

Broadband for all

- a trusted base for the digitalization of our societies

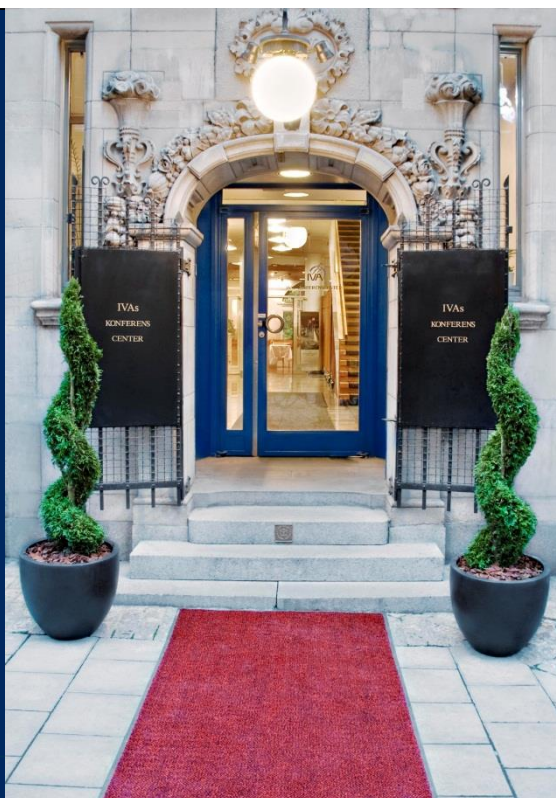
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Welcome to Stockholm on
June 26-27, 2017

Broadband for all

- a trusted base for the digitalization of our societies



Seminar

June 26-27, 2017
Stockholm

Location

Royal Swedish
Academy of
Engineering
Sciences (IVA)
Grev Turegatan 16
Stockholm

- In a 5G context with transforming industries and societies, what new requirements will emerge on spectrum regimes and network regulations?
- How will digitalization impact the transportation system and what are the key policies to support the developments?
- What are the perspectives and best practices for successful broadband policies and regulations?
- In 2016, the seminar gathered 100 Government & Regulator representatives from 33 countries on all continents.

With contributions from the following speakers



Dan Sjöblom
Director-General
PTS, Sweden



Peter Eriksson
Minister for Housing and
Digital Development,
Sweden



Ajit Pai
Chairman
FCC,
United States



R S Sharma
Chairman
TRAI, India



Ulf Ewaldsson
SVP, Business Area
Digital Services,
Ericsson

Seminar – Morning session

Monday June 26, 2017

08:00 - 08:30

Registration and morning tea - networking

08:30 - 10:30

Welcome and introduction

- Ulf Pehrsson, Vice-President Government & Industry Relations, Ericsson

Keynote: Perspectives from Sweden

- Peter Eriksson, Minister for Housing and Digital Development, Sweden

Keynote: Perspectives from United States

- Chairman Ajit Pai, FCC, United States

Keynote: Perspectives from India

- Chairman R S Sharma, TRAI, India

Keynote: Digitalization for the Networked Society

- Ulf Ewaldsson, Senior Vice-President, Business Area Digital Services, Ericsson

10:30 - 11:00

Coffee break - networking

11:00 - 12:00

Panel debate: How will digitalization impact the transportation system and what are the key policies to support the developments?

Chair: Maria Håkansson, Vice-President, Internet of Things, Ericsson

- Jan-Bert Dijkstra, Director, Program "Optimizing use", Ministry of Infrastructure and the Environment, Directorate-General for Mobility and Transport, the Netherlands

- Åsa Vagland, Deputy Director, Division for Transport and Society, Ministry of Enterprise and Innovation, Sweden

- Rainer Schnepfleitner, Department Head Regulation Affairs and Competition, CRA, Qatar

12:00 - 13:30

Lunch - networking

Seminar – Afternoon session

Monday June 26, 2017

13:30 - 15:30

Broadband for all in Sweden

- Dan Sjöblom, Director-General, PTS, Sweden

Broadband for all in Taiwan

- Nicole Chan, Chairperson, NCC, Taiwan

Broadband for all in Nigeria

- Sunday Dare, Executive Commissioner, NCC, Nigeria

Investment strategy and the 5G Action Plan

- Philippe J. Lefebvre, Head of Sector, 5G Deployment Strategy, DG CONNECT, European Commission

15:30 - 16:00

Coffee break - networking

16:00 - 17:00

Panel debate: In a 5G context with transforming industries and societies, what new requirements will emerge on spectrum regimes and network regulations?

Chair: Lasse Wieweg, Director, Government & Industry Relations, Ericsson

- Martin Proulx, Director-General, Spectrum, Information Technologies and Telecommunications (SITT), Canada

- Arturo Robles, Commissioner, IFT, Mexico

- Nicola Shorland, Head of Department, Strategy division, ANFR, France

- Le Van Tuan, Deputy Director General, ARFM, Viet Nam

17:00 – 17:10

Concluding remarks

- Ulf Pehrsson, Vice-President Government & Industry Relations, Ericsson

17:30 – 21:00

Dinner networking cruise on M/S Blue Charm. Boarding: Strandvägen, Quay 17 at 17:30. Departure 18:00 sharp.

Bilateral meetings

Tuesday June 27, 2017

We are pleased to offer a number of activities that you can select from to match your interests and thereby ensure maximum value of your visit to Stockholm. On request we can also arrange for other meetings to respond to specific needs.

Your individual program will be created based on your choice of activities:

- Bilateral meeting with the **Swedish Regulator PTS**
- Dialogue about the **ITU leading up to the WRC-19**
- 40 min bilateral meetings with **Ericsson experts** in the fields of spectrum, technology and cyber security & privacy
- A three hour **Technology Briefing** including technology demonstrations
- A one and a half hour **PTS Seminar** on spectrum
- A two hour **Workshop** on Cyber-security issues in a 5G & IoT context

09:00 – 17:00 PTS Headquarter	PTS bilateral meeting – regulations (general) - Dan Sjöblom, Director-General, PTS
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08:00 – 09:00 Room: Operation Center	Dialogue about the ITU study period leading up to the WRC-19 - Håkan Ohlsén, Director, Spectrum and Radio Technology Strategy, Ericsson - Lasse Wieweg, Director, Government & Industry Relations, Ericsson
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09:00 – 12:00 Room: Jeanne	PTS bilateral meeting – regulations (spectrum) – 40 min - Jonas Wessel, Director of Spectrum Department, PTS - Bo Andersson, Chief Economist, PTS
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09:00 – 12:00 Room: Diana	Bilateral meeting – Meet Ericsson's Cyber-security & Privacy technical experts – 40 min - Mats Nilsson – Securing mobile infrastructure & PPP industrial collaboration - Patrik Ekdahl - IoT End to end security - Patrik Palm and Dario Casella: Privacy by design
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09:00 – 17:00 Room: Niklas	Bilateral meeting – Spectrum & technologies – 40 min - Håkan Ohlsén, Director, Spectrum and Radio Technology Strategy, Ericsson - Lasse Wieweg, Director, Government & Industry Relations, Ericsson
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12:00 – 13:00	Lunch is served at the Ericsson Studio
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12:15 – 12:45 Room: Aashika	Lunch presentation: India's Digital Identity Platform, a.k.a. 'Aadhaar' - Chairman R S Sharma, TRAI, India
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PTS

Valhallavägen 117
Stockholm City

Ericsson

Ericsson Studio
Grönlandsgatan 8
Kista, Stockholm

5G Technology briefing

Tuesday June 27, 2017

Ericsson

Ericsson Studio
Grönlandsgatan 8
Kista, Stockholm

Room:
Forum

09:00 - 12:00

A digital transformation is taking place in almost every industry. 5G will expand the broadband capability of mobile networks and help consumers and enterprises boost the efficiency of their lives and their business. New business models using distributed cloud services and programmable networks will allow an unprecedented level of information sharing and collaboration among all kinds of industries. The result is an unprecedented capacity for individual empowerment, entrepreneurship and innovation as well as a vehicle for entire industries to transform, that gives rise to a new era - The Networked Society.

This transformation will put new demands on the networks, with requirements varying radically between different use cases but also between different devices. The not so distant 5G mobile network systems – will provide global, wireless, connectivity with superior performance for people and machines, with capabilities to handle very large data rates and data volumes, while being very reliable to allow for critical industrial and societal applications. The 5G systems also need to accommodate for IoT devices with limited capabilities where device cost, power consumption or coverage (range) are among the key properties.

This briefing will address the latest developments in 5G research & standardization, as well as, offer insights into some early 5G trials supporting the transformation of industries.

08:30 - 09:00	Registration and morning tea
09:00 - 09:10	Welcome and introduction - Mikael Halén, Director, Government & Industry Relations, Ericsson
09:10 - 10:00	5G for the transformation of industries - Peter de Bruin, Master Researcher, Ericsson Research, Ericsson - Erik Josefsson, Head of Industry & Society Business Innovation, Ericsson
10:00 - 10:15	Coffee break and networking
10:15 - 10:55	5G technology research & standardization - Magnus Frodigh, Research Director, Ericsson Research, Ericsson
10:55 - 12:00	Technology demonstrations - Live Robots in 5G – Low latency - 5G on 28 GHz - Antennas for 5G - Gbit speeds in 4G - Cellular for Massive IoT - ITS - Dialogues on: Ericsson Mobility Report, Consumer Research, Smart Cities and Corporate Responsibility & Sustainability
12:00 - 13:00	Lunch is served at the Ericsson Studio

PTS Spectrum seminar

Tuesday June 27, 2017

Ericsson

Ericsson Studio
Grönlandsgatan 8
Kista, Stockholm

Room:
Operations Center

13:00 - 14:30

Sweden is one of the leading countries when it comes to progressive spectrum management. The Swedish market is in many regards unique even though it shares many regulatory challenges with the rest of the world. The Radio Spectrum Policy Group (RSPG) is the key EU advisor consisting of the relevant authorities from all 28 EU member states.

5G is one of the key areas of work for European spectrum managers, both nationally, regionally and globally. During this seminar PTS will share the latest news and information on what is happening on EU and national level when it comes to spectrum to enable 5G. There will also be time for a Q&A session.

- The need for harmonization and long term policy on spectrum issues
- Spectrum for 5G on national, regional and global level
- Identification of spectrum related challenges such as spectrum sharing, usage and licensing
- The Swedish large scale 5G test and trial plan

13:00 - 13:30	Jonas Wessel, Director of Spectrum Department, Swedish Post and Telecom Authority, PTS Vice Chairman Radio Spectrum Policy Group, RSPG
13:30 - 14:00	Bo Andersson, Chief Economist, Swedish Post and Telecom Authority, PTS Rapporteur RSPG working group on 5G
14:00 - 14:30	Q&A and discussion

Workshop:

Cyber-security in a 5G and IoT context

Tuesday June 27, 2017

Ericsson

Ericsson Studio
Grönlandsgatan 8
Kista, Stockholm

Room:
Hiba

13:00 - 15:00

Two topics will be discussed:

- Security not just the icing on the cake
- IoT a game changer for Cyber-security

Moderator: Rene Summer, Director, Government & Industry Relations, Ericsson

Introduction: Rene Summer: (5 min)

Presenter #1: Security not just the icing on the cake: Keijo Mononen, Director, Network Security, Ericsson (30 min)
QA 20 min

Presenter #2: IoT a game changer for Cyber-Security: Bodil Josefsson, Engagement Lead Security, Ericsson (30 min)
QA 20 min

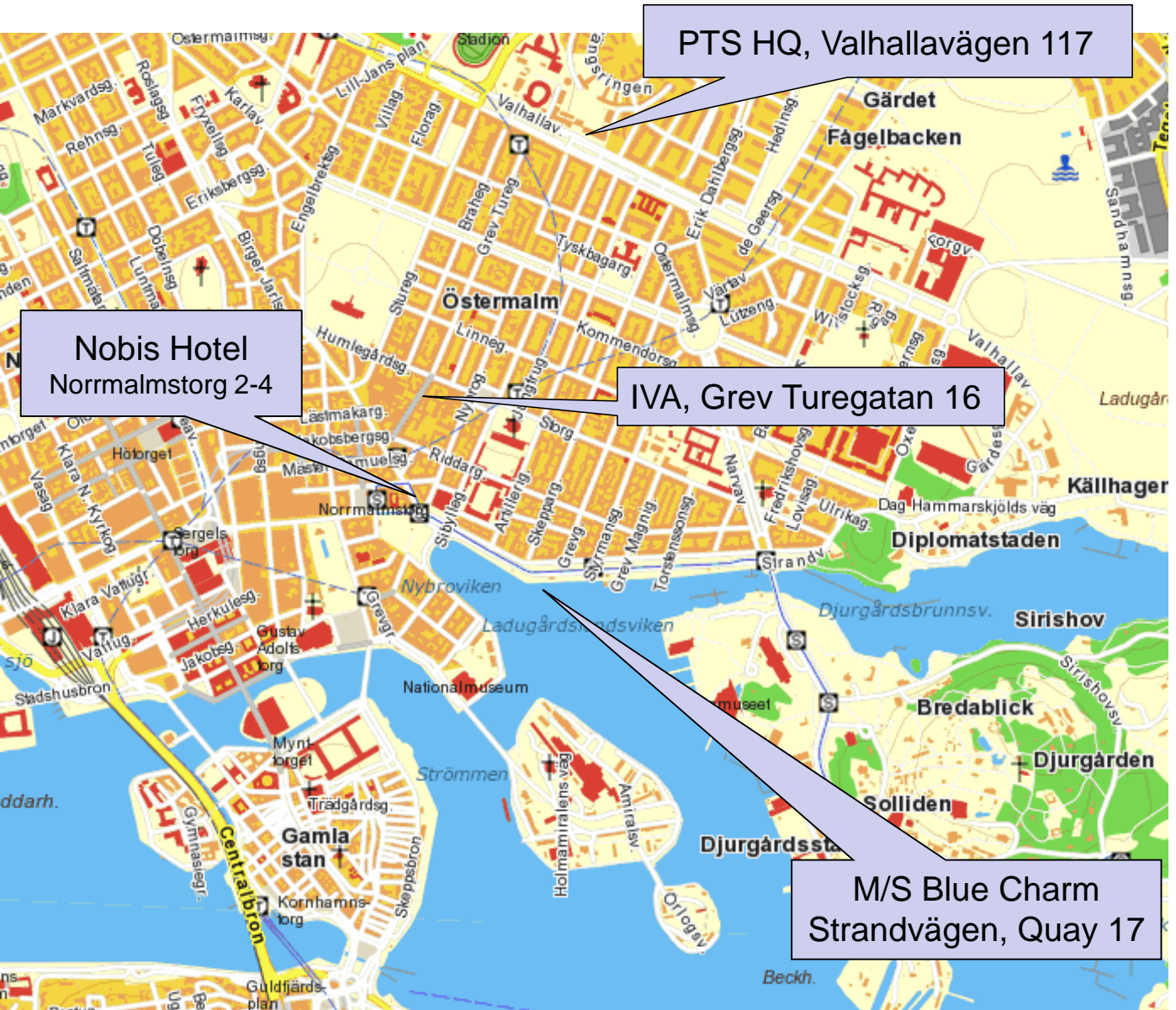
Conclusions: Rene Summer, Director, Government & Industry Relations, Ericsson (5 min)

Chatham House Rule

The program is arranged by Ericsson

Stockholm City

Appendix 1



Ericsson, Kista

Contacts:

Address: Grönlandsgatan 8, Kista

Mikael Halén

+46 70 267 0309 (mob)

Mia Lund

+46 70 267 4891 (mob)

Katarina Thörnberg

+46 76 335 5623 (mob)

PTS, Stockholm

Contact:

Address: Valhallavägen 117, Stockholm City

Ola Bergström

+46 70 290 5877 (mob)

Ericsson Studio in Kista

Appendix 1



GRÖNDALSGATAN 8 (BUILDING 16), 164 80 KISTA, STOCKHOLM. TEL. +46 10 71 44 880

Ericsson, Kista

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Mikael Halén

+46 70 267 0309 (mob)

Mia Lund

+46 70 267 4891 (mob)

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+46 76 335 5623 (mob)

Broadband for All in Taiwan

National Communications Commission

Nicole Chan

2017.06.26

Content



Broadband
Market



Universal
Service



Future Plans
& Strategies



Regulatory
Paradigm Shift



WEF Network Readiness Index (2016)



Mobile network coverage



國家通訊傳播委員會
National Communications Commission



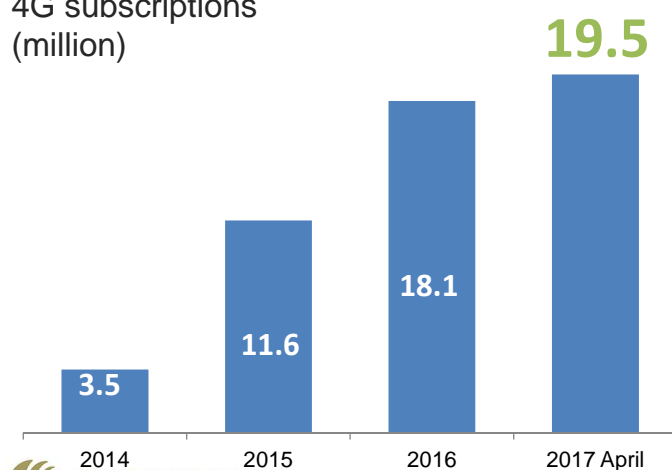
Internet and telephony
competition

3



Broadband Market in Taiwan - 4G mobile

4G subscriptions
(million)



國家通訊傳播委員會
National Communications Commission



Penetration rate

83%



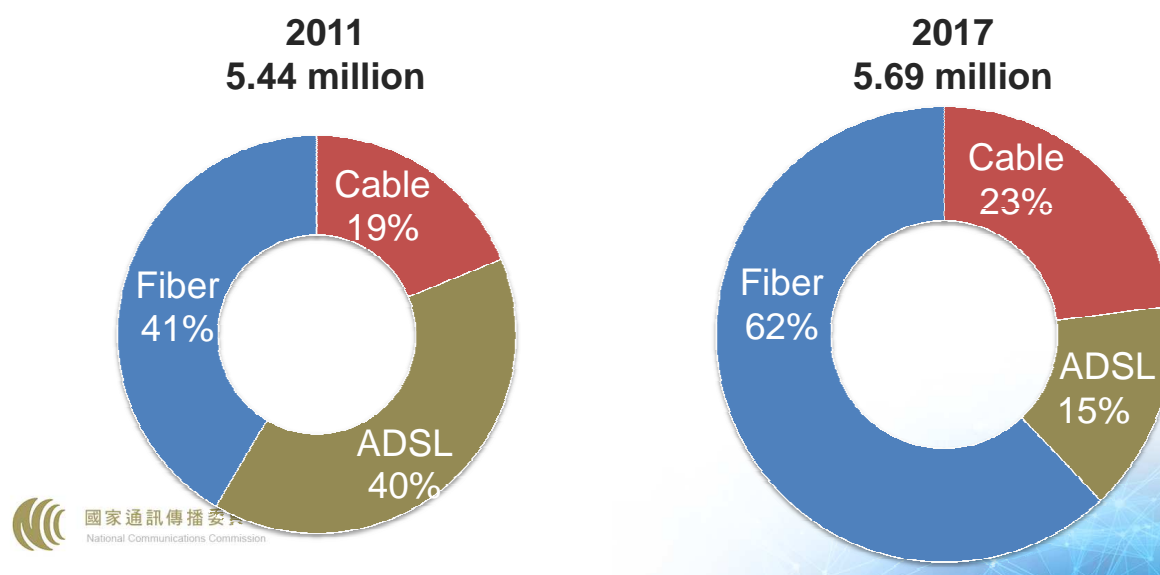
Population coverage

93~99%

4

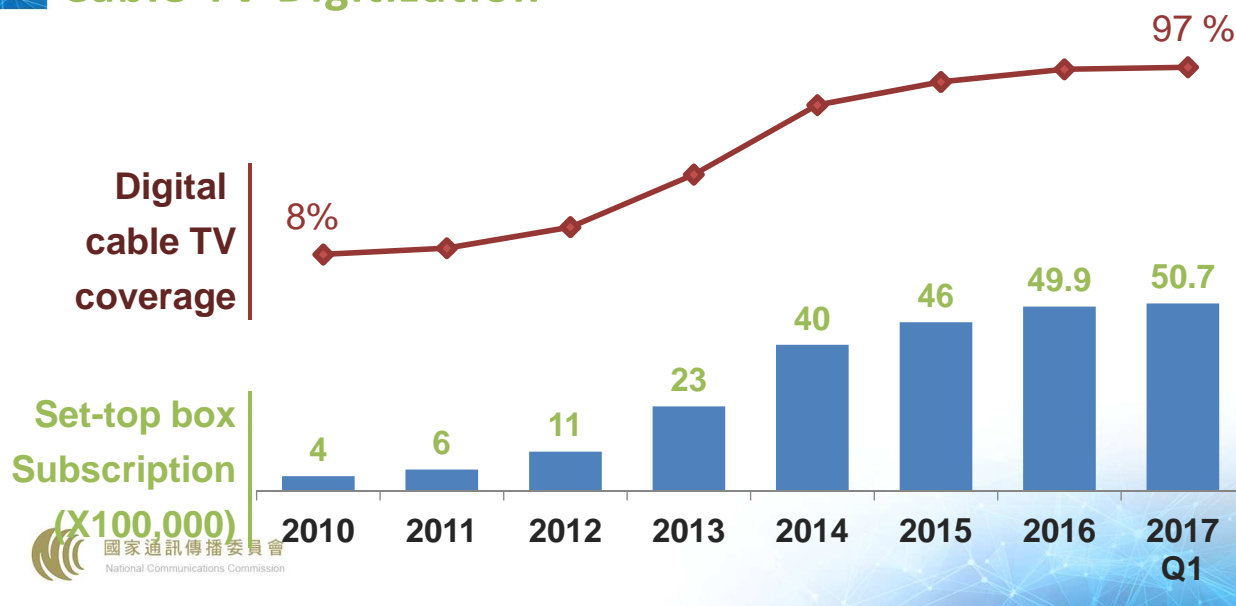
Broadband Market in Taiwan

- Fixed Broadband Subscription



Broadband Market in Taiwan-

Cable TV Digitization



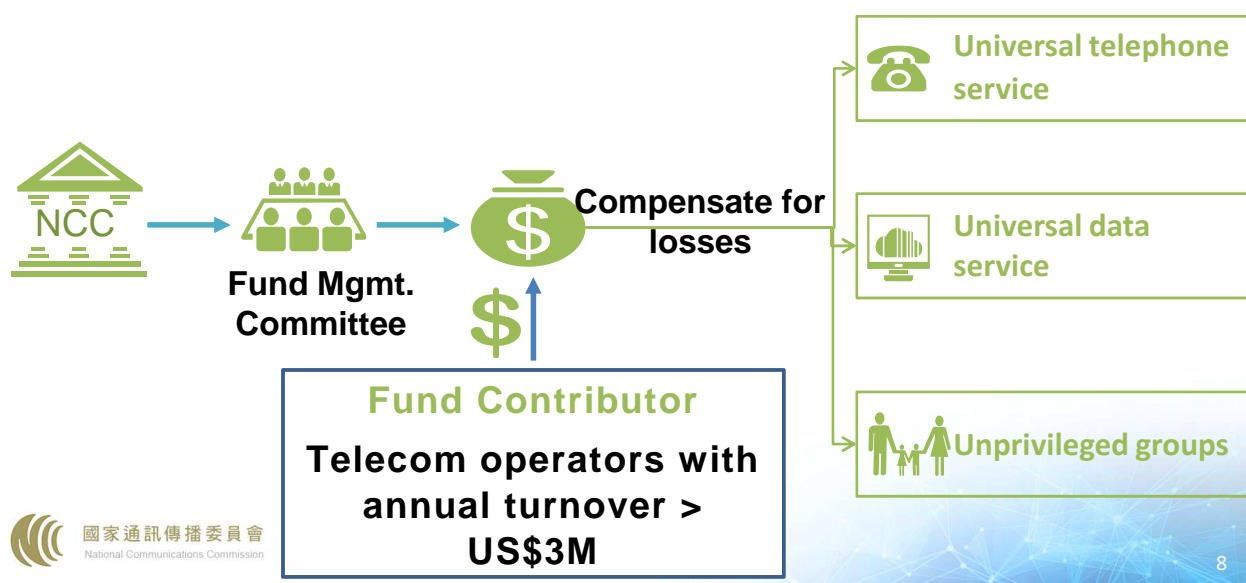


Universal Service

7



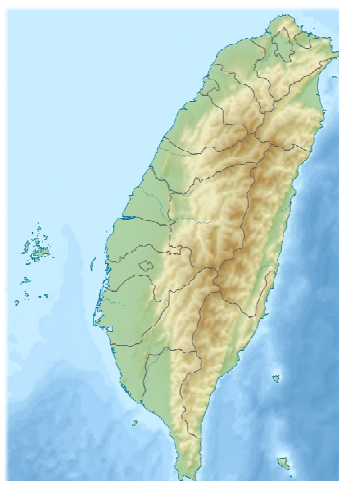
Universal Service Fund



8



The Challenge of Rural Coverage



	population (million)	Area (km ²)
Taiwan	23.54	36,200
Rural area	0.8 (3%)	21,333 (60%)



Policy Goals



**Promote reasonable
prices**



**Increase
broadband coverage**



Optimize QoS



Broadband for elementary schools and libraries

100 Mbps

All the elementary schools of the off-shore islands are connected to 100Mbps fiber network.

100 %

All the elementary schools and libraries are connected to a fiber network.



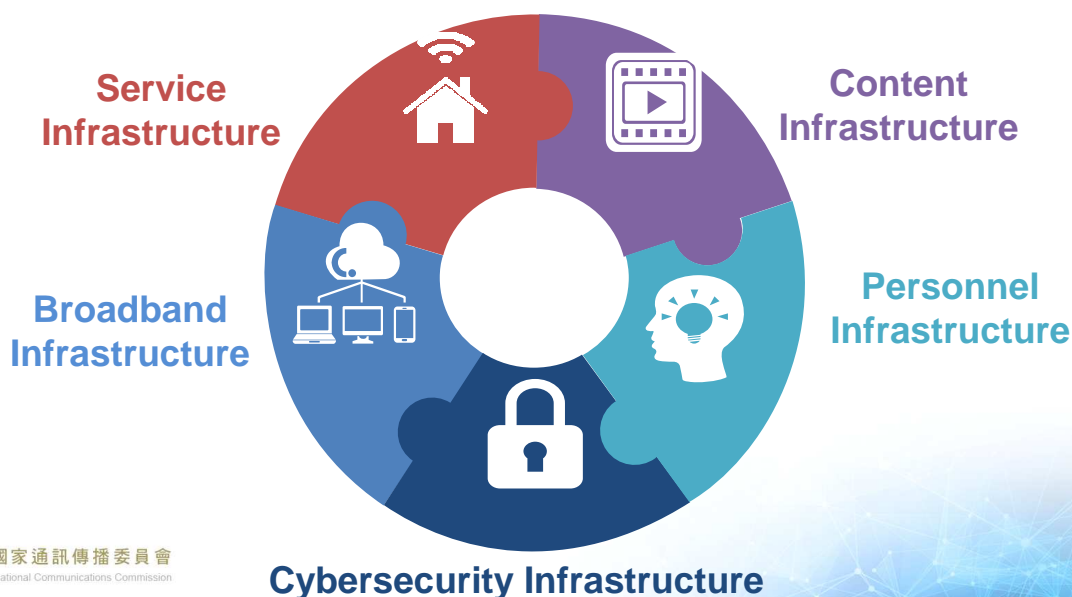
**Future Plans
& Strategies**



13



Forward-Looking Digital Infrastructure Program



14



Goals of DIGI+ (2020)

1 Gbps

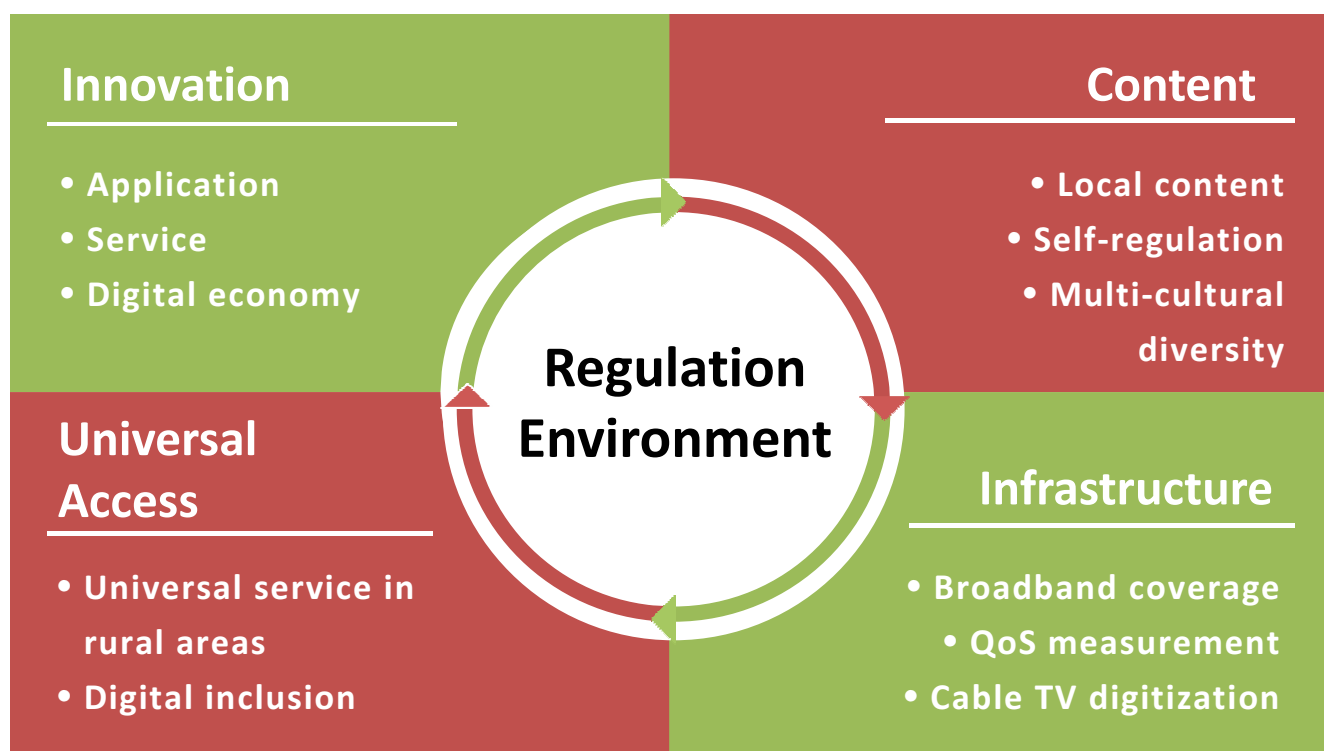
**Connection
speed of
households**

10 Mbps

**The minimum
connection
speed of
underprivileged
households**

60 %

**Penetration rate
of digital life
service**



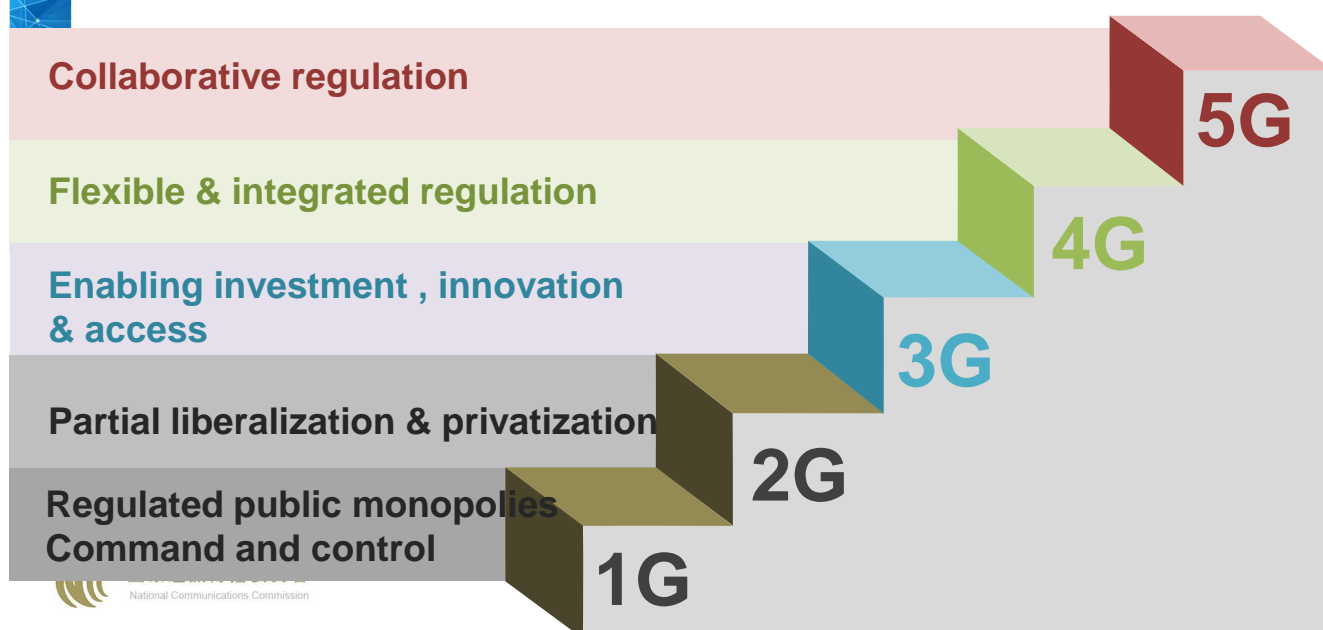


Regulatory Paradigm Shift

17



Paradigm Shift of ICT Regulatory Environment





Digital Communications Act (Draft)

Proper use of network



- Traffic management
- Technology neutral
- E-message



Network environment



- Information security
- Communication secrecy
- Cross-border data flow

Consumer protection



- QoS requirement
- Service information disclosure

Responsibility of service providers



- Disclaimer clauses
- Terms of service

19



Telecommunications Management Act (Draft)

Service

Promote effective competition and innovation

Network

Promote quality and secure network

Resource

Secure effective use of spectrum and numbers



20



Conclusion

Broadband Access

Availability
Affordability
Accessibility

Innovative Economy

**Promote broadband
as an important
basis for driving the
digital service
economy**

Digital Nation

**Raise Taiwan's
standing in the
global ICT sector**

Seminar "Broadband 4 All"

*- a trusted base
for the
digitalization of
our societies*

Stockholm
26 June 2017

*Philippe J. Lefebvre – Head of Sector, 5G Deployment,
DG CONNECT, European Commission*



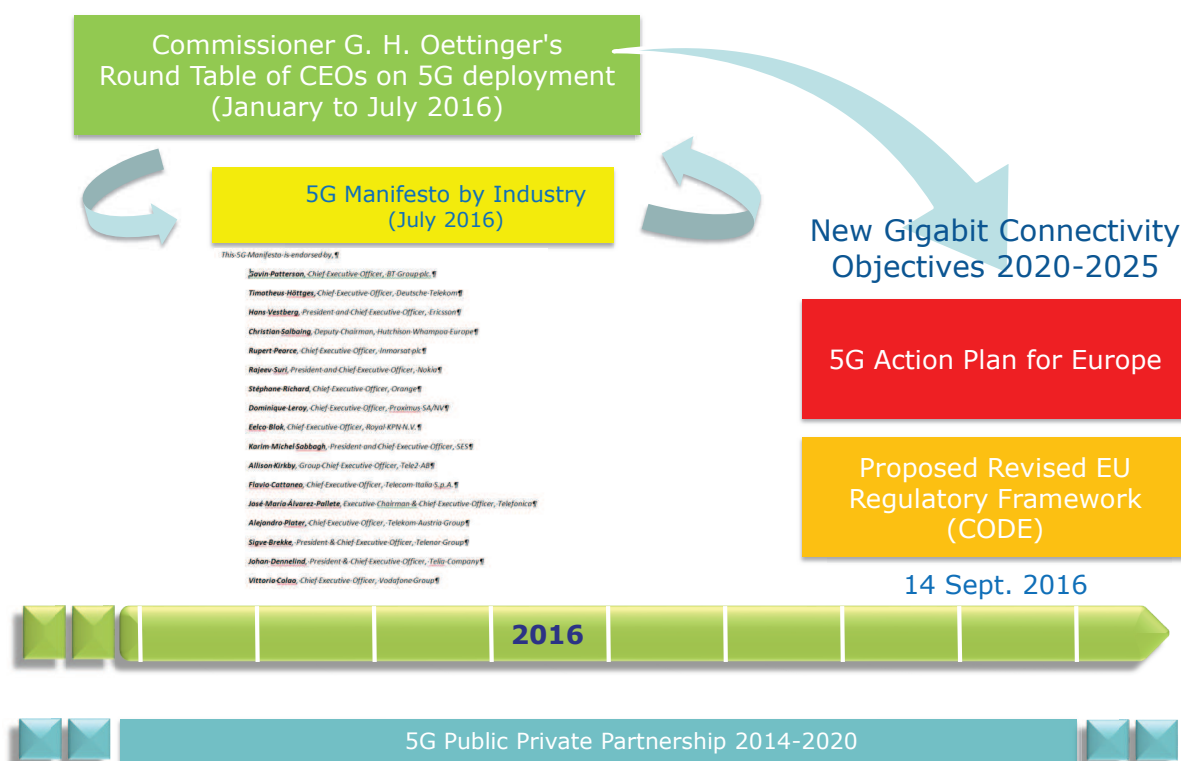
Why an EU Policy about 5G ?

EU Digital Single Market (DSM)

Pillar

5G Connectivity Infrastructure (fixed+mobile)

- ✓Connectivity as a competitive advantage
- ✓Key to "digitise" economy and society (vertical industries)
- ✓Potentially critical infrastructure



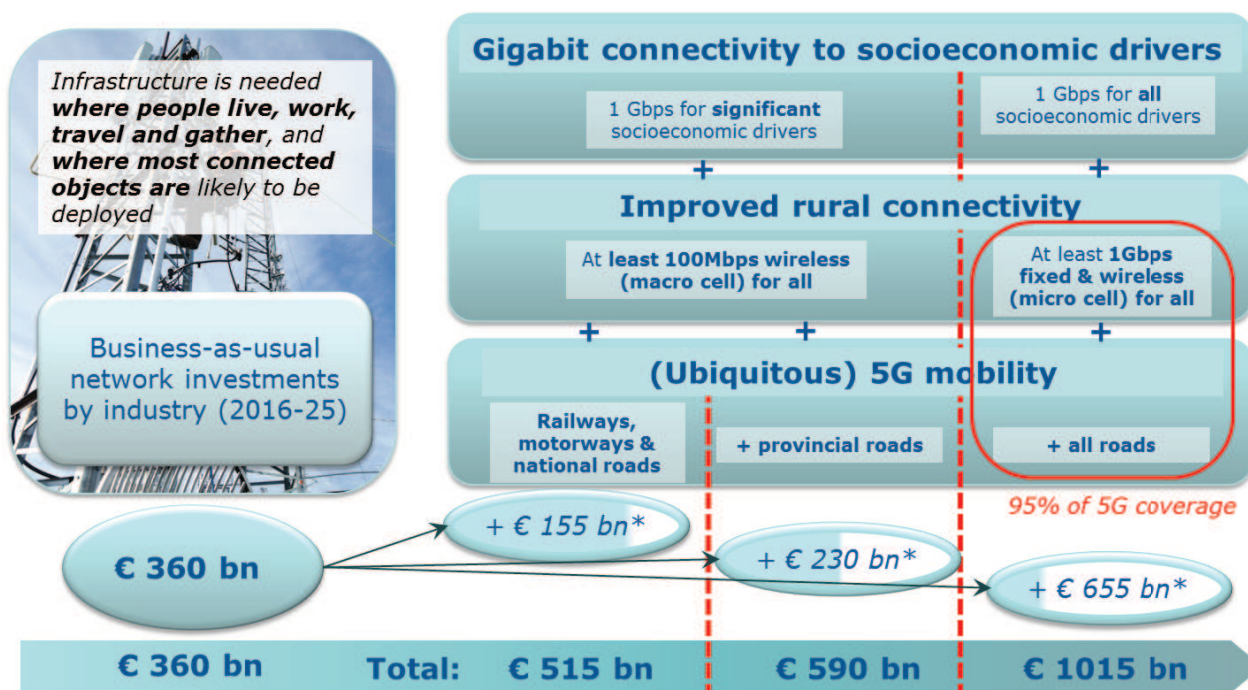
3 strategic connectivity objectives for 2025

1. All main socio-economic drivers should have access to extremely high - gigabit – connectivity
2. All urban areas and major roads and railways should have uninterrupted 5G coverage and 5G should be commercially available in at least one major city in each EU Member State by 2020
3. All European households, rural or urban, should have access to connectivity offering a download speed of at least 100 Mbps

To be met by 3 main new measures

1. A new European Electronic Communications Code and BEREC Regulation to help build future networks
2. An action plan for 5G
3. WiFi4EU

Estimated cost of coverage options



5

Regulatory incentives to rollout 5G

1

Electronic Communications Code and BEREC Regulation

Modernisation of current telecoms rules to drive investment

Increased competition and predictability for investments:



- **Market regulation** only where **end-user interest** requires it and where operators' commercial arrangements **don't** deliver **competitive outcomes**
- **Reduced regulation** where **rival operators co-invest** in very high-capacity networks & easier for **smaller players** to be part of investment projects
- Making **investment case more predictable** for "first movers" who **take the risk** to invest in less profitable areas, such as rural areas

Better use of radio-frequencies:



- **Long licence durations**, coupled with more stringent requirements to use spectrum effectively and efficiently.
- **Coordination of basic parameters** such as the timing of assignments to ensure timely release of spectrum to the EU market
- More **converged spectrum policies** across the EU

6

2

Action plan for 5G

Common roadmap for a coordinated deployment of 5G in 2020

"Keeping the EU ahead of the race"

- ✓ Common EU calendar / coordinated national plans for commercial launch
 - ✓ **Communication Committee of Member States (CoCom) to implement coordination**

"A 5G-ready Europe" - strategic pre-requisites:

- ✓ Availability of spectrum - fast track for EU spectrum decisions re. 5G
- ✓ Availability of fibre connectivity – fibre capacity for 5G backhauling
- ✓ Reducing the cost of 5G deployment (emission limits, local taxes,)

"5G in support of Growth"

- ✓ Commission as facilitator of cross-sectoral business synergies
- ✓ Innovative ecosystems and collaboration (5G Venture Financing Initiative)
- ✓ Pan-European 5G trials / pilot projects (Connected Driving Corridor...)

"Preserving 5G Global Interoperability for consumers"

- ✓ Promote common global standards

-> **Open challenge:** Application Net Neutrality

7

A "taste of 5G" to All!

3

WiFi4EU

Free Wi-Fi for Europeans in public spaces

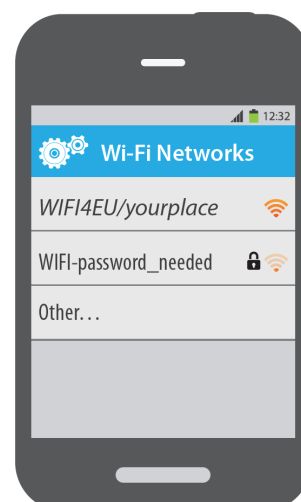
- **120 million of EU investment** for interested local authorities to offer free Wi-Fi in public spaces

➡ At least **6000 to 8000 local communities**

➡ **49-50 million connections per day**

➤ How will it work?

- The **EU** to fund the equipment & installation with **vouchers**; public bodies to pay monthly subscription & maintenance
- Local **communities** need to commit to **providing very high speed internet** via WIFI4EU, and that they are not competing with a similar, existing private or public Wi-Fi offer



8

Outstanding regul

Common roadmap for a coordinated deployment of 5G in 2020

Application Net Neutrality

- ✓ Common EU calendar / coordinated national plans for commercial launch
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"Preserving 5G Global Interoperability for consumers"

- ✓ Promote common global standards

9

Implementation is everything!



Contact: philippe.lefebvre@ec.europa.eu

Broadband for all – the Swedish experience

Dan Sjöblom

Director-General Swedish Post and Telecom Authority

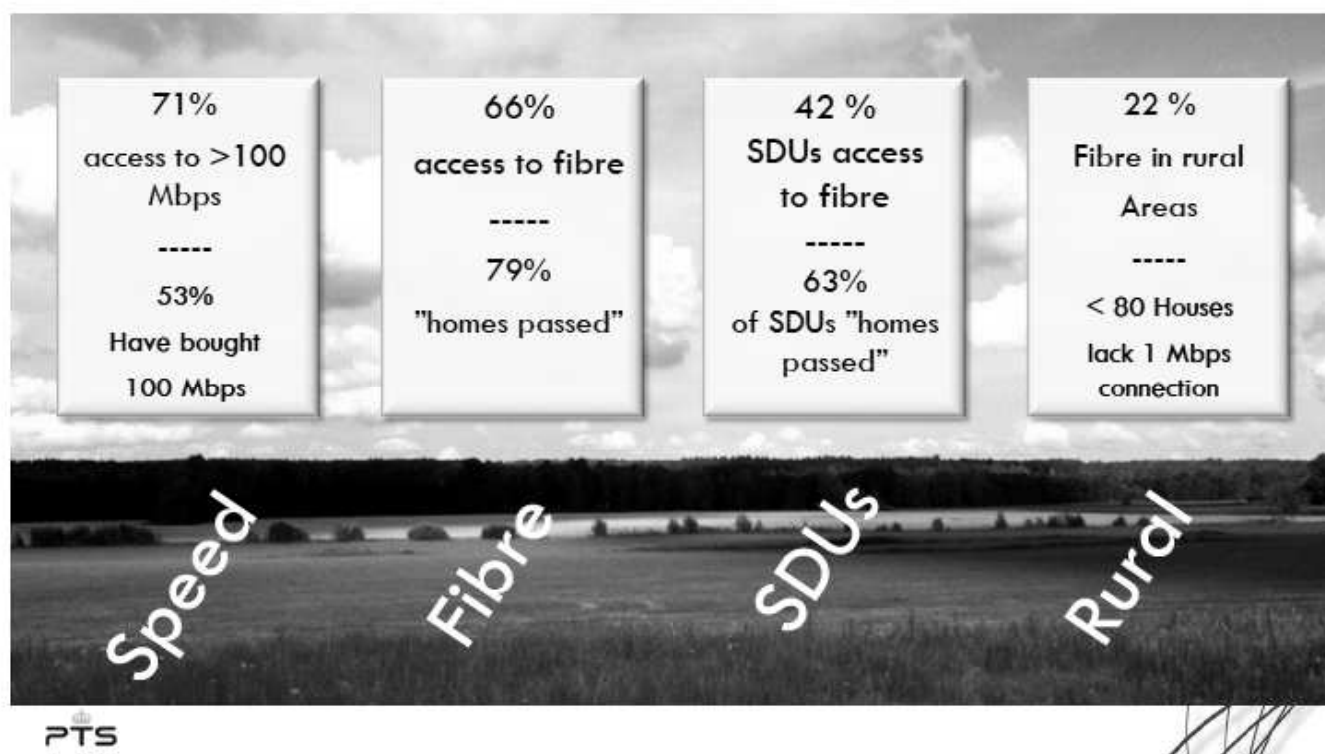


Where we are now...

- A snapshot from the Swedish market

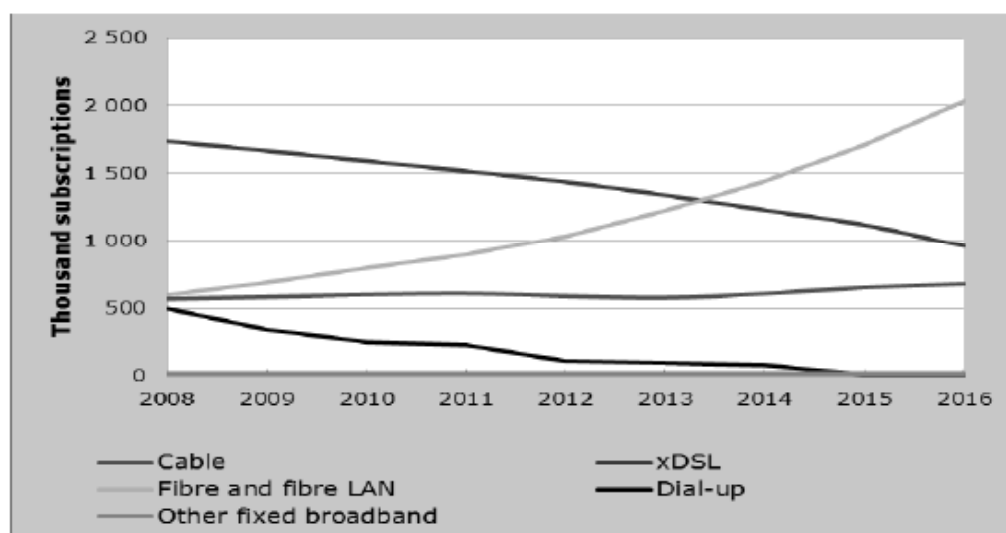


Fixed market

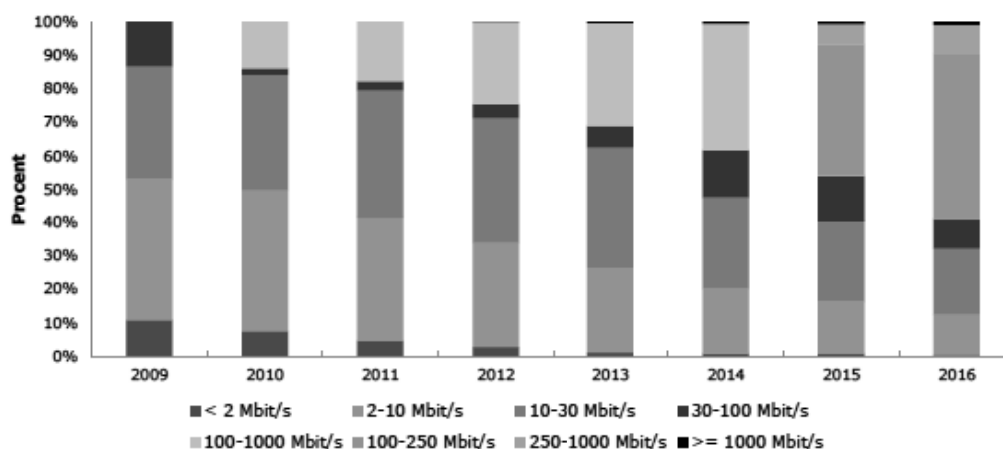


Fixed broadband

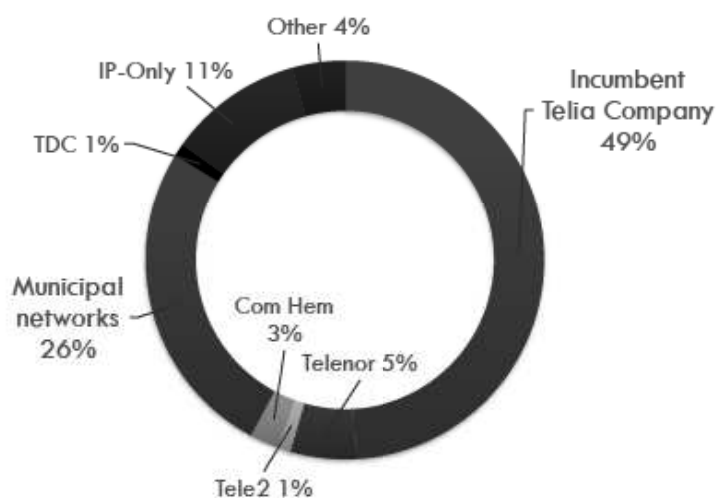
Fibre (LAN) continues to grow



More than half of all fixed subscriptions are +100 Mbit/s



Investments in fixed infrastructure by different market actors



Source: Annual reports

Mobile market



Wireless access in Sweden

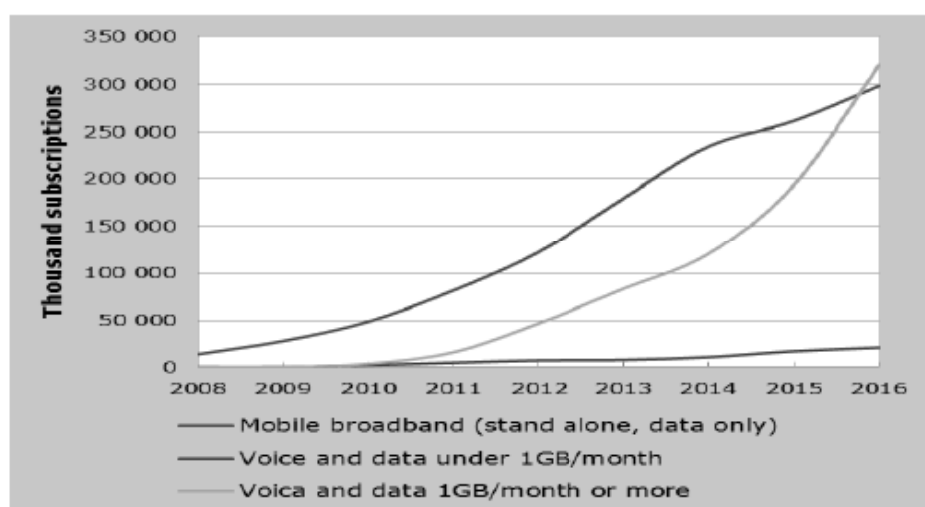
77 % area coverage from wireless services with 10 Mbps or more

99,98 % of households has access to LTE wireless broadband.

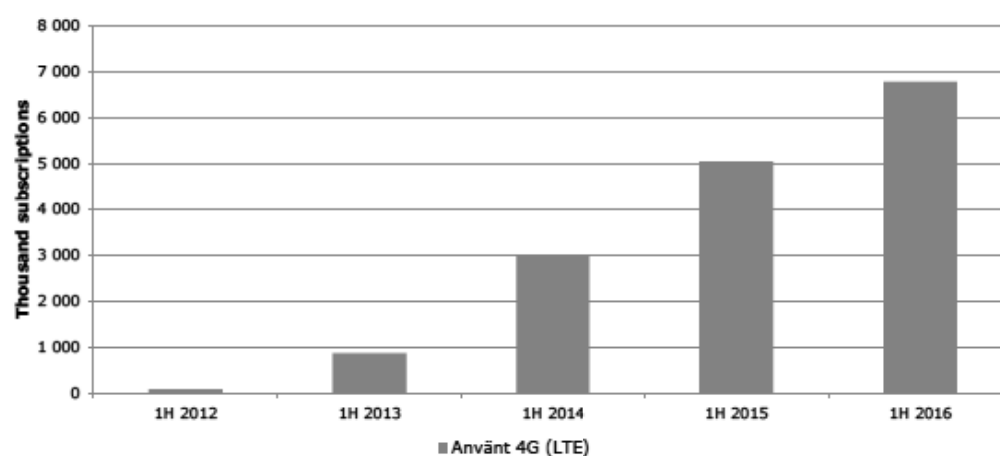
91% had access to 30 Mbps – the EU goal is that all households and business should have that access by 2020



Continued growth in mobile data traffic



4G subscriptions continue to grow



We have seen...

- The convergence of networks into an All-IP network
- Traditional physical services becoming digital
- This has presented challenges for traditional business models and regulation



Inclusion of all as a vision

Exclusion

**Access
Accessibility**



Geographical differences

MDU 100 % access
to fibre



SDU 42 % access to
fibre



22 %
fibre in
rural
areas

65 %
fibre in
urban
areas



PTS

W

Rural challenge

Rural Areas
3,5
pers/km²

Urban Areas
1500
pers/km²

PTS

W

Success factor- The Swedish Broadband Forum Cooperation among actors



Regional and
local associations



Market
players



Government
stakeholders



Remaining challenges when everyone has a broadband connection

- **Network resilience**
 - A digital society is depending on networks and services available and accessible at all times.
 - Stronger regulatory demands on the network operators in terms of network security and resilience.
- **User integrity**
 - Personal information is a commodity in a digital world. More focus on how service providers and network operators handle our information.
- **Accessibility**
 - Everyone should be able to use the digital services. Elderly, people with disabilities and those still not interested in using the Internet.







Broadband For All – the Nigerian Experience and Case Study

by

Prof. Umar Garba Danbatta, FNSE, FRAES

Executive Vice Chairman/Chief Executive Officer
Nigerian Communications Commission

Represented by Mr Mohammed Chubado Babajika
Deputy Director, Licensing & Authorization

A Presentation to the Broadband for all Seminar (BB4All)
Stockholm, Sweden

26 June 2017



Outline

- ▶ **Executive Summary**
- ▶ **Introduction**
- ▶ **Setting our Goals and Priorities**
- ▶ **Implementation Action Areas**
- ▶ **Current Position and Future Prospects**
- ▶ **Conclusion**





Executive Summary

- ❖ We have been asked to present Nigeria's Broadband experience as a “Case Study” for discussions.
- ❖ We will therefore share experiences and learnings leading to our current position – we will highlight opportunities and prospects in Nigeria (Africa's largest economy) and seek your perspectives on areas of improvement.
- ❖ Our goal is the delivery of ubiquitous, affordable, always-on high-speed internet to all Nigerians, and we continue to record appreciable milestones towards this ideal – our mobile Broadband penetration is currently app. 21%, and app. 47.44% of our citizens regularly access the internet. These figures continue to grow, as we work towards “democratising” the availability of Broadband infrastructure.
- ❖ Our successes so far were achieved through the combination of a friendly regulatory regime, an intensive & all-inclusive policy process, targeted implementation and comprehensive evaluation.
- ❖ We are now focusing on closing the physical infrastructure gap, making required spectrum resources available and providing a supportive ecosystem to enhance private sector-led investment and growth.
- ❖ All these are being done within the framework of the National Broadband Plan (2013), the NCC's Strategic Vision & 8 point agenda (2015), as well as Nigeria's Economic Recovery and Growth Plan (2017).



Introduction

- ❖ As the ITU has correctly noted, *“In the 21st century, the social and economic development of every country on earth will depend on Broadband networks”**.
- ❖ Studies have also shown that *“every 10% increase in broadband penetration in developing countries results in a commensurable increase of 1.3% in GDP”***.
- ❖ The Federal Government of Nigeria therefore recognizes that Broadband networks are a **basic national infrastructure** – just like transport, energy and water networks.
- ❖ At the NCC, we also see Broadband networks as the *“infrastructure of infrastructures”* whose widespread availability will completely transform the way essential services are delivered – from e-health to e-education to e-banking to e-commerce to e-government – thus helping meet the Sustainable Development Goals in every sector.



Introduction

- ❖ Build an efficient national broadband networks and everything else will follow:
 - ❖ The ability to control and use energy more efficiently.
 - ❖ The ability to manage healthcare in poor, or isolated populations.
 - ❖ The ability to deliver the best possible education to future generations.
 - ❖ The ability to take better care of our environment.
 - ❖ The ability to streamline transport networks.
 - ❖ And, crucially, the ability to help meet the Sustainable Development Goals
- ❖ So, Nigeria's first step was to establish very clear strategies and milestones for its journey towards national availability of **affordable, accessible and available** Broadband infrastructure and services.

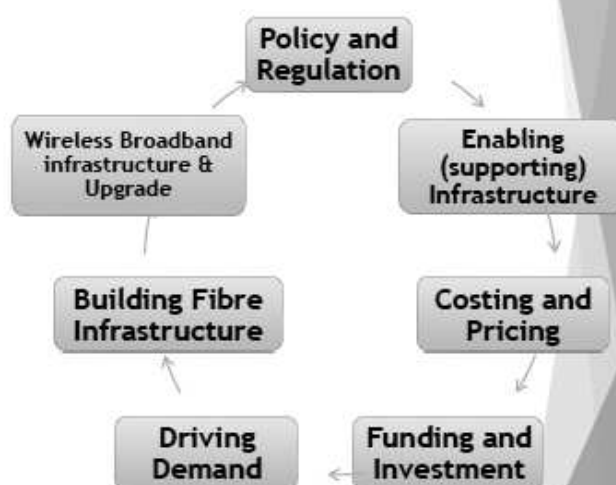


Setting our Goals and Priorities



Setting Our Goals and Priorities: *The National Broadband Plan*

- ❖ The Federal Government of Nigeria (FGN) in 2013 articulated a **National Broadband Plan (NBP)** to enable Nigeria effectively harness the transformational impact of efficient Broadband networks for national socio-economic development*.
- ❖ The NBP provides roadmaps and timelines to deliver a **five-fold increase in Broadband penetration** over a span of five (5) years (i.e. from 6% in 2013 to 30% by 2018) by:
 - Providing available, accessible and affordable broadband services to all citizens.
 - Transforming the economy to a digital knowledge-based one.
- These objectives are to be achieved by focusing concerted action on seven (7) key areas:-



Setting Our Goals and Priorities: *The National Broadband Plan*

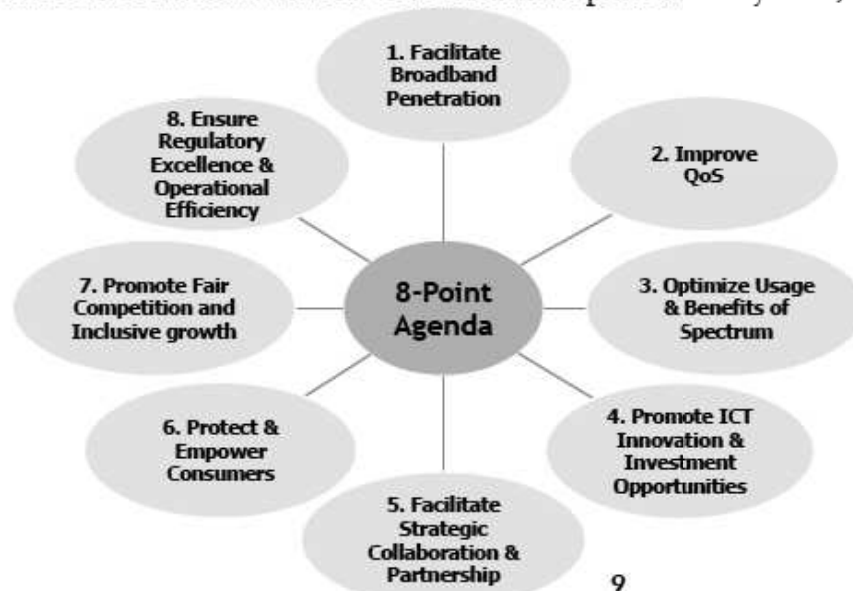
- To ensure effective implementation, specific aspects of the NBP were assigned to responsible parties. The following areas were assigned to the NCC :

• Policy & Regulation	<ul style="list-style-type: none"> ▪ License new operators as required ▪ Define the open access framework and secure RoW waiver with States
• Enabling Infrastructure	<ul style="list-style-type: none"> ▪ Incentivise rollout of fibre infrastructure ▪ Spectrum licensing for LTE in 2.5GHz and 2.6GHz bands. ▪ Release spectrum on the sub-40GHz bands for mobile backhaul
• Costing & Pricing	<ul style="list-style-type: none"> ▪ Agree Cost-based leased pricing model & implement agreed whole price caps ▪ Agree plan for review of the cost of acquiring spectrum licences
• Funding & Investment	<ul style="list-style-type: none"> ▪ Agree Financial Incentives for achieving rollout targets ▪ Agree Funding options for accelerating broadband Infrastructure rollout
• Driving Demand	<ul style="list-style-type: none"> ▪ Set up Public Access Points and ICT Training Centers ▪ Connect all Universities, Schools, Colleges and Hospitals
• Building Fibre Infrastructure	<ul style="list-style-type: none"> ▪ Set up Public Access Points and ICT Training Centers ▪ Connect all Universities, Schools, Colleges and Hospitals
• Wireless Broadband Infrastructure Upgrade & Expansion	<ul style="list-style-type: none"> ▪ All cell sites to be LTE compatible ▪ Spread 3G to at least 50% of the population



Setting Our Goals and Priorities: *The NCC's 8-Point Agenda and Strategic Vision*

- ❖ The NCC has developed a strategic vision centred on eight (8) pillars to address the NBP challenges and ensure the attainment of 30% broadband penetration by 2018, among others.



- The strategic vision of the NCC covers all aspects of the long term plan of the NBP.
- One of its key pillars is to ensure the efficient deployment of broadband infrastructure to facilitate rollout of broadband services throughout Nigeria.



9



Setting Our Goals and Priorities: *The NCC's 8-Point Agenda and Strategic Vision*

- ❖ Recall that the ITU's Strategic Framework is based on three (3) complimentary goals, i.e. Growth, Inclusiveness and Sustainability:

• Growth	Enable and foster access to and increased use of telecommunications/ICTs
• Inclusiveness	Bridge the digital divide and provide broadband for all
• Sustainability	Manage challenges resulting from telecommunication/ICT development, innovation and partnership

ITU strategic vision goals and targets [Source: ITU Strategic Plan (2016 -2019)]

- ❖ The NCC's strategic vision was launched in 2015 to align its regulatory efforts with the goals of the ITU and to further strengthen the capability of the telecoms industry to fast-track socio-economic development in line with the NBP objectives.





Setting Our Goals and Priorities: *The Economic Recovery and Growth Plan (ERGP)*

- ❖ The Federal Government of Nigeria recently articulated the National Economic Recovery and Growth Plan (ERGP) with the objectives of restoring growth, improving the living standards of the Nigerian people and building a globally competitive economy.
- ❖ The ERGP is designed to accelerate infrastructure development (specifically power, roads, rail, ports and broadband); and “make it easier to do business in Nigeria by improving the legal and regulatory environment, and related processes”.
- ❖ For the ICT sector, the ERGP recognizes that “*a vibrant ICT sector is required to drive national competitiveness and expand production frontiers across all sectors of the economy*”.
- ❖ Given the huge capital requirements for bridging Nigeria’s massive infrastructure deficit, the ERGP saliently acknowledges the private sector’s pivotal role to secure independent financing either directly or in collaboration with government agencies under Public-Private-Partnership (PPP) arrangements.



Setting Our Goals and Priorities: *The Economic Recovery and Growth Plan (ERGP)*

- ❖ A key action component of the ERGP is the ***SMART Nigeria Digital Project*** being championed by the Federal Ministry of Investment, Trade & Industry and the Federal Ministry of Communications.
- ❖ The FGN is therefore pursuing a digital-led growth strategy to
 - ▶ encourage rapid ICT penetration among all socio-economic levels and increase the current coverage of the active mobile broadband subscription per 100 from 20.95 to 50 per cent in 2020.
 - ▶ increase the contribution of ICT and ICT-enabled activity to GDP by 10% and create 2.5million new jobs by 2020.
- ❖ This will be achieved through “significant expansion of Broadband coverage, increasing e-government and establishing ICT clusters” around the country.



Reaching our Goals – *What we have done so far...*

13



Reaching our Goals: *Action Areas & Achievements*

Action Area 1 – Policy & Regulations

- ❖ Define the open access framework and secure Right of Way (RoW) with states.
- ❖ License new operators as required.

- ❖ NCC has
 - ▶ Strengthened its collaborative mechanism and partnership with relevant government MDAs to improve the level of ICT adoption/use.
 - ▶ Articulated the Open Access Model – a robust regulatory framework for strategic and systematic Broadband infrastructure licensing and deployment.
 - ▶ Successfully engaged State Governments and MDAs to remove impediments to infrastructure rollout/operations and safeguard network assets (State Governors, the Nigeria Police Force, and other MDAs are regularly engaged to unseal BTS and resolve disputes).
 - ▶ Aggressively implemented the Infrastructure Sharing Guidelines and licensed infrastructure companies and collocation services providers.
 - ▶ Intensified efforts to facilitate enactment of a Law to protect telecom infrastructure as critical national infrastructure.
 - ▶ Embarked on licensing framework review; we have held consultations on key issues such as roaming, regulation of VAS, spectrum licensing, etc.

14



Reaching our Goals: Action Areas & Achievements

Action Area 2 – Enabling Infrastructure

❖ Incentivise rollout of fibre infrastructure

❖ Spectrum licensing for LTE in 2.5 GHz and 2.6 GHz bands

NCC has

- ❖ Developed a licence framework for price-regulated infrastructure companies (Infracos) to bridge gaps between national and planned fibre networks – *2 Infracos have been licensed, operational issues impeding their rollout are being addressed before others are licensed (details on Slide 17).*
- ❖ Facilitated the deployment of over 1000km of Optic Fiber Cable (OFC) through the USPF's BTRAIN (Backbone Transmission Infrastructure) Project to connect rural and semi-urban areas to the National Transmission Backbone infrastructure.
- ❖ Licensed six (6) slots of 2.6 GHz band to MTN Nigeria for Broadband service deployment*. A second licensing round has commenced.
- ❖ Commenced efforts towards the release of spectrum on the sub-40GHz bands for mobile backhaul – *this will reduce pressure on the existing lower microwave frequency bands and increase broadband access across the country.*



Reaching our Goals: Action Areas & Achievements

Action Area 3 – Costing and Pricing

❖ Cost-based Pricing Model

❖ Review Spectrum Licence Fees

NCC has

- ❖ Established pricing parameters and regulatory measures for the competitiveness of the transmission cable market.
 - The parameters were reached through a painstaking process which included the analysis of key factors (e.g pricing, regulatory climate, competition, international experience); as well as the conduct of robust consultations with stakeholders and the creation of a cost model utilizing Operators' inputs.
- ❖ Commenced a review of our Licensing framework - *inbuilt statutory mechanisms for the review of spectrum and other statutory fees are constantly being monitored.*





Reaching our Goals: Action Areas & Achievements

Action Area 4 – Funding & Investment

❖ Financial Incentives for achieving rollout targets

❖ Funding options for accelerating Broadband Infrastructure rollout

The Commission has

- ❖ Licensed two (2) Infrastructure companies (Infracos)* to move excess capacity from our shores to the hinterlands and provide price-regulated broadband services under a Public-Private Partnership (PPP) scheme - *we are currently developing subsidy agreements with them to achieve this. Pilots are being conducted in Lagos and North Central Zones; other regions are in the pipeline (details on slide 19).*
- ❖ Successfully engaged with the Central Bank of Nigeria to facilitate priority access to scarce foreign exchange for Broadband rollout and QoS improvements.
- ❖ Commenced the implementation of a mandatory Code of Corporate Governance for the industry – this will serve to strengthen entities in the industry and attract investment.
- ❖ Successfully engaged with investors at various domestic and international fora to attract Foreign Direct Investments (FDI) for infrastructure deployment.

17



Reaching our Goals: Action Areas & Achievements

Action Area 5 – Driving Demand

❖ Set up Public Access Points and ICT Training Centers.

❖ Connect all Universities, Schools, Colleges and Hospitals

- ❖ Through the Universal Service Provision Fund (USPF), NCC has carried out several high impact interventions, including the following:
 - ▶ **BTS Project** - Deployment of BTSs and passive infrastructure in under-served and un-served communities with weak market viability (58 sites in the Southwest, 36 sites in the South-South and 12 sites in the Federal Capital).
 - ▶ **RuBI-Pilot** –subsidized deployment of Broadband networks in rural/semi-urban areas (14 locations across the country so far).
 - ▶ Rehabilitation of Emergency Communication Centers (ECC) in 14 States to aid speedy law enforcement, security and emergency response.
 - ▶ Establishment of Virtual Examination Centers in two selected WAEC approved Secondary Schools in the Northern and Southern Zones.
 - ▶ Data Sharing, e-Learning Platforms & ICT Infrastructure for four (4) Universities and Teaching Hospitals in the Northern and Southern Zones.
 - ▶ Training facility with modern infrastructure to promote learning at DBI Learning Centers in Yola, Enugu, Asaba and Oshodi.
 - ▶ **UnICC Project** – delivery of broadband infrastructure to facilitate research and learning in Universities using OFC. Deployment is ongoing in 9 (nine) Universities.
 - ▶ Establishment of Schools and Tertiary Institutions Knowledge Centers across the country to equip students and their neighboring communities with ICT Learning tools.
 - ▶ **Stakeholder Initiated Projects (SIP)** - Provision of ICT/CBT (Information and Communications Technology/Computer Based Test) Centers. 12 Centers so far completed; an additional four (4) Skills Acquisition Centers are scheduled for completion.



Reaching our Goals: Action Areas & Achievements

Action Area 6 – Building Fibre Infrastructure

- ❖ Build metro fibre networks in all the major cities and state capitals.
- ❖ Incentivize building of last mile wireline infrastructure to homes, etc.
- ❖ Extend international cable landing points to other coastal states.

❖ The Commission has

- Established a Broadband Implementation & Monitoring Committee to properly and regularly assess broadband infrastructure deployment.
- Fine-tuned the Infrastructure provision licenses awarded for the Lagos and North Central zones.
- Advertised the bidding and selection process for interested service providers (Infrastructure Companies – Infracos) in the remaining five zones namely, North-East, North-West, South-East, South-South and South-West.
- The Infracos will provide & operate infrastructure services and facilitate broadband penetration. They will leverage on the excess international marine cable capacity available on our shores to optimize access/use of affordable fixed and mobile broadband everywhere in Nigeria.



Reaching our Goals: Action Areas & Achievements

Action Area 7 – Wireless Broadband Infrastructure Upgrade & Expansion

- ❖ All cell sites to be LTE compatible.
- ❖ Spread 3G to at least 50% of the population

The Commission has

- ❖ Licensed one slot of 30MHz frequency in the 2.3GHz band for the provision of Wholesale 3G Wireless Access Services.
- ❖ Re-planned the 23 GHz microwave frequency band for backhauling, which is strategic for supporting the throughput of point-to-point digital fixed wireless systems and mobile infrastructure in Nigeria.
- ❖ Approved for two major operators (Etisalat and Airtel) to re-farm part of their 1800 MHz band for 4G/LTE roll-out.



Our Current Position

21

NCC
NIGERIAN
COMMUNICATIONS
COMMISSION



Our Current Position

- ❖ The ITU/UNESCO Broadband Commission for Sustainable Development releases statistics on broadband penetration levels for ITU member states, so that respective countries can gauge performance based on their set National Broadband Plan goals.
- ❖ Key indicators from the 2016 Report show that Nigeria is well on its way to meeting its NBP targets, although there is still much to be done...



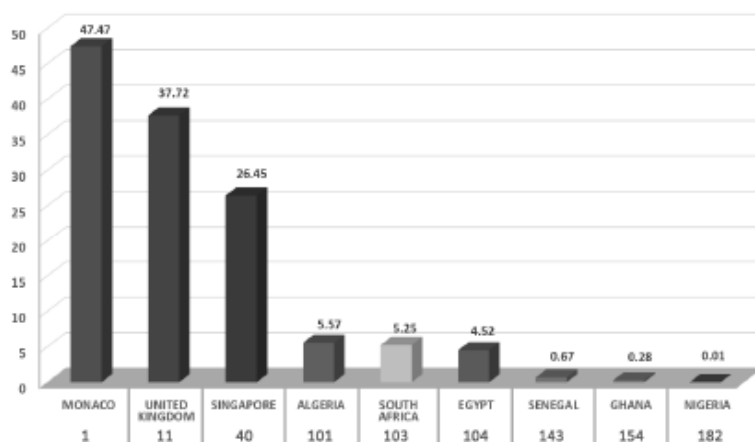
22

NCC
NIGERIAN
COMMUNICATIONS
COMMISSION



Our Current Position

1. Fixed Broadband Subscriptions



MEMBER STATE	FBS/100	RANK
Monaco	47.47	1
United Kingdom	37.72	11
Singapore	26.45	40
Algeria	5.57	101
South Africa	5.25	103
Egypt	4.52	104
Senegal	0.67	143
Ghana	0.28	154
Nigeria	0.01	182

Active Fixed-Broadband Subscription per 100 inhabitants (FBS) in selected ITU Member States.

Source: ITU/UNESCO Broadband Commission for Sustainable Development (2016)

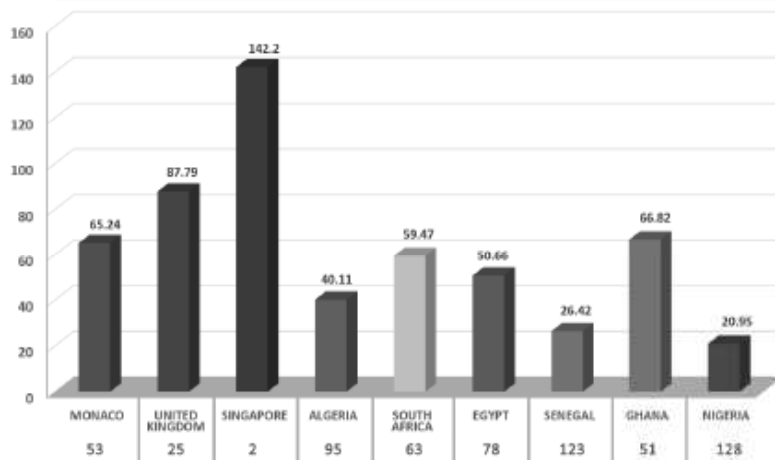
** Wireless is the primary access medium in Nigeria, although efforts are ongoing to also develop FTTx infrastructure.*

23



Our Current Position

2. Mobile Broadband Subscriptions



MEMBER STATE	MBS/100	RANK
Monaco	65.24	53
United Kingdom	87.79	25
Singapore	142.2	2
Algeria	40.11	95
South Africa	59.47	63
Egypt	50.66	78
Senegal	26.42	123
Ghana	66.82	51
Nigeria	20.95	128

Active Mobile-Broadband Subscription per 100 inhabitants (MBS) in selected ITU Member States.

Source: ITU/UNESCO Broadband Commission for Sustainable Development (2016)

** We moved from 11.7% in 2015 to 20.95% in 2016 – additional 9.2% growth in just one year.*

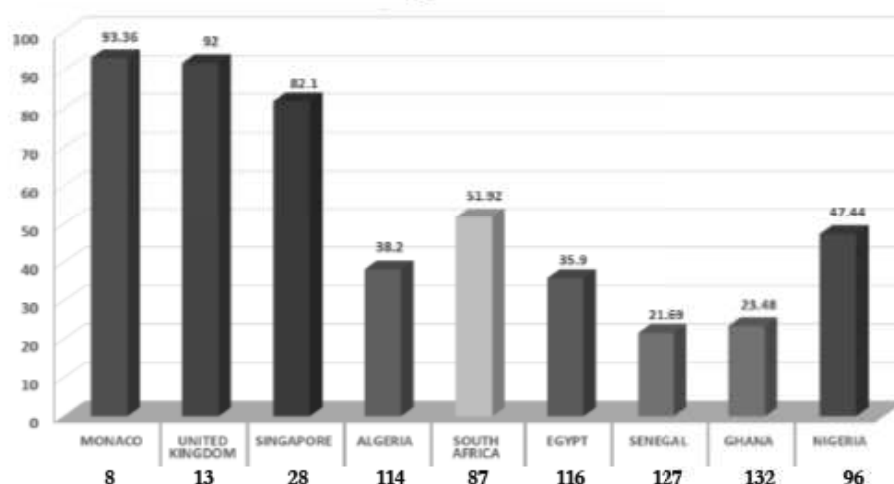
24





Our Current Position

3. Percentage of Individuals using the Internet



MEMBER STATE	PII	RANK
Monaco	93.36	8
United Kingdom	92	13
Singapore	82.1	28
Algeria	38.2	114
South Africa	51.92	87
Egypt	35.9	116
Senegal	21.69	127
Ghana	23.48	132
Nigeria	47.44	96

Percentage of Individuals using the Internet (PII) in selected ITU Member States.

Source: ITU/UNESCO Broadband Commission for Sustainable Development (2016)



Our Current Position

- ❖ Nigeria's Active Mobile Broadband Penetration has reached 20.95% relative to less than 10% about a year ago.
- ❖ The Percentage of Internet Penetration has reached a milestone of 47.44%, second to South Africa in Africa.
- ❖ The number of individuals using the internet continues to grow exponentially - with about 90 million active internet users, Nigeria is Africa's highest ranking country and ranks 10th globally. This illustrates the huge opportunity available for Broadband investments in Nigeria.
- ❖ Mobile is still the primary access medium for Nigerians; this gives us an opportunity to "leapfrog" by building resilient mobile Broadband networks (leveraging on existing mobile infrastructure), thus enhancing faster, and more widespread access, especially in hard-to-reach areas.
- ❖ The success so far achieved is strongly attributed to the robust regulatory framework put in place by the NCC, as well as the targeted implementation of the action items earlier discussed.

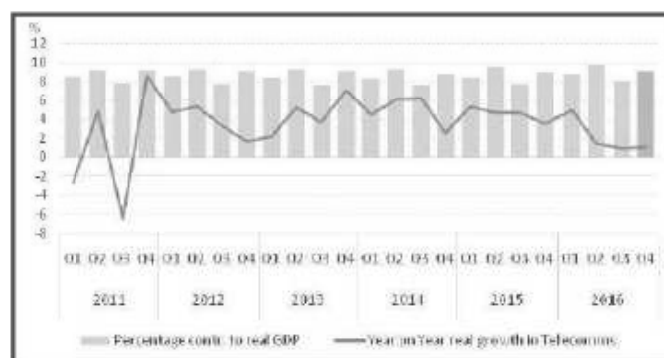


Our Current Position

Socio-Economic Benefits

The National Bureau of Statistics (NBS) reports that:

- ❖ In real terms, the telecoms sector contributed 9.1% of Nigeria's N1,663 billion to GDP in the 4th quarter of 2016, which represents an increase of 1.1% points relative to the previous quarter.
- ❖ In 2015 and 2016, the sector fared better than the overall economy – the share of telecoms in real GDP increased in both years, and was 8.9% in 2016.
- ❖ The FGN is looking at generating up to 30% of GDP by 2019 through ICT deployments*.



Contributions of Telecoms Industry to GDP (2011-2016)

Source: NBS

27



Our Current Position

Socio-Economic Benefits (2)

The positive impact of Broadband infrastructure deployments on socio-economic development is multi-faceted, specifically in the inter-linked areas of growth, employment and productivity:

- ❖ Job creation – Indirect employment in the form of business centers, vendors, kiosks, operators call centers, umbrellas, shops and computer villages that require less capital.
- ❖ Efficient business and government processes to improve productivity and service delivery.
- ❖ Participatory Governance – transparent and accessible e-governance (interactive suggestions) and participation.
- ❖ Blurring boundaries of social identities – improved access to mobility and information for disadvantaged people and communities.
- ❖ Enhanced Social interactions – using new platforms (e.g. Facebook, WhatsApp, etc.) to share information.
- ❖ Reduction of the inequality/opportunity asymmetry between rural and urban dwellers.
- ❖ Increase efficiency and reduce cost of data services.
- ❖ Consumer surplus – Efficient access to information through the Internet, saving and improvement in transport (e-tickets), education (teleconferencing, e-library, distance learning), health (telemedicine, e-diagnoses), commerce (e-banking, mobile money), etc.

28



Future Prospects and Opportunities

29



Future Prospects and Opportunities

The Backbone Fibre Infrastructure Gap

- ❖ As noted earlier, mobile remains the choice access medium for Broadband subscriptions in Nigeria, creating a huge opportunity for surmounting ecosystem issues and achieving faster growth whilst leveraging on existing infrastructure.
- ❖ Currently in Nigeria, more than 10 Terabytes of telecommunications capacity exists at the landing points, but the challenge is the deployment of fiber infrastructure to effectively deliver this capacity to the distribution nodes at the metropolitan areas of all regions in the country.
- ❖ The wide gap between the existing and planned Fibre Infrastructure has been identified in the NBP as a critical dependency regarding the achievement of our penetration target of 30% by 2018.
- ❖ The issuance of Infraco Licenses, the fine-tuning of their terms of deployment and the commencement of the licensing process for additional Infracos discussed earlier are some of the measures that NCC is taking to address this gap.

30



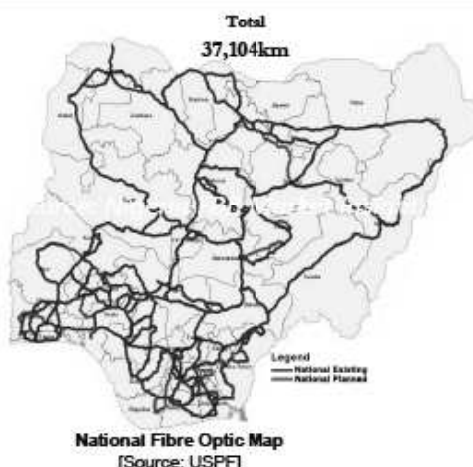
Future Prospects and Opportunities

The Backbone Fibre Infrastructure Gap (Contd.)

WACS (MTN-led) – 5.2TBit/s
SAT 3 (NITEL) – 320GBit/s
Main One – 1.28TBit/s
Glo 1 – 640GBit/s
ACE – 5.12TBit/s



International Cable Landings in Nigeria
[Source: Kroll Map Company]



National Fibre Optic Map
[Source: USPF]

Carrier	Backbone (Km)	Metro (Km)	Access (Km)
MTN	12,300	1,100	40
Glo	11,000	600	0
Airtel	7,800	300	0
ET	2,500	420	0
Phase 3	7,000		
Multi-link	5,417	670	
Mainone	0	300	30
Broadband	0	1,600	200
Total	46,017	4,990	270

Fiber infrastructure of Carriers
[Source: Nigeria FBB Market Insight, Feb. 2017, Huawei]

Benchmarking with South Africa, Nigeria needs to deploy additional 144,680km of Fiber to meet immediate goals

31



Future Prospects and Opportunities

Spectrum

- ❖ Given the overwhelming reliance on mobile access, the NCC is currently reviewing its spectrum licensing framework to better accommodate stakeholders' needs.
- ❖ Consultations have commenced on spectrum trading, active infrastructure sharing, refarming, and the licensing of available spectrum resources in the 2.6GHz and other suitable bands.
- ❖ We are also working with the National Frequency Management Council on harvesting digital dividend spectrum for Broadband deployments.

Pricing and Competitiveness

- ❖ Despite the huge mobile access and growing smartphone penetration, there are still challenges with reaching an acceptable price point for data services.
- ❖ The NCC had to intervene with a temporary retail data price floor – this is however in abeyance pending the conduct of a comprehensive cost study.
- ❖ There are also issues with stimulating demand – local content and affordability – these are being addressed on a national scale.
- ❖ There is therefore a huge opportunity for infrastructure providers (physical and virtual) to offer cost-effective solutions and bridge the competitiveness gap.





Conclusions

33



Conclusions

- ❖ Nigeria is on course to meet its Broadband objectives – Nigerians have always proven to be early adopters of technology and the impact is being felt in our socio-economic endeavors.
- ❖ Our sector is certainly moving in the right direction towards 100% achievement of our National Broadband Plan objectives, and the Nigerian Communications Commission is repositioning itself to address emerging dynamics of the industry.
- ❖ We will continue to attract investors to make necessary infrastructure commitments through our friendly and well articulated regulatory frameworks, our **consumer-centric but investor-friendly focus**, and our insistence on proper governance.
- ❖ The Federal Government has also committed itself to creating a conducive atmosphere for investment inflows, improving government processes and the ease of doing business in Nigeria.
- ❖ Government has now resolved to declare a “national emergency” on ICT infrastructure rollout, review licensing frameworks in the sector, harmonise Right of Way fees and charges, and harvest digital dividend spectrum for Broadband use so as to hasten/deepen the Broadband penetration*.
- ❖ In general, our sector continues to contribute substantially to the socio-economic transformation of the country in the areas of employment, productivity and economic growth as well as GDP.

34



THANK YOU



TELECOM REGULATORY AUTHORITY OF INDIA

“BROADBAND FOR ALL”

PERSPECTIVE FROM INDIA

R. S. SHARMA
Chairman, TRAI



INDIA TELECOM HIGHLIGHTS

1

**Fastest
Growing
Market in the
World**

3

**Telephone
Subscribers
~1.2 Billion**

5

**Lowest call
Rates in the
World**

2

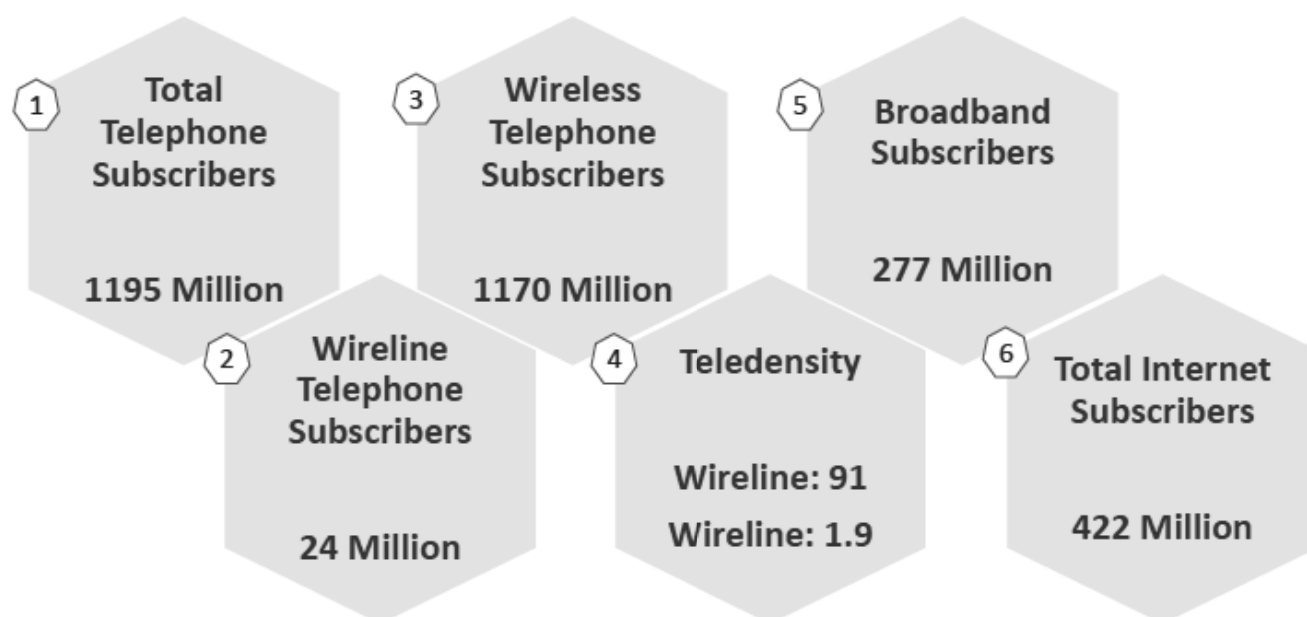
**Second
Highest
Number of
mobile
Subscribers**

4

**Average
Addition of
~5 million
Subs. per
month**



INDIAN TELECOM SECTOR – SNAPSHOT*



*As of 31st March 2017



NATIONAL TELECOM POLICY - 2012

- Provide affordable and reliable broadband-on-demand to achieve
 - 175 million broadband connections by 2017 (achieved)
 - 600 million by 2020

- Provide high speed and high quality broadband access to all village panchayats through a combination of technologies progressively to all villages and habitations by 2020



DATA USAGE (In PB)

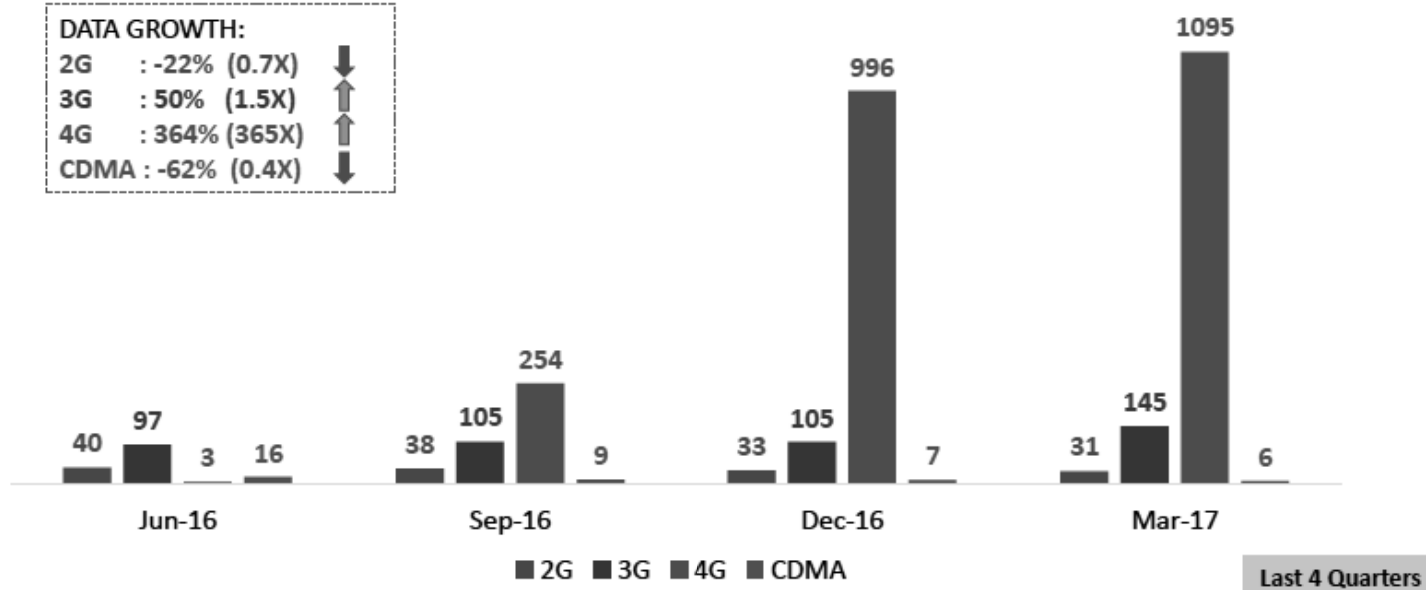
DATA GROWTH:

2G : -22% (0.7X) ↓

3G : 50% (1.5X) ↑

4G : 364% (365X) ↑

CDMA : -62% (0.4X) ↓



DIGITAL INDIA



A program to transform India into a digitally empowered society & knowledge economy



KEY VISION AREAS



Digital infrastructure as a utility to every citizen



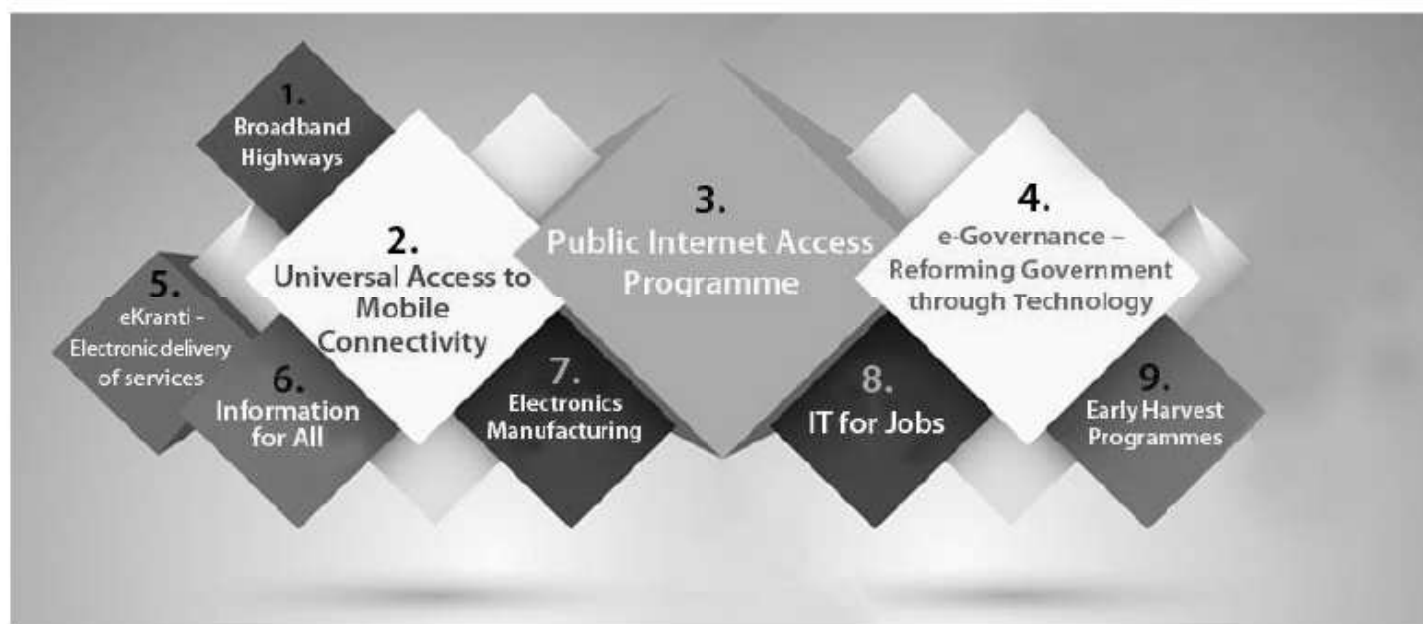
Governance and services on demand



Digital empowerment of citizens



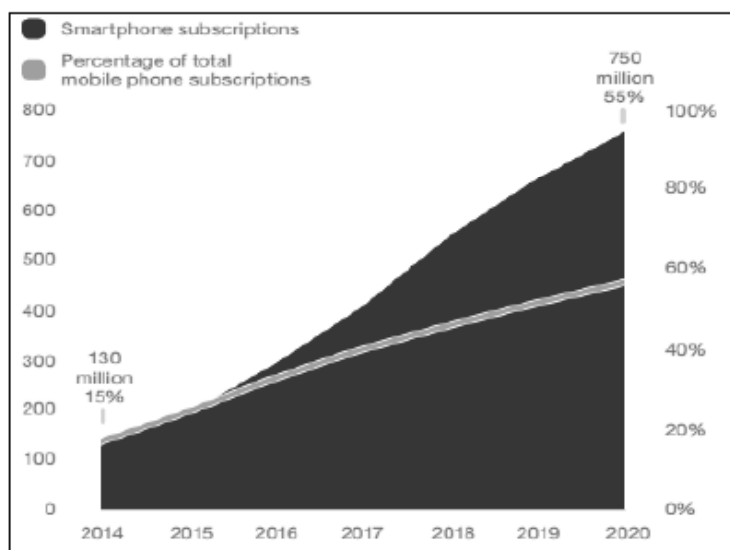
PILLARS OF DIGITAL INDIA



7



KEY TRENDS: SMARTPHONE GROWTH



Source: Ericsson mobility report

Parameters	2014	2020	CAGR 14-20
Mobile subscribers (million)	970	1,380	6%
Smartphone subscribers (million)	130	750	35%
Data traffic per active smartphone (GB/month)	1	4.5	25%
Total mobile traffic (PB/month)	200	2,800	55%



RESULTANT EFFECT

- Consumers are evolving to a more **video-centric app behavior**
- 4G uptake will accelerate due to increased smartphone penetration & affordability of the service;
- **Data traffic** in the networks could potentially grow by **>11X by 2022***, based on elasticity in pricing of the service
- Future data revenue market share ambitions will require focus on **capacity deployed to serve the surge in demand**

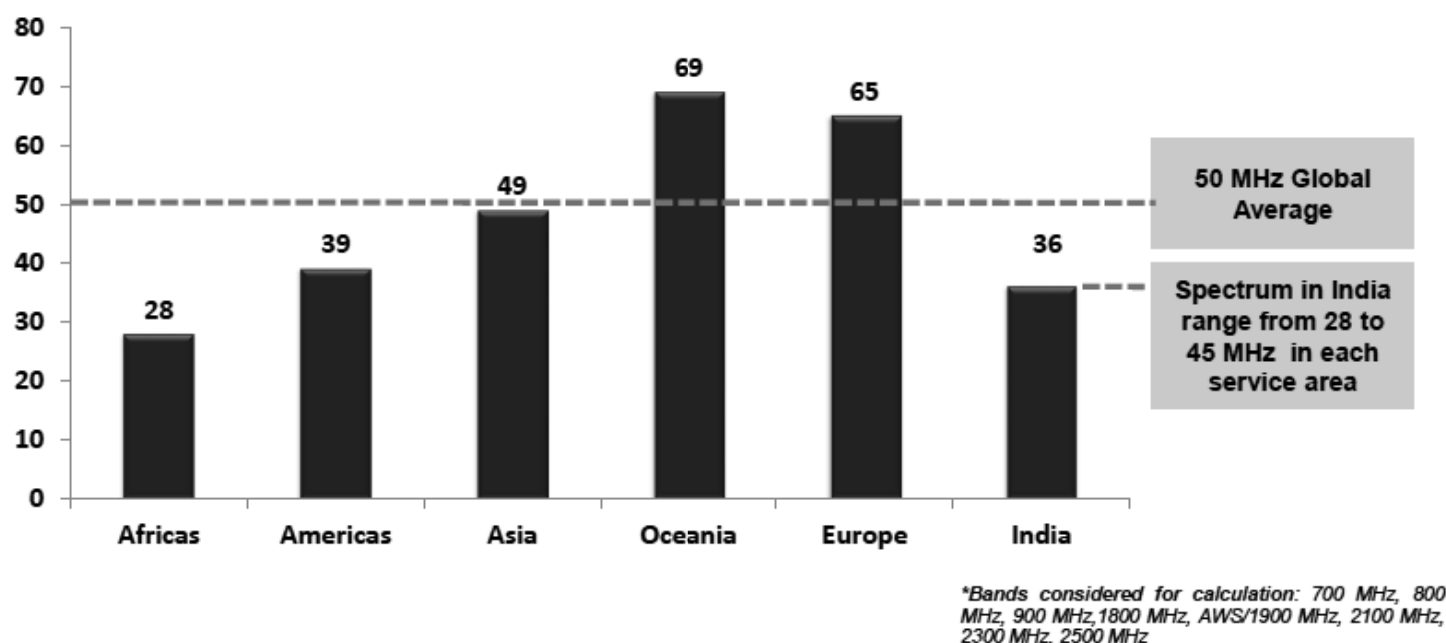
*Eriasson mobility report



STEPS FOR BROADBAND PROLIFERATION



INCREASE IN SPECTRUM HOLDING PER OPERATOR (IN MHz)



STEPS TAKEN TO ENHANCE BROADBAND PROLIFERATION

TRAI made recommendations to the Govt on:

- Delivering Broadband Quickly: What do we need to do?
- Spectrum trading that allow telecom companies to buy and sell rights to unused spectrum among themselves
- Spectrum sharing, aimed to improve spectral efficiency and quality of service
- Liberalisation of spectrum enabling it to use for any technology by either obtaining from auction or by getting administrative spectrum converted to market priced one by paying balance price
- Virtual Network Operators, that will help in optimum utilization of spectrum resources of operators

The Government has accepted most of the above recommendations of TRAI



STEPS TAKEN TO ENHANCE BROADBAND PROLIFERATION

Other recommendations made for enhancing broadband in India:

- **Encouraging Data usage in Rural Areas:**

A scheme under which a reasonable amount of data (say 100 MB per month) may be made available to rural subscribers for free. This would help in bridging the urban-rural affordability gap and to support Government's efforts towards cashless economy by incentivising digital means

- **Proliferation of Broadband through Public Wi-Fi Networks:**

A framework under which, Public Data Offices (PDOs) in agreement with Public Data Office Aggregators (PDOAs), should be allowed to provide public Wi-Fi services. This will not only increase number of public hotspots but also make internet service more affordable in the country. This will also encourage village level entrepreneurship and provide strong employment opportunities, especially in rural areas.

- **Recommendations on Implementation Strategy for BharatNet:**

For laying of optical fibre in India in rural areas as a part of national broadband plan.

13



STEPS TAKEN FOR AVAILABILITY OF ADDITIONAL SPECTRUM

- Identification of new Bands (700 MHz, 3.3-3.4 GHz and 3.4 to 3.6 GHz)
- Use existing spectrum more efficiently
 - Harmonisation of spectrum
 - Spectrum audit
- Use unlicensed spectrum to offload pressure on commercially allocated spectrum.
Additional spectrum bands need to be identified for unlicensed (V-band)

14



GOING FORWARD

- **Reserve Price for next spectrum auction** to be held for in 700, 800, 900, 1800, 2100, 2300, 2500, 3300-3400, 3400-3600 MHz bands will be recommended soon by TRAI.
 - *Total quantum of spectrum available under these bands is 53 MHz (paired) and 285 MHz (unpaired) in each service area*
 - *Many of these bands will be used for 5G technologies (3.3 to 3.6 GHz)*
- **Consultation with the stakeholders is undergoing on the following issues:**
 - Net Neutrality
 - Cloud Computing
 - Internet telephony
 - Machine-to-Machine/IoT Communication
 - Sustainable Green Telecommunications
 - Ease of doing business in India

15



Thank you

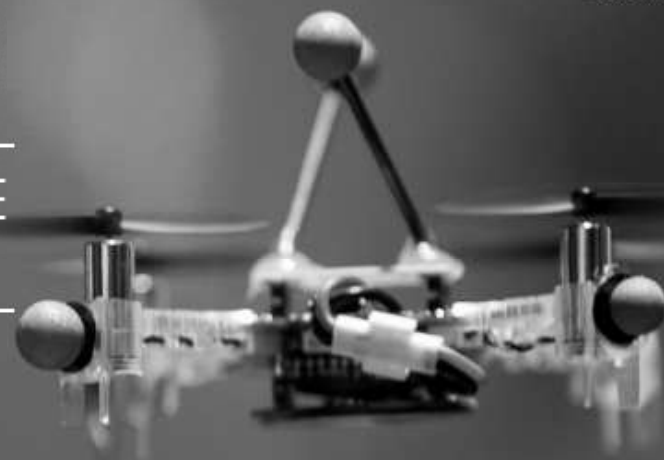
R. S. SHARMA
Chairman, TRAI
cp@trai.gov.in



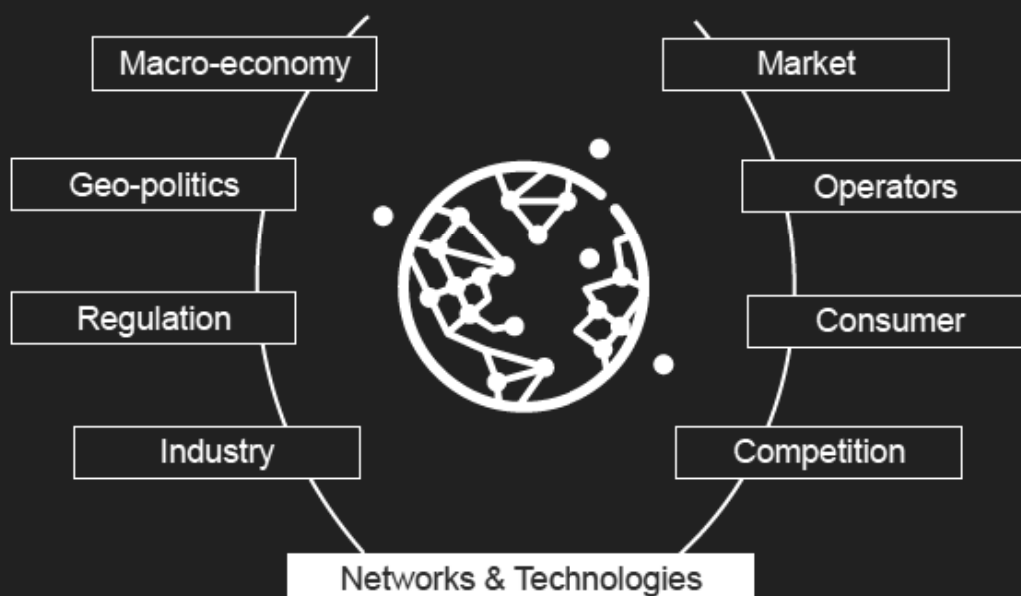
DIGITALIZATION FOR THE NETWORKED SOCIETY

June 26 2017 – Broadband for All

Ulf Ewaldsson, SVP & Head of Business Area Digital Services



THE GLOBAL SITUATION IS INCREASINGLY COMPLEX



ERICSSON MOBILITY REPORT

JUNE 2017



OVER ONE MILLION NEW MOBILE INTERNET USERS ADDED EVERY DAY



4G WILL BE THE DOMINANT ACCESS TECHNOLOGY GLOBALLY BY 2018



TOTAL MOBILE DATA TRAFFIC GREW BY 70% BETWEEN Q1 2016 AND Q1 2017



VOLTE SUBSCRIPTIONS TO REACH 4.6 BILLION BY 2022 – 90% OF ALL LTE SUBS

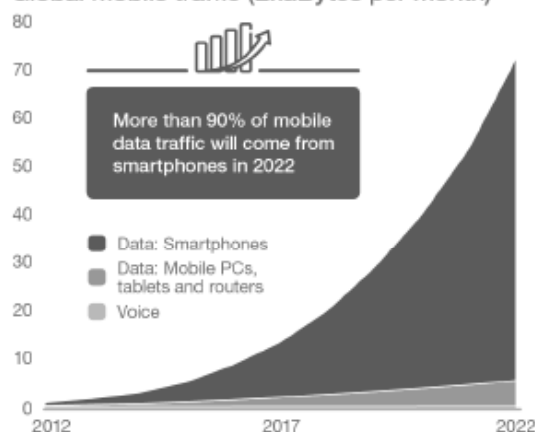


THERE WILL BE HALF A BILLION 5G SUBSCRIPTIONS GLOBALLY BY 2022

SMARTPHONES GROWTH CONTINUES



Global mobile traffic (ExaBytes per month)



- Video
- Audio
- Web browsing
- Social networking
- Software download
- Other
- File sharing

2016
8.8 ExaBytes

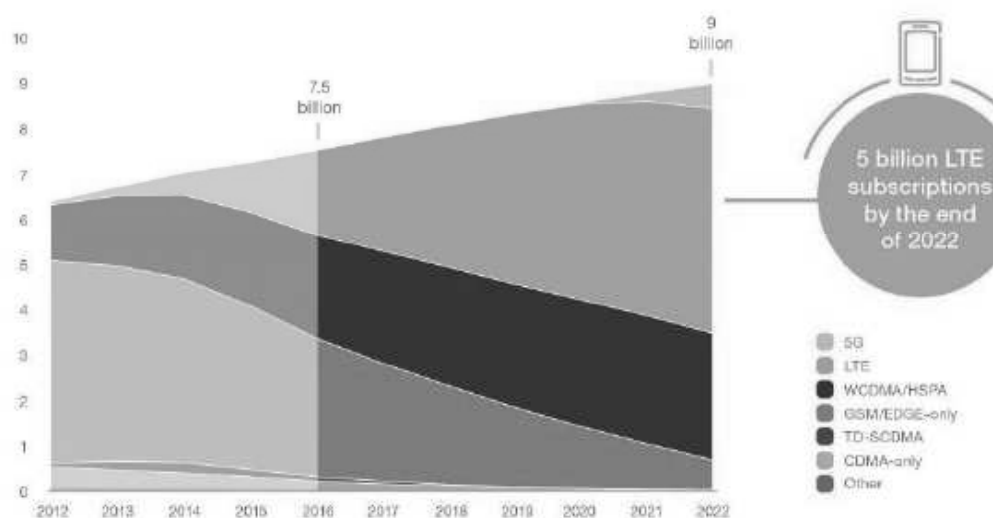


- Total mobile data traffic will increase 8 times – exceeding 70 EB/month in 2022
- Smartphone traffic will increase 9 times – reaching 66 EB/month in 2022
- In 2022, video will account for around 75% of mobile data traffic

SUBSCRIPTIONS BY TECHNOLOGY



Mobile subscriptions by technology (billion)



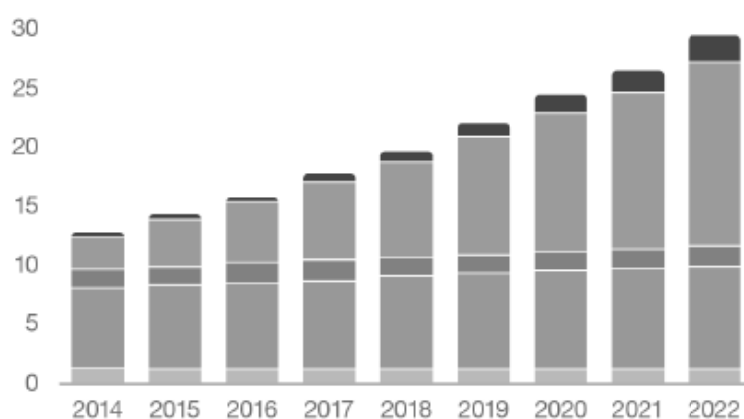
5G subscriptions will exceed half a billion by the end of 2022

Figure note: IoT connections and Fixed Wireless Access (FWA) subscriptions are not included in the above graph

TOWARDS AN IOT-DOMINATED WORLD

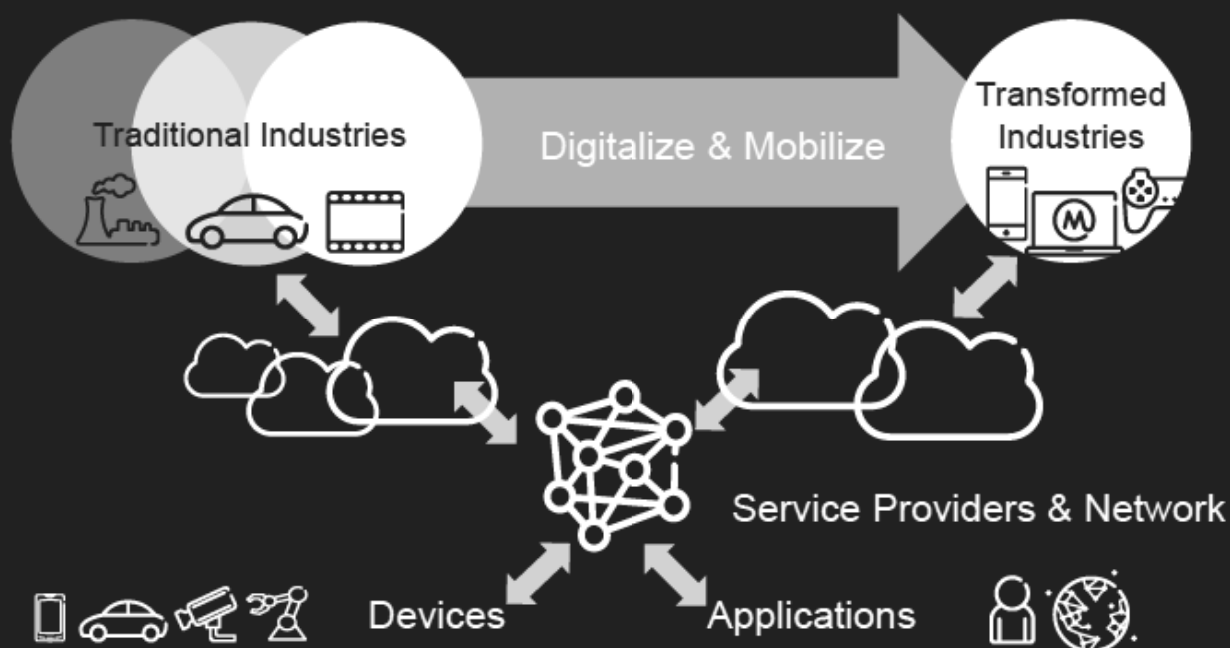


Connected devices (billions)



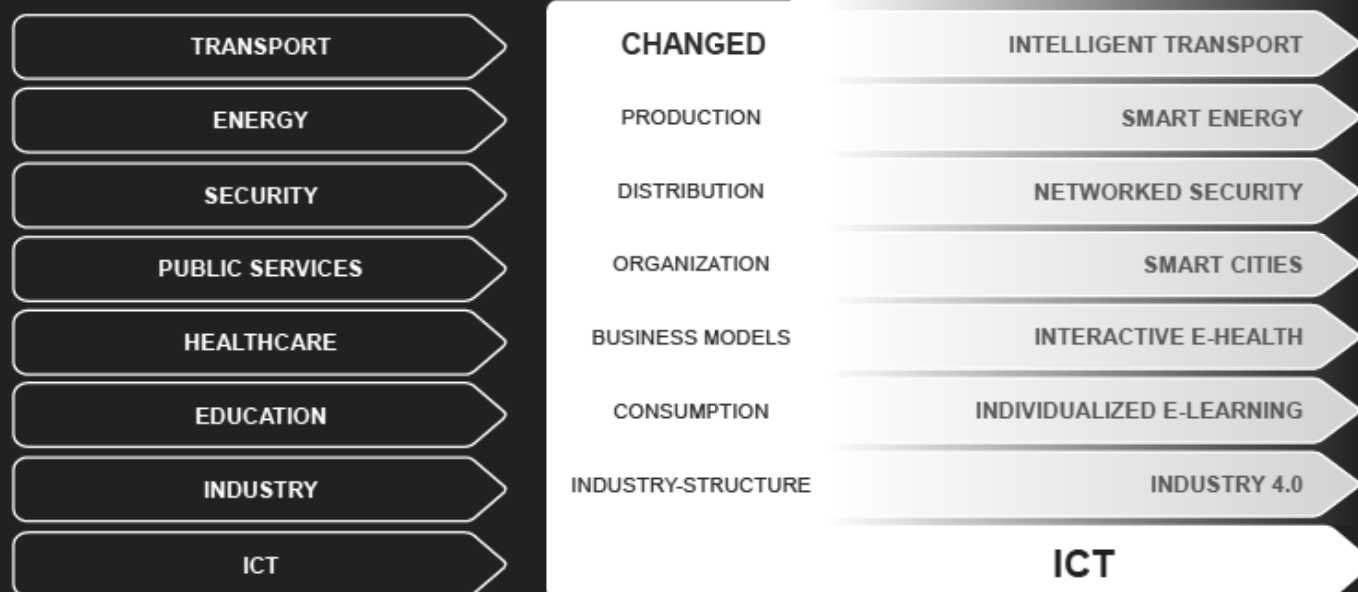
	2016	2022	CAGR
Wide-area IoT	0.4	2.1	30%
Short-range IoT	5.2	15.5	20%
PC/laptop/tablet	1.6	1.7	0%
Mobile phones	7.3	8.6	3%
Fixed phones	1.4	1.3	0%
	16 billion	29 billion	

DIGITALIZATION & MOBILITY



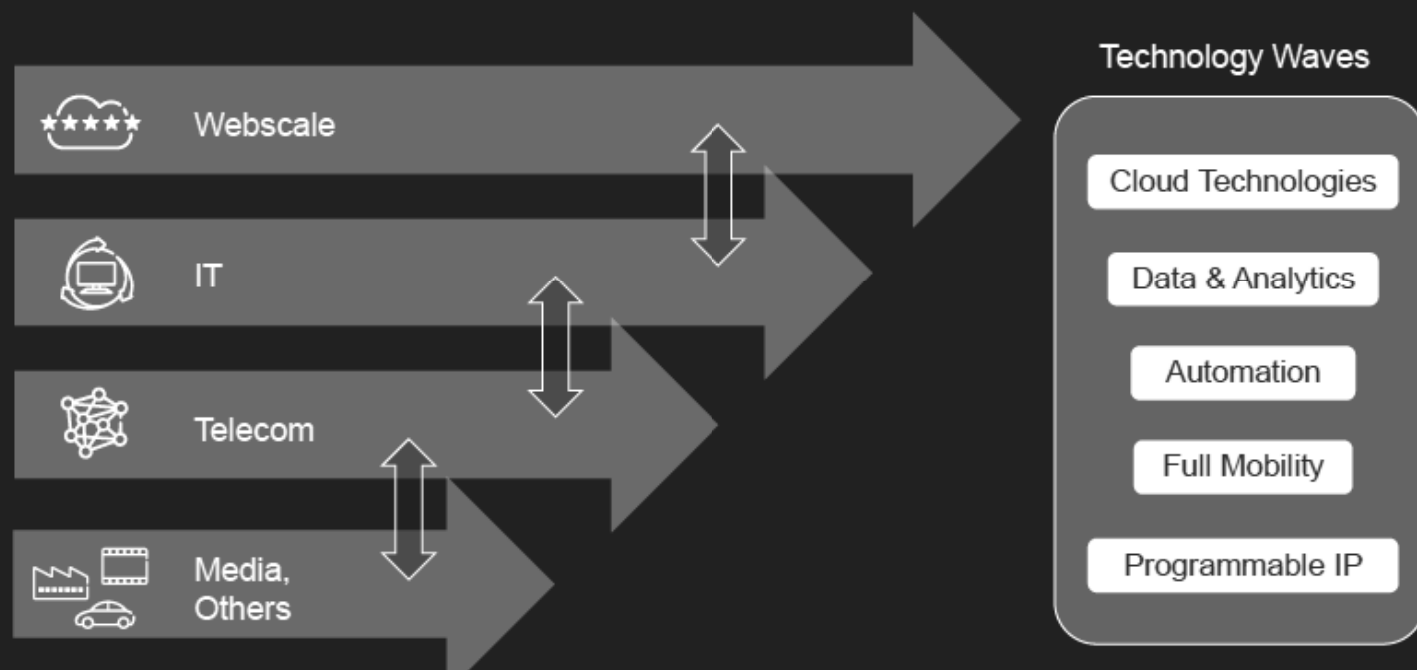
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ICT TRANSFORMING INDUSTRIES

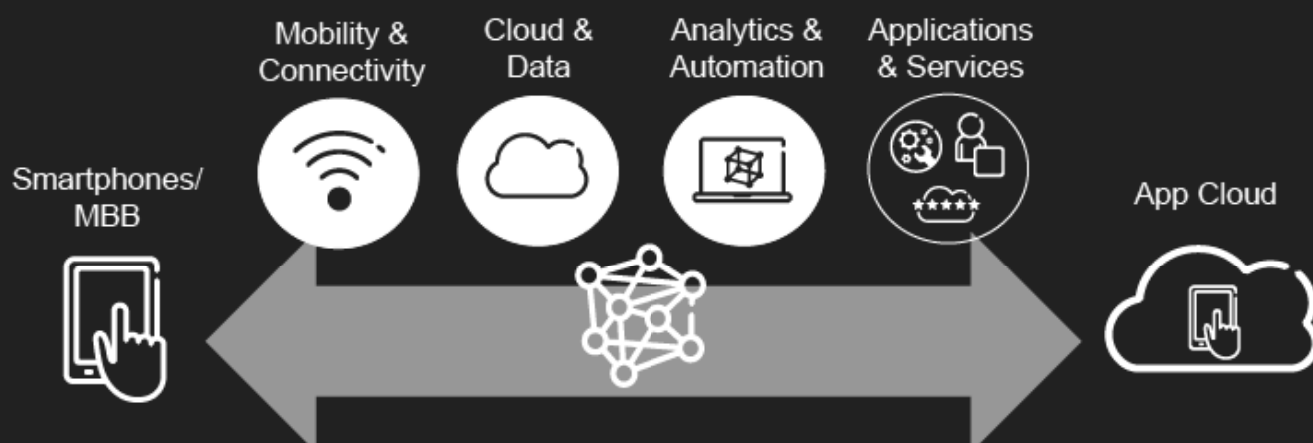


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TRANSFORMATION OF INDUSTRIES WITH TECHNOLOGY WAVES

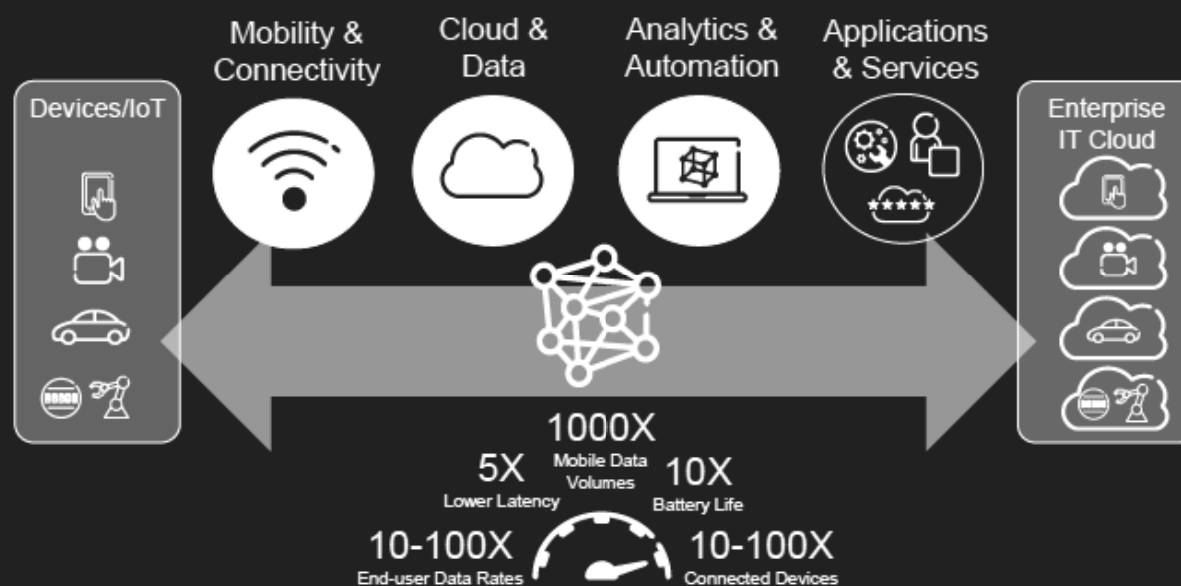


NETWORK EFFICIENCY & PERFORMANCE



Increased efficiency (lower cost per bit) & higher capability for Mobile Broadband

INCREASED NETWORK RELEVANCE FOR OTHER INDUSTRIES



A horizontal, programmable Network platform to connect all clouds to all devices

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5G USE CASES



BROADBAND AND MEDIA EVERYWHERE



SENSORS EVERYWHERE



SMART VEHICLES, TRANSPORT



INFRASTRUCTURE, MONITOR AND CONTROL



CRITICAL CONTROL OF REMOTE DEVICES

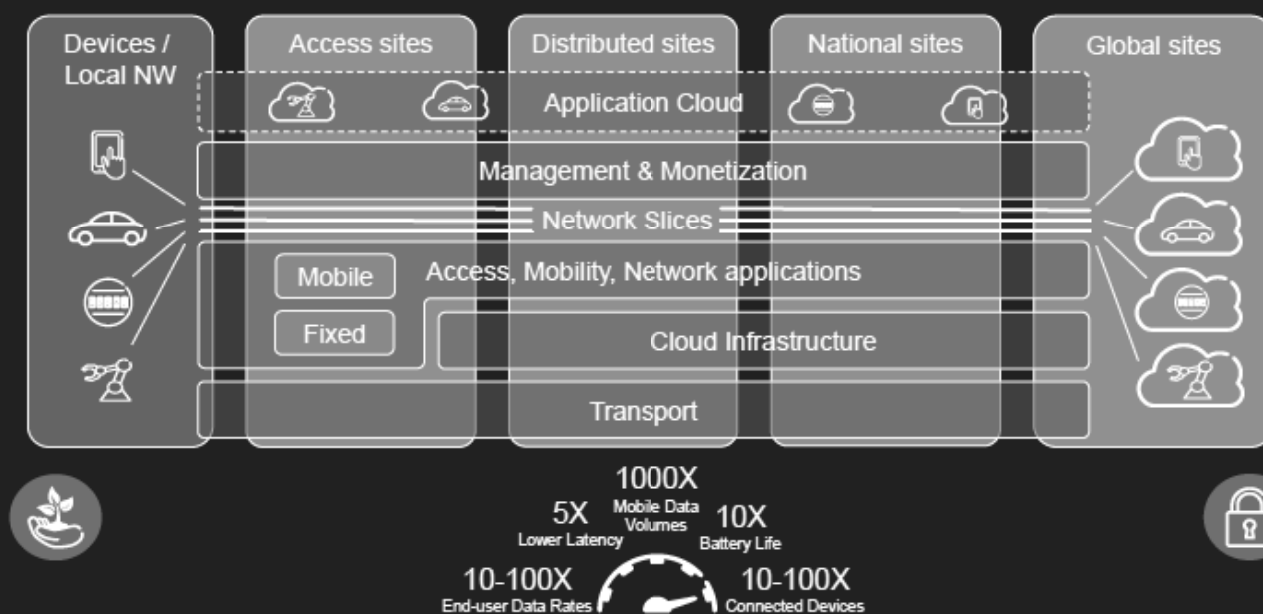


INTERACTION HUMAN-IOT

Broadband & Media leading, more use cases leveraging enhanced capabilities

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ONE NETWORK FOR MULTIPLE INDUSTRIES



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5G SUCCESS FACTORS



- › **5G System – Openness and horizontal network end to end**
(5G is cloud/core, control, access and devices/sensors)
- › **Global ecosystem – Multiple use cases with one global eco-system**
(Leveraging the scale of 4G/LTE)
- › **5G enabling new business – Operators driving growth in IoT, media and industry transformation**
(New capabilities for digitalization and mobilization)
- › **The Network platform - Relevance to other industries**
(Speed is essential to position networks in the global web environment)
- › **Industry alignment - Standardization and open source approach**
(A broader set of use cases requires cross industry collaboration)

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ERICSSON POSITION ON SECURITY

1. Services should always be available
2. Security should require minimum effort from users
3. Communications should be protected
4. All access to information and data should be authorized
5. Manipulation of data in the networks should be possible to detect
6. The right to privacy should be protected



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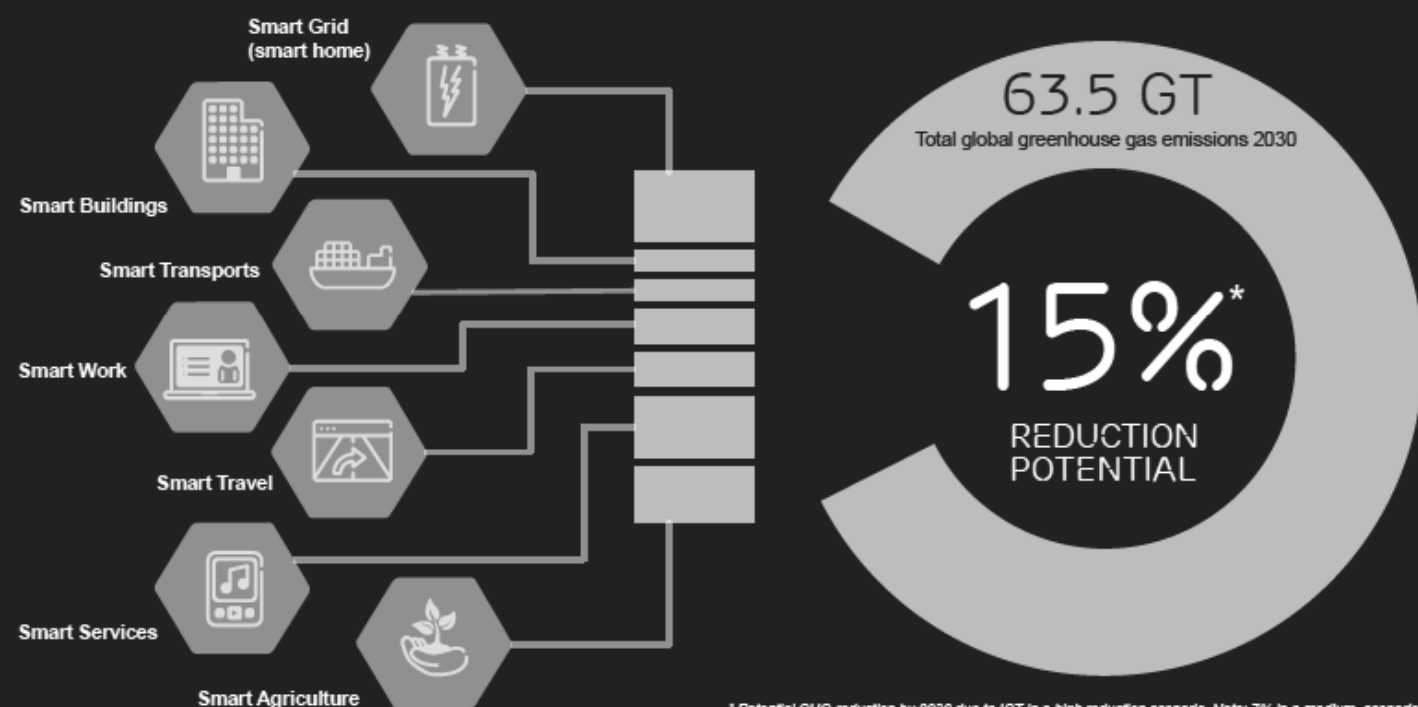
IOT SECURITY CHALLENGES



Managing the complex security environment is needed

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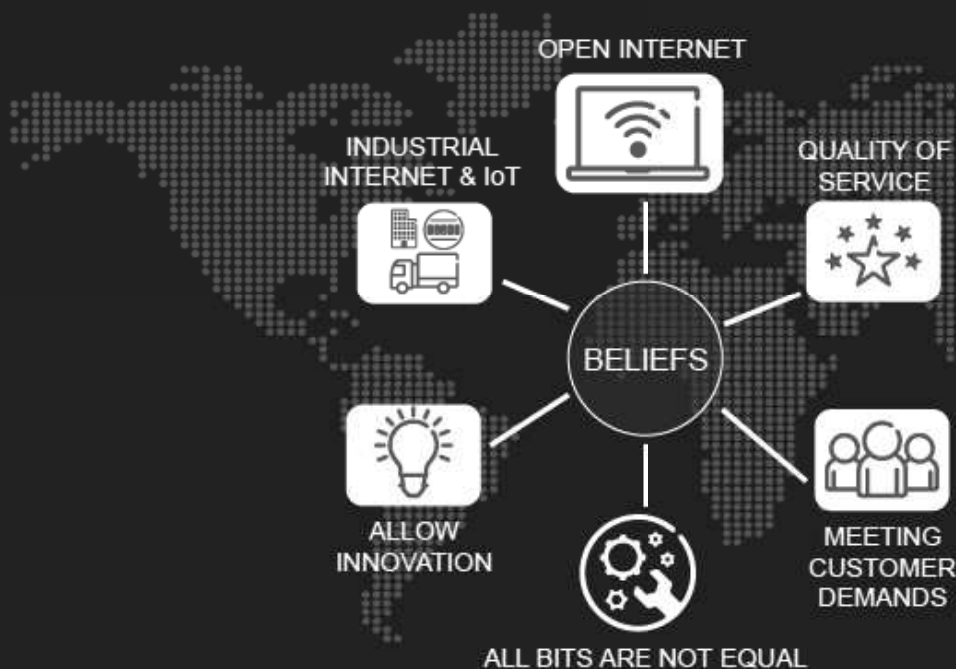
ENABLEMENT EFFECT OF ICT IN 2030



ALL BITS ARE NOT EQUAL



AN OPEN INTERNET



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DIGITAL SINGLE MARKET



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NEW LOGICS IN THE DIGITAL ERA



Consumption Logic

Usage Logic



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ERICSSON



5G FOR THE TRANSFORMATION OF INDUSTRIES

Peter de Bruin – Program Manager 5G Industry Collaborations, Ericsson Research
Erik Josefsson – Head of Business Innovation, Internet of Things



CHANGE WILL NEVER BE THIS SLOW AGAIN

AUGMENTED REALITY

ARTIFICIAL INTELLIGENCE

AUTONOMOUS VEHICLES

MOBILITY GENERATIONS

The foundation of
mobile telephony

Mobile telephony
for everyone

The foundation of
mobile broadband

The evolution of
mobile broadband

Non-limiting access;
anywhere, anytime,
anyone, anything



~1980



~1990



~2000



~2010



~2020

4TH INDUSTRIAL REVOLUTION POWERED BY 5G



Massive

10-100X
Connected Devices

10X
Battery Life

Critical

1000X
Mobile Data Volumes

5X
Lower Latency

Industries beyond
Smartphones

1G

2G

3G

4G

5G

4TH INDUSTRIAL REVOLUTION



5G INDUSTRY COLLABORATIONS

We collaborate with industry partners to

- › ...explore the digital transformation of different industries
- › ...explore tomorrow's use cases, using today's technology
- › ...explore new business models and value networks
- › ...together define 5G for Industries



5G INDUSTRY COLLABORATION EXAMPLES



5G INDUSTRY COLLABORATION EXAMPLES

CHRONOS
C-ITS Test & Validation for Future Transportation Systems

- Establish the open and controlled test environment for validation of Connected Driving (C-ITS) systems
- Improve knowledge in connected and autonomous driving

5G NETMOBIL
5G solutions for the connected mobility of the future

- Explore 5G technology for ITS use cases in urban, rural and highway environments
- Developing a system architecture for 5G-based and 4G/LTE-based systems
- Coordinated testing of 5G and 4G/LTE systems

CMA
Test Site for Future Automated and Shared Mobility Systems

- Enabling the use of 5G networks for intelligent transport systems
- Investigating "non-terrestrial" scenarios for network operators and alternative 5G networks
- Real-time vehicle fleet monitoring and management
- Developing service architecture and network architecture for 5G-based systems
- Cooperation of 5G and 4G/LTE systems

KOI
Coordinated Industry Communication

- Use 5G technology and high standards for 5G-based communication
- Develop 5G-based communication for 5G-based communication
- Develop 5G-based communication for 5G-based communication

REMOTE OPERATION
Robot remote control with haptic feedback over LTE

- Develop 5G-based communication for 5G-based communication
- Develop 5G-based communication for 5G-based communication
- Develop 5G-based communication for 5G-based communication

SGEM
5G Enabled World Class Manufacturing

- Develop 5G technology in a manufacturing environment
- Develop 5G technology in a manufacturing environment
- Develop 5G technology in a manufacturing environment

WITool
Wireless Internet of Tools

- Enable all for production equipment (CNC machines) and tool companies (CNC tool companies) to connect to the cloud
- Enable all for production equipment (CNC machines) and tool companies (CNC tool companies) to connect to the cloud
- Enable all for production equipment (CNC machines) and tool companies (CNC tool companies) to connect to the cloud

CONNECTED ENERGY

- Infrastructure for surveillance of distribution networks for the power grid
- Secure 4G/LTE cloud platform solution
- Industrial grade solution

PIMM
Pilot for Industrial Mobile Communication in Mining

- Develop 5G-based communication for 5G-based communication
- Develop 5G-based communication for 5G-based communication
- Develop 5G-based communication for 5G-based communication

Transport

Manufacturing

Process Industries

5G ENABLED TRANSPORT



Partners:



ITWL - INTEGRATED TRANSPORT
RESEARCH LAB
KTH ROYAL INSTITUTE OF TECHNOLOGY

5G ENABLED MANUFACTURING



Radically improve wireless industrial internet & compute for SKF bearing manufacturing and monitoring

- Increase efficiency, flexibility and traceability
- Stress test technology for 5G requirements
- Analytics/ Machine learning for remote maintenance



Partners:



Photo: SKF, GP April 2017

CONNECTED SCREW DRIVES

Opportunity

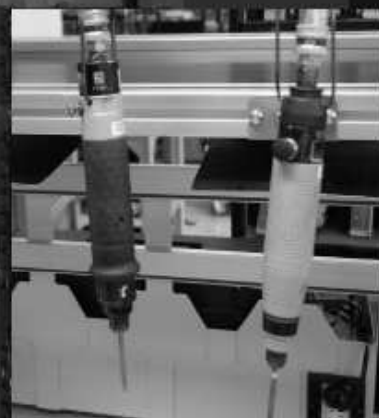
- › Manual maintenance process 1000 high-precision screwdrivers

Solution:

- › Automated solution with real-time motion sensor over cellular IoT (NB-IoT) & cloud

Result:

- › 50% manual work reduction
- › 6 months break even, 210% ROI after 1 year
- › Completely phase out manual tracking



- No cabling
- Low cost module
- 10-year battery life
- 7x improved converge
- Reduced maintenance staff

Partners:



5G ENABLED MINING

PIMM — Pilot for Industrial Mobile Communication in Mining

- Increased productivity
- Improved Safety

[00] REAR

[001] FRONT

[1] [002] FR

Partners:



REMOTELY CONTROLLED MACHINES



*As mine operator I want to remotely control my wheel loader because it will **increase productivity***

*As a mine manager I want to have autonomous trucks in the mine because it will **increase productivity***

Photo: Boliden

IOT IN THE MINE



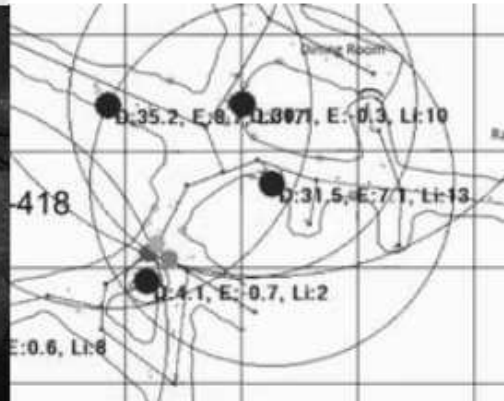
*“As a mine operator I want to secure good **air quality** for improved safety by more advanced control of ventilation”*

*“As responsible for mine safety I want to secure improved safety by understanding **rock movements**”*

*“As responsible for mine safety I want **accurate positioning** because it will improve safety”*



Photos: Boliden



LOGISTICS AND COMMUNICATIONS

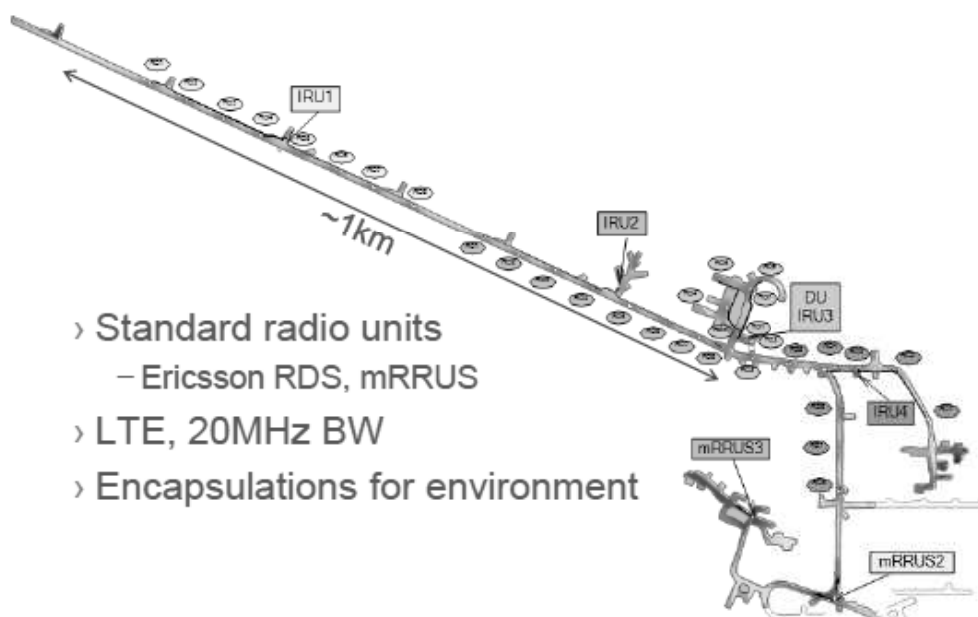
*"As a mine operator
I want to use a **standard
smartphone** for my
communication because it will
be more efficient"*

*"As a contractor,
I want to use my **regular
devices** in the mine because it
will be more efficient"*

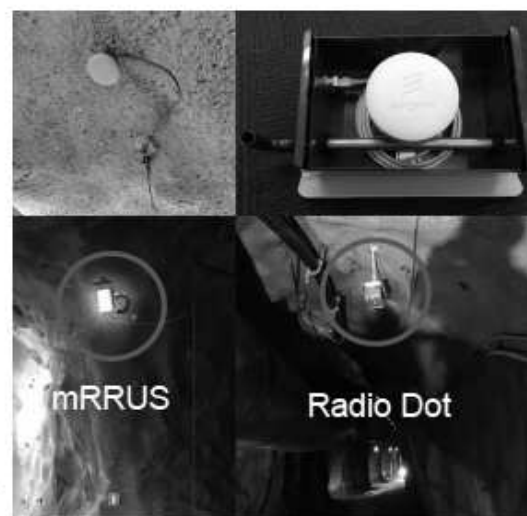
*"As a mine manager I want
autonomous trucks going to
the concentrator because it
will increase productivity"*



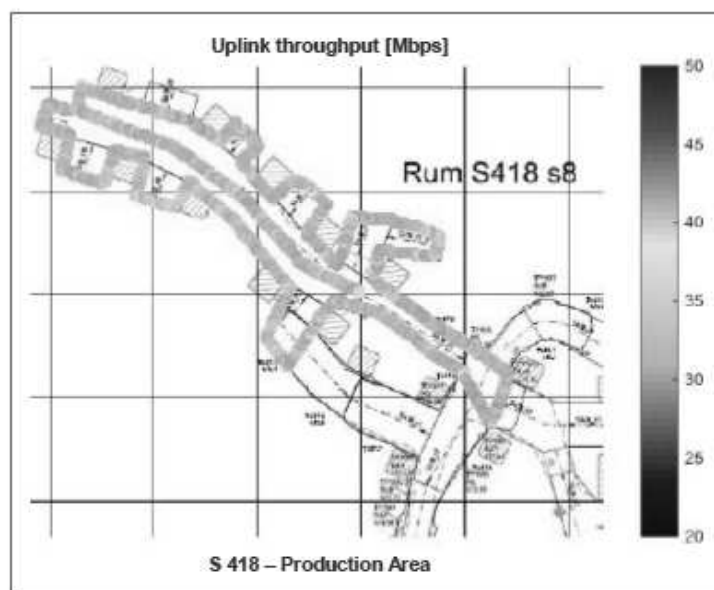
KANKBERG RADIO INSTALLATION



- › Standard radio units
 - Ericsson RDS, mRRUS
- › LTE, 20MHz BW
- › Encapsulations for environment



KANKBERG RADIO COVERAGE



Ericsson | 2017-05-19 | Page 17

› Excellent coverage

- Uplink rate typically >40Mbps
(Device maximum 45Mbps)

› Continuous connection of equipment and personnel

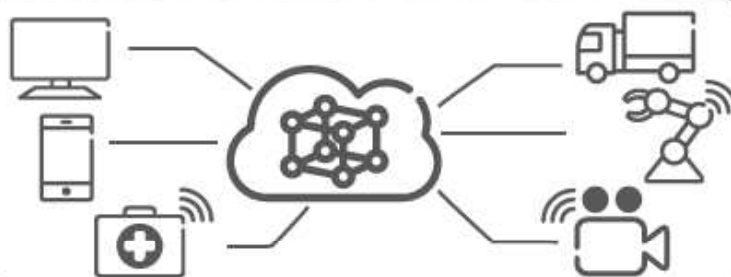
- Enabling mine automation



THE DIGITALIZED MINE



Using **one versatile network**, supporting all use cases **simultaneously**



New Business Models



Complex Value Networks

Communication is the enabling foundation for mining digitalization and automation, enabling **new use cases** which will generate **new values**

EXAMPLE OF A VALUE NETWORK

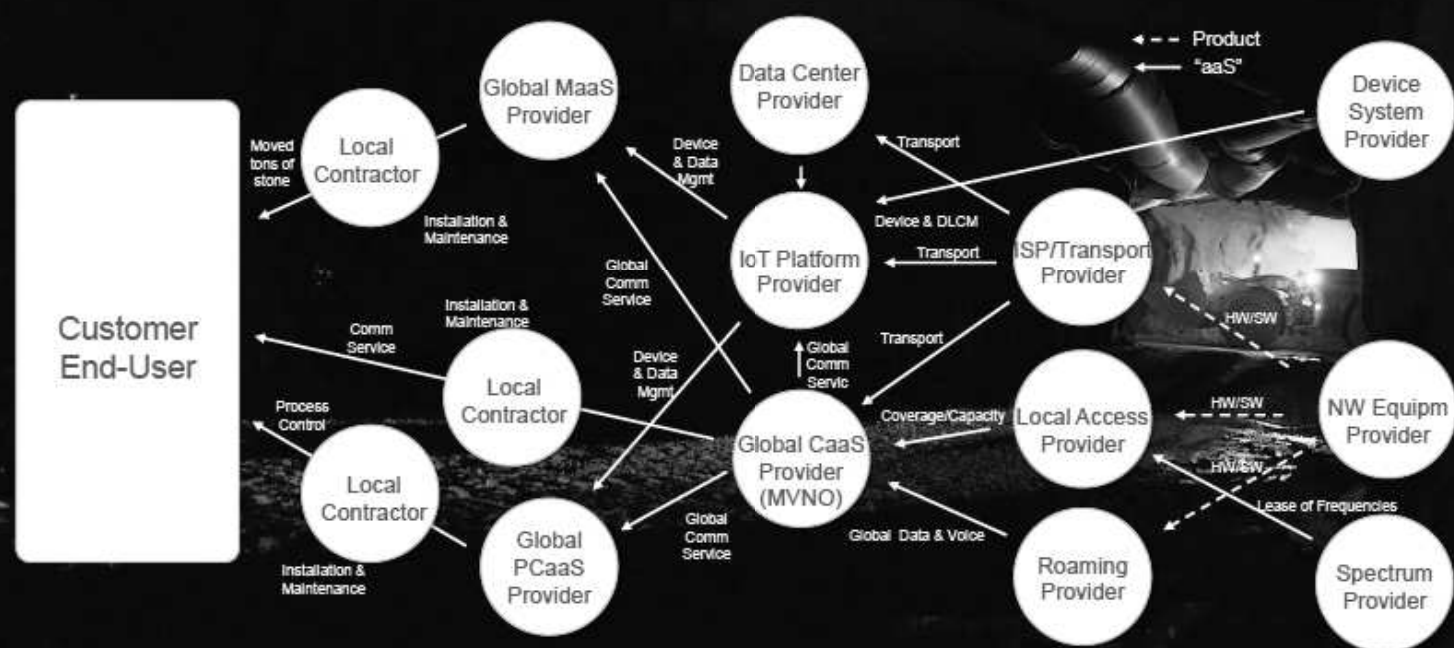


Photo: Bolden

GLOBAL

WIRELESS

IOT



KEY DIFFERENTIATORS



- › Technology development is happening now! Collaboration is key!
- › Spectrum availability (sharing/flexible/...) needs attention
- › Legislation may be impacted (autonomous vehicles, cyber security etc.)



*"Connectivity and technology
collaboration are critical foundations
for industry transformation success"*



ERICSSON



IOT - A GAME CHANGER FOR CYBER SECURITY



OUR EVOLVING SOCIETY



5G GAME CHANGER

DIGITALIZATION

SYSTEMS
GO MOBILE

MISSION CRITICAL
ICT INFRASTRUCTURE

5G



Enabler for more
advanced use cases

Every company is
a digital company

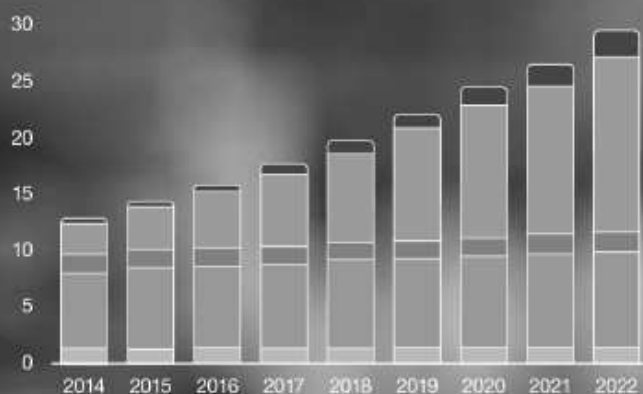
New attack vectors
emerge






More value,
more attacks

CONSEQUENCES CAN BE FATAL IF SECURITY IS NOT ENSURED

TOWARD AN IOT-DOMINATED WORLD

Connected devices (billions)



	2016	2022	CAGR
 Wide-area IoT	0.4	2.1	30%
 Short-range IoT	5.2	16	20%
 PC/laptop/tablet	1.6	1.7	0%
 Mobile phones	7.3	8.6	3%
 Fixed phones	1.4	1.3	0%
	16 billion	29 billion	10%

Source: Ericsson Mobility Report, June 2017

SECURITY SOLUTIONS THAT CAN SCALE WILL BE NEEDED

IoT - a game changer for cyber security

IOT CHARACTERISTICS PUT NEW DEMANDS ON SECURITY



Decisions taken
based on data



Volume of devices



Ecosystems with
many stakeholders



End-2-end security

IoT - a game changer for cyber security

IOT SECURITY CHALLENGES



Can I trust the identity of the device?

Is the network resilient to attacks?

Who has access to my data and to what data?



Can I be sure that data has not been manipulated?

Is the device behaving as it should?

Is privacy and confidentiality ensured?

Is my operation compliant?

IoT - a game changer for cyber security

IOT SECURITY CHALLENGES



Can I trust the identity of the device?

Trusted identities

Is the network resilient to attacks?

Who has access to my data and to what data?

Trusted infrastructure



Trusted data

Privacy and confidentiality

Can I be sure that data has not been manipulated?

Is the device behaving as it should?

Is privacy and confidentiality ensured?

Is my operation compliant?

Managing the complex security environment is needed

IoT - a game changer for cyber security

MANAGING COMPLEXITY

Trust and Security are not the icing on the cake



IoT - a game changer for cyber security

KEY ASPECTS OF A TRUSTED TECHNOLOGY PARTNER



IoT - a game changer for cyber security

TRUSTED "GLOBAL CITIZEN"

Independence & neutrality

COMMERCIAL FACTORS

Independent ownership

Publicly traded

Global company



GEOPOLITICAL FACTORS

Foreign Policy: A company headquartered in a neutral non-power seeking country

Domestic Policy: Headquartered in a mature democracy, clear separations of powers, enforcing equality and rule of law, low corruption levels.

IoT - a game changer for cyber security

SECURE ENTERPRISE

House keeping

Secure products and services

- Adhere to a security framework in all phases of developing new products and services

Information security

- Implement security controls to protect information assets

Respect for privacy

- Align business with legal requirements for privacy

IoT - a game changer for cyber security

SECURE TECH PROVIDER

Know-how, skills and capabilities – e2e



ERICSSON CAPABILITIES



Protect ICT Infrastructure

Build Secure IoT Business



**Managed
Security
Services**



**Professional
Security
Services**



**Network
Security**



**Security
Management**



**Identity
Management**



**Data Centric
Security**

ERICSSON POSITION ON IOT SECURITY



KEY PRINCIPLES

1. Identities of IoT devices must be **trusted**
2. Services should always be **available**
3. **Confidentiality** of IoT communication must be protected
4. All access to information and data should be **authorized**
5. **Integrity** of IoT data must be ensured
6. When IoT data is enriched with personal data, **privacy** must be protected



IoT - a game changer for cyber security

ERICSSON POSITION ON IOT CERTIFICATION



KEY PRINCIPLES / NECESSARY CONDITIONS

1. Minimum level of security verified through labeling
2. IoT used for critical infrastructure must be certified
3. Global harmonization of industry driven standards
4. Labeling/certification and mutual recognition of regional certification
5. Market driven voluntary approaches are preferred



IoT - a game changer for cyber security

KEY TAKE-AWAYS



IoT - a game changer for cyber security | 2017-05-21 | Page 17



Secure IOT partner

Manages and orchestrates
security end-2-end



Thanks!

<https://www.ericsson.com/internet-of-things/iot-security>



IoT - a game changer for cyber security | 2017-05-21 | Page 18



ERICSSON



CYBER-SECURITY

PUBLIC POLICY RESPONSE ?

■ STOCKHOLM ■ RENE SUMMER ■ ERICSSON ■ JUNE 2017

5G & IOT GAME CHANGERS FOR CYBER SECURITY



TRANSPORT

ENERGY

SECURITY

PUBLIC SERVICES

HEALTHCARE

EDUCATION

INDUSTRY

ICT

CHANGED

CONSUMPTION

DISTRIBUTION

PRODUCTION

ORGANIZATION

BUSINESS MODELS

INDUSTRY-STRUCTURE

INTELLIGENT TRANSPORT

SMART ENERGY

NETWORKED SECURITY

SMART CITIES

INTERACTIVE E-HEALTH

INDIVIDUALIZED E-LEARNING

INDUSTRY 4.0

ICT

THREAT LANDSCAPE



ESTIMATED GLOBAL COST OF CYBER CRIME & ESPIONAGE

THREE ATTACK CATEGORIES



>400 BUSD

Total global cost of cyber crime and espionage

~1%
OF GDP

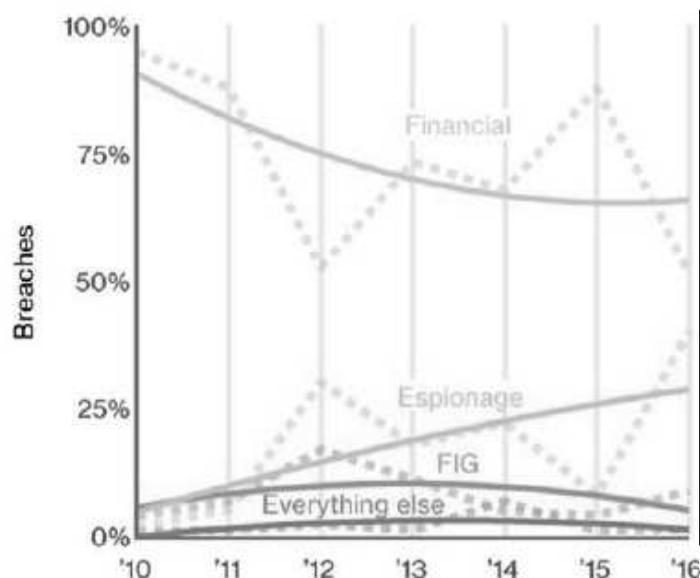
ENISA THREAT LANDSCAPE REPORT 2016

....CYBER ESPIONAGE IS MERELY A MOTIVE THAN A CYBER-THREAT....

....IT UNITES ALMOST ALL OF THE OTHER CYBER-THREATS...[TOOLS AVAILABLE]..

.... IN ADDITION TO SOME HIGH-CAPABILITY CRAFTED BY STATE-SPONSORED ACTORS...

93% OF ALL CYBERATTACKS IN 2016 motivated by financial and espionage purposes



Sectors targeted by financially motivated attacks; Accommodation, Food, Financial, Insurance, Healthcare and Information and Retail.

Sectors targeted by espionage motivated attacks: Manufacturing, Public Administration and Educational services.

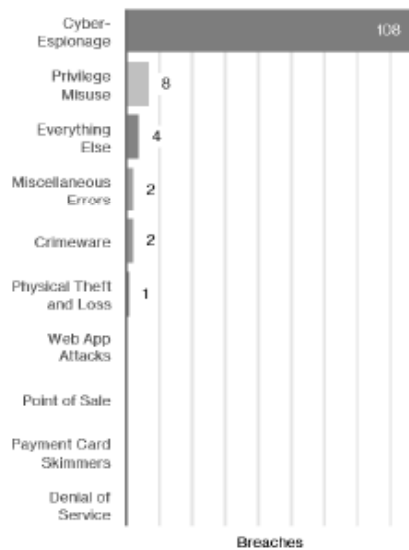
FIG= Fun, Ideology, Grudge

Source: Verizon: 2017 Data Breach Investigations Report 10th Edition

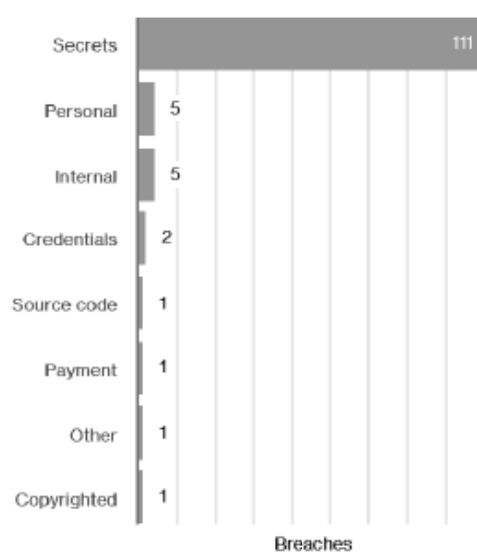
EXAMPLE: MANUFACTURING



Frequency of incident classification patterns within Manufacturing industry breaches (n=124)



Varieties of data breached within the Manufacturing industry (n=122)



Manufacturing sector: mechanical, physical, or chemical transformations of materials, substances, or components into new products."

When you make stuff, there is always someone else who wants to make it better, or at least cheaper. A great way to make something cheaper is to let someone else pay for all of the R&D and then simply steal their intellectual property.

With that in mind, it will probably be of no surprise that Cyber-Espionage is by far the most predominant pattern associated with breaches in

PUBLIC POLICY LANDSCAPE



CAPABILITY = POWER OF HOW

REGULATION & LAW

Industrial Policy, PPP, R&D

Standardization & Certification

Competent Authorities, operational capabilities



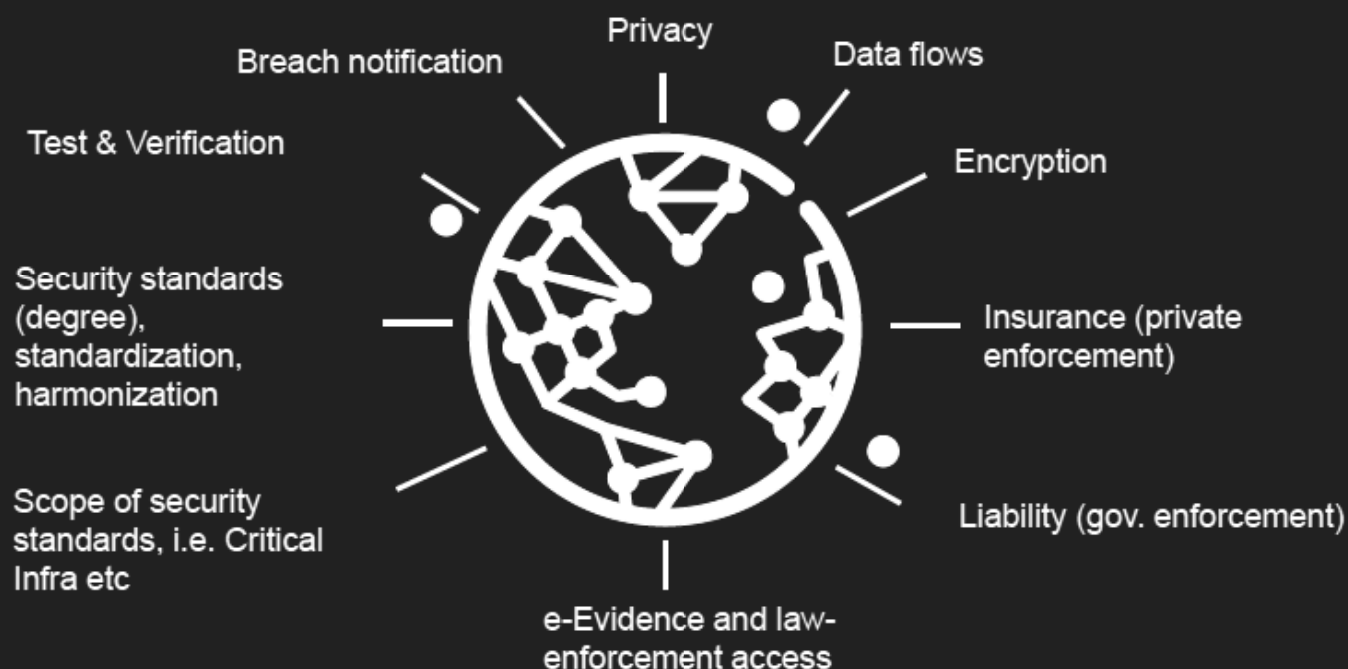
International Law, UN, Cyber Convention, FTA

Domestic law, Telecom Law, Privacy Law, Finance Law, Critical Infra., Law, Public Procurement law,

National Interest, Export Control, Foreign Trade and Investment Legislation, National Security Law.

KEY PUBLIC POLICY ISSUES

Industrial espionage not on policy agenda



KEY PUBLIC POLICY IMPERATIVES

-ECONOMIC ESPIONAGE



**PUBLIC
POLICY
RESPONSE**

INCREASE AWARENESS

BUILD CAPABILITY: DETECT, PROTECT AND RESPOND

PROTECTING CRITICAL SECTORS

PROTECT INNOVATION FROM ESPIONAGE

FDI SCREENING & SECURITY SCREENING



ERICSSON