don't know?**

A: We're more than just a cellular company—we're a diversified technology solutions provider. Our IT division, Sunstate Technology Group, offers managed IT services and solutions to local governments, public safety workers, nonprofits and businesses in Arizona and New Mexico. In 2022, we also launched a fiber infrastructure division: PHOTON by SBi™.

**Q: How did your company's partnership with Ericsson begin?**

A: In 2012, we were looking to modernize our 2G network, upgrading to 3G and setting the stage for LTE and beyond. We chose Ericsson to be our Radio Access Network provider due to the company's excellent reputation for quality equipment, innovation and staying power.

**Q: What are you most excited about with 5G?**

A: The most exciting thing about 5G is that we're always figuring out how to use technology in ways that we never imagined. Yes, 5G means faster speeds for the things we do today, but that's not all. 5G opens the door to new possibilities. Just think about how different our online activities are today compared to 15 years ago.

We're going to see a continuing trajectory of new uses as 5G converges with augmented and virtual reality. I'm talking about advances in autonomous driving and precision agriculture as well as new ways to enjoy entertainment and sports as social media platforms evolve.

Of course, those living in rural communities and on tribal lands deserve to have access to high-quality 5G services, too. To deliver it, carriers like us need the support of our nation's policymakers. We have a team that's proven to be capable of maximizing funds to bring technology to remote areas. Without a continuing commitment from policymakers, 5G that is reasonably comparable to urban and suburban areas cannot happen.

**Q: What does the future look like for Cellular One?**

A: We look forward to the launch of 5G in our network. This technology will allow us to offer wireless home broadband internet as well as a faster mobile experience. We will also proudly carry on our founder's legacy—living out a deep and lasting commitment to community involvement and philanthropic work. We're currently in the process of launching a 501c3 foundation to expand the reach of our community impact work by empowering tribal youth.

# Share

# Mobile quality of experience: Network readiness for new services

The next wave of 5G applications will bring new network requirement challenges. Communications service providers will have to apply new models for rating mobile quality of experience (QoE) to design networks that support performance needs of future applications.

## Key insights

- Data captured from US networks shows that 5G substantially improves video streaming quality compared to 4G.
- Application developers and network planners need a new approach to rate QoE for emerging mobile services.
- A need to continue improving mobile network performance capabilities to meet the requirements of new mobile experiences and rising user expectations of QoE will grow with uptake of new services.

The first wave of 5G primarily brought enhanced user experience for existing applications to smartphone users. New types of applications and use cases are expected in the next wave, bringing to networks new challenges in delivering sufficient mobile QoE to customers. Mobile user experience is a function of both application quality and network quality. Service providers need ways to rate experiences and to become known in the market for delivering a mobile experience consumers and enterprises can rely on. Ultimately, this will impact how much customers are willing to pay for a service.

### Models to predict the quality of mobile experiences

Traditional proxy measures for QoE are generic and unrelated to a specific application and network combination. What users can expect from the network is typically measured in three ways:

- Population coverage (percentage with access to a specific cellular access technology [4G, 5G] in low- or mid-band spectrum)
- Radio signal strength (measured on the device and presented as 1-4 bars)
- Speed tests (user-initiated peak rate tests of throughput at a given location during a defined time)

These measures indicate network fundamentals for users but have limited value as input for planning networks for more advanced experiences. An alternative method is to calculate the quality of various mobile experiences using secondary data points retrieved from devices and analyzing by:

- Uniformly capturing data across different service, equipment, measurement and device providers
- Applying algorithms and standardized models, where a specific set of data points can be measured and correlated with the QoE for a specific service

ITU's Telecommunication Standardization Sector (ITU-T) set out to standardize and secure a broad anchoring for models to use. The ITU-T Rec. P.1203 is the world's first standard for measuring the QoE of video streaming services for longer viewing sessions and has been established for years. Models for measuring cloud gaming[1] and video telephony[2] QoE are under development. These will rely on a set of data points as input, with a known impact on the QoE, and a calculated overall rating as output.

In collaboration with Ookla, Ericsson conducted a nationwide data-gathering project in the US during the first quarter of 2023. All data points were uniformly captured from smartphones across the three largest service providers' mobile networks, and were used to rate mobile QoE with the aforementioned approach. The three experiences studied were video streaming (ranging in resolution from 144p to 4K), mobile gaming and video conferencing. All these services are mature and expected by customers to be delivered with excellent quality over a cellular network. The results indicate an ongoing need for network performance improvements to deliver a consistent QoE for these types of applications. General network readiness for delivering good QoE for cloud gaming and extended reality (XR) applications is still in its infancy.

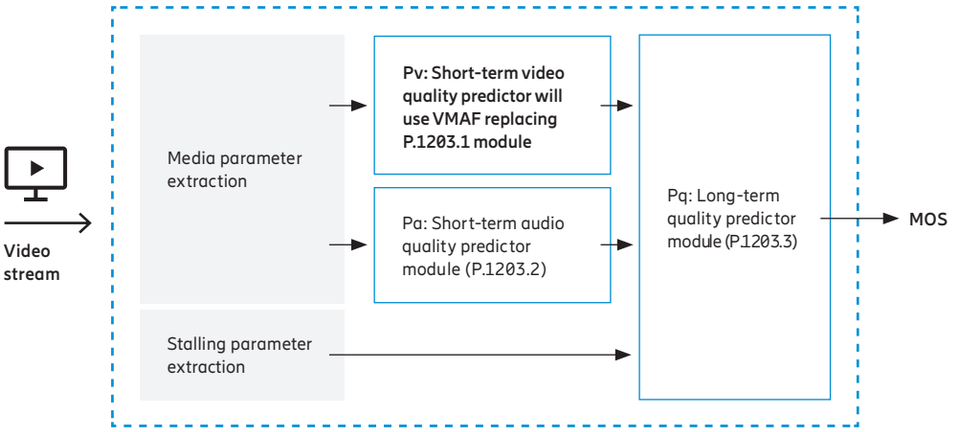
### Modeling mobile video streaming QoE

Video is the dominant traffic type in cellular networks, and its use continues to grow. A total of 80 percent of all data traffic in cellular networks is forecast to be video by 2028. Video consumption has gradually shifted from broadcast to streaming, and mobile video quality evolves toward full-HD, 2K and 4K resolutions. However, user experience of mobile video depends on many different measurable aspects, such as intrinsic encoding quality (affected by resolution, frame rate and codec) and dynamic quality effects (such as time-to-content, rebufferings and resolution adaptation to channel capacity).

[1] ITU-T work item P.BBQCG, www.itu.int/ITU-T/workprog/wp_item.aspx?isn=17809.

[2] G.CMVTQS, www.itu.int/ITU-T/workprog/wp_item.aspx?isn=17785. Note: Video telephony is not the same as video conferencing, but still similar to a two-party video conference call.

**Figure 1: Video streaming quality model**




Theoretical maximum of experience quality, defined by encoding quality (MOS)

| MOS | |
|---|---|
| Excellent | 4.5-5.0 |
| Good | 3.5-4.5 |
| Fair | 2.5-3.5 |
| Poor | 1.5-2.5 |
| Bad | 1.0-1.5 |

Video QoE is well-researched and relies on models that were standardized before 5G was introduced, such as the ITU-T P.1203 standard.[3] This includes modules for estimating short-term video (P.1203.1) and audio (P.1203.2) quality, and an integration module (P.1203.3) estimating the final session quality due to adaptation and stalling. The short-term video quality scores are fed into the integration module and the final quality score is then presented as a single mean opinion score (MOS) ranged 1 to 5 or the whole experience. This is an objective model designed to mimic the behavior and perception of humans, producing the MOS values that would result from running a subjective video quality test with a group of individuals in a laboratory environment.

In this study, Ericsson replaced the P.1203.1 module with the open source-based Video Multimethod Fusion Approach (VMAF) algorithm, as P.1203.1 does not support some commonly used codecs.[4] Since the test video is known and pre-encoded, VMAF could be used offline to assess the video encoding quality for the resolutions utilized, while P.1203.3 was used to add the dynamic effects of time-to-content, rebufferings and resolution adaptation. The resulting QoE measure (output) from the model is presented as a single mean opinion score (MOS) in a range of 1 to 5 for the whole experience (see Figure 1). This figure shows the P.1203 architecture, with P.1203.1 exchanged to VMAF.

The model relies on a theoretical maximum value defined by the resolution, where standard definition (SD) is the lowest possible resolution that gives a good experience (MOS 3.5-4.5) on a smartphone, and excellent experience (MOS 4.5-5) requires at least full HD (see Figure 2).

### Insights into mobile video streaming QoE

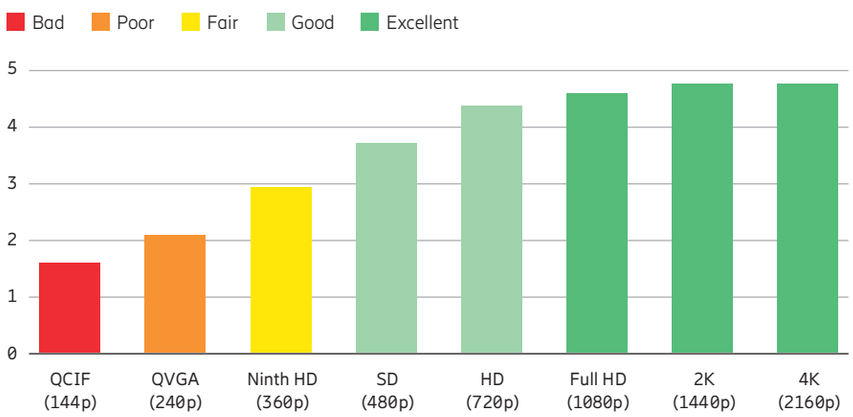
When applying the model (Figure 1) to mobile video streaming deliveries over commercial networks in the US, it was found that:

- Excellent quality (MOS 4.5-5) was achieved by 61 percent of the mobile video streams measured. The measurements varied 44-72 percent across the 3 large service providers. The differences between service providers relate to spectrum used and network rollout strategies. The premium resolution samples were limited and represented only 12 percent (2K) and 4 percent (4K) of all measured streams.
- Only 13 percent of the streams measured were less-than-good (below 3.5 MOS). Poor radio conditions were the root cause for 40 percent of the less-than-good experiences, with either poor radio frequency (RF) strength, poor RF quality, or a combination of both.
- 5G increases video streaming quality compared to 4G and Wi-Fi. The proportion of streams with excellent quality increased from 58 percent (4G) to 72 percent (5G). The QoE gap compared to Wi-Fi decreased from 22 percent to 8 percent. 5G has reduced Wi-Fi's previous streaming quality advantage.

### Insights into mobile gaming QoE

Two-thirds of mobile app revenues come from mobile games,[5] and we are at the beginning of the fourth gaming wave (after console, PC and mobile games) with cloud gaming increasingly offered by service providers. The transition from mobile app games, studied here, to mobile cloud games will materially change network performance requirements. For mobile games executed in an app[6] on a smartphone or tablet, the QoE depends on latency, packet loss and jitter. A simple evaluation model was applied to the captured data for these parameters to rate the QoE:

**Figure 2: Maximum possible MOS for video streaming to smartphones**




[3] Ericsson Technology Review (June 2017), https://www.ericsson.com/4ac633/assets/local/reports-papers/ericsson-technology-review/docs/2017/video_quality_of_experience_june_2017.pdf.

[4] https://github.com/Netflix/vmaf

[5] Data.ai State of Mobile 2023 (January 11, 2023), https://www.data.ai/en/go/state-of-mobile-2023/

[6] No video component is transmitted, only metadata in the uplink and downlink.

- 57 percent of the mobile gaming experiences measured were of excellent quality. Mobile app-based gaming is latency-sensitive. However, the differences in latency between service providers was limited, and all 3 Tier-1 providers fall within the 54-58 percent bracket for an excellent QoE. The shift from 4G to 5G increased gaming sessions with excellent QoE by 6 percentage points.
- Server locations influence mobile gaming QoE due to longer delays. There is a difference in mobile gaming QoE between servers located in the US (82 percent providing excellent quality) and elsewhere (38 percent providing excellent quality).

In this case, a simple evaluation model was used to rate the QoE. More work is needed to develop a deeper understanding of what parameters influence the perceived QoE for mobile gaming.

### Insights into mobile video conferencing QoE

COVID-19 led to 2D video conferencing being universally adopted in home offices. Not only is it here to stay in the hybrid workplace, but it will evolve toward immersive 3D communication. While PCs presently dominate as the platform for video conference calls at work and home, mobile devices are growing in importance in the workplace and when commuting. The QoE for mobile video conferencing is dependent on video resolution and round-trip delays. A few aspects make mobile video conferencing different to using a fixed network connection. The high-end resolutions of 4K and 2K are typically not used, and the usage of Full HD (1080p) and lower resolutions vary somewhat between different video conferencing services. Video conferencing is inherently latency-sensitive, but material drops in quality do not occur until after about 100 ms in round-trip delay.

In anticipation of a standardized model, we have used the same resolution base as for video streaming (see Figure 2).

The resolution estimate comes from the available bit rate at the initiation of the video conferencing service. The impact of network delays leverages the ITU-T G.107 model, initially defined for voice-quality predictions, as users tend to be more sensitive to audio delays than video delays. The key results were:

- 79 percent of mobile video conferencing experiences (4G) were of excellent quality, with both throughput and latency variables meeting the threshold for excellent quality.
- 88 percent of mobile video conference experiences (5G) were of excellent quality—a leap upward by 9 percentage points from the 79 percent for 4G.
- 5G emerged as the best network, even 3 points ahead of Wi-Fi, for overall QoE of mobile video conferencing.

### Network readiness for new types of mobile experiences

The most significant value of the approach described in this article will be for new types of experiences, for which both application developers and network planners need new tools to rate QoE. However, QoE models are experience-specific and need to be standardized for new types of experiences like cloud gaming and XR. As part of the analysis, the capabilities of existing networks to meet quality thresholds on downlink, uplink and latency for these types of services were examined. 5G connectivity requirements vary for mobile cloud gaming and AR use cases:

- Mobile cloud gaming:[7] 10 Mbps downlink, 5-9 Mbps uplink and 30-75 ms one-way latency
- AR:[8] 2-60 Mbps downlink, 2-20 Mbps uplink and 5-50 ms one-way latency

Through modeling of measured downlink throughput and round-trip delays, network readiness for these types of services were measured as follows, as a percentage of modeled service access attempts:

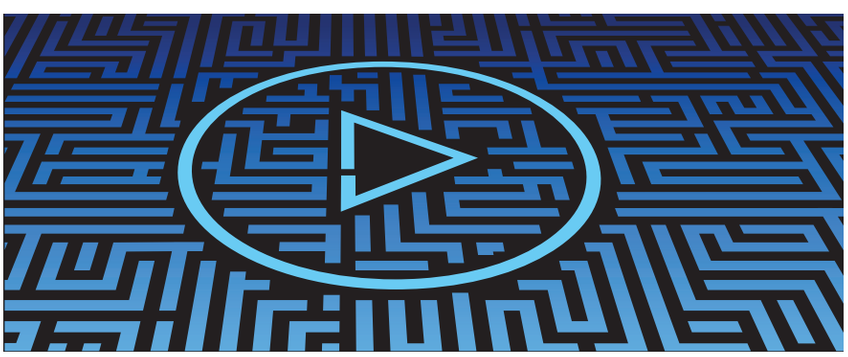
- Mobile cloud gaming: 40 percent of measured throughput and latency values meet minimum requirements
- AR: 3-32 percent of measured throughput and latency values meet minimum requirements

The large spread in network readiness values for AR depends on the "flavor" of AR in play and where in the requirement span each flavor falls. The locations of servers required for remote rendering have a high impact on the results for data points collection coupled to latency. As AR flavors, server locations, model development and data point collection mature, the initial spread in network readiness will be replaced by specific values.

The difference between the high percentage (61 percent) of mobile video streaming experiences rated "excellent quality" and the low percentage for meeting the minimum network requirements of mobile cloud gaming (40 percent) and AR (3-32 percent) experiences points to a need for continued 5G network evolution. This will be necessary to meet a large variety of requirements of new types of services, with higher demands on network performance.

### Performance capabilities need further improvements

The work to define QoE rating models for new experiences with high network performance requirements is still to be undertaken. However, the work to define the models and the job of capturing datapoints for predicting quality for an experience can happen in parallel, so that both models and robust data sets can guide network evolution plans before standards are complete. A need to continue improving mobile network performance capabilities to meet the requirements of new mobile experiences, and rising user expectation on QoE, will grow with uptake of new services.



The proportion of "excellent" quality mobile video streams increased from 58 percent over 4G to 72 percent over 5G.

**72%**

[7] Xbox Game Pass requirements, Microsoft.

[8] Ericsson Technology Review (August 24, 2021), https://www.ericsson.com/en/reports-and-papers/ericsson-technology-review/articles/xr-and-5g-extended-reality-at-scale-with-time-critical-communication

# Ericsson Mobility Report: Meeting evolving network requirements


**Dive deeper into the data and learn what service providers can do to meet both consumer demand and enterprise expectations on service quality.**

**Download the Ericsson Mobility Report Business Review edition at t.eric.sn/46UP90F.**

Communications service providers worldwide are continuing to invest in 5G, driven by the prospect of superior connectivity and emerging opportunities. This comes despite geopolitical unrest and a macroeconomic slowdown in some markets. Managing this growth while improving the mobile user experience requires continued network evolution.

In this edition of the Ericsson Mobility Report, we uncover insights that highlight key considerations for future network evolution, based on analysis of data traffic growth and patterns across different locations in mobile networks.

**Key findings from the report**

- 5G mobile subscriptions are set to reach 1.5 billion globally by the end of 2023.
- Revenue is rising for service providers in the top 20 5G markets, increasing by 7 percent in the last 2 years.
- 5G subscriptions in North America reached a penetration of 41 percent at the end of 2022, and more than 250 million subscriptions are expected by the end of 2023.
- 5G smartphones are expected to account for 62 percent of all smartphones shipped in 2023.
- FWA connections worldwide are projected to increase to 300 million by the end of 2028.
- North America and Western Europe have the highest FWA regional adoption with close to 70 percent of FWA service providers offering it over 5G.
- The monthly global average usage per smartphone is expected to exceed 20 GB at the end of 2023.
- Network slicing enables the introduction of new business models for different market segments.
- Growth in devices and applications using AR in wide-area use cases is expected to accelerate later this decade.

# Expanding the 5G device ecosystem with Ericsson's New Radio (NR) Reduced Capability (RedCap) solution

The simple software addition will allow communication service providers to introduce services beyond enhanced mobile broadband (eMBB) on 5G standalone architecture, broadening the ecosystem and offering new monetization opportunities in both the consumer and industrial spaces.

Ericsson's NR RedCap is a new RAN software solution that enhances existing 5G use cases and enables new ones for an array of devices. It does so by bridging the capability and complexity gap between Low-Power Wide-Area and ultra-reliable low latency communications uses in existing 5G settings, with an optimized design for mid-tier use cases.

NR RedCap can effectively scale down the complexity, size and capabilities of device platforms to offer cost-efficient integration into devices such as wearables and industrial sensors. It brings a mix of capabilities in throughput, battery life, complexity and device density needed to cost-effectively power diverse use cases that do not always need the high-performance capability of current 5G technology.

For consumers, NR RedCap will enable longer battery life and richer functionality for smartwatches and other wearables, such as augmented reality glasses for sightseeing, shopping, learning and other activities. Industry will benefit from enhancements in video monitoring, smart manufacturing and inventory management.

**Why move to 5G standalone?**

- Enhanced user experience
- Super-fast response times
- Higher data rates
- Greater capacity and coverage
- Increased monetization opportunities
- Simplified operation and service agility
- Ultimate 5G architecture

**Key benefits of NR RedCap:**

- Broaden connectivity options for diverse use cases
- Improve consumer experience and extend battery life
- Accelerate the transition from 4G to 5G

**For more details on NR RedCap specifications and opportunities, download the white paper, "RedCap – expanding the 5G device ecosystem for consumers and industries" at t.eric.sn/47hmthU**

# Ask the experts

In this edition of "Ask the Experts," we talk to **Gagan Shori**, Customer Security Director in the Customer Security Unit for Group Function Technology, about securing 5G networks with zero trust architecture. We also hear from **Stefan Calmerman**, VP of Network Evolution for Customer Unit Regional Carriers and **Ricardo Omana**, Account CTO for UScellular, about the many ways in which massive MIMO improves uplink coverage.

**Want to ask our experts to shed light on a certain topic?**
Submit your questions by contacting your Ericsson account representative.

**Gagan Shori**
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**Q: How does zero trust architecture (ZTA) secure 5G networks?**

A: As global networks accelerate their transition to 5G integration, it unveils unparalleled potential with faster speeds, lower latency and the capability to connect billions of devices. However, because we live in a world of cyber risks, 5G critical infrastructure and consumer applications require a higher security posture.

The core tenet of ZTA is "Trust nothing, verify everything." In simpler terms, it's a concept that neither an asset nor a user, irrespective of its location or ownership within or outside the network, should be trusted implicitly. Instead, every access request should undergo rigorous authentication and authorization before being granted.

But how does one practically integrate ZTA into the broad 5G network? Here's a structured approach:

- Embrace zero trust network access (ZTNA): Familiarize yourself with core elements like the policy engine, administrator and enforcement point. Understanding their interactions lays the foundation of ZTA.
- Elevate identity and access management (IAM): Prioritize access based on authentication. Use robust mechanisms like multifactor authentication and maintain a comprehensive identity lifecycle management system.
- Implement micro-segmentation: One key feature of ZTA is network segmentation, ensuring that even if an attacker gains access to one part of the network, they cannot perform lateral movement.
- Always be watching: With AI and machine learning, use continuous monitoring and analytics to go through the vast 5G data to detect unusual patterns and potential threats.
- Seal it with end-to-end encryption: 5G data both at rest and in transit should always be encrypted.
- Utilize secure network slicing: 5G's unique capability to create virtual networks tailored for a specific use case is a transformative feature. However, it's crucial to secure each slice, particularly those managing sensitive data.
- Do not neglect patch management: Consistently update all network elements to fix open vulnerabilities.
- Shift from perimeter-based security: Traditional security models that relied on perimeter defenses, such as firewalls, are not sufficient in the current threat landscape. ZTA emphasizes that trust is not determined by location inside or outside the network perimeter but by rigorous verification.
- Prioritize physical security measures: Infrastructure components like base stations need protection from physical threats too.
- Cultivate a security-first mindset: A robust security culture, updated policies and creating awareness among employees are seen as vital for the successful implementation of zero trust.
- Sync up with threat intelligence: In a dynamic threat landscape, real-time threat intelligence is your compass.

The adoption and integration of ZTA is essential. Organizations must take incremental steps to implement zero trust principles and align with the maturity framework to minimize trust and maximize security.

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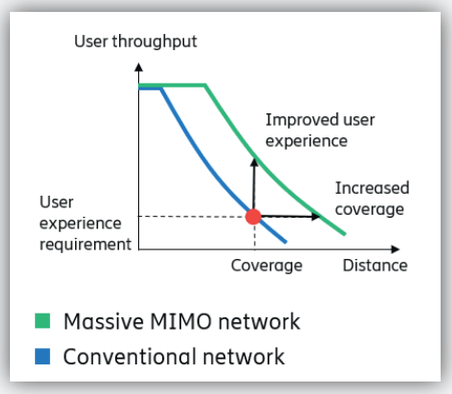
**Q: How does massive MIMO improve uplink coverage?**

A: Massive MIMO is a technology designed to enhance the performance of both downlink and uplink, although most of the highlighted benefits so far have been on the downlink. Here we'll focus on the typical weakest link in a cellular system—the uplink—and how massive MIMO can bring improvements in coverage of up to 60%, which has been measured in the field.




1. **Enhanced spatial multiplexing:** Massive MIMO involves deploying a large number of antennas at the base station, which allows for efficient spatial multiplexing of uplink signals. Multiple users can simultaneously transmit their data using the same time and frequency resources, significantly increasing the system capacity and throughput. You can make the analogy of a bigger "garden rake" to capture more "leaves."
2. **Spatial processing and beamforming:** Now that we collected more "leaves," what can we do with them? This is where processing and beamforming play a role. The abundance of antennas enables sophisticated beamforming techniques, directing transmitted signals toward their intended receiver and minimizing interference in other directions. This targeted beamforming optimizes the received signal quality, improving uplink coverage and signal strength.
3. **Array gain:** The presence of a massive antenna array allows for significant array gain, resulting in higher received signal power and improved signal-to-noise ratio (SNR). This gain boosts the coverage and reliability of the uplink transmissions, especially for users located at the cell edge. Note that this also helps the downlink because the antenna array is the shared conduit to both receive and transmit signals.
4. **Diversity gain and interference suppression:** The large number of antennas and where those are placed (horizontally and vertically) provide diversity gain, allowing the system to benefit from spatial diversity in the uplink. By spatially separating signals and utilizing advanced interference cancellation techniques, the system can improve coverage and increase data rates, effectively mitigating interference from other users and sources.
5. **Robustness to fading and multipath propagation:** The presence of a massive antenna array helps combat fading and multipath propagation effects by effectively utilizing spatial diversity. This improves the robustness of uplink communications, particularly in challenging propagation environments, enhancing coverage and reliability.
6. **Efficient resource allocation:** Massive MIMO allows for efficient allocation of resources such as power and bandwidth, ensuring that uplink resources are optimally utilized to achieve better coverage and higher data rates. As an example, it can direct the power in the direction of a narrow beam for a particular user, instead of wasting energy in other directions.

These capabilities collectively contribute to extending coverage by improving signal quality and increasing the capacity and performance of the uplink in wireless communication systems. **Learn more about 5G Ericsson Uplink Booster at t.eric.sn/45UT1xq.**

# Serve

# Ericsson Cycling Team raises funds for St. Jude Children's Research Hospital and the National Multiple Sclerosis Society

Employees give back to their communities by supporting lifesaving missions through two major cycling events: Bike MS and the North Texas Bike Rally.

Participation in philanthropic events allow Ericsson employees to live out our core value of Respect. Many employees have found ways to incorporate their personal hobbies and interests into these charitable endeavors. The Ericsson Cycling Team is a perfect example.

Team Ericsson, as it's known, was formed in early 2007 by an employee who had a passion for cycling and a family member who was battling multiple sclerosis (MS). Many of his coworkers joined him in the inaugural Bike MS event in Dallas, and two years later, the team had 89 riders supporting the cause.

Today, Team Ericsson comprises 122 Ericsson employees across North America. Over the past 16 years, with the help of Ericsson's corporate donation matching, the team has raised a total of $731,000 for the National Multiple Sclerosis Society, St. Jude Children's Research Hospital, and Make-a-Wish Foundation of North Texas.

Here we highlight two recent events in which Team Ericsson was proud to participate.

**Riding toward a world without multiple sclerosis**

Each year, nearly 50,000 cyclists and more than 5,000 teams participate in Bike MS—the largest fundraising cycling series in the world. In May, several members of the Ericsson Cycling Team hit the road in Frisco, Texas, for the Bike MS 2023 Round-Up Ride, biking all the way to Fort Worth. This event marked 36 years of pedaling closer to a cure in North Texas.

**Making a difference for families with children facing cancer**

In June, our cyclists joined hundreds of others for the North Texas Bike Rally, benefiting St. Jude's Children's Research Hospital. The goal of the event was to raise funds for families to help with treatment, travel, housing or food. Treatments discovered at St. Jude have helped push the overall childhood cancer survival rate from 20% to more than 80% since it opened in 1962.


Congratulations and a huge thank you to Team Ericsson members **Maritza Estridge Alvarez, Constance An, Ian Bloomfield, Kinikia Brodeur, Jose Davila, Fabio De Paulo, Regina Duran, Damon Elsden, Carlos Gonzalez, Alan Minney, Adam Myers and Ivan Vinas.**

# Nemont donates portion of phone sales—totaling more than $18K— to support local libraries

Throughout the busy fair season in Montana, Nemont was present at each fairground with a booth selling new phones. For every phone sold at each event, the carrier donated $100 to that county's local library through their "Connect at the County Fair" initiative.

Nemont, which operates across northeast Montana, has a long history of getting involved with and giving back to the communities they serve. This year marked the second year the company used their presence at local fairs as an opportunity to do good.

"Last year we donated funds back to the fairs themselves," said Nemont's PR and marketing specialist Gregg Hunter. "This year, we wanted to spread the donation further into the community, so we decided on donating to the libraries." Although next year's cause is yet to be determined, Hunter stressed they will continue to give back in this way.

In total, Nemont donated a staggering $18,400 to seven different libraries to support the growth and development of their valuable resources.

The success of the "Connect at the County Fair" initiative earned Nemont a 2023 Annual Achievement Award from the Competitive Carriers Association (CCA) in the category of Outstanding Service Award (Carrier). The company received the honor at CCA's Annual Convention, which took place in Atlanta in October.

"Giving back to the community is at the heart of everything we do at Nemont. We understand the power of a thriving library in enriching lives and fostering a love for reading and knowledge."

**Gregg Hunter,** PR and Marketing Specialist, Nemont Communications

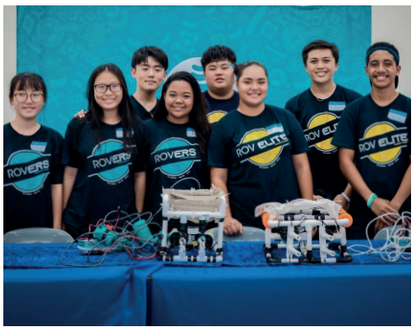
CONNECT at the COUNTY FAIR

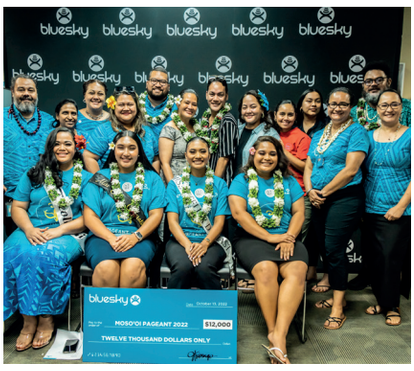
# Bluesky advances the growth of American Samoa's future

By empowering the youth of American Samoa through diverse initiatives, Bluesky is helping pave the way for new thinking, new avenues and new opportunities for the island territory.

Bluesky, the leading telecommunications and network service provider for mobile, cable TV and internet in the United States Territory of American Samoa, has long been committed to fostering the development of local youth. Over the years, the company has contributed more than $100,000 in support through various partnerships and sponsorships, including the following:

- **Sports**—Helping build momentum for the American Youth Football of Samoa, Junior Prep Sports of American Samoa, American Samoa Tennis Association's Junior Tennis Team, American Samoa Softball Association, American Samoa Jr. Golf club, American Samoa Volleyball clubs, American Samoa Rowers Association and American Samoa Basketball Association
- **Technology**—Supporting the STEM programs of seven local high schools, as well as the Army JROTC Robotics team, who competed in the 2023 VEX Robotics Championship competition
- **Scholarships**—Sponsoring scholarships to celebrate the talents and accomplishments of students at both the high school and community college levels
- **Future workforce**—Collaborating with the local government through Youth Employment Programs and offering on-the-job training for students majoring in business, accounting, ICT and engineering
- **Environmental preservation**—Partnering with Finafinau, an organization that promotes youth leadership in environmental advocacy and climate action, Bluesky supports initiatives and enables students to participate in the Native Youth Community Adaptation Leadership Congress, which combats the detrimental effects of climate change
- **Recreation**—Contributing funds for the development of a new community playground



# Why Ericsson?

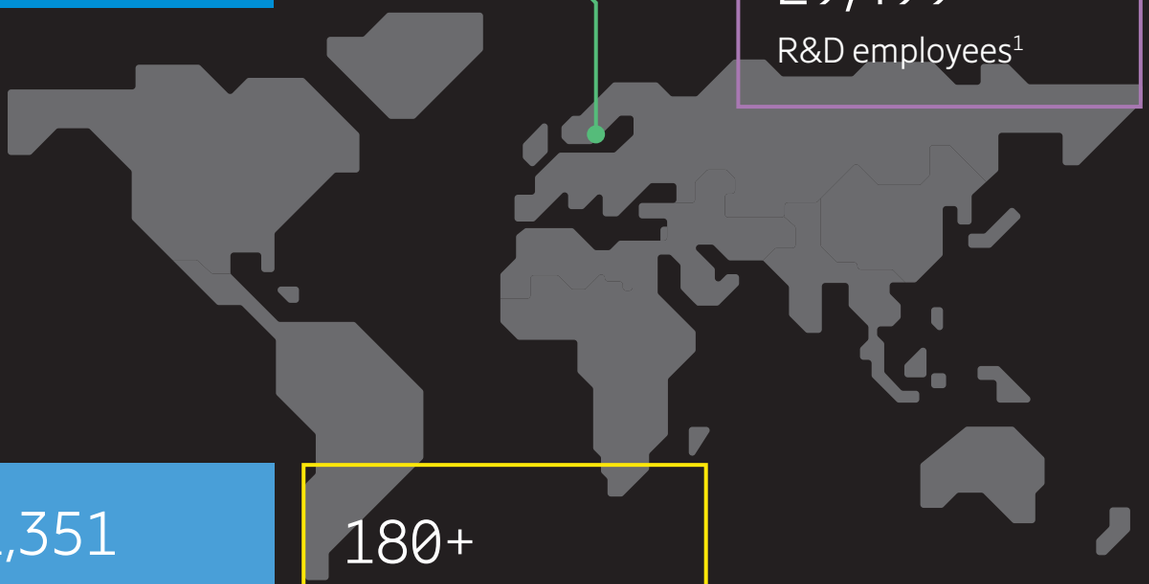
## Regional focus, global expertise

A leading provider of information and communication technology (ICT) to service providers, Ericsson enables the full value of connectivity by creating game-changing technology and services that are easy to use, adopt and scale—making customers successful in a fully connected world.

147+ years
of enabling communication

Global Headquarters:
**Stockholm, Sweden**

29,499
R&D employees[1]



101,351
employees[2]

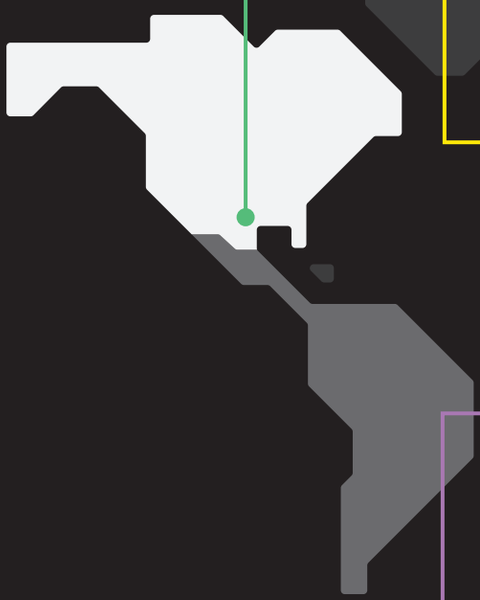
180+
Operates in 180+ countries

60,000+
patents

155 live 5G networks
globally[3]

[1] As of 12/31/2022
[2] As of 11/1/2023
[3] As of 11/1/2023

North American Headquarters: **Plano, Texas**



30+
U.S. locations

5 live 5G networks
in the U.S.[5]

70+
regional carrier customers

$100M
5G smart factory investment in Lewisville, TX

7,900
U.S. employees[4]

[4] As of 11/1/2023
[5] As of 5/1/2023

## About Ericsson Regional Connect

Regional carriers are unique enterprises. They are an integral part of the communities they serve as much as they are businesses seeking growth and sustainability. The Ericsson Regional Connect program was born out of Ericsson's recognition that regional carriers across the US are united by these common values—and by common challenges: Values we share and challenges our global solutions are perfectly suited to meet.

With an array of live and virtual events, online forums and tools, Ericsson Regional Connect comprises a unique community that brings regional carriers together in an unprecedented way:

**Connect**—Ericsson Regional Connect facilitates a wide range of opportunities for professionals in the industry to meet and partner with their peers.

**Share**—Regional carriers will have access to Ericsson's global technological leadership and expertise. And they will have a forum for sharing knowledge, ideas and best practices with one another.

**Serve**—Apply what you gain from Ericsson Regional Connect to better serve your customers, connect the unconnected and give back to your communities.

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## About Ericsson

Ericsson enables communications service providers and enterprises to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovation investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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