ITU Initiatives on Big Data

19-20 June 2018
Tashkent, Uzbekistan

Sameer Sharma, Senior Advisor
ITU Regional Office
Asia-Pacific

ITU at a glance

Meet us

What we do

‘Committed to Connecting the World’

3 Sectors

ITU Radiocommunication

Coordinating radio-frequency spectrum and **assigning** orbital slots for satellites

ITU Standardization

Establishing global standards

ITU Development

Bridging the digital divide

193 MEMBER STATES

+700 INDUSTRY & INTERNATIONAL ORGANIZATIONS

+150 ACADEMIA MEMBERS

MEMBERSHIP

ICTs and the SDGs

"The spread of information and communication technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies, as does scientific and technological innovation across areas as diverse as medicine and energy". ***Agenda for Sustainable Development (Paragraph 15)***

ICTs are catalytic drivers to enable the achievement of all the SDGs

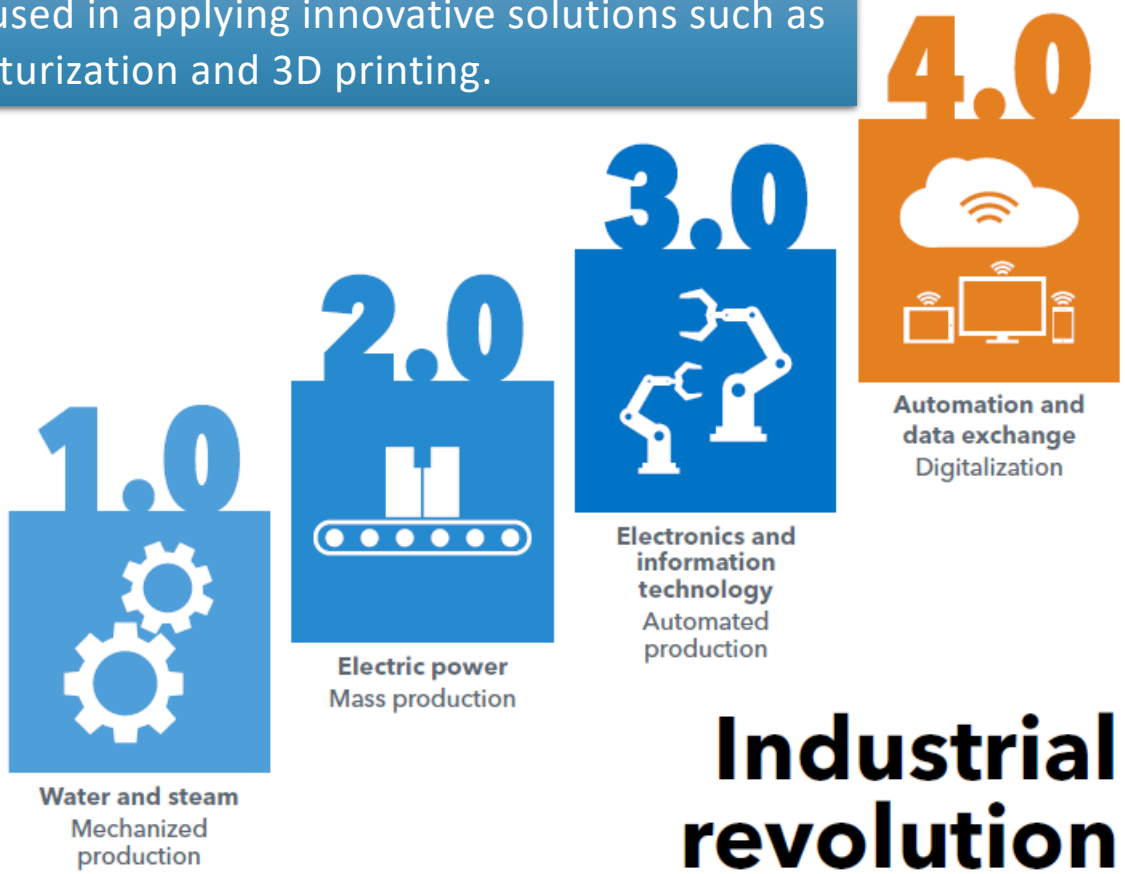
Specifically referenced in the SDG targets:

- SDG4 Quality Education (4b)
- SDG5 Gender Equality (5b)
- SDG9 Industry, innovation and Infrastructure (9c)
- SDG 17 Partnerships for the Goals (17.8, as a means of implementation)

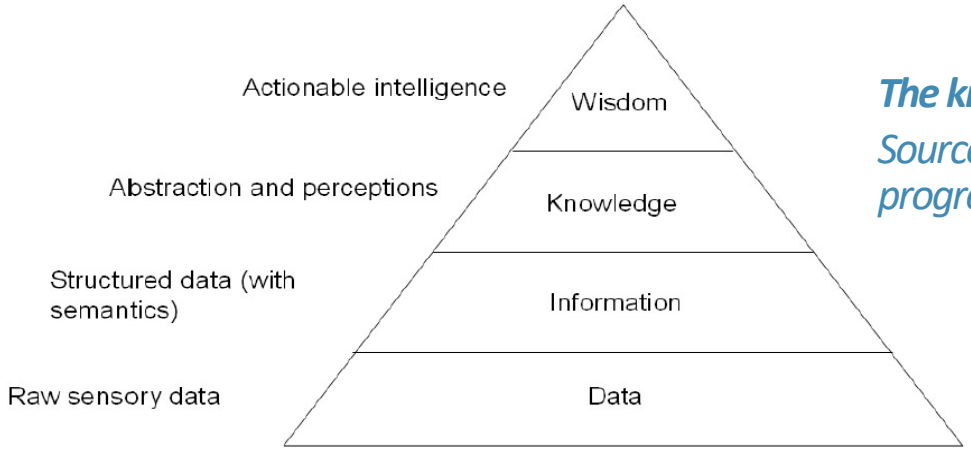
Industry 4.0

Industry 4.0 and the use of ICTs are being used in applying innovative solutions such as Internet of Things, cloud computing, miniaturization and 3D printing.

Industry 4.0 based solutions enable better interoperability, more flexible industrial processes, and autonomous and intelligent manufacturing. Physical components of industrial production are being transformed into cyber-physical systems by smart, digital networking, allowing for real-time management of production processes across great distances and products.



Data Transformation: from Raw Data to Actionable Intelligence



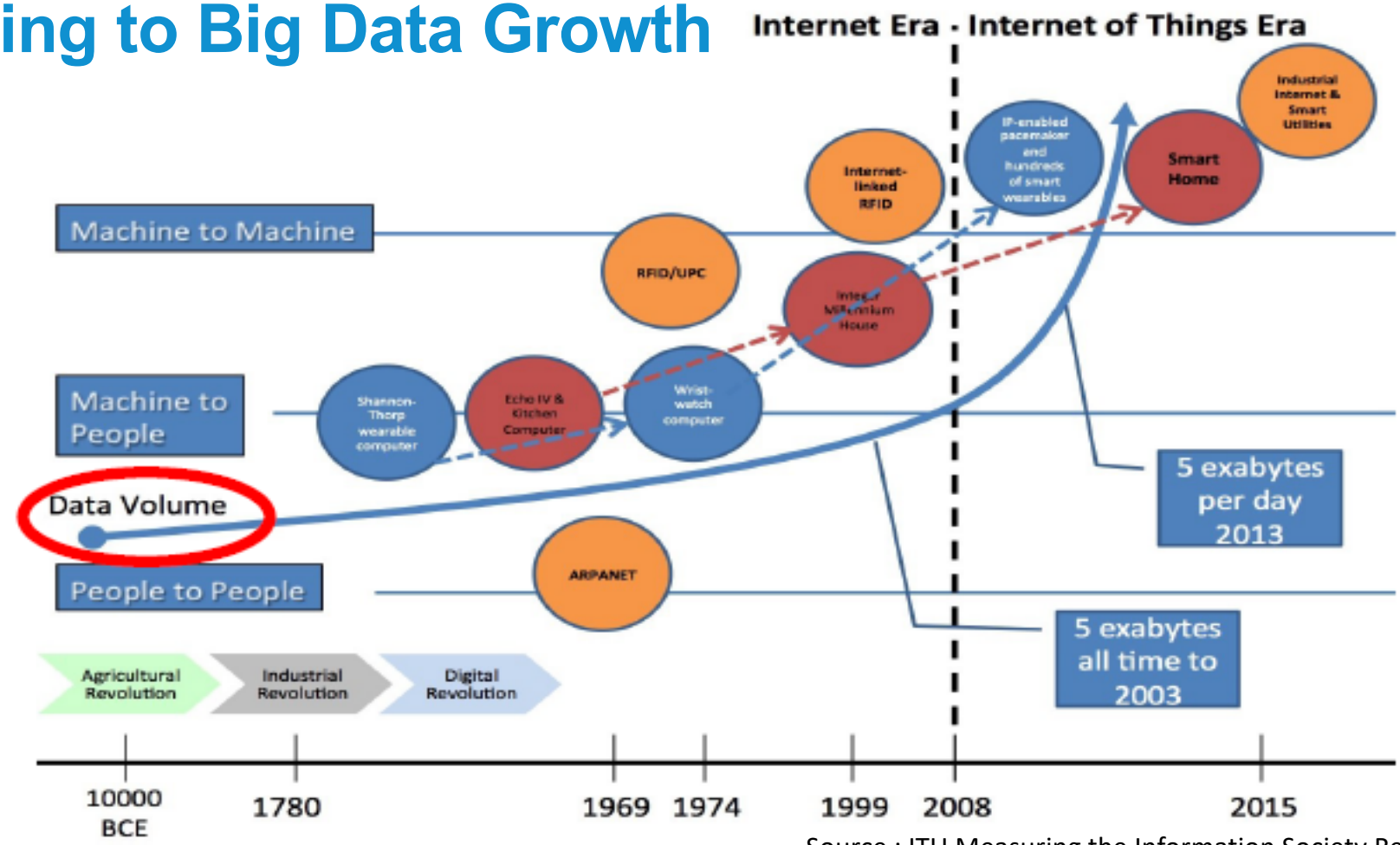
The knowledge hierarchy applied in data processing

Source: Barnaghi and al., "Semantics for the IoT: early progress and back to the future" (IJSWIS, 2012)

- Raw data are generated - as an example, by things (and more) in IoT
- Additional information enables creation of structured metadata (first step of data enrichment)
- Abstraction and perceptions give detailed insights of data by reasoning , using knowledge (ontologies, rules) of relevant domains (second step of data enrichment)
- Actionable intelligence allows decision making

Source : Mr. Marco Carugi

Technological Developments Leading to Big Data Growth



Source : ITU Measuring the Information Society Report 2015

ITU's Work – Big Data

- Highlight technological developments that have facilitated the emergence of big data
- Identify sources and uses of big data for development and monitoring of the information society
- Develop standards related to big data

#ICT4SDG

3 Pillars of Sustainable Development

- Economic development
- Social inclusion
- Environmental protection

How Big Data is Defined?

More

- Capture as much as possible
- Present Need has no place in planning
- Acquire as much as possible

Messy

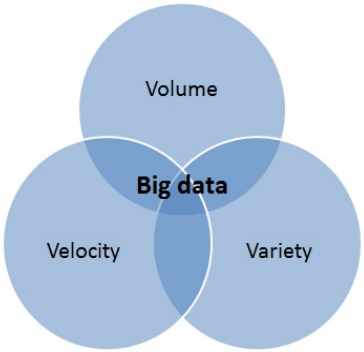
- Far better to capture more of varying quality than small data of high quality

Correlations

- People seek causes
- We know the '*what*' well before the '*why*'.

Volume: refers to the amount of data collected, stored, analysed and visualized, which big data technologies need to resolve;

Velocity: refers to both how fast the data is being collected and how fast the data is processed by big data technologies to deliver expected results.



Variety: refers to different data types and data formats that are processed by big data technologies;

ITU- T Recommendation Y.3600 A paradigm for enabling the collection, storage, management, analysis and visualization, potentially under real-time constraints, of extensive datasets with heterogeneous characteristics.

As networks converge, data reuse provides a great opportunity to innovate..

+

Enabling Environment, Digital Inclusion

Skills and capacity Building

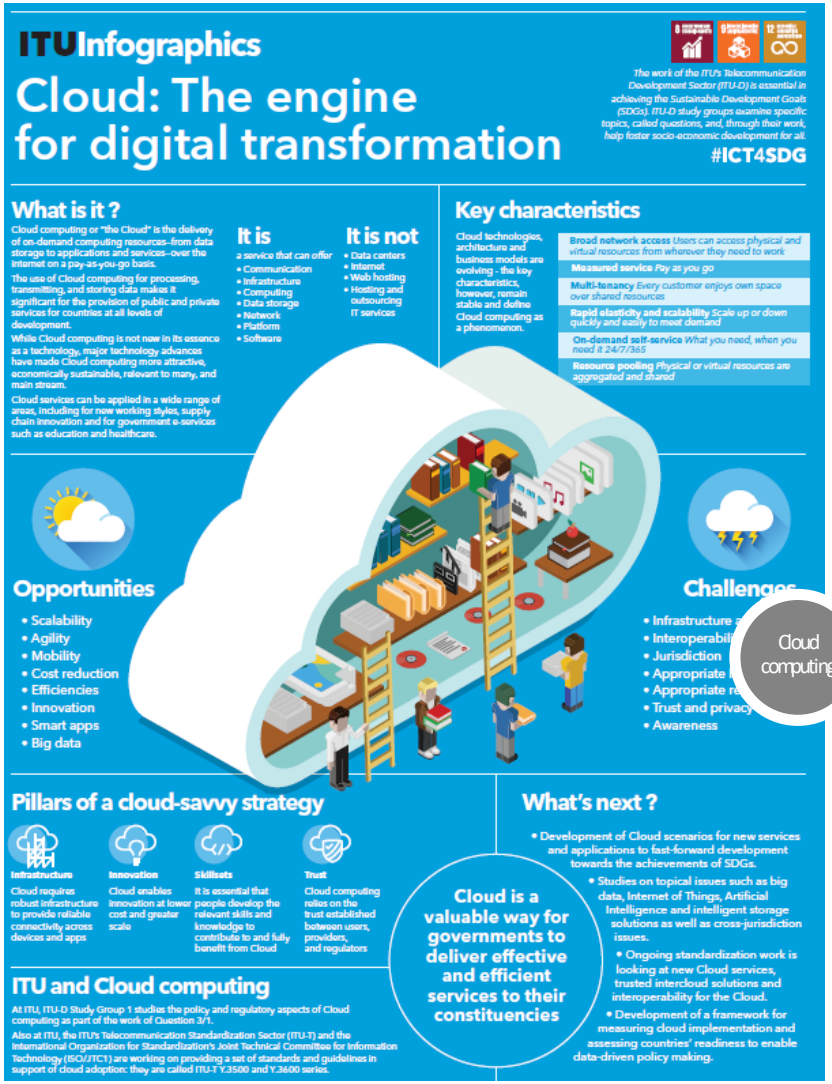
Innovation

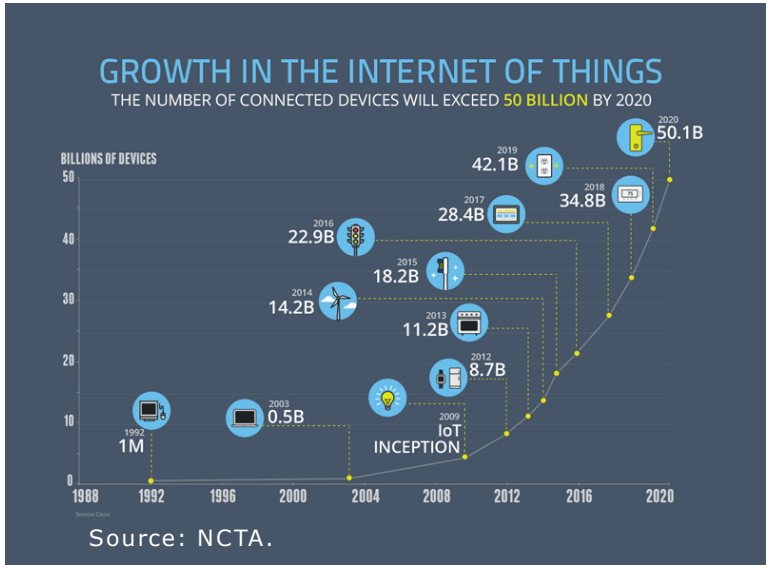
Source: ITU-T Focus Group on Smart Sustainable Cities

Country/Sector Development priorities:

- Digital Economy agenda
- Universal Health Coverage
- End Hunger, Food Security
- Education for all
- Smart City

Digital Transformation Initiatives forms a key driver of Big Data


ITUInfographics
Cloud: The engine for digital transformation
The work of the ITU's Telecommunication Development Sector (ITU-D) is essential in achieving the Sustainable Development Goals (SDGs). ITU-D study groups examine specific topics, called questions, and, through their work, help foster socio-economic development for all.
#ICT4SDG
What is it ?
Cloud computing or "the Cloud" is the delivery of on-demand computing resources–from data storage to applications and services–over the Internet on a pay-as-you-go basis.
The use of Cloud computing for processing, transmitting, and storing data makes it significant for the provision of public and private services for countries at all levels of development.
While Cloud computing is not new in its essence as a technology, major technology advances have made Cloud computing more attractive, economically sustainable, relevant to many, and main stream.
Cloud services can be applied in a wide range of areas, including for new working styles, supply chain innovation and for government e-services such as education and healthcare.
It is
a service that can offer
• Communication
• Infrastructure
• Computing
• Data storage
• Network
• Platform
• Software
It is not
• Data centers
• Internet
• Web hosting
• Hosting and outsourcing IT services
Key characteristics
Cloud technologies, architecture and business models are evolving - the key characteristics, however, remain stable and define Cloud computing as a phenomenon.
Broad network access Users can access physical and virtual resources from wherever they need to work
Measured service Pay as you go
Multi-tenancy Every customer enjoys own space over shared resources
Rapid elasticity and scalability Scale up or down quickly and easily to meet demand
On-demand self-service What you need, when you need it 24/7/365
Resource pooling Physical or virtual resources are aggregated and shared
Opportunities
• Scalability
• Agility
• Mobility
• Cost reduction
• Efficiencies
• Innovation
• Smart apps
• Big data
Challenges
• Infrastructure
• Interoperabil
• Jurisdiction
• Appropriate
• Appropriate re
• Trust and privacy
• Awareness
Pillars of a cloud-savvy strategy
Infrastructure
Cloud requires robust infrastructure to provide reliable connectivity across devices and apps
Innovation
Cloud enables innovation at lower cost and greater scale
Skillsets
It is essential that people develop the relevant skills and knowledge to contribute to and fully benefit from Cloud
Trust
Cloud computing relies on the trust established between users, providers, and regulators
Cloud is a valuable way for governments to deliver effective and efficient services to their constituencies
What's next ?
• Development of Cloud scenarios for new services and applications to fast-forward development towards the achievements of SDGs.
• Studies on topical issues such as big data, Internet of Things, Artificial Intelligence and intelligent storage solutions as well as cross-jurisdiction issues.
• Ongoing standardization work is looking at new Cloud services, trusted intercloud solutions and interoperability for the Cloud.
• Development of a framework for measuring cloud implementation and assessing countries' readiness to enable data-driven policy making.
ITU and Cloud computing
At ITU, ITU-D Study Group 1 studies the policy and regulatory aspects of Cloud computing as part of the work of Question 3/1.
Also at ITU, the ITU's Telecommunication Standardization Sector (ITU-T) and the International Organization for Standardization's Joint Technical Committee for Information Technology (ISO/JTC1) are working on providing a set of standards and guidelines in support of cloud adoption: they are called ITU-T Y.3500 and Y.3600 series.


GROWTH IN THE INTERNET OF THINGS
THE NUMBER OF CONNECTED DEVICES WILL EXCEED 50 BILLION BY 2020
BILLIONS OF DEVICES
1992 1M
2003 0.5B
2009 IoT INCEPTION
2012 8.7B
2013 11.2B
2014 14.2B
2015 18.2B
2016 22.9B
2017 28.4B
2018 34.8B
2019 42.1B
2020 50.1B
1988 1992 1996 2000 2004 2008 2012 2016 2020
Source: NCTA.


Internet of Things


Big data

Cloud computing

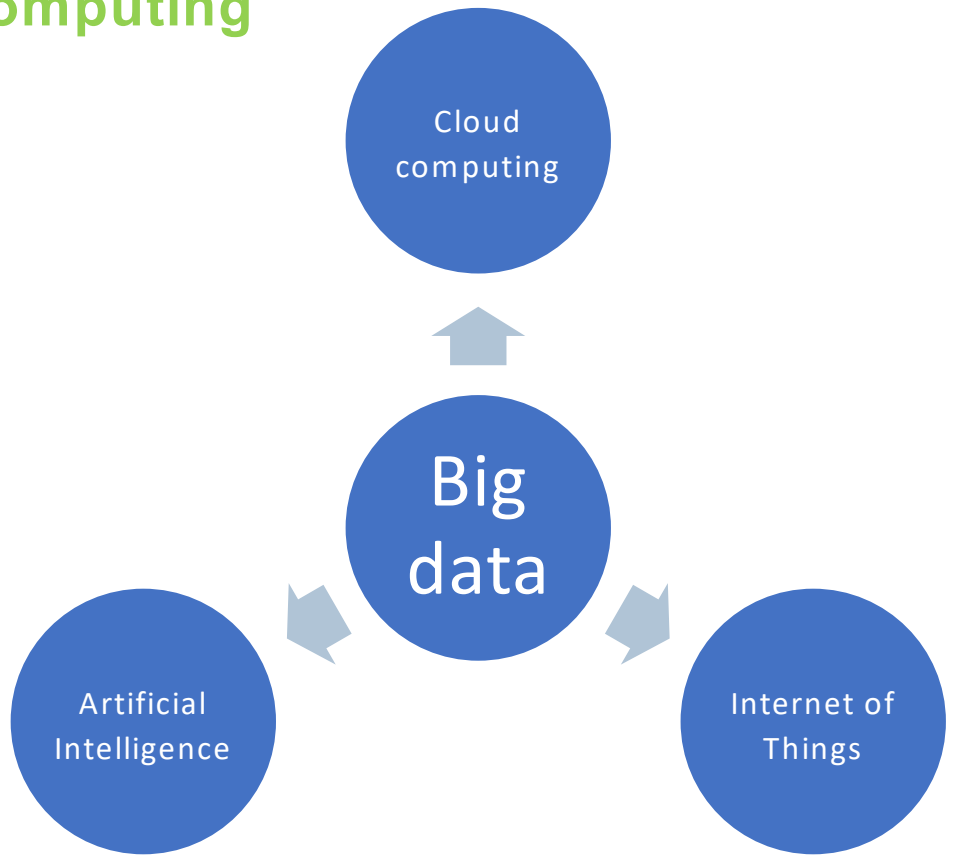

Artificial Intelligence

AI for Good
Global Summit
Accelerating progress towards the SDGs
#AIforGood
In partnership with
XPRIZE
acm

Emerging Enabling Technologies

Relationship : Big Data & Cloud Computing

Big data refers to technologies and services which extract valuable information from the extensive datasets characterized by the Vs, while **Cloud Computing** is, as defined in [ITU-T Y.3500], the paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand.



The Internet of Things

The ITU-T's definition of the IoT calls it "a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies"

What Is It?

"A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication" (ITU-T)

Who Makes It?

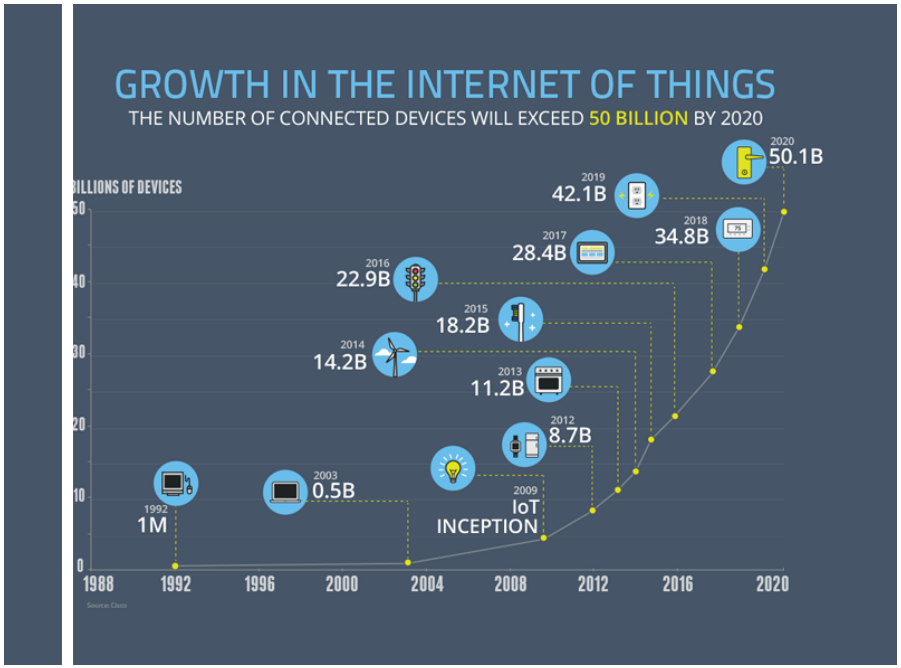
Device manufacturers, network operators, application platforms, software developers and (cloud-based) data analytics services providers

How Is It Accessed?

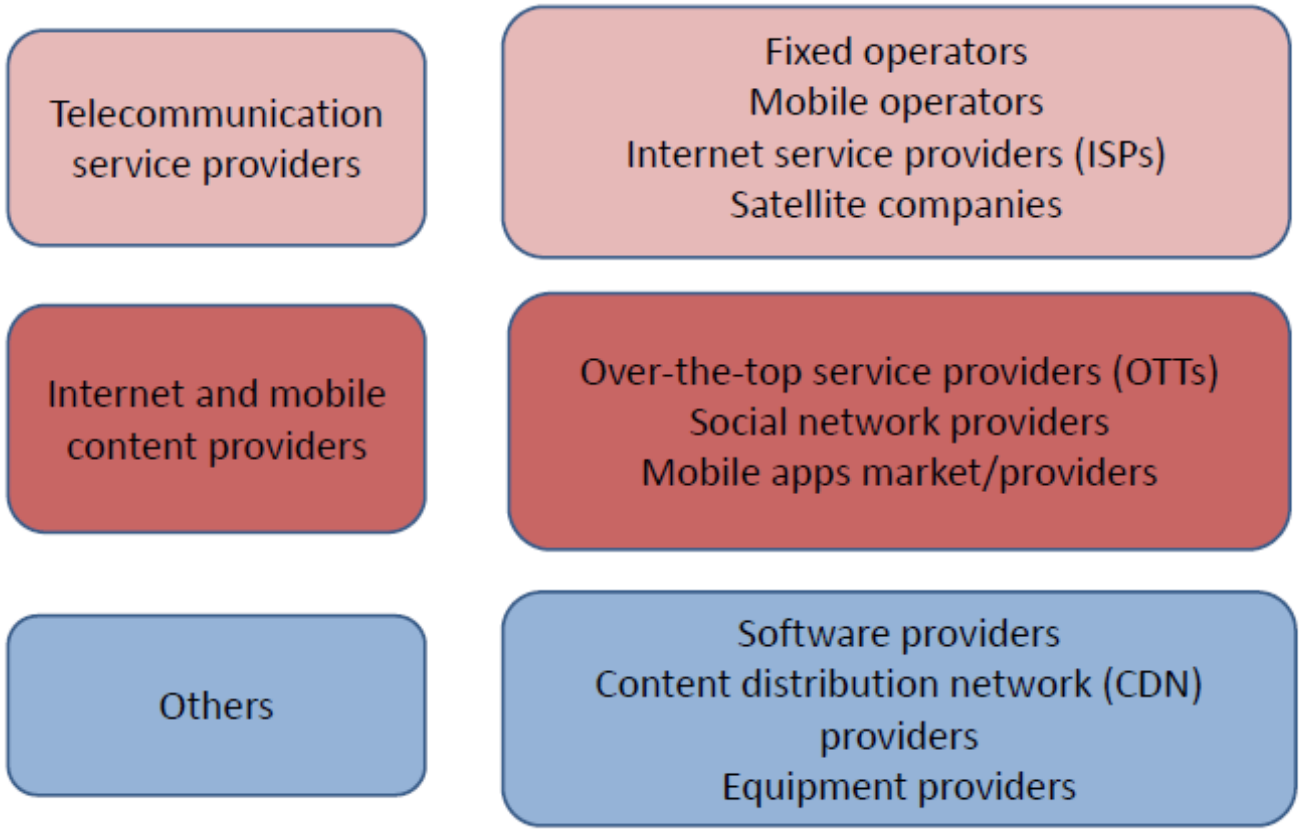
Connection of IoT devices via Wi-Fi, Bluetooth, mobile phone networks, specialized radio networks, global Internet

Main current areas of investment

- Smart cities
- Smart metering & grids
- Connected vehicles
- Healthcare



ICT Sector – Sources of Big Data



Big Data for Measuring the Information Society

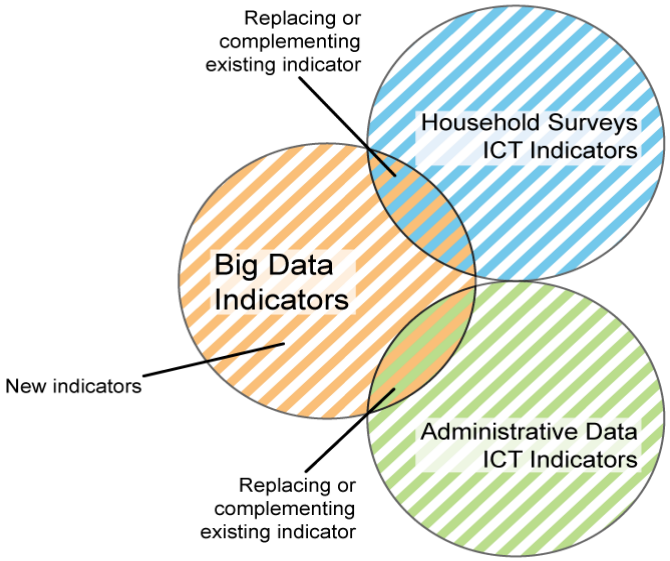
Objectives and expected results

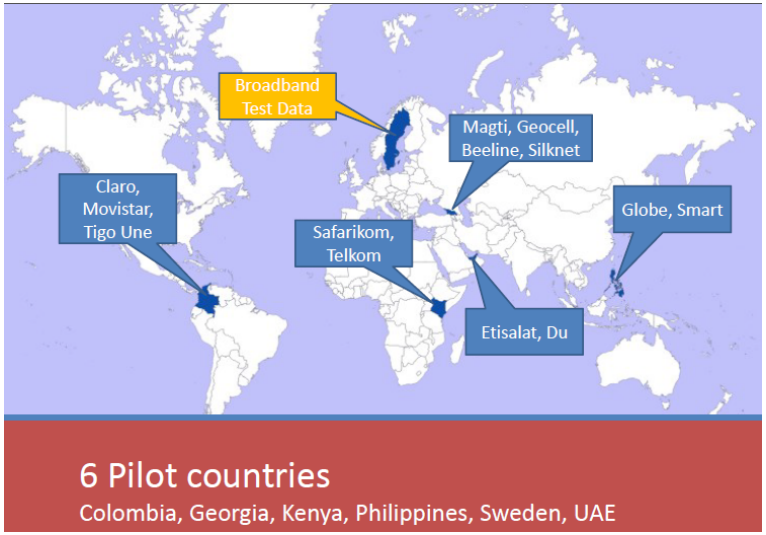
- Show how big data can be used to produce ICT indicators, including developing and testing methodologies
- Produce official statistics based on big data
- Enhance capacities in countries on the use of big data
- Illustrate possibilities and limitations of the data sources and indicators
- Demonstrate how the indicators can be used for policy and investment decisions

Data Sources

- Mobile Network Operators
- Internet Service Providers (ISPs)

Big Data for Measuring the Information Society





Challenges

Access to the data : Legal clearance (regulations), Administrative aspects, Data protection (DPA), What source data are collected and available?

Processing and analysis of large data sets : Location of the processing, Methodology for processing, quality of the data and indicators

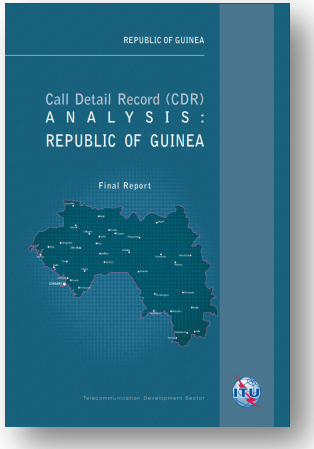
Which indicators can be calculated? : Are the resulting indicators valuable and usable for policy and investment decisions? Are the data comparable nationally, internationally, over time?

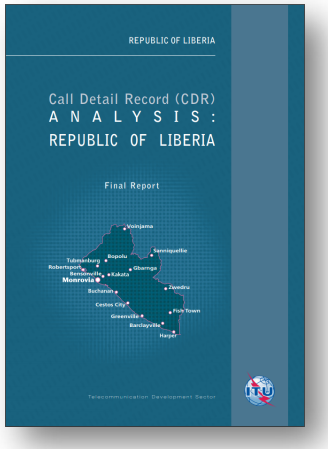
Big Data for Development - Emergency Response Enhancement

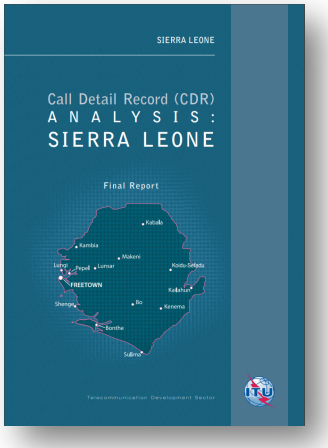
- ❑ Big data to facilitate the timely exchange of information to respond to epidemic outbreaks
- ❑ Piloted in context of 2014-15 Ebola outbreak
- ❑ Beneficiary countries : Guinea, Liberia and Sierra Leone
- ❑ Foundation for Least Developing Countries to leapfrog into effective use of Big Data

Figure 1: Tracking population movement to develop an epidemic outbreak model in Sierra Leone

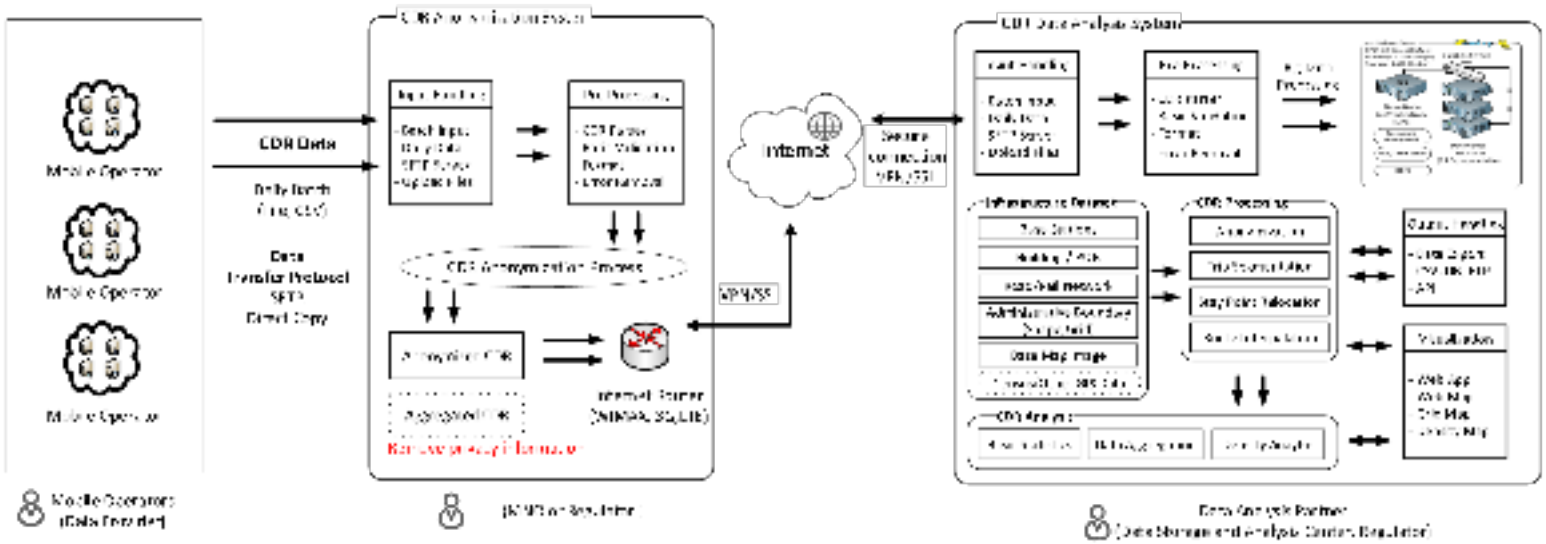
- **What:** estimate the human trajectories and spatiotemporal distribution of population
- **How:** Through analysis of anonymized Call Data Records as a "Big Data" source, derive visual information on citizens' mobility and their spaciotemporal distribution







Big Data for Development - Emergency Response Enhancement



More info at https://www.itu.int/en/ITU-D/Emergency-Telecommunications/Pages/BigData/default.aspx

Challenges

Privacy – user specific and personal information with CDR
Accuracy – geolocation estimation
Availability of data – support of operators and mobile industry
Data discontinuity – when people do not use their mobile phone

Cybersecurity usage

May be of use in event of Cyberattacks that impact real life of citizens

Example of Big Data technology application: Monitoring and predicting failures for plant facilities

Customer's challenge

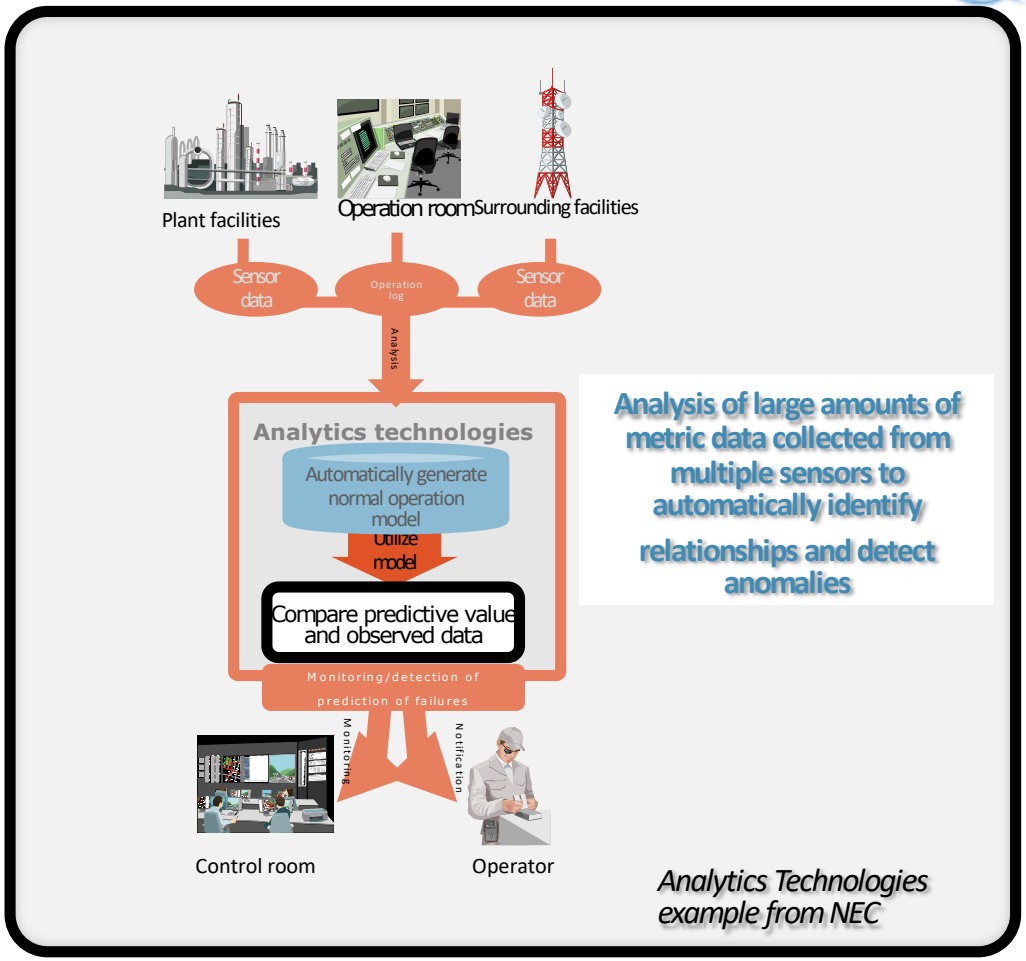
- Avoid damages by predicting failures, shorten the lead time to identify the cause of failure

Effect of solution

- Monitor/detect prediction of failures of plant facilities
- Detect abnormalities from large volume of sensor data at an early stage, avoid large-scale damage before it happens

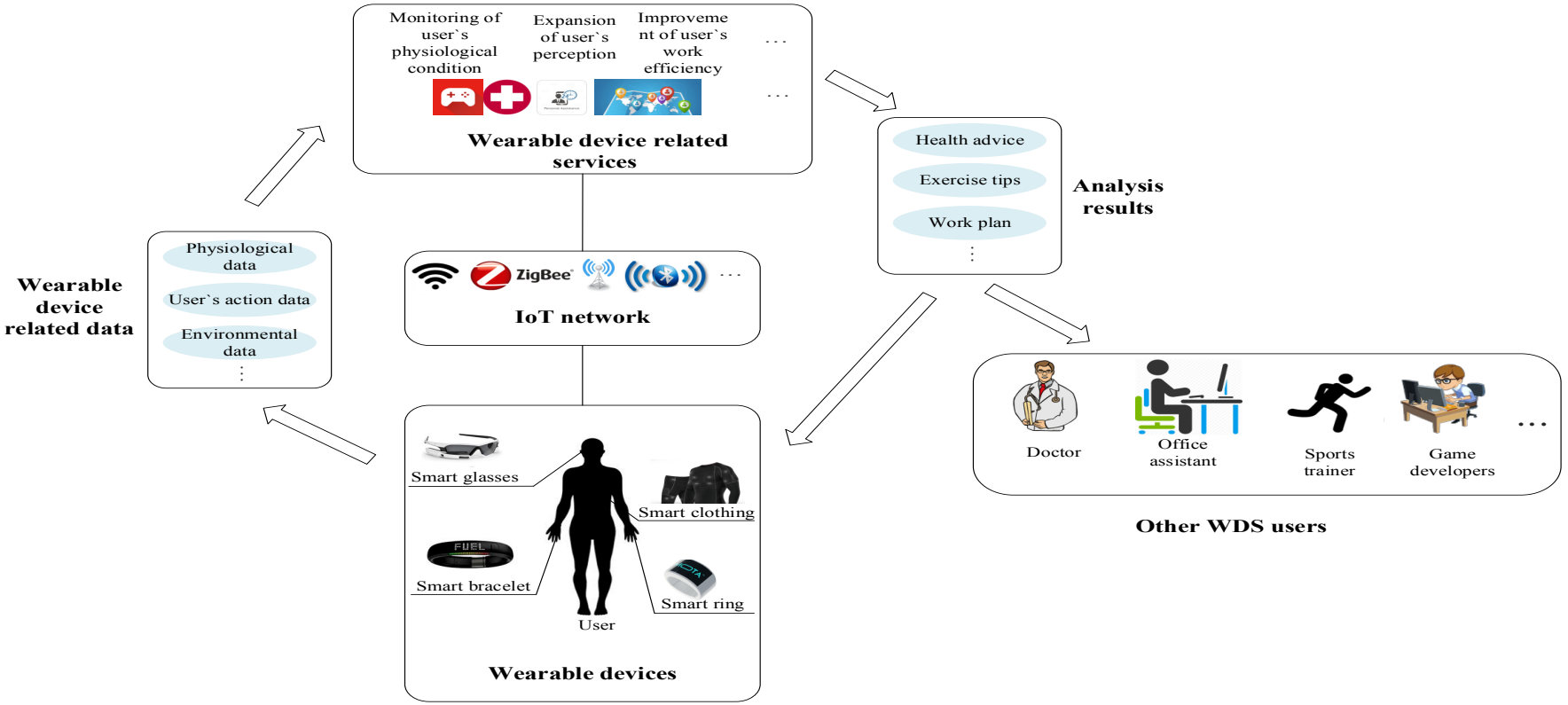
Point of introduction

- Visualize operational status from the existing data by Analytics technologies
- Utilize massive data in real time and realize high accuracy monitoring/detection of failure prediction



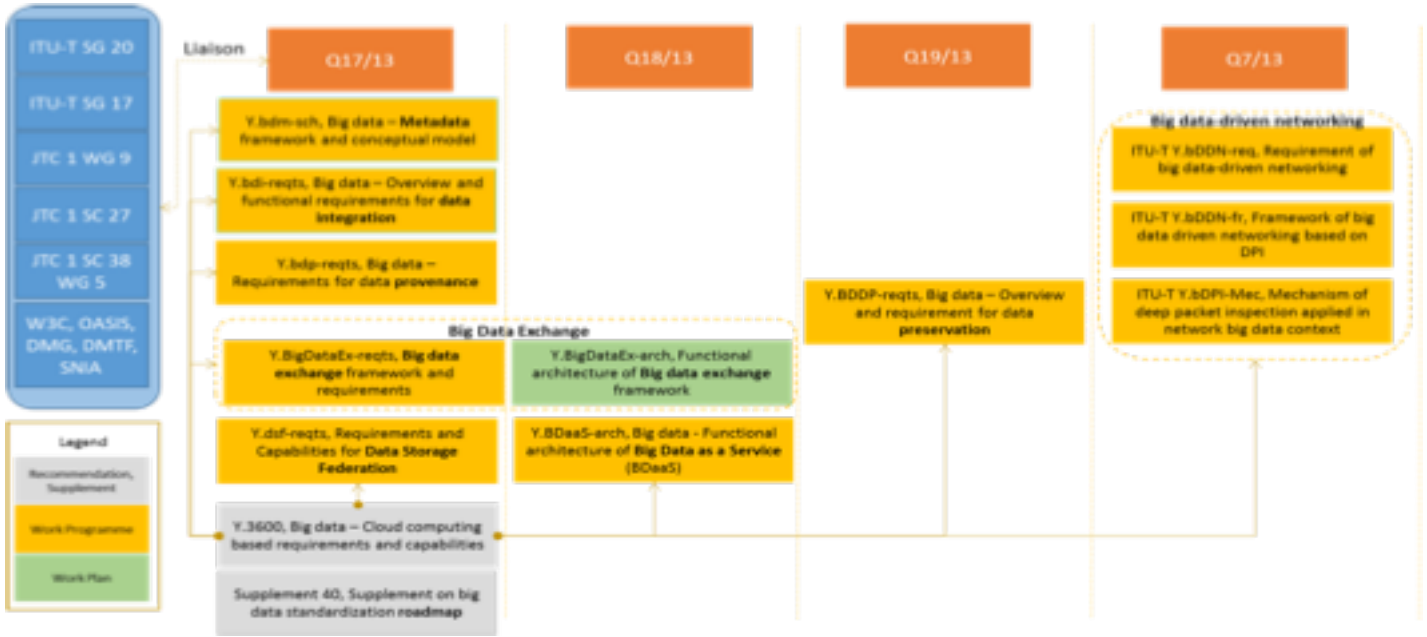
Source : Mr. Marco Carugi

Analytics Applications with Wearable Devices/ Services



Source: ITU-T SG20 Y.4117 « Requirements and capabilities of IoT for support of wearable devices and related services » / Marco Carugi

Big Data activities in ITU-T SG13 - status Q3 2017



Overall development roadmap of Big Data in ITU-T SG13

big data [ITU-T Y.3600]: A paradigm for enabling the collection, storage, management, analysis and visualization, potentially under real-time constraints, of extensive datasets with heterogeneous characteristics.
NOTE – Examples of datasets characteristics include high-volume, high-velocity, high-variety, etc.

IoT big data characteristics [ITU-T Y.4114]: IoT data set characteristics of high-volume, high-velocity and/or high-variety related to the challenges of IoT data set operations.

NOTE 1 – The term "volume" refers to the size of the IoT data sets, the term "velocity" refers to the speed of IoT data streams in and out of the IoT data sets and the term "variety" refers to the diversity of IoT data types of the IoT data sets.
NOTE 2 – Additional dimensions of data, such as veracity, variability, etc., may also be associated with the IoT big data characteristics.
NOTE 3 – Examples of operations on IoT data sets include collection, pre-processing, transfer, storage, query, analysis and visualization.

Source : Mr. Marco Carugi

Big Data and Radiocom Standards

Radiocommunications: meteorological service (both terrestrial and space), earth exploration satellite service, broadcasting (video on-demand), future IoT for smart cities, power grids management.

ITU-R Study Groups Big Data related topics

Collection of Data – IoT and M2M

Transmission of Data – Networks and services (5G, Satellite, Broadcasting, EESS, METSAT, etc.) intelligent transport systems, meteorological systems, smart cities

ITU-D SG1 and SG2 Questions under study (2018-2021)

SG1: Enabling environment for the development of telecommunications/ICTs

Study Question	Relevant SDG WSIS Action Line
Q1/1: Strategies and policies for the deployment of broadband in developing countries	
Q2/1: Strategies, policies, regulations and methods of migration and adoption of digital broadcasting and implementation of new services	
Q3/1: Emerging technologies, including cloud computing, m-services, and OTTs: Challenges and opportunities, economic and policy impact for developing countries	
Q4/1: Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks	
Q5/1: Telecommunications/ICTs for rural and remote area	
Q6/1: Consumer information, protection and rights: Laws, regulation, economic bases, consumer networks	
Q7/1: Access to telecommunication/ICT services by persons with disabilities and other persons with specific needs	

SG2: ICT services and applications for the promotion of sustainable development

Study Question	Relevant SDG WSIS Action Line
Q1/2: Creating smart cities and society: Employing ICTs for sustainable social and economic development	
Q2/2: Telecommunications/ICTs for e-health	
Q3/2: Securing information and communication networks: Best practices for developing a culture of cybersecurity	
Q4/2: Assistance to developing countries for implementing conformance and interoperability (C&I) programmes and combating counterfeit ICT equipment and theft of mobile devices	
Q5/2: Utilizing telecommunications/ICTs for disaster risk reduction and management	
Q6/2: ICT and the environment	
Q7/2: Strategies and policies concerning human exposure to electromagnetic fields	

www.itu.int/ITU-D/study-groups/

ITU-D study groups assist Member States in achieving their SDG targets and development goals

Conclusion

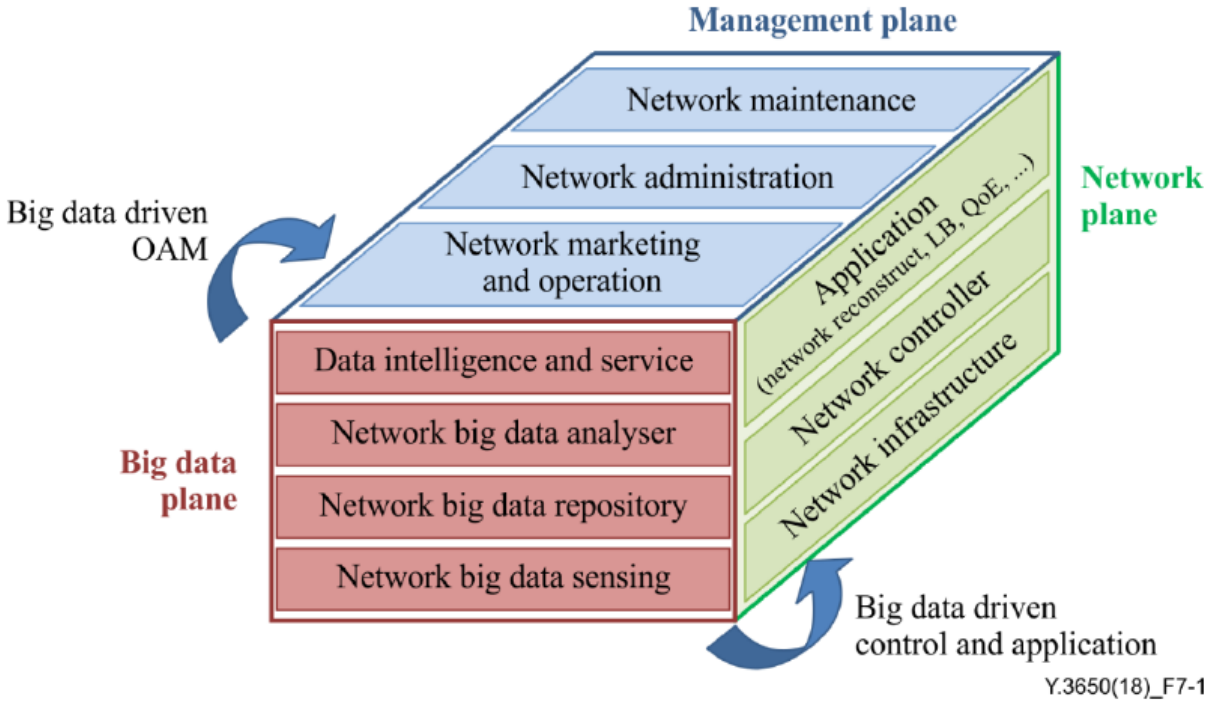
- Use of Big Data in Public Policy to enable evidence based decision making
- Governments using BD for efficient and effective use of public services such as health, education, agriculture, disaster response, national statistics and enhancing scientific research promoting SMEs
- Some challenges remain
  - ✓Privacy
  - ✓Security
  - ✓Ownership
  - ✓Interoperability
- ITU providing platform for harmonized standards to Big Data and demonstrating its practical use for achieving UN Sustainable Development Goals

Thank you

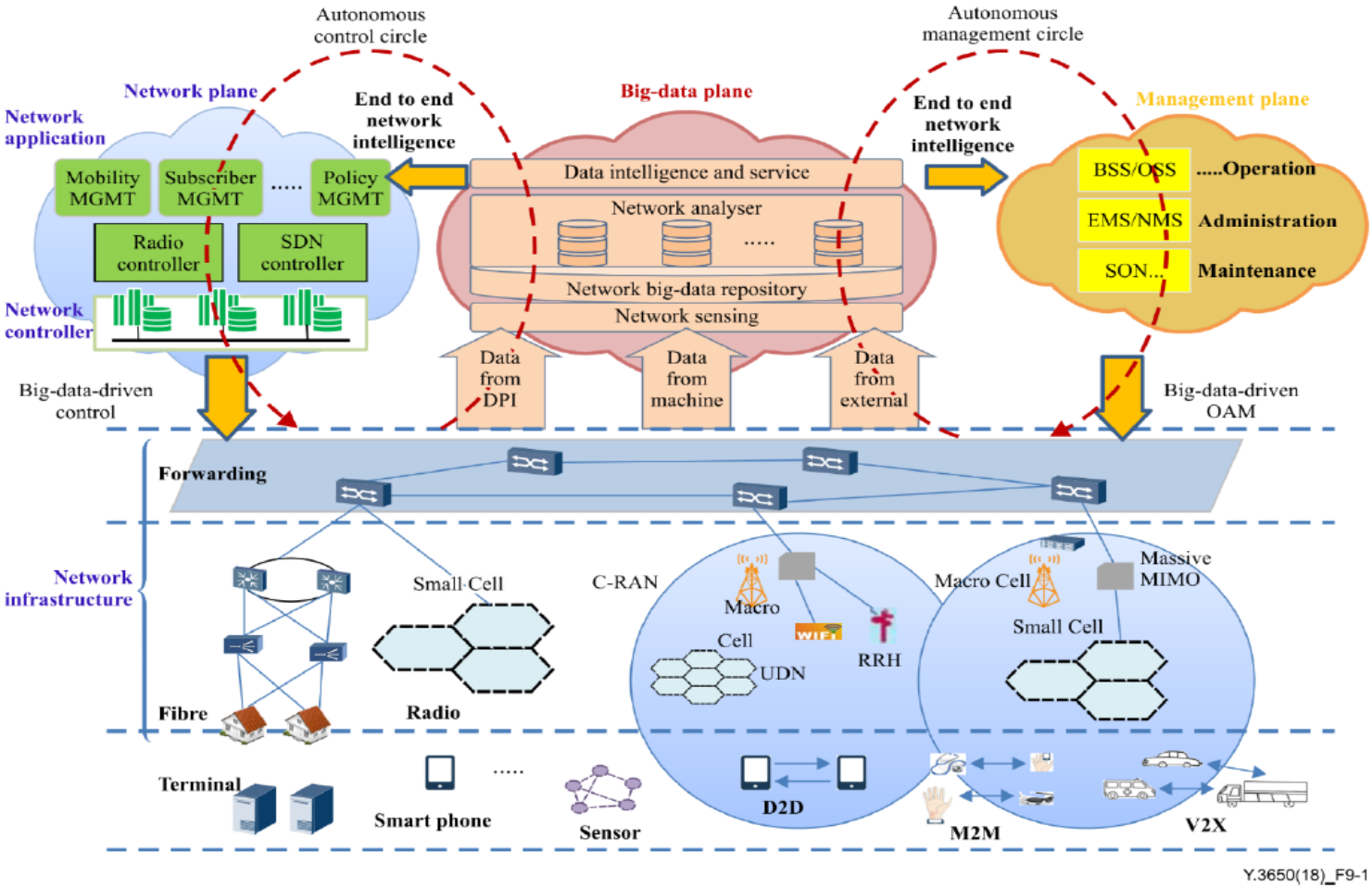
Sameer.Sharma@itu.int

Framework of Big Data Driven Network

The big data generated by networks themselves implies a great deal of useful information for network management, operation, control, optimization and security, etc. Such valuable and such a tremendous amount of information, unfortunately, cannot be efficiently utilized by traditional network architecture.



The Module Architecture of bDDN



bDDN is composed of three planes, and each plane is composed of several layers. The big data plane is composed of four layers. The bottom lays the data sensing layer, which, with the help of DPI and other technologies, collects various data (including traffic data, network device performance data, network management data and operation data, etc.) from the network scientifically.

Standardization of Big Data for Sustainable Development

ITU-T Recommendation Y. 3600 by Study Group 13 : Big data – Cloud computing based requirements and capabilities

Provides requirements, capabilities and use cases of cloud computing based big data. Cloud computing based big data provides the capabilities to collect, store, analyze, visualize and manage varieties of large volume datasets, which cannot be rapidly transferred and analysed using traditional technologies.

ITU-T Recommendation Series Y Supplement 40 by Study Group 13 : Big Data Standardization Roadmap

describes the landscape and conceptual ecosystem of big data from an ITU-T perspective, related technical areas, activities in standards development organizations (SDOs) and gap analysis.

ITU-T Recommendation Y. 3601 by Study Group 13: Big data – framework and requirements for data exchange

provides a framework for data exchange in a big data ecosystem. Big data exchange covers multiple processes for data import and data export within a big data ecosystem. Big data exchange is used for exchanging data of multiple types and multiple formats from a data source to a data target. Y.3601 identifies general concepts, patterns, activities, and functional requirements based on the big data ecosystem and capabilities defined in ITU-T Y.3600.

ITU-T Recommendation Y. 3650 by Study Group 13: Framework of big-data-driven networking

specifies a framework for big-data-driven networking. Recommendation includes the model architecture of big-data-driven networking (bDDN), the high-level capabilities of bDDN and the interface capabilities among different planes and layers.

Ongoing work

- **in SG13** on **conceptual model**, overview, framework and requirements for **data integration, data provenance, data preservation, functional architecture** of big data, Big Data as a Service and **some applications** like big data to better shaping mobile network traffic.
- in ITU-T **FG ML5G** on **data formats for machine learning technologies** (network load prediction, channel modelling).

SG 20 is working on a Recommendation "Specific requirements and capabilities of the IoT for Big Data"

complements the developments on common requirements of the IoT [ITU-T Y.2066] and functional framework of the IoT [ITU-T Y.2068] in terms of the specific requirements and capabilities that the IoT is expected to support in order to address the challenges related to Big Data.