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Key principles for an open and innovative Internet – implications for net neutrality

Content

Introduction - The promise of 5G

5G offers the promise that previous general-purpose technologies such as steam, electricity, and computing offered; to boost productivity growth over a sustained period of time by supporting a broad range of consumer, commercial, and industrial applications. It will have a transformative impact on innovation, security, and sustainability.

But to deliver on this promise 5G needs to be ubiquitous, capable, and consistent with CSPs free to offer tailored connectivity for multiple use cases.

5G was designed and built to deliver the tailored connectivity needed to support innovative new services and meet the evolving needs of consumers and businesses. Onerous or imprecisely designed net neutrality regulation risks constraining the opportunities for innovation on 5G networks.

Only when expansive and dynamic mobile connectivity is available as a critical input to cross-sector innovation will the full potential of mobile be realized. That requires investment in, and the mass deployment of, new technologies as well as a regulatory environment that permits users to make the most of the capabilities of the technology.

This paper begins by explaining how tailored connectivity is delivered through network slicing. Next, it expands on how tailored connectivity enables digital transformation and contributes to driving innovation and sustainability across the broader economy and society. From there, it looks at use case examples of positive impact across three key sectors. Finally, it concludes by setting out five guiding principles for fit-for-purpose net neutrality regulation.

Tailored connectivity is key to digital transformation

Step change 5G [1], underpinned by mid-band spectrum capacity, gigabit capable backhaul, and 5G core powered end-to-end network slicing, provides a platform to deliver tailored connectivity to consumers and businesses for the first time. It will enable intelligent networks that can be automatically configured to optimize the performance of the services they are used for. This will change the way digital services are delivered, offering a powerful open innovation platform and a global engine for sustainable, inclusive growth.

Tailored connectivity is key to digital transformation. It enables innovation by putting the power of specific connectivity capabilities in the hands of service and content developers, and, ultimately, users. It is pivotal to meeting evolving consumer and business needs. Additionally, tailored connectivity underpins investments by enabling CSPs to monetize the full capability of their networks and bring the full suite of connectivity tools to the challenge of advancing global green and digital agendas.

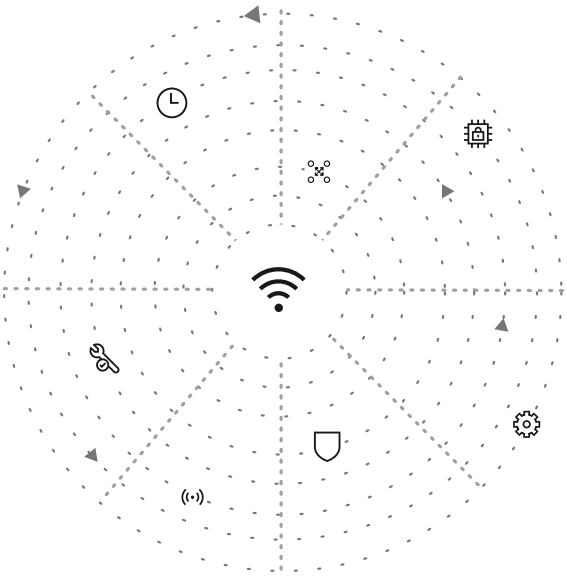
Net neutrality regulation will be uniformly applicable to all generations of mobile technology. As policymakers and regulators consider, develop, and apply net neutrality rules, it is vitally important that these allow tailored connectivity while protecting end users and keeping the internet open. These rules will then apply equally to all mobile networks,

Tailored connectivity through network slicing

5G was designed and built to deliver the tailored connectivity needed to support innovative new services and meet the evolving needs of consumers and businesses. It is now possible to create multiple virtual networks on top of a single physical infrastructure with each virtual network tailor-made to fit a particular service or use case. The network is effectively "sliced" to ensure the right connectivity capabilities are delivered when and where they are needed.

End-to-end network slicing on 5G Standalone networks makes it possible to provide different capability slices to meet multiple needs at the same time. For example, a given network can provide a highly secure, low latency connectivity slice for an industrial application, while simultaneously supporting high-speed non-time critical connectivity for large-volume data transfers.

This tailored connectivity is pivotal to underpinning the different use cases described below. It will power the green and digital transitions across industries and public services by ensuring the right connectivity capability at the right time and in the right place. It is the key to unlocking innovation and to realizing the full potential of 5G networks as critical infrastructure.



The way to achieve network characteristics that are specifically tailored to the different needs of services is to transform the network into a set of logical networks using shared infrastructure. This is referred to as network slicing. Each logical network, or slice, is designed to serve a defined service or use case and comprises all the required network resources, configured and connected end-to-end.

The network slice is a logically separated, self-contained, independent, and secured part of the network, targeting different services with different requirements on speed, latency, and reliability. Network slice characteristics are, for example, low latency, high bandwidth, and ultra-reliability for a critical IoT use case or higher latency and lower bandwidth for a massive IoT use case.

Tailored connectivity enables technological transformation

The pivot to multi-touch smartphones, apps, and mobile data has been underway for over a decade, with internet companies announcing 'mobile first' strategies in 2010 and with a growing number of applications now mobile only. With step change 5G [1] , the innovation that has boosted consumer welfare will extend to industries and public services, and be used to close the digital divide by extending the reach of gigabit capable connectivity. Mobile offers the promise of previous general-purpose technologies such as steam, electricity, and computing; to boost productivity growth over a sustained period by supporting a broad range of consumer, commercial, and industrial applications.

The impacts of general-purpose technologies tend to come in waves as new applications and business models are developed; mobile connected computing is a key building block for further ICT driven growth. It will have a transformative impact on innovation, security, and sustainability.

But to deliver on this promise, mobile needs to be ubiquitous, capable, and consistent; with declining unit costs made available by the higher quality of services achieved through new generations of technology and the capability and freedom to offer tailored connectivity for multiple use cases. Step change 5G will amplify this cluster of characteristics, providing for expansive and dynamic gigabit capable connectivity.

Only when expansive and dynamic mobile connectivity is considered a critical building block will the full potential of mobile be realized, and that requires investment in and the mass deployment of new technologies such as step change 5G, gigabit capable backhaul, and 5G SA.

General-purpose technologies result in spillover benefits throughout the economy, complemented by network effects in the case of expansive and dynamic mobile connectivity. Economic, social, and environmental benefits are likely to significantly exceed private returns to investors in mobile networks. Policy and regulation should be positively permissive to incentivize the infrastructure to be built and enable the cross-economy innovation it can unleash.

How all these technologies are built, integrated, and controlled will become a major trust management issue in the future. Particularly for usage in critical infrastructures and to ensure privacy is protected.

Network slicing is one way of tailoring the technical characteristics of the network to the specific demands of the services using it. It is about separating different types of user traffic and creating dedicated core networks ad-hoc to facilitate a whole range of different 5G use cases. Network slicing enables the creation of device type, industry sector, or even customer-specific subnetworks. The network slice control mechanism needs to provide appropriate slice management, the configuration of access control, and secure isolation while still authorizing the shared resources. Each slice may have its own security policy that defines the security controls applicable to its specific threat landscape. Network slices designed for critical services may also use shared resources but require careful isolation. Critical services require high reliability, resiliency, safety, security, and, often, privacy. The security of critical services must ensure that communication parties and connections remain protected. This requires a comprehensive security approach including automated asset management and verification of security policy compliance. [2]

5G and other digital mobile technologies are also unique, powerful, and immediate enablers for reducing carbon emissions, and have the potential to create transformational acceleration of decarbonization efforts. Decarbonizing industries with connectivity & 5G – Ericsson (October 2021)

Digital infrastructure underpinned by 5G connectivity will be key to achieving the EU´s Net-Zero targets. McKinsey's Net-Zero Europe analysis estimates that connectivity can reduce Europe's carbon emissions by 15% by 2030. Making 5G available across the power, transport, buildings, and manufacturing sectors could cut Europe's carbon emissions by up to an additional 5%. [3]

Examples of tailored 5G applications [4]

The following sections provide examples of how stand-alone 5G can help the changing industries as a central pillar of both the green and digital transformations.technology components are also important precursors to several 6G building blocks.

Government emergency services

Emergency services touch on key players within emergency and mission-critical operations. These include first responders like police, fire, and public safety departments, in addition to their solution (hardware, ICT, infrastructure) providers. In many places municipalities and government agencies in the emergency services sector experience challenges with their current connectivity standards, which hinder their ability to respond effectively and precisely in situations where lives may be at stake. The lack of network reliability and real-time control inhibits the use of digital equipment such as robotics and drones, where connectivity failures result in grave consequences.

Network slicing eliminates data silos and allows secure, unhindered, high-performant data sharing across agencies, which is critical when responding to emergencies. Network slicing of a 5G network enables higher QoS. guaranteeing real-time control and greater reliability. The configurability of 5G slicing also promotes interoperability, which allows for easier management of all wireless access points via a single WAN or LAN network. It also makes 5G a scalable, dynamic, flexible, and cost-effective option and its isolated traffic within the slice is more secure with network security being highly configurable to suit specific needs.

The principal areas where network slicing enhances the provision of emergency and mission-critical services are mission-critical push-to-talk communications; visors, and helmets enabled with AR/VR, drones, and bomb-defusing robots – all of which require reliable, low-latency, high-bandwidth connectivity.

With mission-critical communications, multiple standards for networks are hindering innovation and scalability, and are costly to maintain. Along with increasing global usage, this poses the need for the harmonization of networks and standards. In emergency situations, reliable and instant communications between stakeholders are imperative. In many instances, a failure of communication capabilities can result in lost lives.

Public safety and military agencies gain several benefits, including economic advantages. As a result of network slicing, organizations can achieve reduced costs for operations, connectivity, integration, and deployment as well as in equipment unit costs from global scalability and harmonized spectrum usage.

The capabilities of mobile broadband allow first responders and other agencies to improve productivity by working smarter, faster, and more effectively. Additionally, wider, highly available coverage enables safer and more efficient responses and operations.

Energy generation and transmission services

Energy generation and transmission is experiencing growth in several ways. Investments in this sector reached USD 302 billion by 2019 worldwide, up from USD 168 million in 2009. Advancements are creating new opportunities to increase efficiency and reduce costs through remote monitoring and control.

There's also interest from customers and employees to take on corporate social responsibility and sustainable development. New regulations, policies, and directives are encouraging and stimulating the adoption of clean energy generation and consumption.

However, there are several key challenges related to connectivity that need to be addressed. High reliability is critical to ensure real-time control, in case of a malfunction. Growing amounts of data will need to be analyzed in real time and over large geographical areas, so organizations will need to address data availability and management to ensure operational efficiency. The increase in devices makes it critical for networks to have the ability to handle an exponential increase in connected equipment, devices, and sensors.

Connectivity costs are expensive, but options like WAN are insufficient to meet requirements. Full coverage is a requirement for use cases that require extensive geographic coverage, such as remote-controlled wind farms. Network security is critical to safe operations. In this segment, an increasing amount of communication is found outside the physical infrastructure of plants creating more vulnerability to several mission-critical operations.

Network slicing is able to address several of the connectivity challenges in the energy generation and transmission sector. Network slicing guarantees reliability and real-time control through QoS. QoS is also guaranteed through slicing and 5G will be able to provide better coverage than fixed solutions, as well as a more flexible option in demanding terrain. Network slicing also provides the ability to configure for high availability and is scalable. To

address security challenges, network slicing allows for isolated traffic to be configured to meet varying requirements. Finally, CSPs will be able to deploy slices on a global level with predictable costs.

Industrial transformation services

The production segment of manufacturing consists of several players focused on the preparation, processing, and fabrication of goods from raw materials. It's a segment that's undergoing significant transformation, spurring the growth of advanced manufacturing facilities.

A key growth driver is the rapid technological adoption and demand for mass customization. Consumers and enterprises want more personalized production of goods, which adds additional value and creates a larger addressable market.

Therefore, production facilities are adopting smart factory technologies, which incorporate cooperative robots, extensive deployment of IoT, AI, and other technologies that enable extensive automation and flexibility on the production floor, creating a shift from traditional production methods to digital ones.

Manufacturing faces significant connectivity challenges to implement Industry 4.0 and smart factory automation. E.g., mission-critical use cases like collaborative robots require real-time control and access, meaning high throughput and ultra-low latency. Additionally, the high density of connected devices will require flexible network solutions to manage so many connections.

Smaller manufacturers need affordable network solution implementations and maintenance. As they are enmeshed with their customers, partners, and suppliers, they need to share data securely and efficiently internally and with third parties.
Network slicing addresses many of these challenges and enables valuable use cases or manufacturing. With a network slice, the CSP can guarantee the level of reliability and control required through QoS for collaborative robots. Slices can be configured to provide high availability, with the ability to scale rapidly as needs grow. Traffic isolation enables network security to be finely tailored to meet specific requirements.

CSPs will be able to deploy these slices on a global level to provide predictable costs, and interoperability with other systems can be provided through an infrastructure layer that's shared with public services. Key use cases include AR devices enabling quality inspection and diagnosis for maintenance workers, technicians, and operators throughout a plant, remotely controlled robots, 3D video-driven interaction between collaborative robots and humans, as well as optimizing processes inside the factory.

Conclusion

Principles for fit-for-purpose net neutrality

Ericsson supports an Open Internet that allows end users to access the lawful content, applications, and services they want while enabling continued investment, customization, and innovation in the services they need.

Net neutrality regulation that is fit for purpose requires balanced rules and careful application in order to ensure the Internet remains open and continues to be a driver of innovation. Key to this innovation is the provision of tailored connectivity services to meet the needs of subscribers, service innovators, and evolving use cases.

At Ericsson we believe any policy/legislative/regulatory actions on net neutrality should be focused on delivering each of the following outcomes:

1

Consumers are able to access all lawful content, applications, and services they want

2

CSPs can **manage their networks** effectively to ensure they are safe, sustainable, and effective in meeting the needs of all users

3

CSPs are able to **provide tailored connectivity services** to meet the demands of their customers. Differentiation is encouraged while discrimination is prohibited

4

Content and service providers are able to **continue innovating to meet evolving needs** of consumers and businesses

5

CSPs are able to **develop and market tailored connectivity offerings**, e.g. through slicing or QoS differentiation by other means, that support this innovation and help power the green and digital transitions

Above all, national regulators should ensure that the implementation of net neutrality rules does not discourage or delay the development and deployment of innovative, differentiated connectivity services that will be key to supporting the digital and green transitions across industry and public services. Allowing CSPs to tailor connectivity to suit specific devices, applications, and circumstances while basic internet safeguards are in place strikes the correct balance.

Glossary

5G	5th generation mobile network
5G SA	5G Standalone
AR/VR	Augmented Reality/Virtual Reality
CSP	Communications service provider
EU	European Union
ICT	Information and Communications Technology
IoT	Internet of Things
LAN	Local Area Network
mMIMO	massive Multiple-Input and Multiple-Output
QoS	Quality of Service
WAN	Wide Area Network

References

1. We define step change 5G first as mMIMO on mid-band with gigabit capable backhaul (fiber/ microwave), which delivers a step change in capacity and throughput, which is further enhanced by adding additional spectrum bands. For example in rural areas, based on NUTS3 population density, 5G using 700MHz and 3.5GHz TDD will deliver a 6.2 – 7.2 times improvement in capacity over existing 4G LTE, a 3.4 – 3.7 times increase in average throughput, and a 2.4 – 2.5 times increase in peak throughput. If 26GHz spectrum is added, these ranges increase to 9.8 – 13.9 times (capacity), 6.2 – 7.8 times (average throughput), and 5.7 – 5.9 times (peak throughput). When Stand Alone core is deployed, the step change becomes a giant leap with a plethora of new use cases enabled, e.g. massive IoT and ultra-low latency IoT.
2. The very low latency supports highly responsive applications such as are necessary for example in smart transport, logistics, drone communications, and healthcare monitoring. Using all of the features a 5G core can support, a 5G standalone network with the spectrum and backhaul described above will achieve higher connection speeds, and provide reliable connection to a greater number of devices.
For a fuller discussion about strengthening security through network slicing, see: Resilient 5G systems - Ericsson
3. McKinsey analysis Connectivity & Climate Change
4. Example drawn from: Network slicing: Top 10 use cases to target (ericsson.com), p. 15

Authors

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Gabriel Solomon is Head of Government & Industry Relations, Europe & Latin America, responsible for shaping policy and the regulatory environment for communications technologies and step change 5G. We identify and challenge the main barriers to pervasive connectivity, advocating for policy pivots that can increase investment incentives, amplifying this with public support where appropriate, to accelerate the deployment and uptake of innovative services. We work with governments, regulators, stakeholders and industry bodies to drive solutions. Gabriel has an MBA from INSEAD and Chairs the UK Telecommunications Academy, an ITU affiliate that transfers knowledge to emerging markets through accredited academic institutions.

Jared Carlson is Ericsson's Vice President of Government Affairs and Public Policy, leading Ericsson's outreach to regulatory agencies and the Administration. Jared joined Ericsson in 2007 and his portfolio includes advocating for Ericsson's interests in the areas of Net Neutrality, spectrum for 5G and other services, broadband regulation, and many other topics. Prior to joining Ericsson, he held management positions within the Federal Communications Wireless Bureau. He joined Nextel and worked in a senior government affairs role there and Sprint-Nextel. He represents Ericsson on the Board of the United States Telecommunications Training Institute and currently co-chairs the Federal Communications Bar Association's IoT Committee.

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