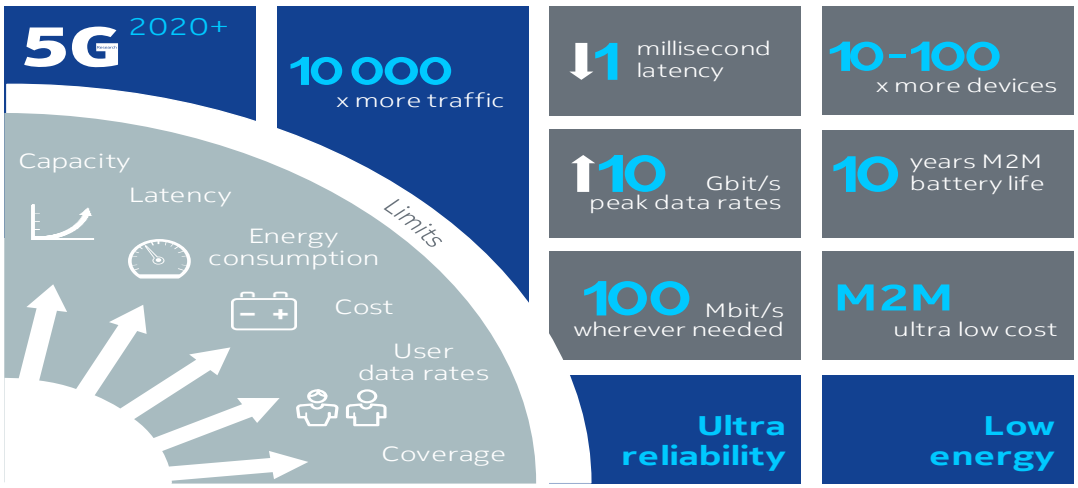
5th generation (5G) of communication networks a key enabler of the Internet of Things (IoT)

Background

Adoption of each generation of wireless technology including the current generation called 4G, or Long-Term Evolution (LTE), has been a major driver of innovation and employment in Canada and other countries. The advancement of wireless networks in 4G has enabled an advancement in mobile applications and services. The appetite of consumers, however, for a new generation of capabilities, such as self-driving cars, healthcare and fitness "wearable" technologies, and the capability to control their home environment while on the move is placing increasing demands on existing networks. For the Internet of Things (IoT) to meet any of the lofty ambitions policymakers frequently cite, a future evolution of mobile broadband networks must take place utilizing technologies and techniques that are still largely aspirational or in their early development. For the mobile broadband ecosystem that is a critical part of the IoT to develop as technologists and policymakers imagine, key technology and policy enablers are needed.

What is at stake?

- **Jobs & growth:** 5G is a key technology for many growing business sectors including software, video, gaming, data analytics, and machine-to-machine (M2M) communications.
- **Investments:** significant early investment in 5G will help close the gap in ultrafast mobile broadband between Canada and other countries.
- **Research:** sustained investment in 5G research will begin to address limitations in mobile broadband availability in rural areas.



Why 5G matters for citizens?

Demand: Consumers generate an increasing amount of mobile traffic, which necessitates more capacity and lower latency. 5G will offer an expected peak data rate higher than 10 Gbit/s compared to the 300 Mbit/s LTE can offer today, combined with virtually zero latency, meaning that the radio interface will not be the bottleneck even for the most challenging use cases.

Societal innovations. 5G will support applications and industries of the future such as innovative health care services, self-driving cars and the next generation of industry automation. 5G will mean stepping away from best effort networks towards truly reliable communication. Flexible integration of existing access technologies such as LTE and Wi-Fi with new technologies creates a design that is future proof up to 2030.

Internet of things. 5G will be designed for use cases expanding from humans to machines, requiring more of networks. 5G supports the huge growth of machine-to-machine type communication, also called Internet of Things (IoT), through flexibility, low costs and low consumption of energy. At the same time, 5G will be reliable and quick enough for even mission-critical wireless control and automation tasks such as self-driving cars.

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Energy and cost. 5G will lower costs and the consumption of energy. Energy efficiency is an integral part of the design paradigm of 5G. Virtualized and scalable technologies will further facilitate global adoption. Taking these factors together, 5G could bring Internet access to a larger group of people and things while taking important steps towards a more environmentally responsible network architecture.

Technology Challenges and Policy Enablers

The research that must be undertaken by mobile broadband equipment companies like Nokia in order to bring 5G into reality is substantial. Multiple generations of technology already deployed must work seamlessly together under the 5G umbrella that requires new approaches and capabilities, all with lower power consumption and lower deployment costs as key demands.

Intellectual property rights policy: 5G research activities become risky when genuine innovation is neither protected nor rewarded. Robust protections for intellectual property are an essential ingredient to the successful realization of 5G and the IoT. There has been a global effort by technology aggregators to limit the compensation companies can receive for standards-essential patents (SEPs) connected to standards developed by organizations like IEEE, ETSI, and 3GPP, and proprietary non-standards based patents. It is critical that Canada maintains a fair and balanced IPR framework that rewards investment in R&D given the scale of the effort needed to deliver 5G technologies.

Spectrum needs: Additional radio spectrum for mobile networks needs to be allocated and put into use quickly to meet the increased capacity and coverage demands of 5G. This means looking at new spectrum bands such as millimeter wave and centimeter wave, and using available spectrum more efficiently. Significant efforts in the United States and other markets to free low-band (below 3 GHz) and mid-band spectrum (3-24 GHz) for mobile broadband use increases the importance on Canada similarly considering opportunities in these bands in addition to millimeter wave (24 GHz and above).

Density: 5G we will need to use many more base stations to meet the performance needs of future applications. These dense networks will be deployed as heterogeneous networks, combining macro sites with smaller base stations and using a range of radio access technologies including LTE-A, Wi-Fi and any future 5G technologies.

Siting: The need to densify network infrastructure deployments that involve the location of potentially hundreds of thousands of new small cells and related technologies will increase pressure on local governments to review applications for siting. In the United States, lack of consistent local processes, high fees charged for access to rights-of-way, and in some cases moratoria on deployment of small cells has dramatically slowed the deployment of advanced LTE and early 5G capable technology. Canada should consider a national policy framework of best practices that local governments can look adopt to speed consideration of siting applications and the ultimate availability of 5G.

Performance: In 5G the best possible network performance will not be just about peak speed. There will be a wide range of performance measures to meet individual requirements imposed by each use case. Some real-time applications, such as driverless cars, will require virtually zero latency, while others, such as 3D video capture, will be more tolerant to latency but will require high capacity upload instead.

Recommendations for policy makers

- Allocate more spectrum quickly, and put a plan in place for spectrum for mobile broadband between 600 MHz and 100 GHz.
- Protect R&D incentives with a balanced intellectual property rights framework.
- Pursue opportunities to reduce barriers to deployment such as wide disparities in local siting practices for small cell and related technologies by providing recommended practices to local governments.
- Consider national policy framework and possible fiscal stimulus for early deployment projects related to 5G including for use in connected health, intelligent transportation, and SmartCities.

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