On Internet of Things and the question of impact on the environment

Presented at the ITU-T: Forum on Environmental Efficiency for Artificial Intelligence and other Emerging Technologies

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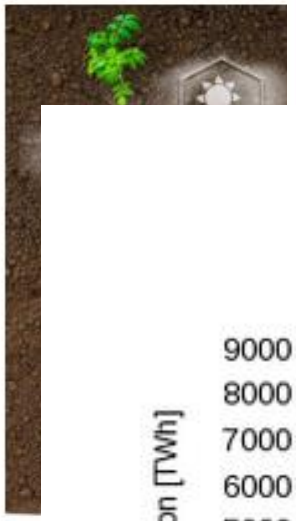
Collaboration Project sponsored by IFD: Telecom Sud Paris, Aarhus University, 2019

10,769 views | Sep 4, 2019, 10:46pm

How IoT And AI Can Enable Environme

Naveen Joshi Con
COGNITIVE WORL
AI



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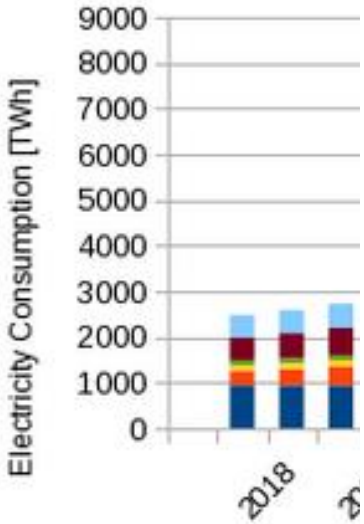
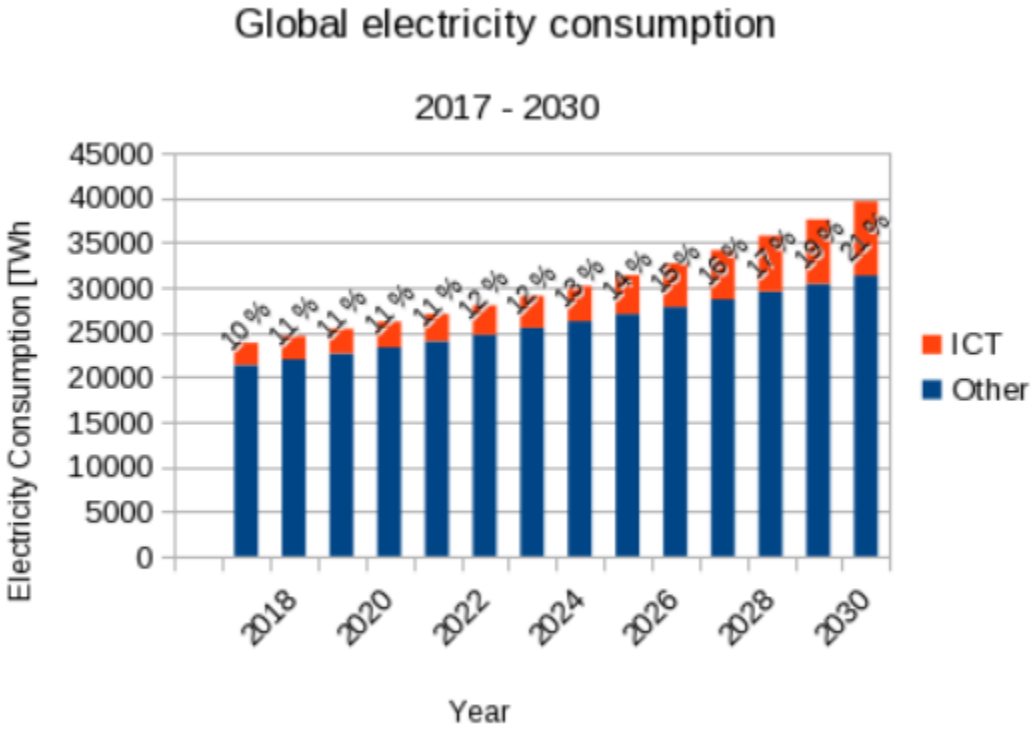
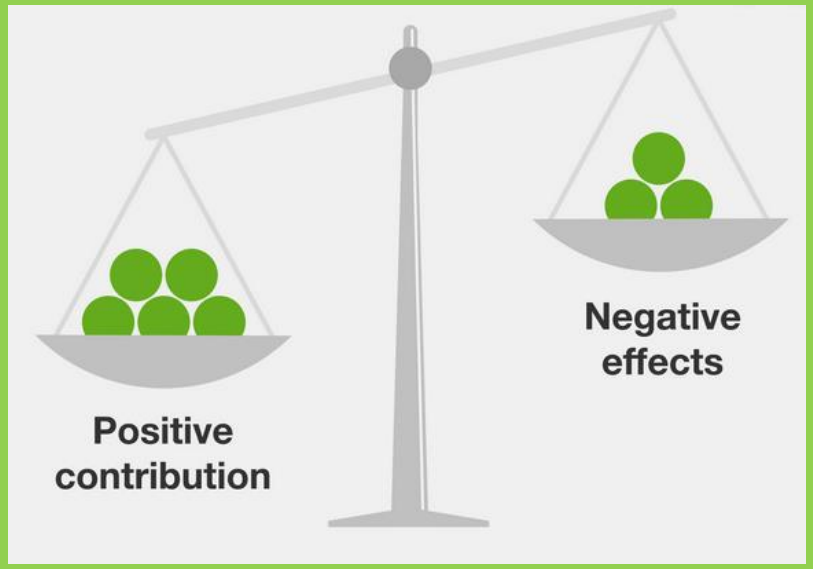
APPLICATION OF IOT AND AI FOR ENVIRONMENTAL SUSTAINABILITY

Global ICT electricity consumption





What is the real balance between IoT and AI benefits and negative effects?



Project: **Nature Friendly- Internet of Things (IoT), 2019 Grant**

Relate and study the Role of ICT, especially Internet of Things (IoT), in sustainable development (SD) particularly in EU countries.

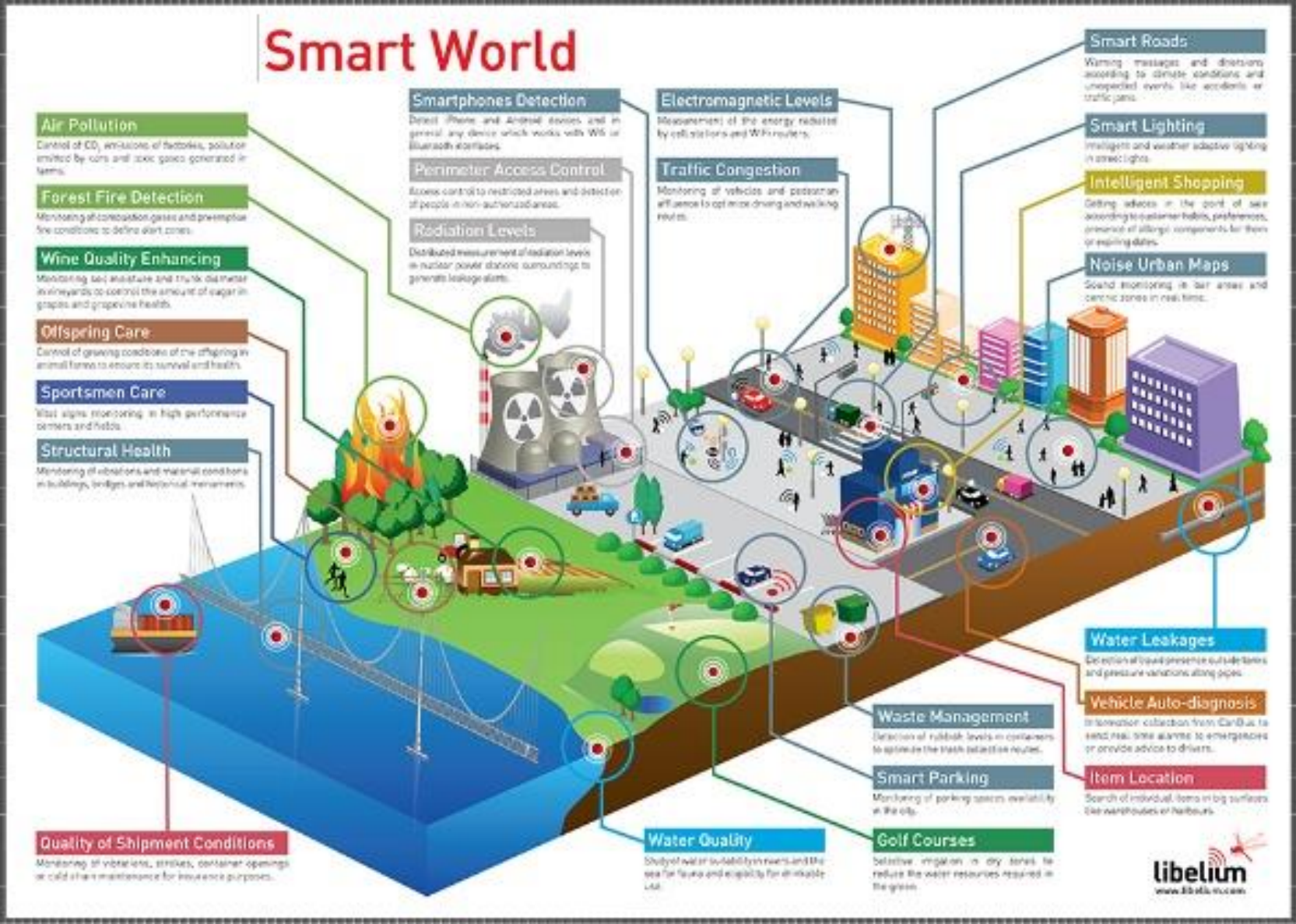
INSTITUT FRANÇAIS
DANEMARK

AARHUS UNIVERSITET
INSTITUT FOR MOLEKYLÆR BIOLOGI OG GENETIK

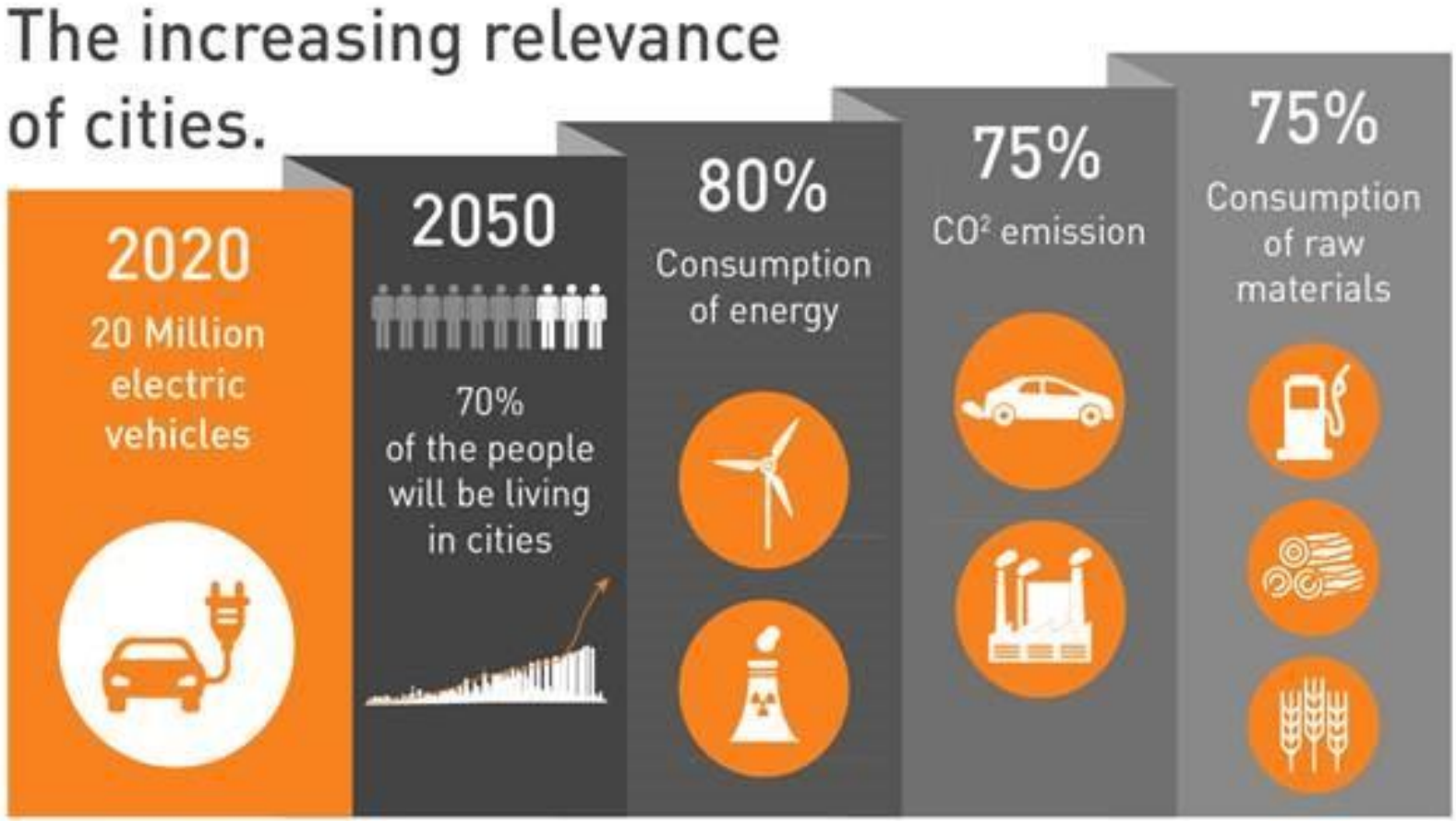
Dr. Ambuj Kumar, DK

Pr. Hakima Chaouchi, FR

IoT - A SMART WORLD of Sensors



Why? Ressources monitoring and optimisation



But also economic growth!

2x

… a significant economic impact

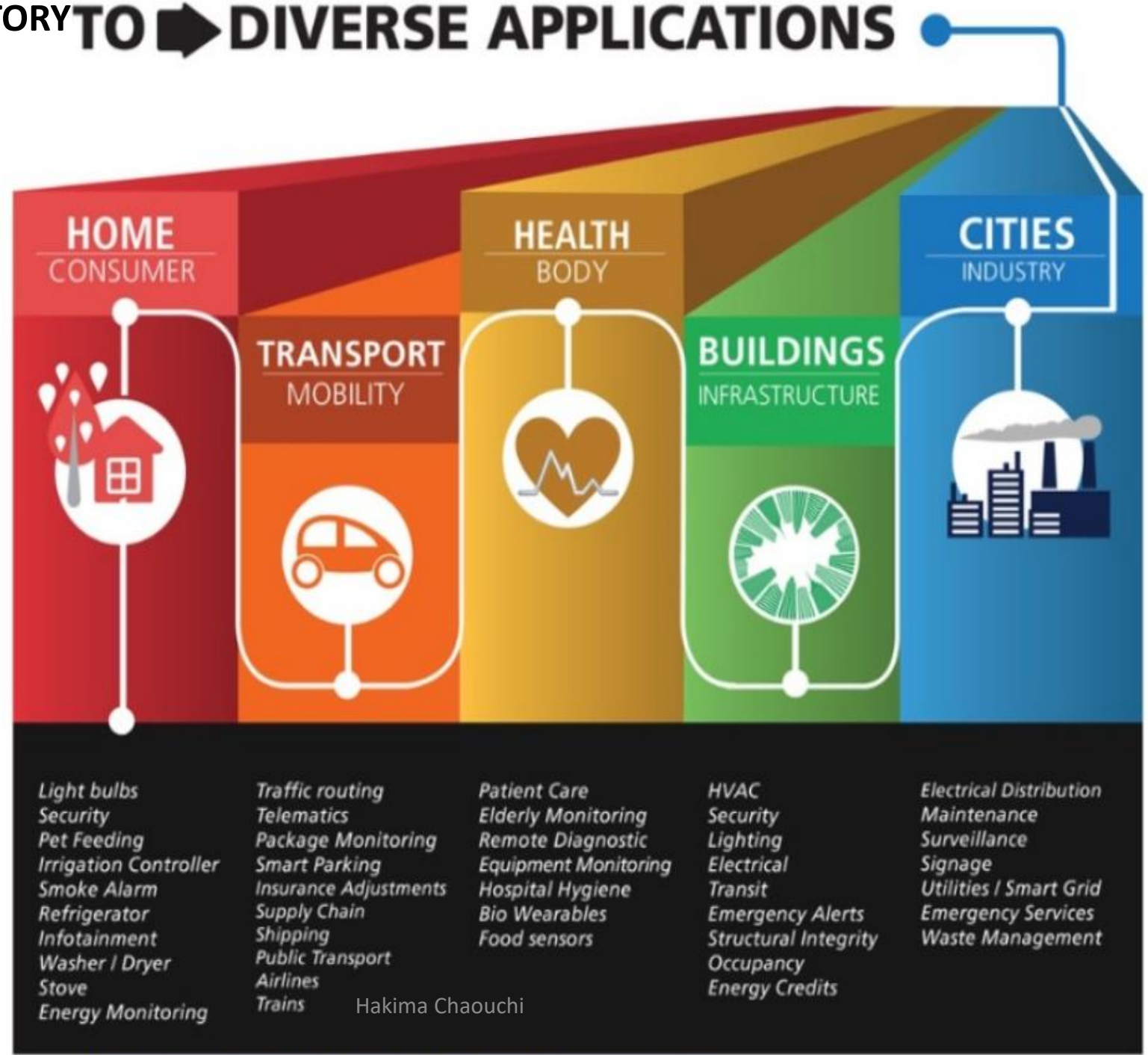
potential value of connected things @ B2B vs. B2C markets

"B2B use cases can generate 70% of potential value enabled by IoT"

Mc Kinsey

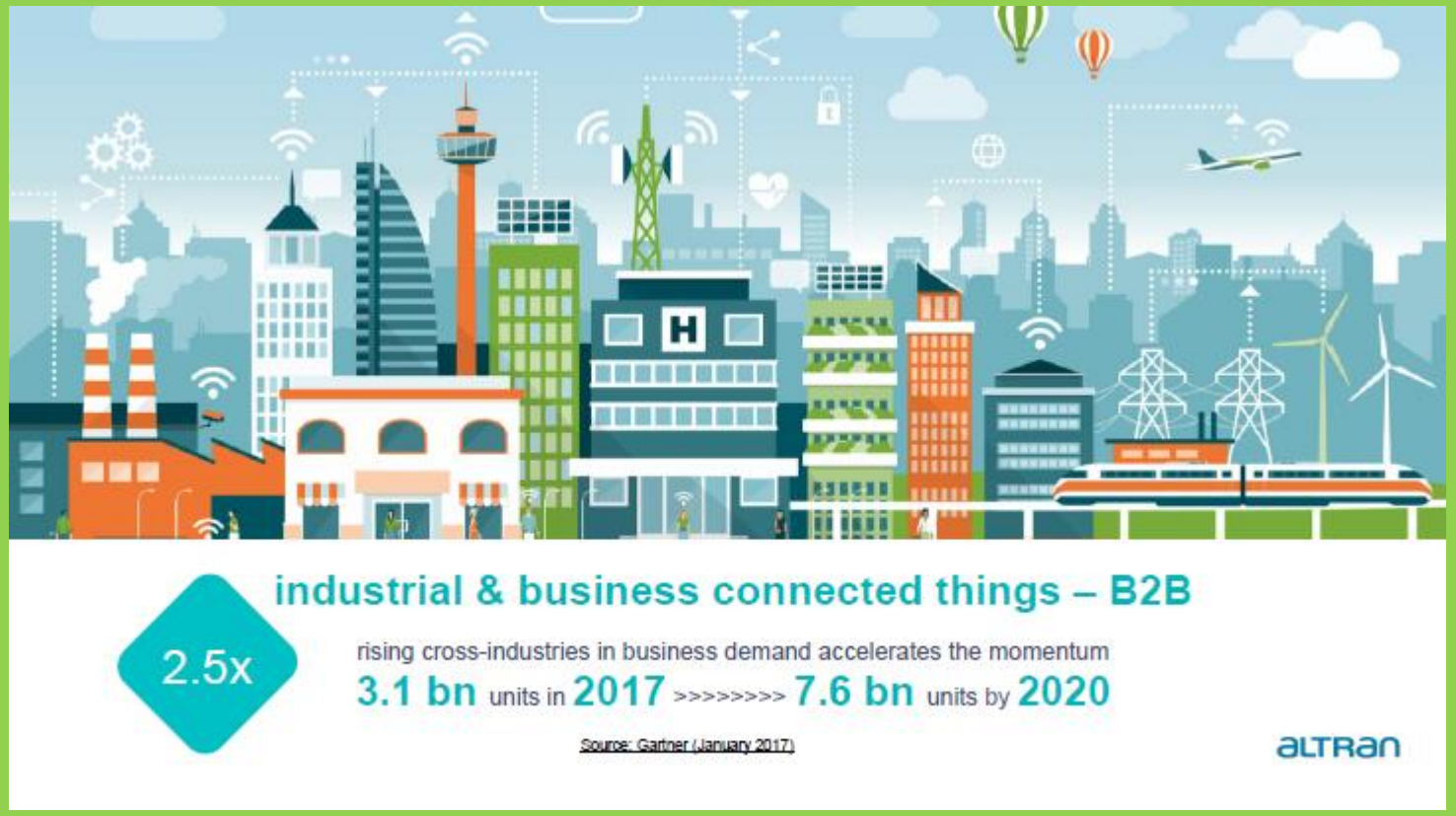
ALTRAN

FROM INVENTORY TO DIVERSE APPLICATIONS

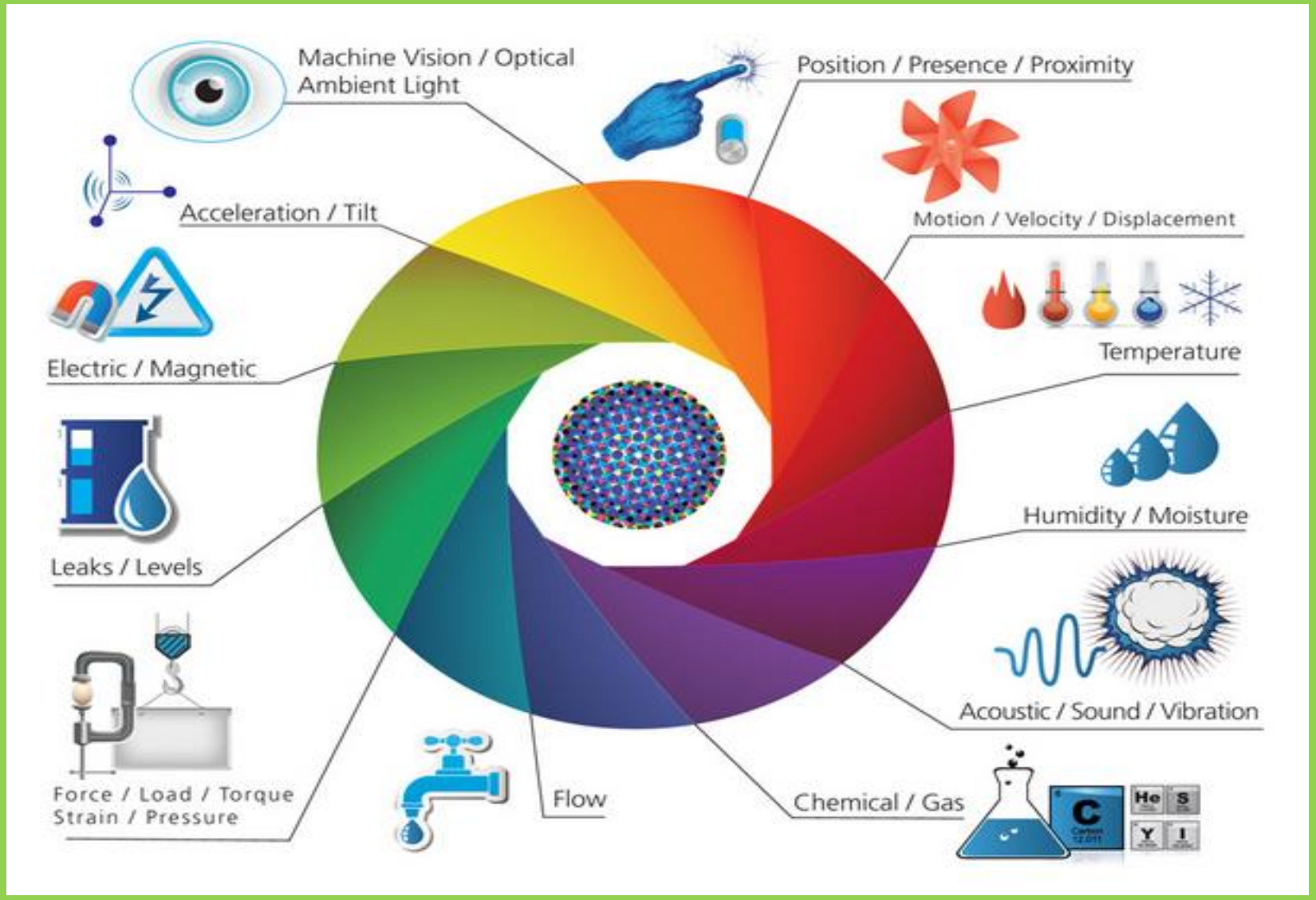


More electronic IoT devices in consumer IoT!

More electronic IoT devices in Industrial IoT!

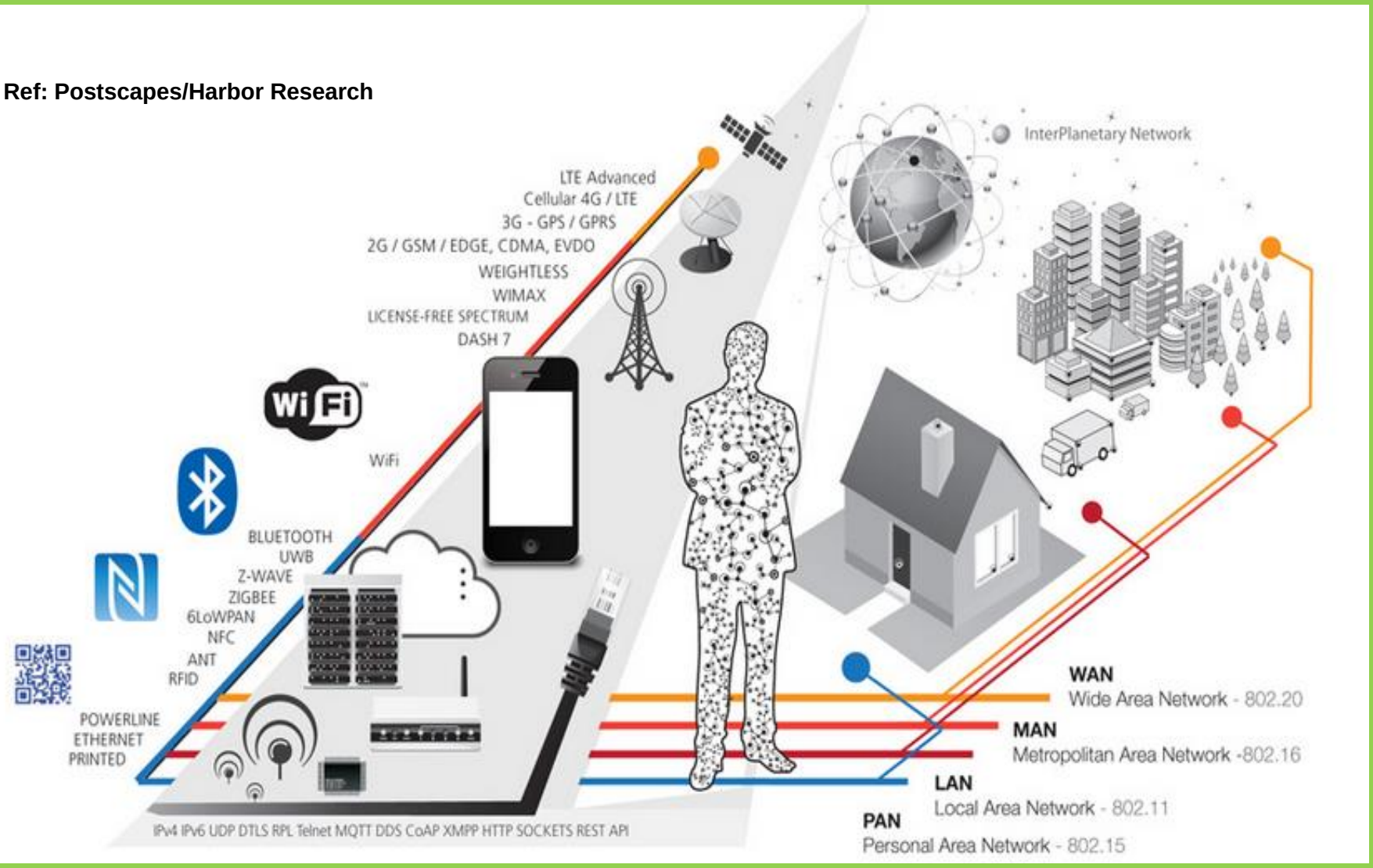


Billions of electronic devices



Communication technologies landscape!

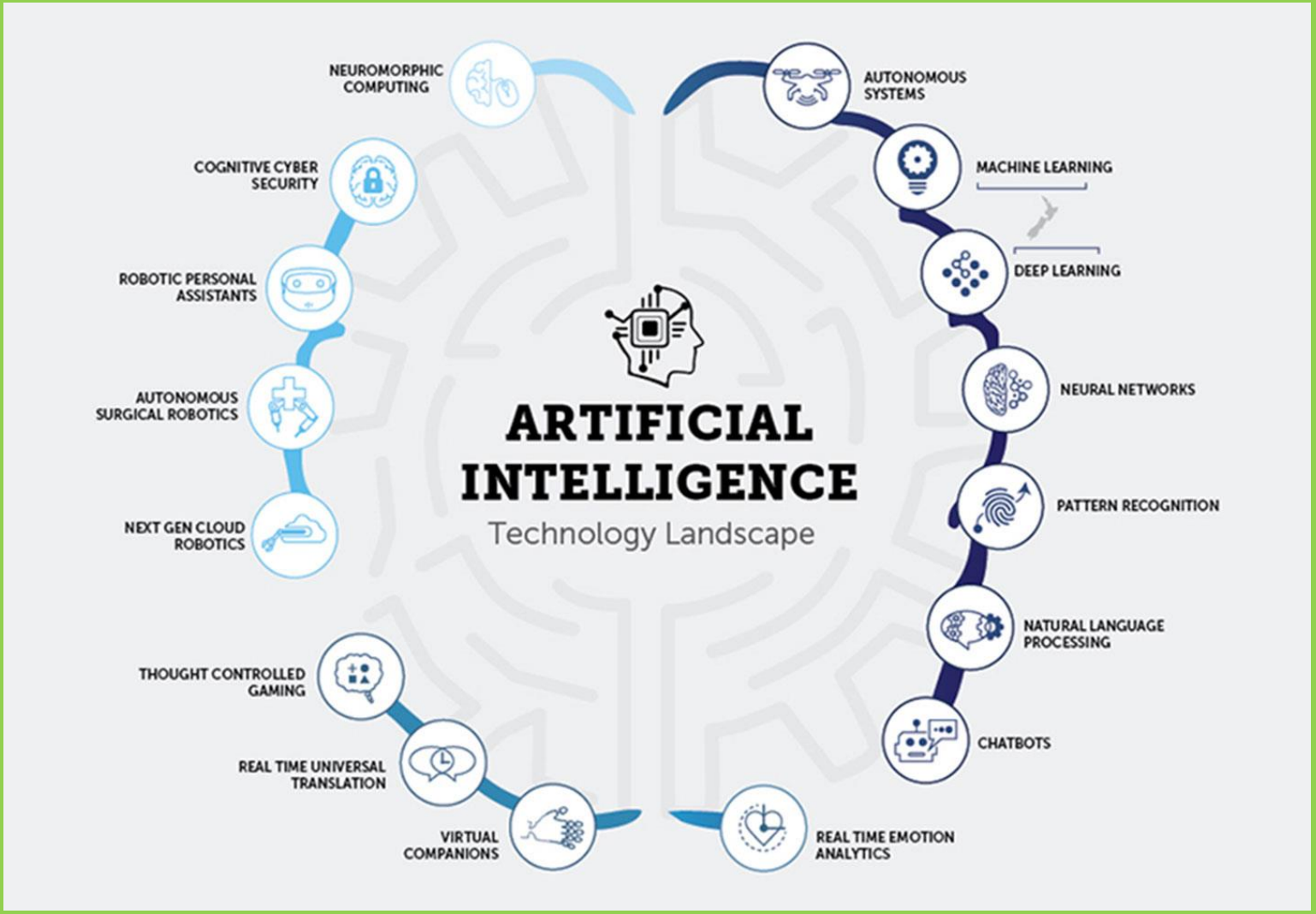
Ref: Postscapes/Harbor Research



IoT Data explosion: Cloud, BigData, Data Mining & Services

Ref: siliconangle.com

Algorithms: Artificial Intelligence



Data Factories!

Environment Impact?

Environment cost and Energy Cost

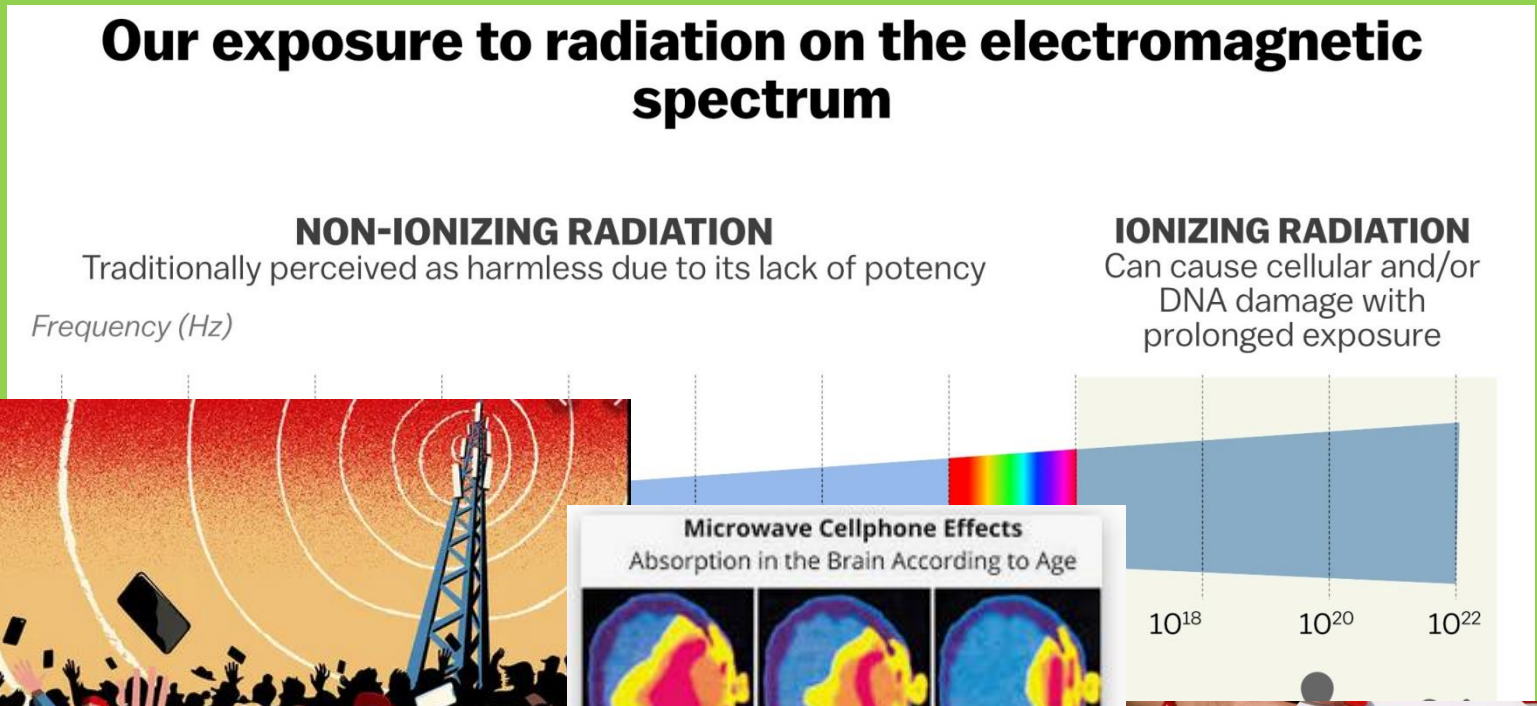
#1: Polution

- 2% of anthropogenic CO_2
- Roughly equivalent to aviation industry

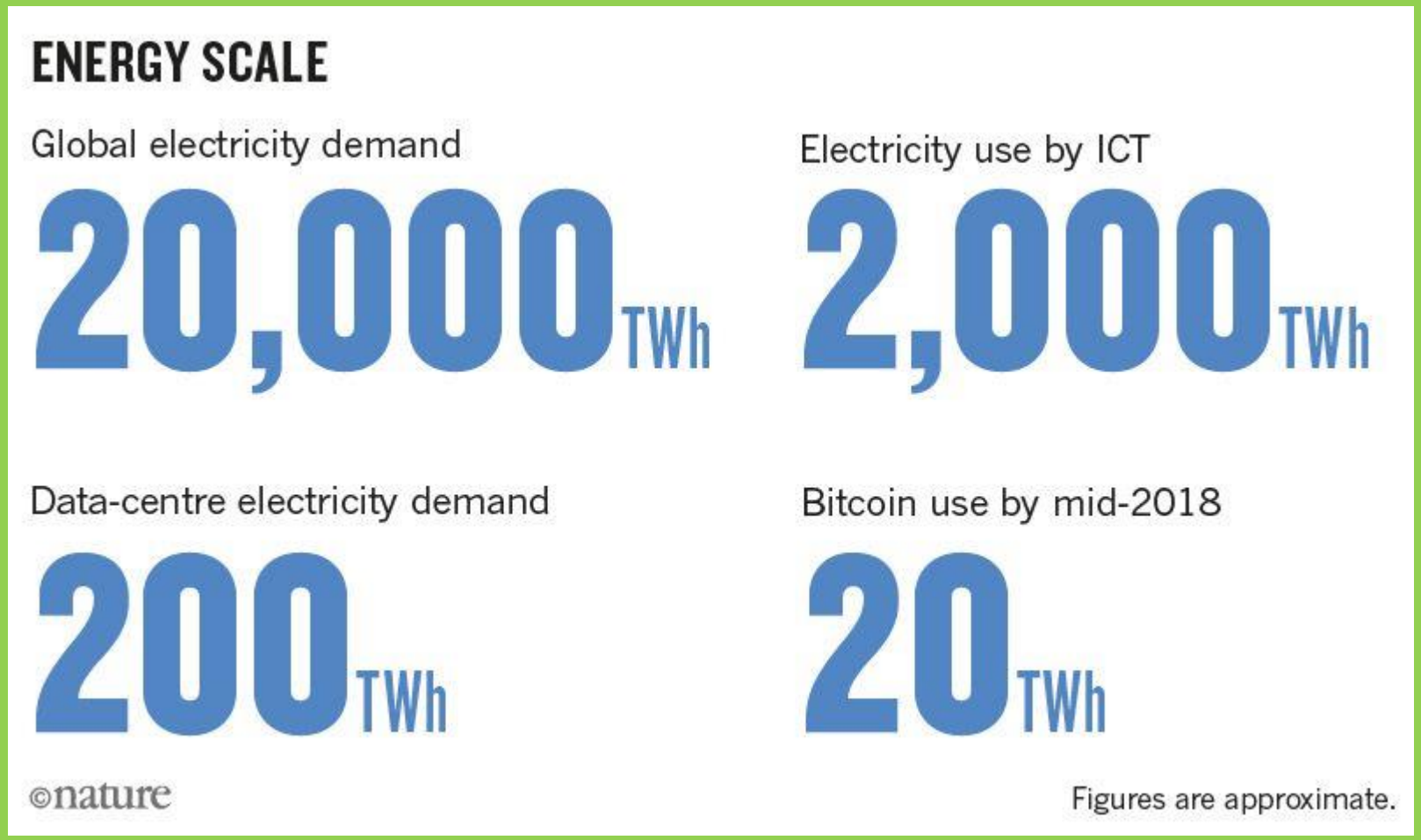
Electronic Waste

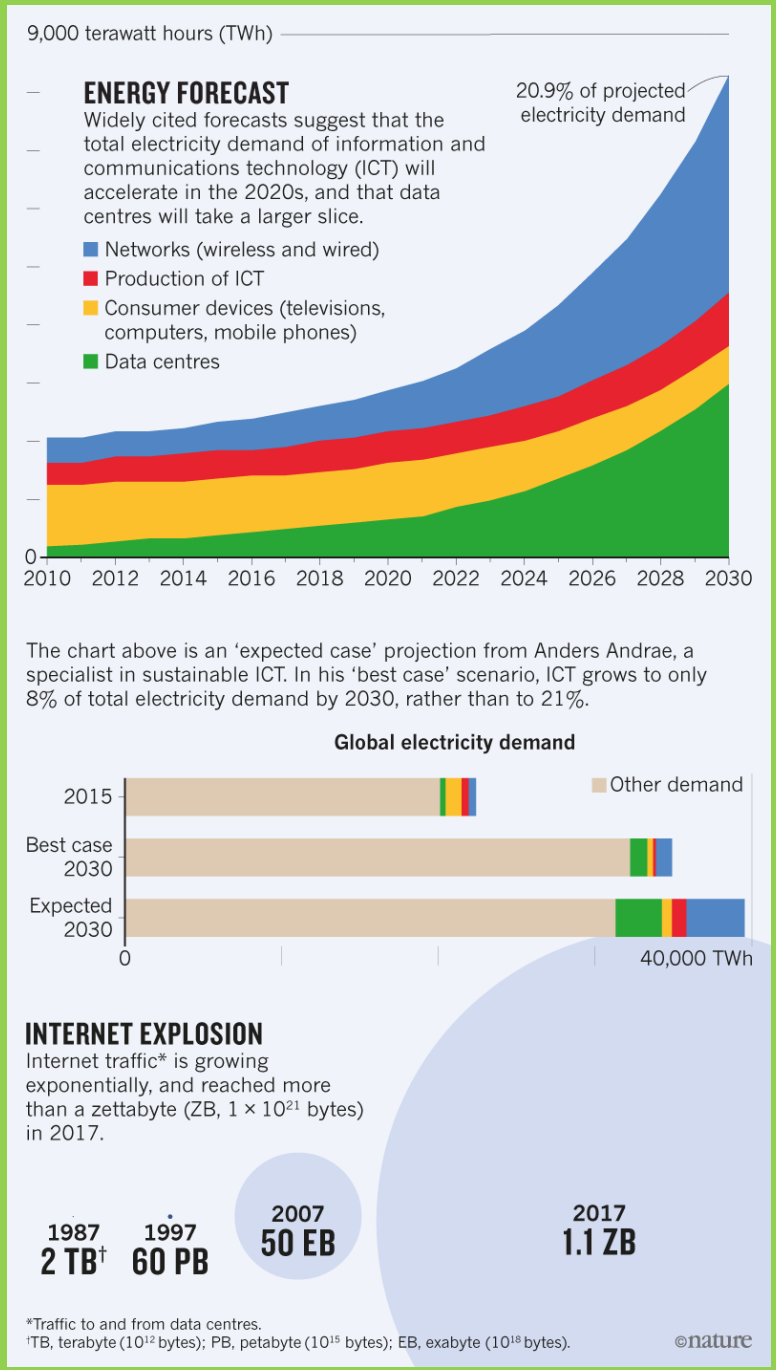
As we add computing and radios to more things, we're also adding to the problem of e-waste. The United Nations found that people generated 44.7 million metric tons of e-waste globally in 2016, and expects that to grow to 52.2 million metric tons by 2021.

#2: Elecromagnetic field large radiation



#3: Power Consumption




9,000 terawatt hours (TWh)
ENERGY FORECAST
Widely cited forecasts suggest that the total electricity demand of information and communications technology (ICT) will accelerate in the 2020s, and that data centres will take a larger slice.
20.9% of projected electricity demand
Networks (wireless and wired)
Production of ICT
Consumer devices (televisions, computers, mobile phones)
Data centres
0
2010 2012 2014 2016 2018 2020 2022 2024 2026 2028 2030
The chart above is an 'expected case' projection from Anders Andrae, a specialist in sustainable ICT. In his 'best case' scenario, ICT grows to only 8% of total electricity demand by 2030, rather than to 21%.
Global electricity demand
Other demand
2015
Best case 2030
Expected 2030
0
40,000 TWh
INTERNET EXPLOSION
Internet traffic* is growing exponentially, and reached more than a zettabyte (ZB, 1 × 10^21 bytes) in 2017.
1987
2 TB†
1997
60 PB
2007
50 EB
2017
1.1 ZB
*Traffic to and from data centres.
†TB, terabyte (10^12 bytes); PB, petabyte (10^15 bytes); EB, exabyte (10^18 bytes).
©nature

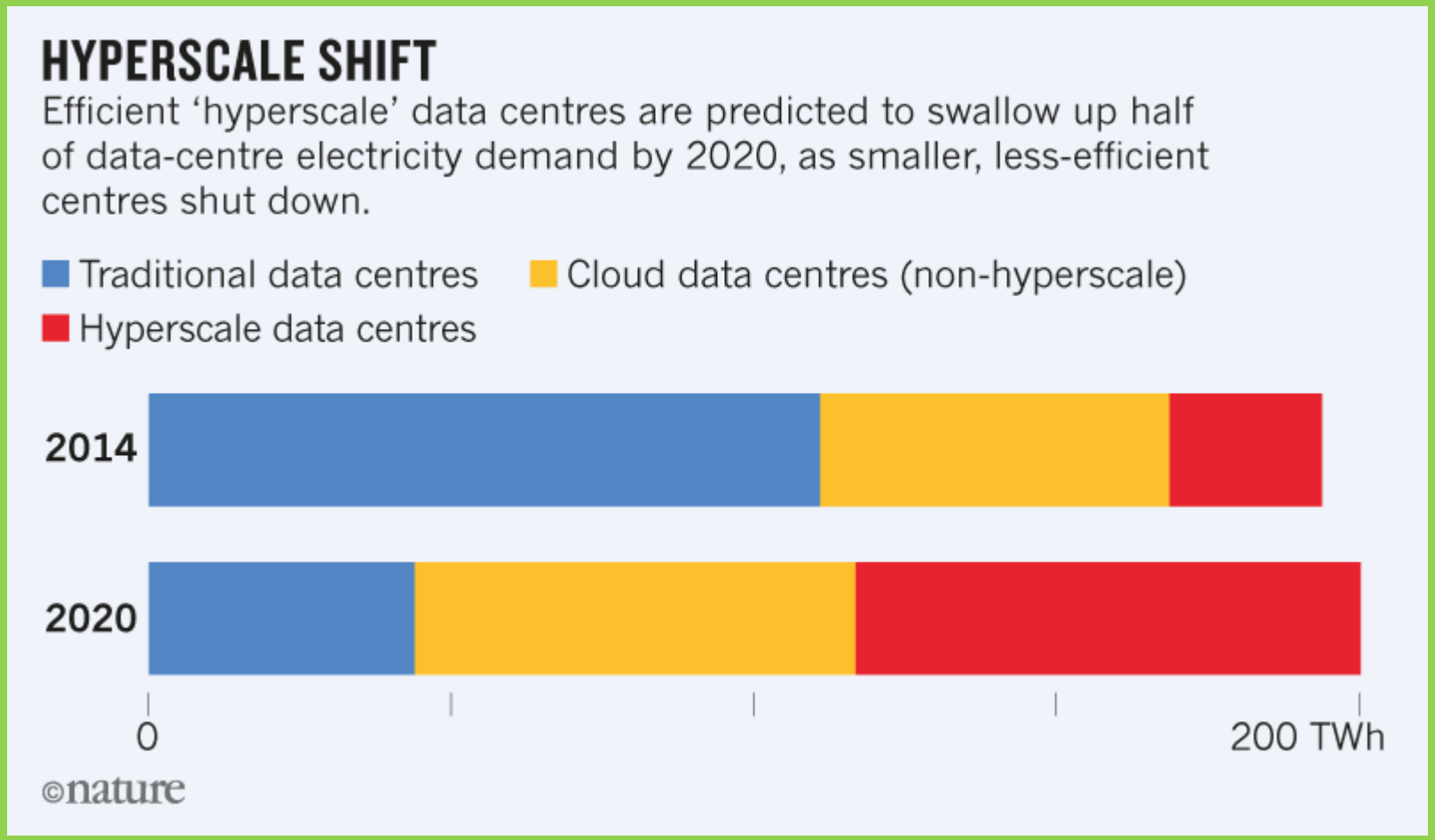
Metodology and sustainability indicators

How is ICT industry measuring its sustainability? Who is monitoring its negative impact?

We need a standard framework to build nature friendly ICT!

Solutions?

Hyperscale Computing



Smart Data centres cooling system

Energy Harvesting

Energy Harvesting (EH)

- **Typical Energy Harvester Output Power**
  - RF: 0.1μW/cm²
  - Vibration: 1nW/cm²
  - Thermal: 10mW/cm²
  - Phot
- **Typical Energy Harvester Voltages**
  - RF: 0.01mV
  - Vibration: 0.1 ~ 0.4 V
  - Thermal: 0.02 ~ 1.0 V

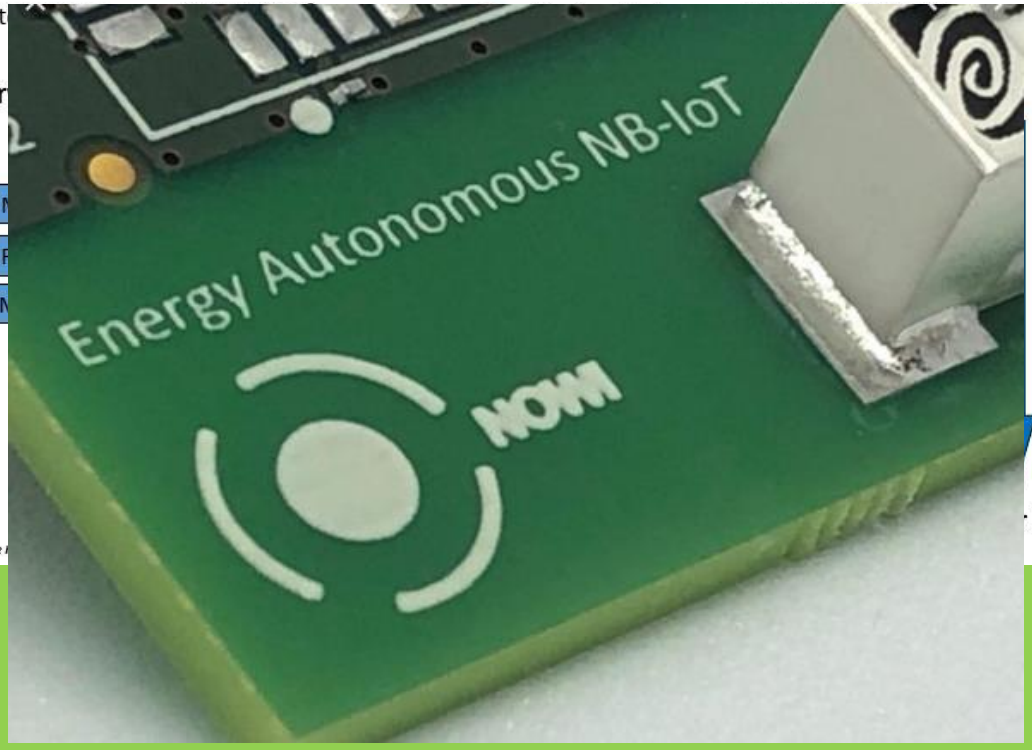
Energy Har

i.e. Denominator

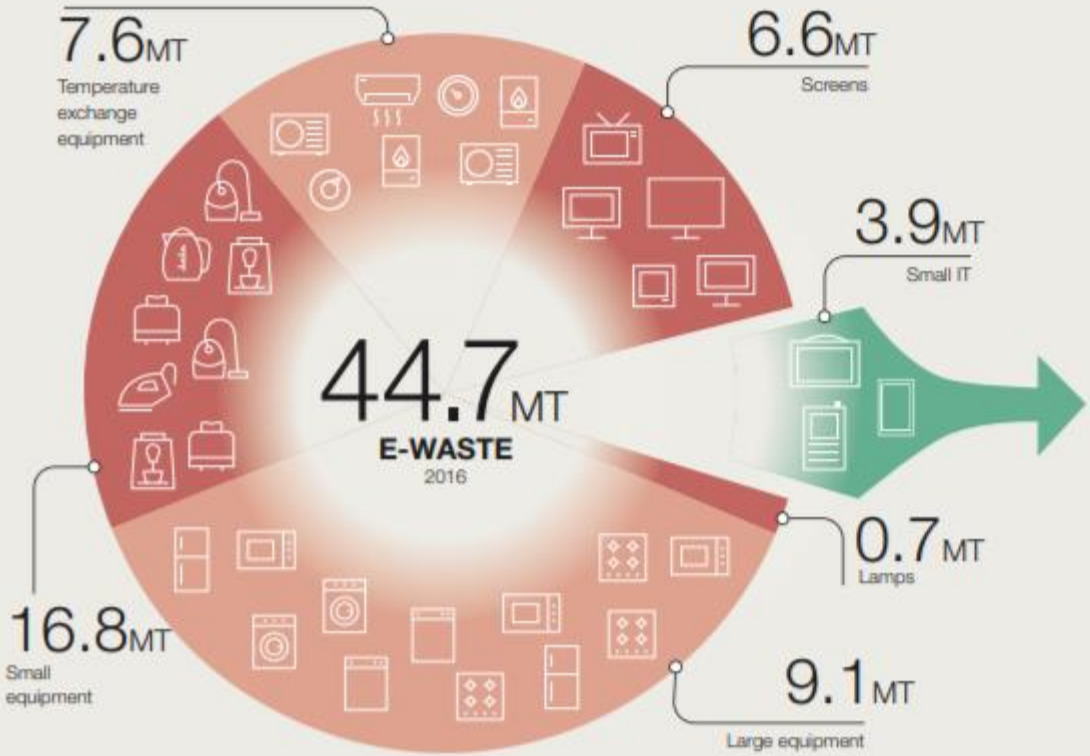
i.e. Numerator

hungry

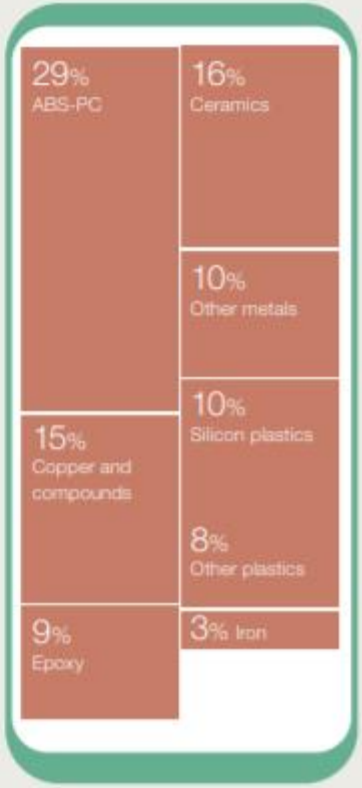
IMAGE CREDIT: Mike



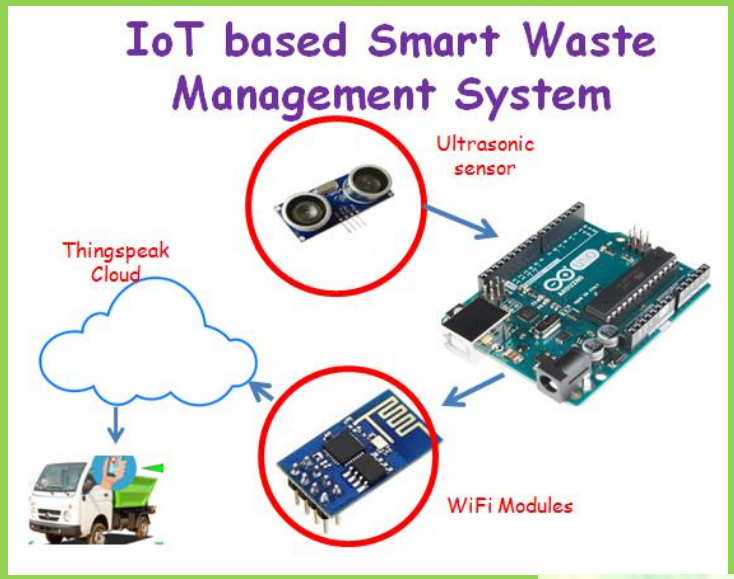
WHAT IS E-WASTE?

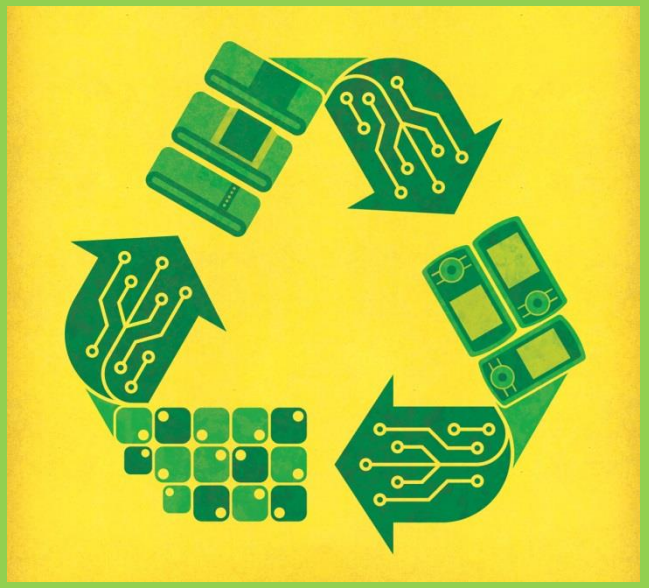


What's in a typical mobile phone?



IoT electronics Recycling

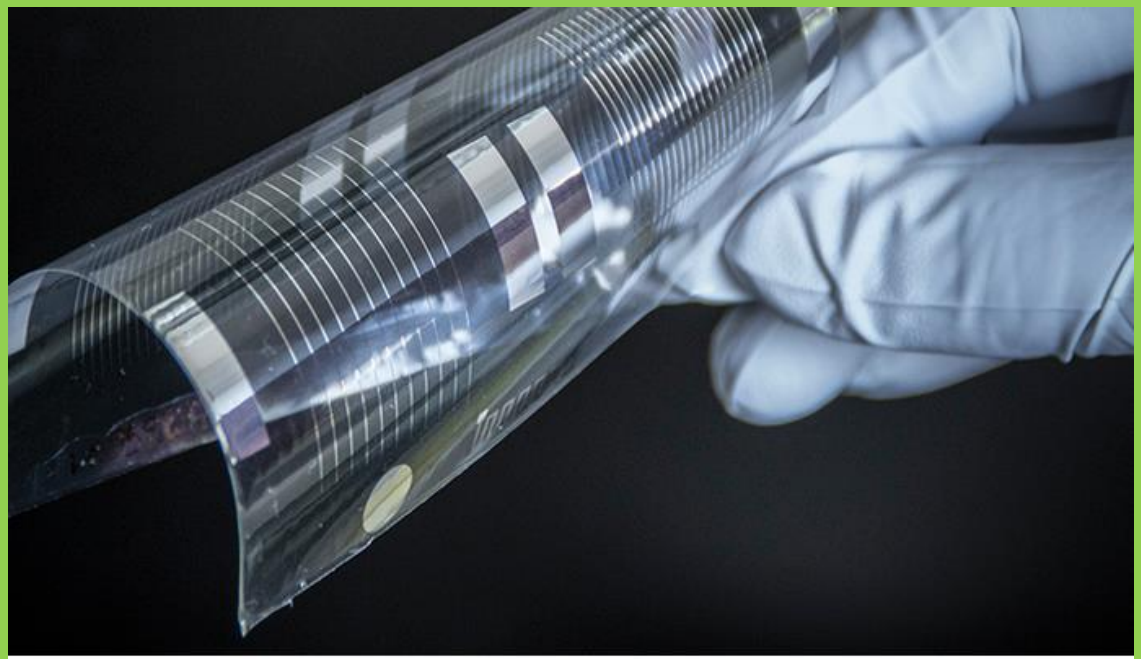




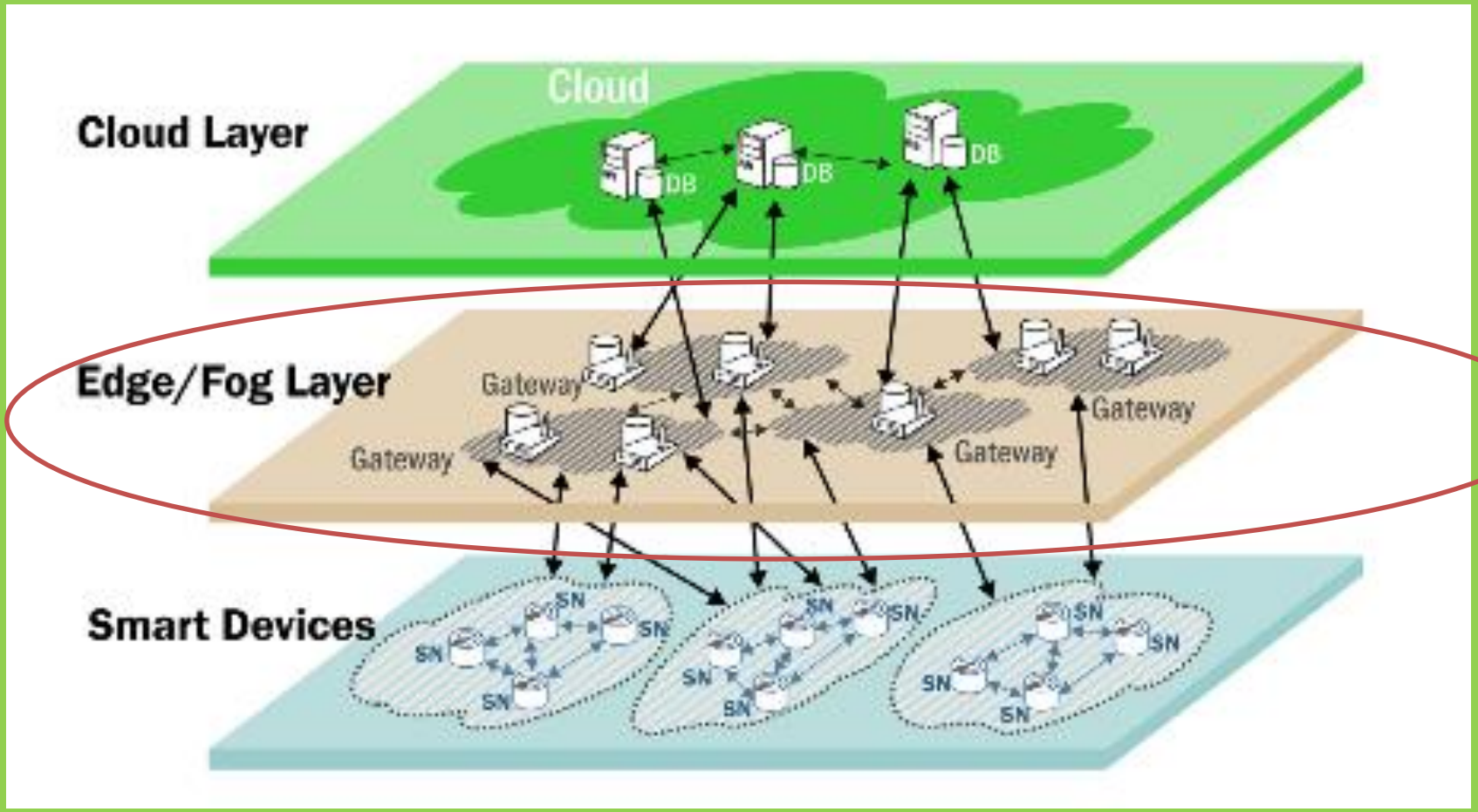
IoT batteries Recycling

Biodegradable electronics

Biodegradable Electronics Could Save Us From The E-Wasteland



Distributed AI: Faster learning, faster inference



Data processing and management lifecycle

§ ITUT-T FG-DPM : Data Processing and management in IoT and Smart Cities

ICT standardisation

International Telecommunication Union

Home : ITU-T : SG 5 : Meeting 2019-09-16 : Contributions

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ITU-T SG 5 C (2019-09-16)

ITU-T SG 5

Environment, climate change and circular economy

Study Period 2017

Meeting from 2019-09-16 to 2019-09-20

held in Switzerland [Geneva]

Other Meetings : 2019-05-13 2018-09-11 2018-05-21 2018-03-05 2017-11-13 2017-05-15

IETF Datatracker Groups Docume

Liaison statement

Green ICT Standards Landscape Questionnaire

Statement | History

State	Posted
Submitted Date	2015-03-26
From Group	ITU-T-SG-5
From Contact	Cristina Bueti
To Group	IETF
To Contacts	The IETF Chair
Cc	The IESG
Purpose	For action
Deadline	2015-03-31 Action Needed
Attachments	Green ICT Standards Landscape Questionnaire

Related activities in the IETF/IRTF

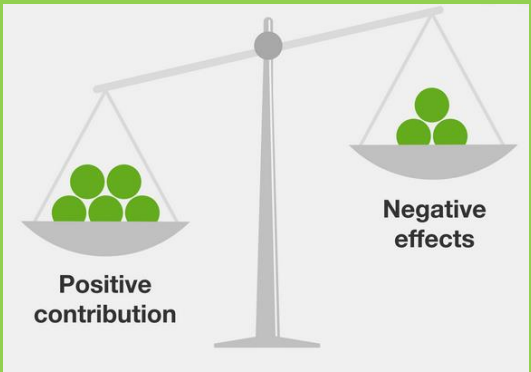
- IETF EMAN – energy management (SNMP)
- IRTF DTNRG – delay tolerance
- IETF 6LOWPAN, ROLL, CORE – constraint networks
- Interconnecting Smart Objects with the Internet (WS in Prague) – see also material referenced at http://www.ietf.org/mail-archive/web/recipe/current/msg00041.html
- …

To Wrap up:

1/ Find the balance: IOT&AI Positive Vs Negative effects per industry

2/ Build a standard Networking and Processing framework that optimizes the processing and storage ressources but also follows a sustainability method while supporting more data and related AI algorithms.

3/ Policy making related to best practices in data storage and datacentres management.



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Acknowledgment: We acknewledge the IFD Franco-French project 2019 (Nature Friendly IoT, Partners: Telecom Sud paris, Aarhus University)