

UiO : **Department of Technology Systems**
University of Oslo

Seminar Security, Privacy & Dependability i kritiske Systemer
IFE, Halden, 21Jan2019

Strømdata og personvern: Skal jeg eller Amazon vite alt om meg?

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Outline

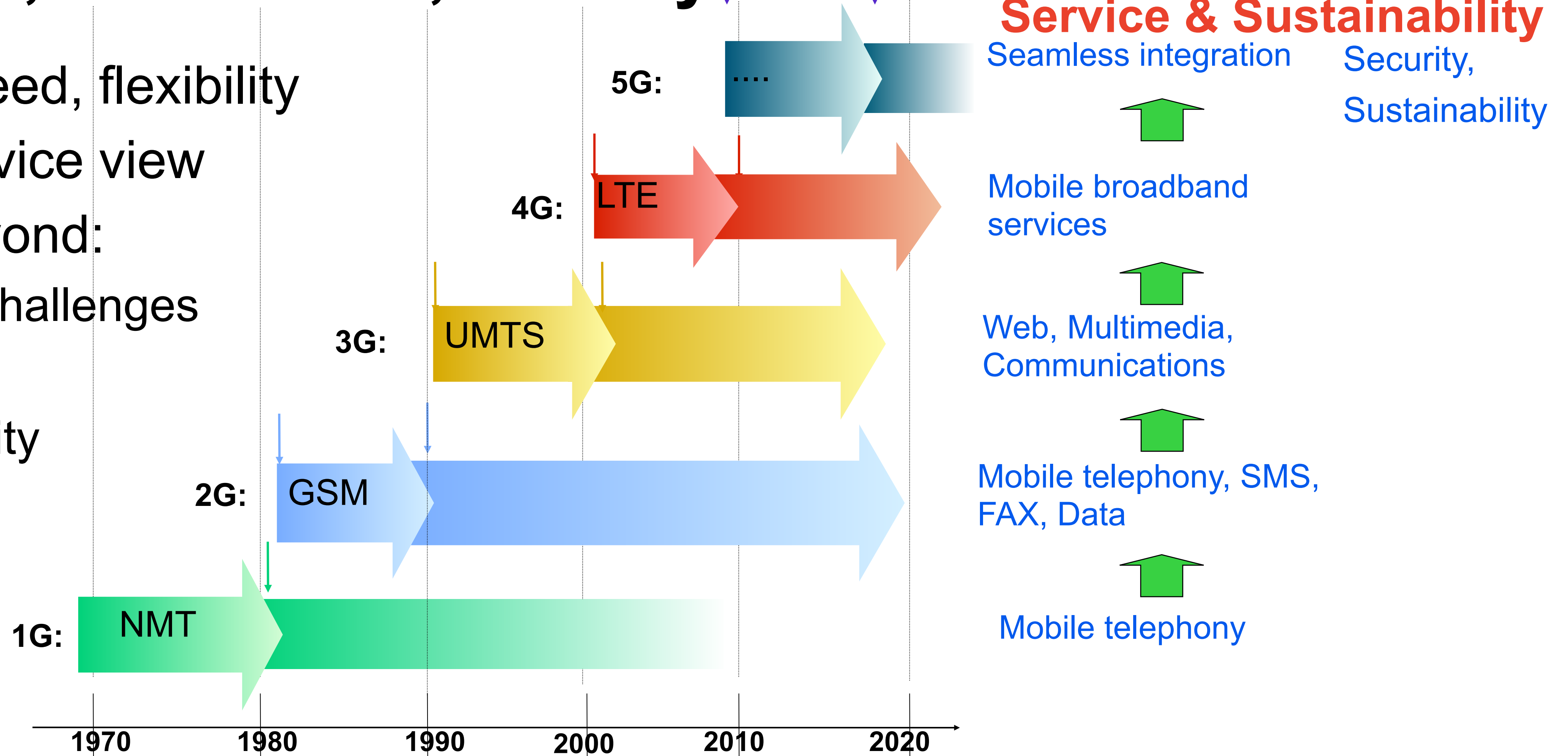
“The last time I was connected by wire was at birth”

- Mobile Network development
 - ➔ from 3G to 5G
 - ➔ “always online, always connected”?
- Security
- Internet and net-neutrality
 - ➔ Facebooks Free Basics
 - ➔ India: “We have been colonised once...”
- Smart Meters
 - ➔ Capabilities
 - ➔ online monitoring
- Conclusions



5G: Speed, Bandwidth, latency and **much more** **Service & Sustainability**

- 1G-3G: Speed, flexibility
- 3G-4G: service view
- 5G and beyond:
 - ➔ Business challenges
 - ➔ ownership
 - ➔ sustainability

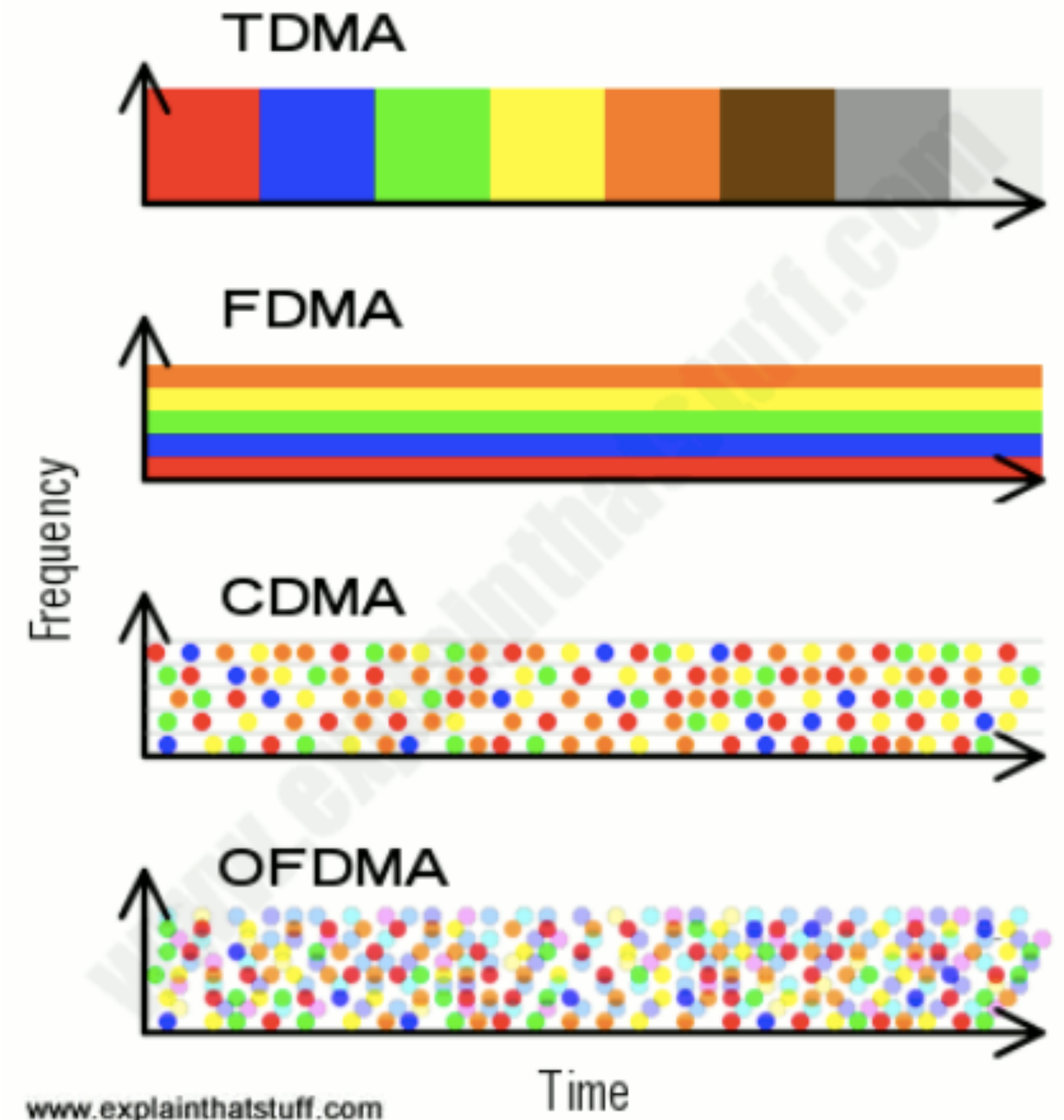


[adapted from Per Hjalmar Lehne, Telenor, 2000]



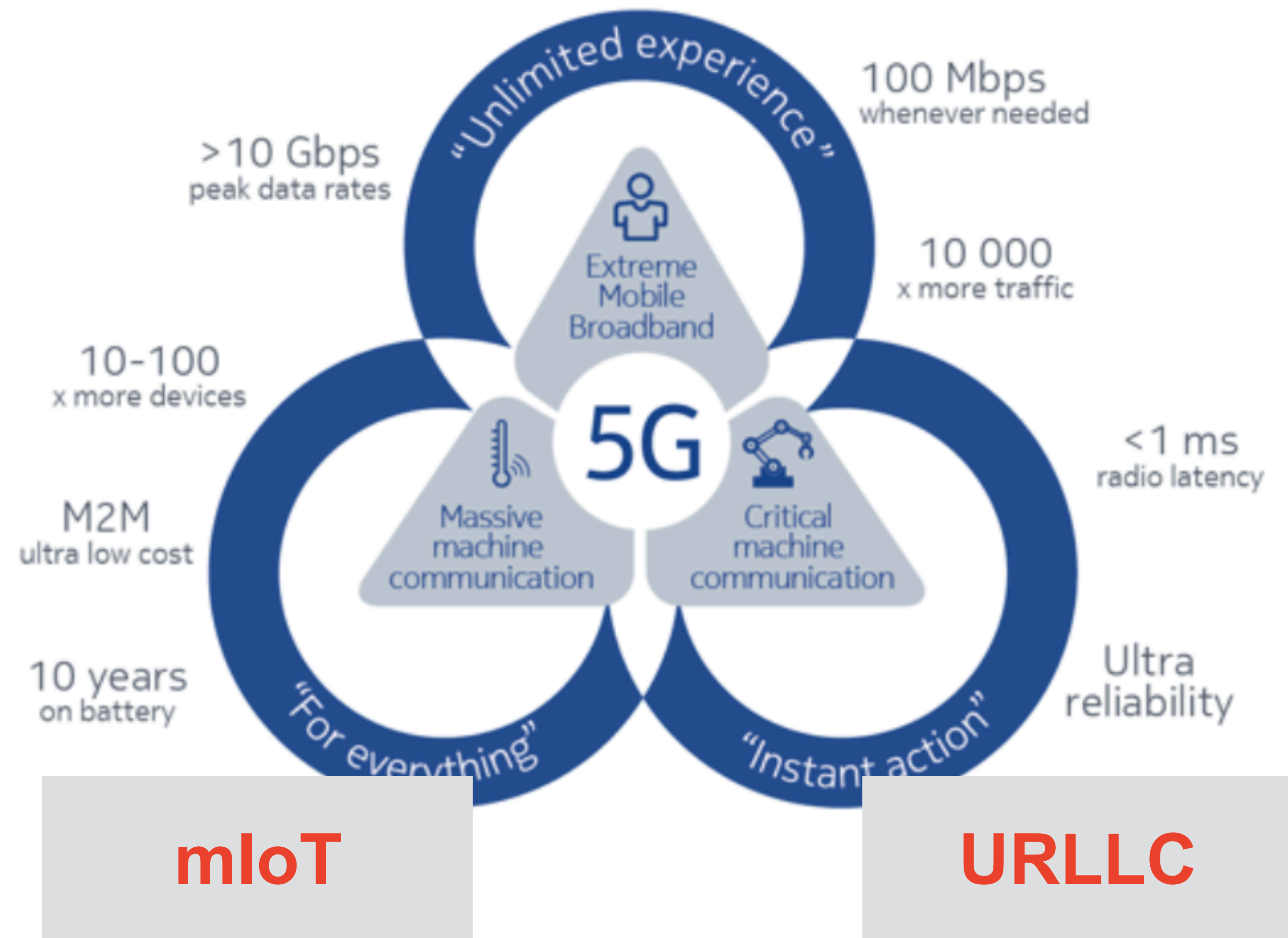
Main differences 2G-5G

- Coverage/Range (2G, 4G)
- Capacity (3G, 4G, 5G)
- Security (2G, 3G, 4G,...)
- Radio technology
 - frequency, time, code
 - allocation
- Internet of Things (4G, 5G)
- Control systems (5G)
 - latency, reliability



5G

- Dhananjay Gore, Qualcomm Research, India at COMSNETS 2018
 - 3GPPP Rel-15 specifications aligned with Qualcomm Research white paper Nov2015
 - <http://www.qualcomm.com/invention/technologies/5g-nr/mmwave>



[source: Nokia <https://networks.nokia.com/5g/get-ready>]



Smart Networks for Industry

- Core demand
- Edge intelligence
 - Edge/fog computing
- End-to-end QoS and i
 - network slicing
 - heterogeneity(?)

1

5G may be disruptive for the manufacturing industry

2

Edge computing for shifting intelligence to the network

3

Network slicing for providing end-to-end QoS & isolation

4

Many industrial requirements not fully addressed yet

5

Close interaction of the whole ecosystem needed

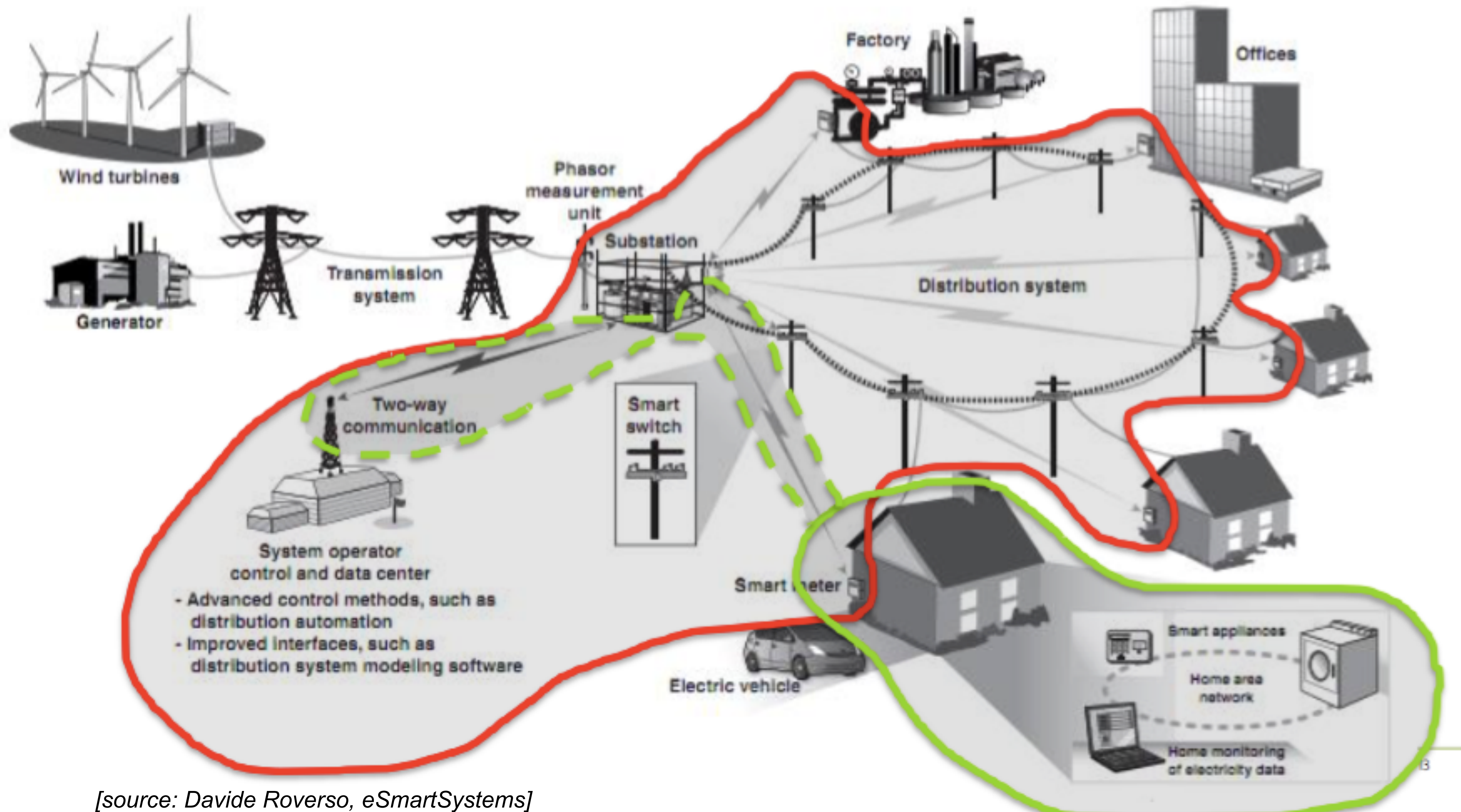
6

Industry 4.0 may become THE killer application for 5G 😊



[Source: Andreas Mueller, Bosch, 2018]

Smart Home vs Smart (Distribution) Grid focus



[source: Davide Roverso, eSmartSystems]

Mobile Security => IoT Security

18. Dezember 2014, 18:14 Uhr Anhören von Handys

So lässt sich das UMTS-Netz knacken



[source:
[www.rediff.co
m](http://www.rediff.com)]



largest security
project in EU

58 partners from
12 countries

80 M€ budget
35 M€ EU & national

Secured Connected Trustable Things (SCOTT)

SECURITY



PRIVACY

TRUSTABILITY



USABILITY



SAFETY

Automotive

Home

Rail

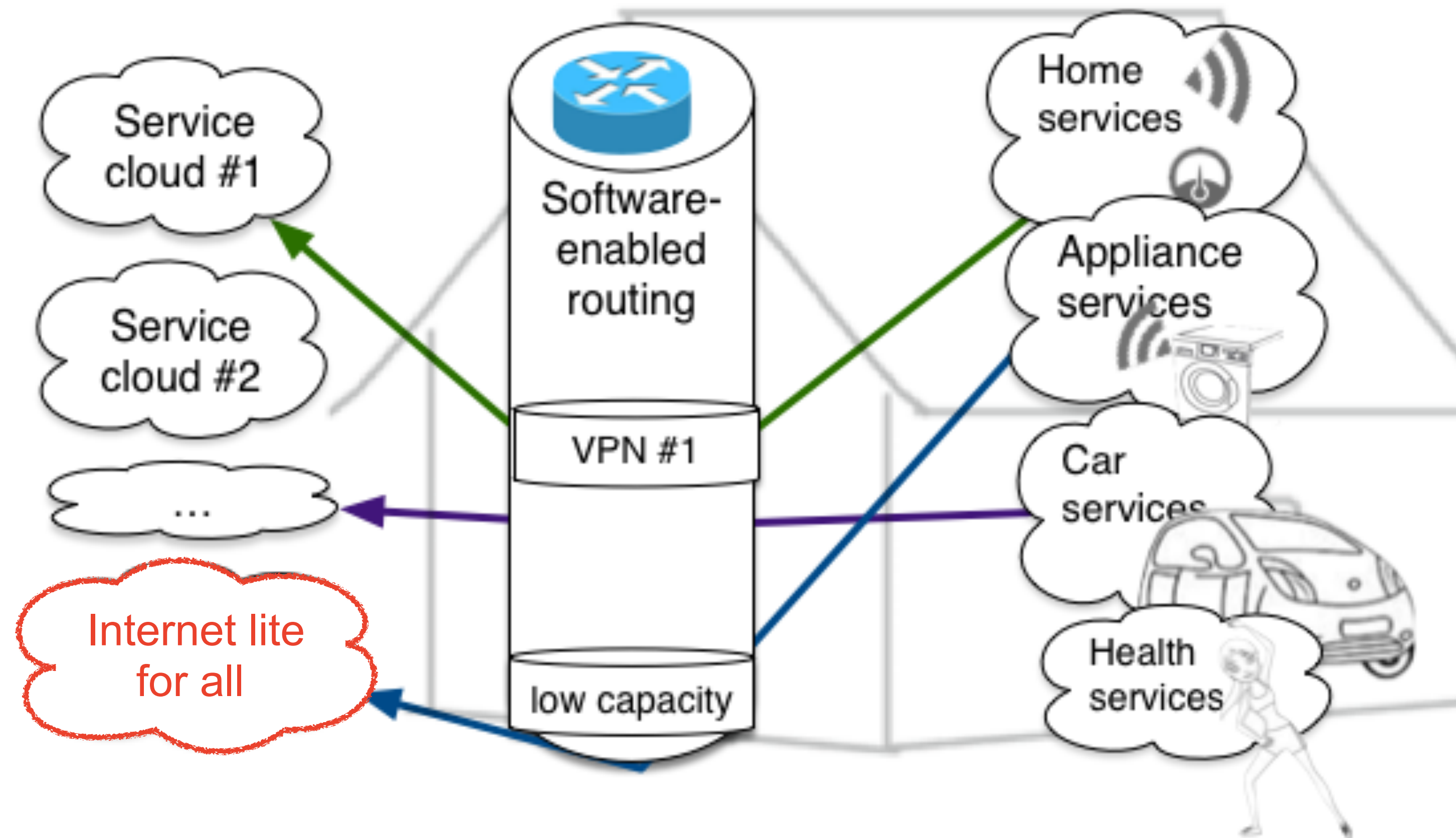
5G

Avionics

- 15 industry-driven Use Cases (TRL 6-7)
- 40 Technology Building Blocks
- 25 Demonstrators
- 5 Domains: Automotive, Aeronautics, Home/Building, Rail, Healthcare, - truly "cross-disciplinary"
- 2017 – 2020 (started in May 2017)

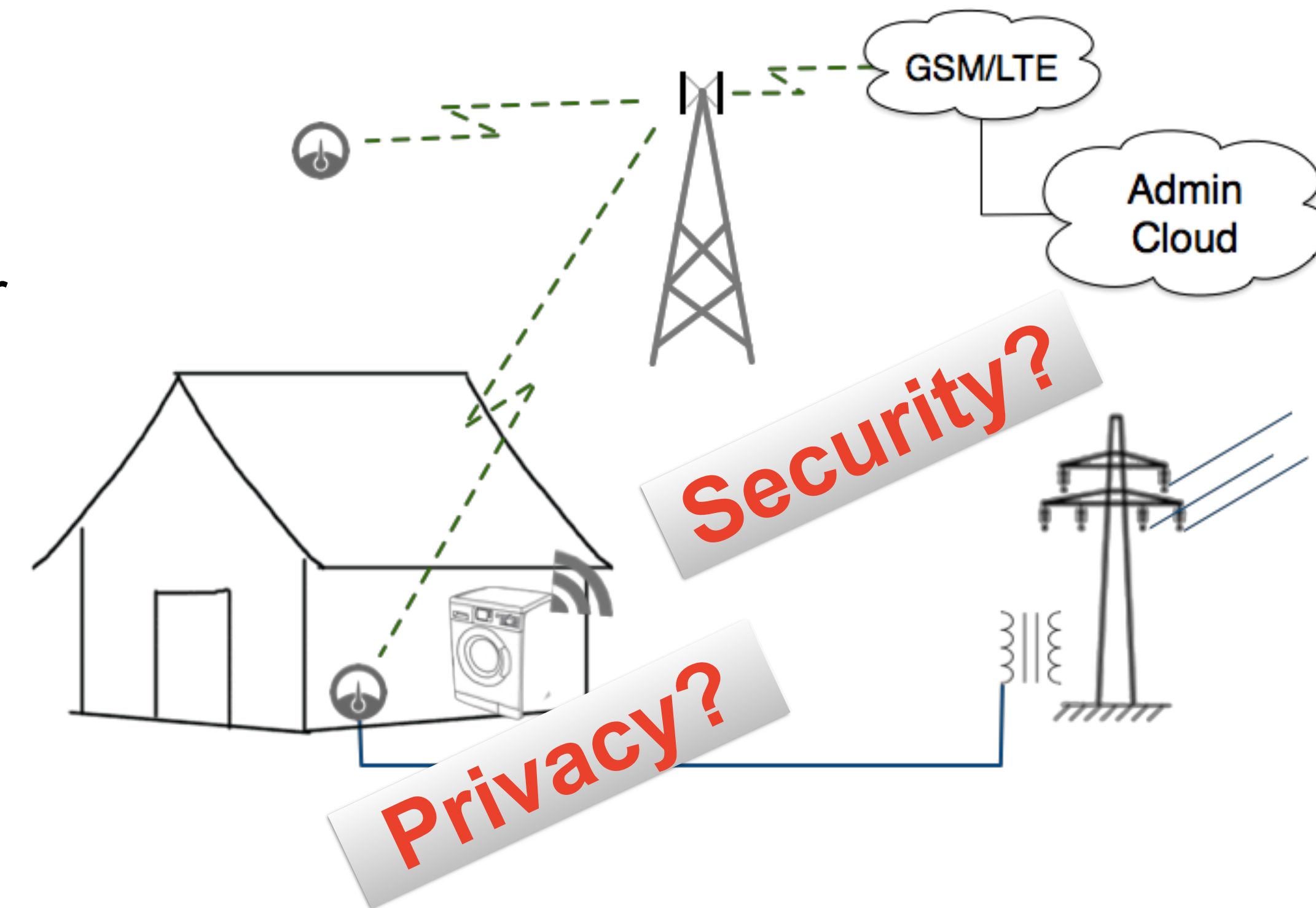
Vision for the Home Domain

- Novel services in the home
 - ➔ Alarm, eHealth
 - high reliability
 - ➔ Appliances
 - convenience, “fridge door open”
 - ➔ Car/Home battery
 - balancing the grid
- Cost-efficient monitoring and management for trusted services
 - ➔ Wireless management
 - Security monitoring
 - Service harmonisation (5G@home)



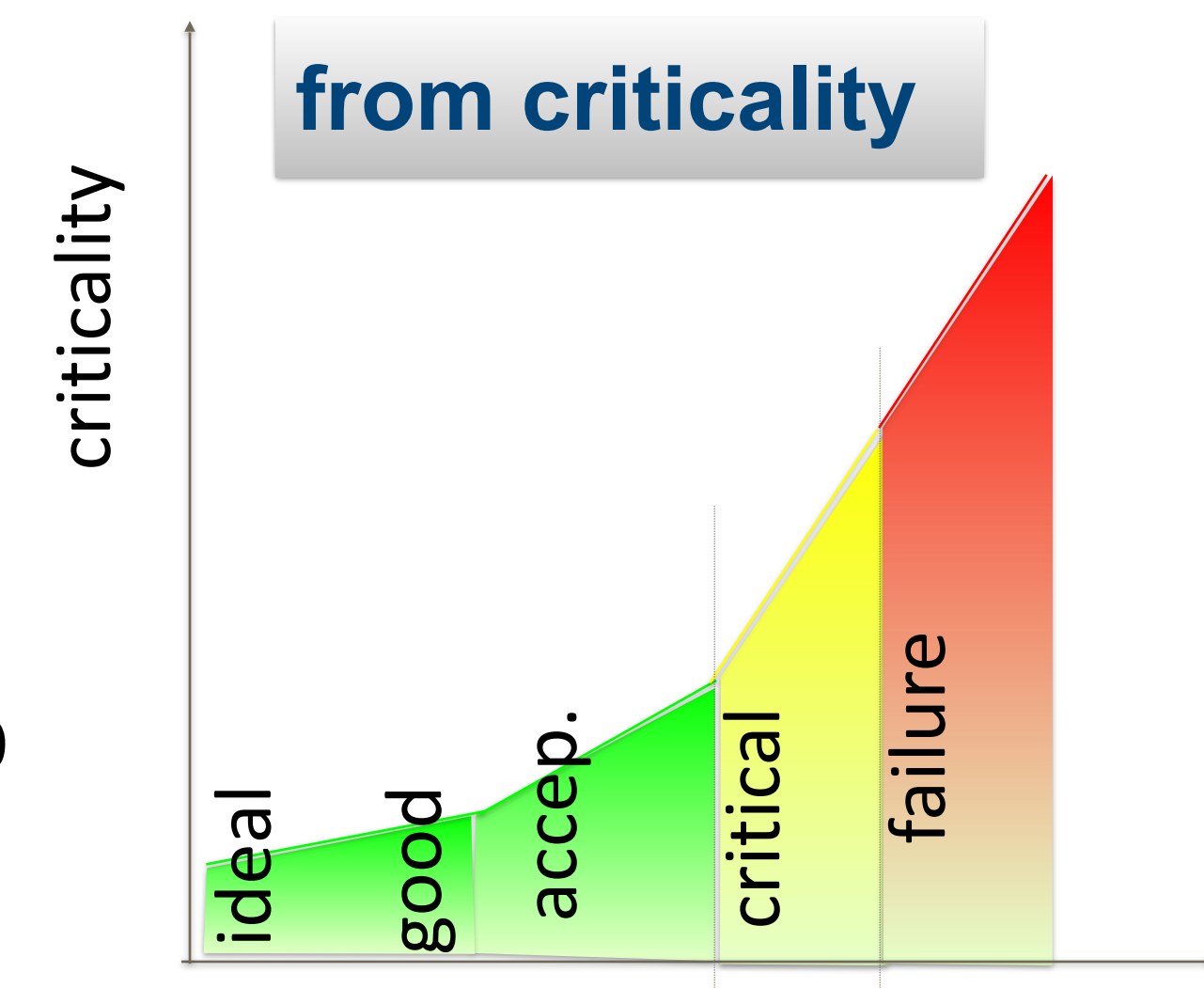
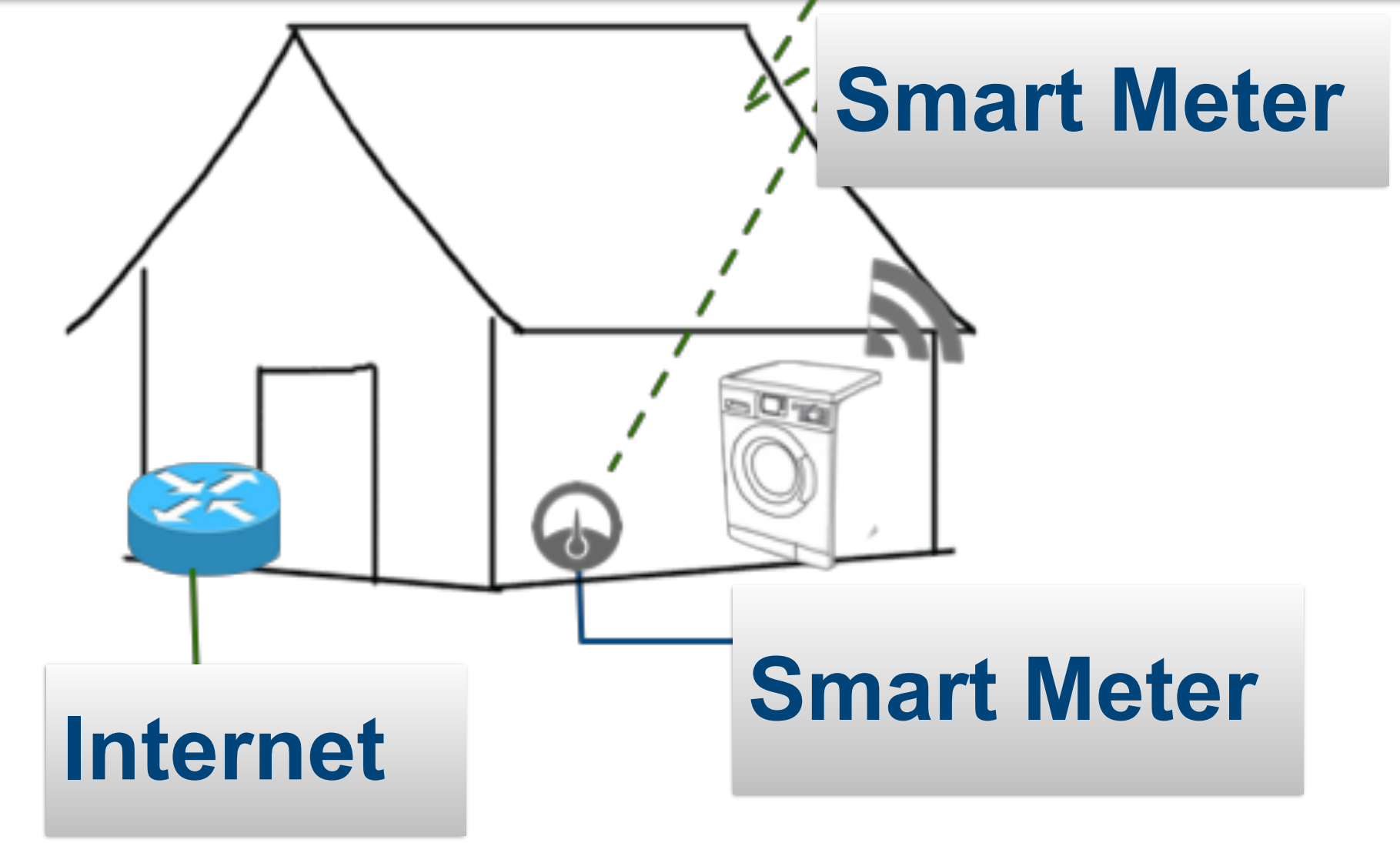
Ecosystem - Application Scenarios for Smart Meters

- Monitoring the grid to achieve a **grid stability** of at least 99,96%,
- **Alarm functionality**, addressing
 - ➔ failure of components in the grid,
 - ➔ alarms related to the Smart Home, e.g. burglary, fire, or water leakage,
- **Intrusion detection**, monitoring both hacking attempts to the home as well as the control center and any entity in between,
- **Billing functionality**, providing at least the total consumption every hour, or even providing information such as max usage,
- **Remote home control**, interacting with e.g. the heating system
- **Fault tolerance and failure recovery**, providing a quick recovery from a failure.
 - Future services
 - ➔ Monitoring of activity at home, e.g. “**virtual fall sensor**”



Security and Privacy challenges

- Smart Meter
 - read and control
 - logic?
- Smart Home
 - intelligent devices
 - on-demand regulation
- Challenges
 - Logic: Centralised ↔ Fog
 - Smart Meter: Information ↔ Control
 - Smart Grid Information ↔ Internet Info



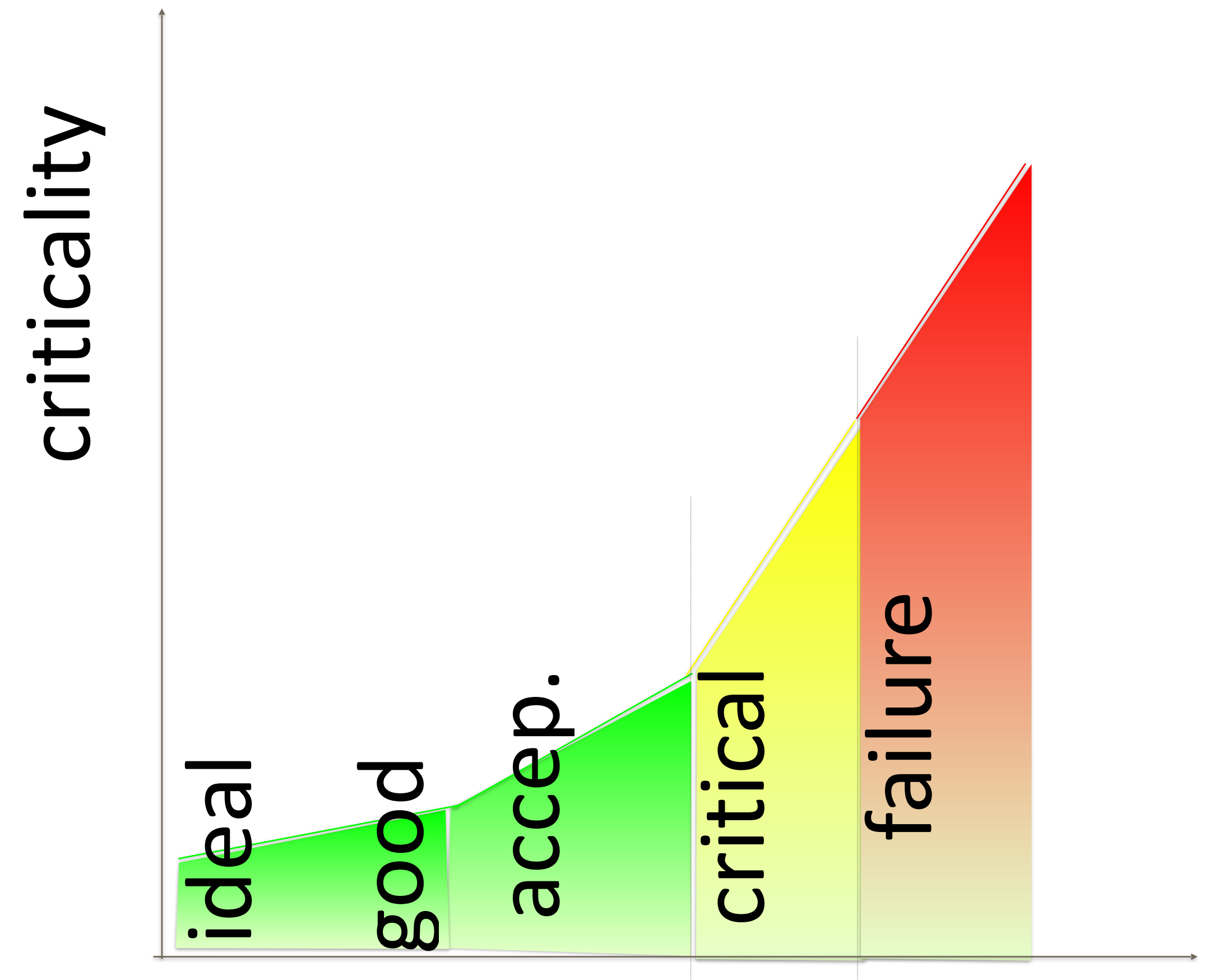
to measurable:
security,
privacy and
dependability

SPD level	SPD vs SPD _{Goal}
(67,61,47)	(●,●,●)
(67,61,47)	(●,●,●)
(31,33,63)	(●,●,●)

Autonomous, sensor-driven systems

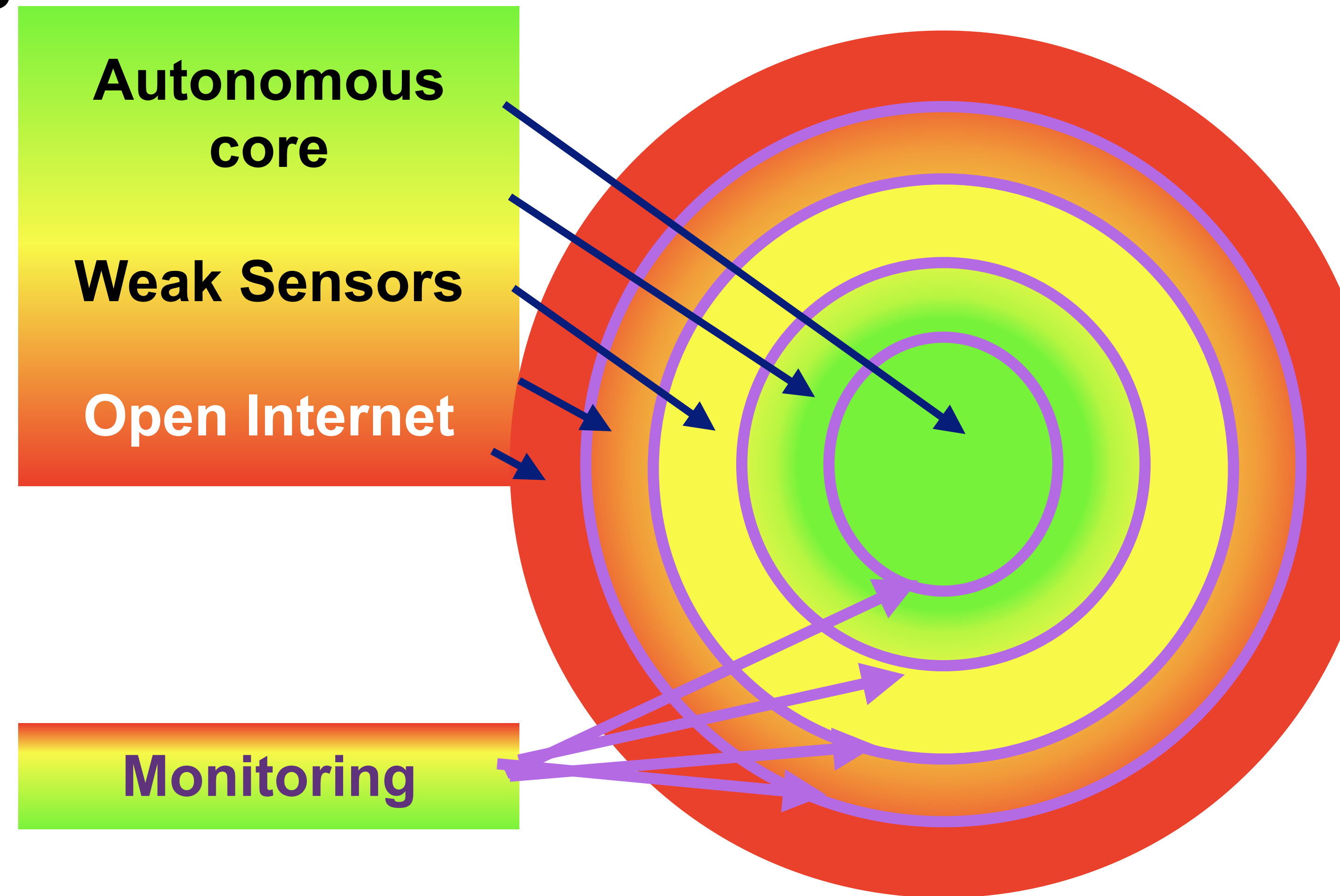
- Design with optimal usage in mind
 - ➔ ideal operation
 - all sensors are working
 - no interference (wireless sensor networks)
 - non-hostile environment
- Real system
 - ➔ Sensors fusker
 - Øresund train crash (wind sensor)
 - ➔ Sensor fail
 - logic, modelling

System under attack

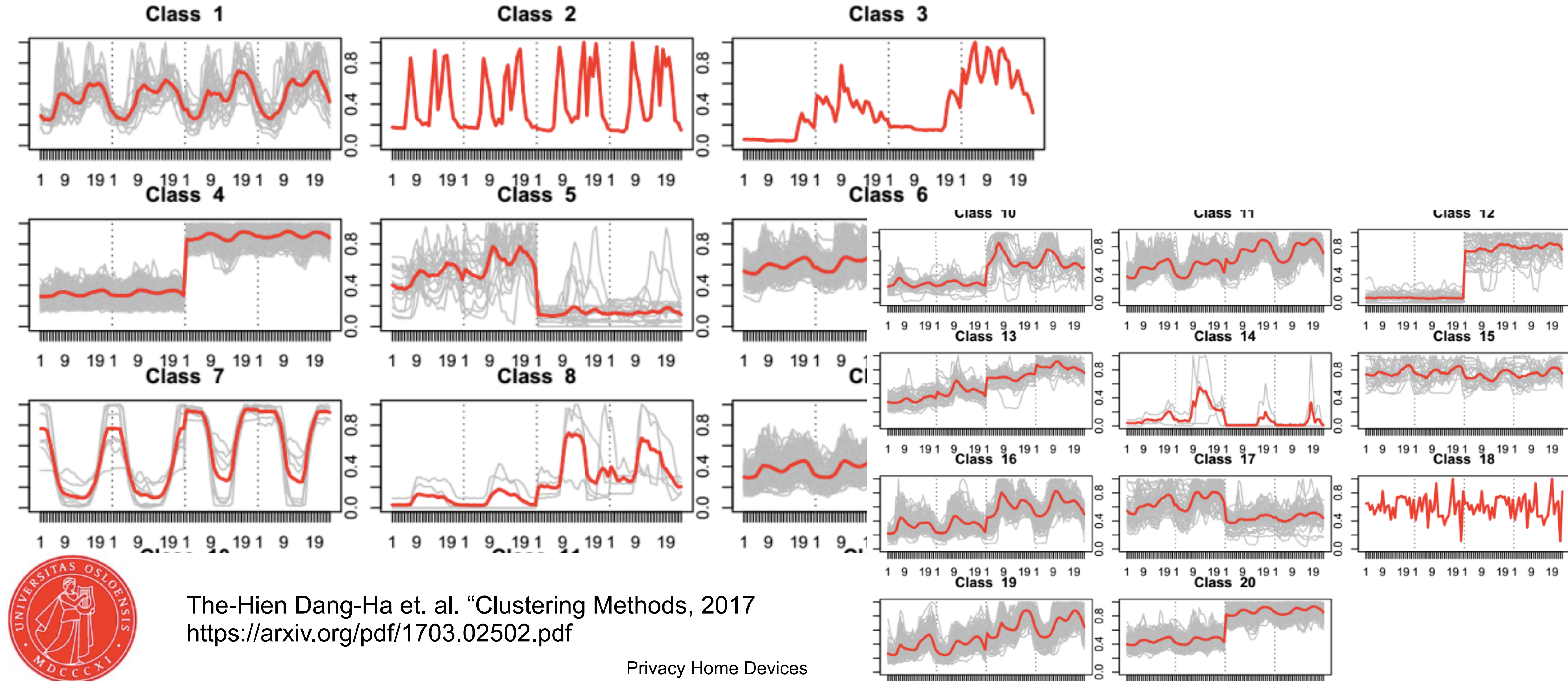


The new security paradigm

- Focus on attack is not sufficient
 - ➔ new vulnerabilities
 - ➔ 10+ years sensor life-time
- Onion approach
 - ➔ Autonomous Core
 - proven autonomy (ship, smart meter)
 - formally proven
 - ➔ Layers
 - monitoring
 - firewall



What can we learn from meter reading? (1/h data)

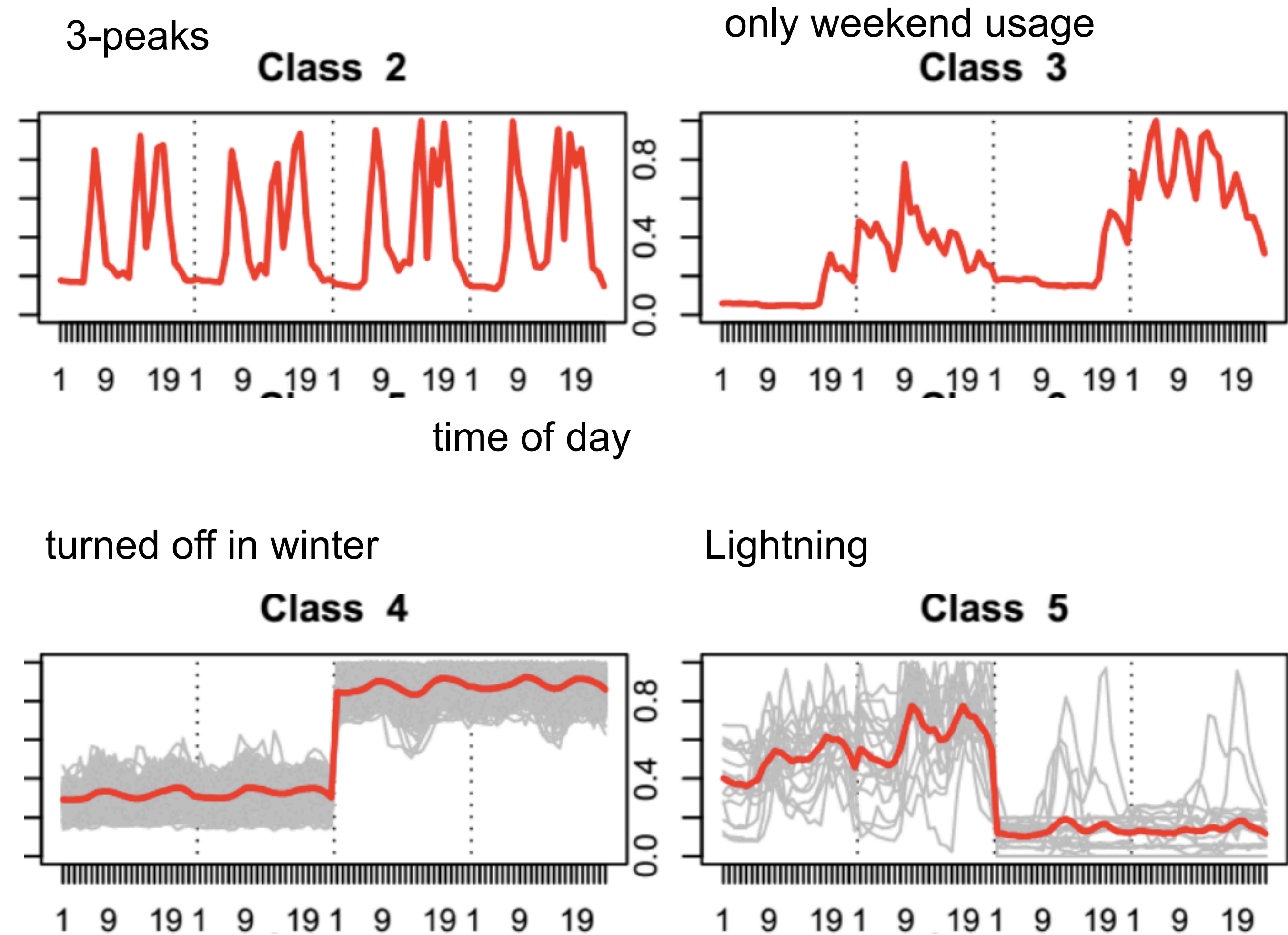


The-Hien Dang-Ha et. al. "Clustering Methods, 2017
<https://arxiv.org/pdf/1703.02502.pdf>



Detailed analysis

- Cabins which are turned off during summer (class 2)
- Cabins which are turned off during winter (class 4)
- Lightings (class 5)
- Households that do not increase consumption in winter (class 3)
- Data to El-Hub (1/h)



Instantaneous and high-resolution

- HAN Port
 - energy usage
 - online monitoring (1/s ... 1/min)
- Typical Norway
 - Power (every 2.5s)
 - Current (every 10s)
 - Voltage (every 10s)
- Connected devices
- Security

physical security, encryption



AMS HAN port (NEK)

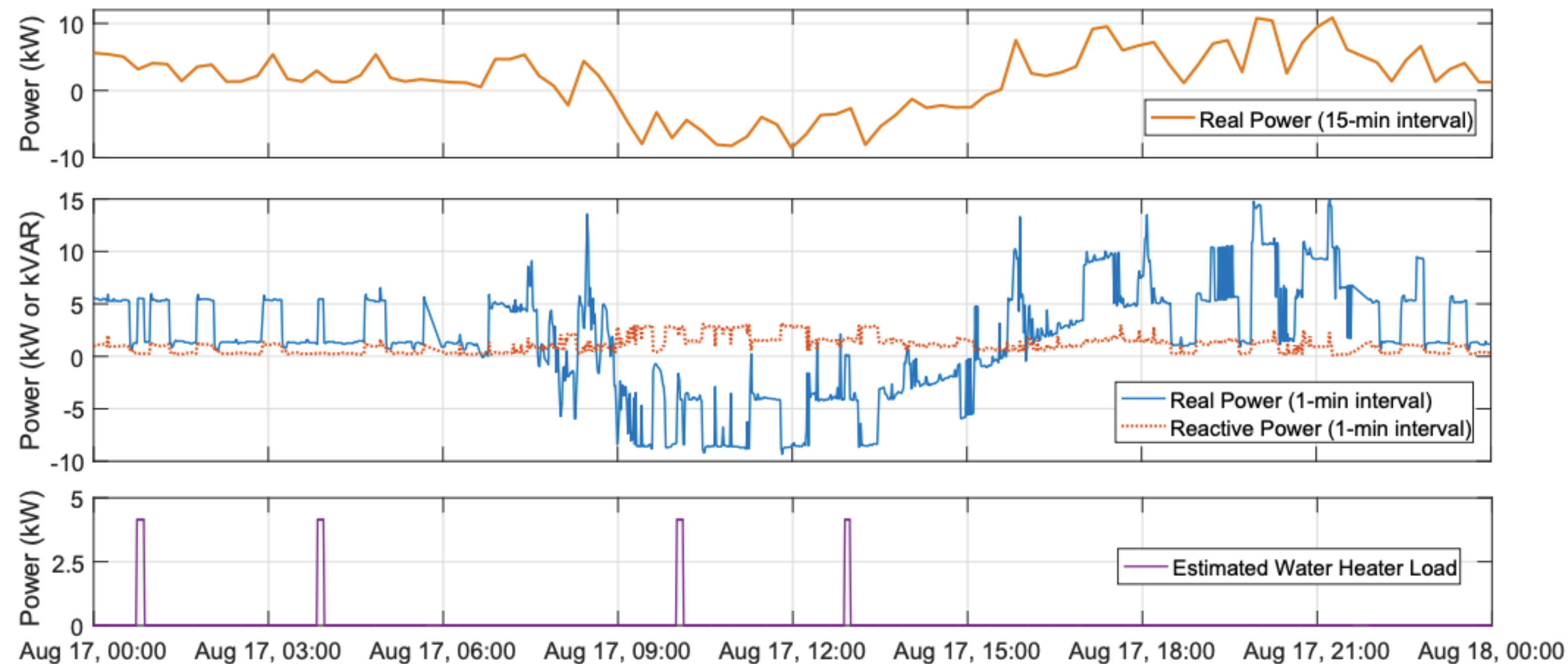
<https://www.nek.no/info-ams-han-brukere/>

Privacy Home Devices



Meter analysis - knowledge about you

- Security
 - ➔ (unencrypted) wireless data
 - ➔ Cloud computing
 - ➔ “is my HAN port open?”
- Information & control
 - ➔ energy saving (water heater)
 - ➔ load control
 - ➔ Fridge, freezer, heat pump,...
 - ➔ usage pattern, “door is open”
 - ➔ “which TV channel do you watch” (every 2s)



http://nilmworkshop.org/2018/proceedings/Poster_ID17.pdf

Dites NON ! aux compteurs communicants LINKY

<https://www.cnet.com/news/researchers-find-smart-meters-could-reveal-favorite-tv-shows/>



“Amazon Echo” in your smart meter

- Amazon/Google/Apple home control
 - works on your command
- “Amazon HAN connect”
 - works all the time
 - brings all your information to the cloud

**Amazon Echo/
Alexa**



**Apple
Home Kit**



**Google
Home/Nest**



Comparison with the Mobile Network

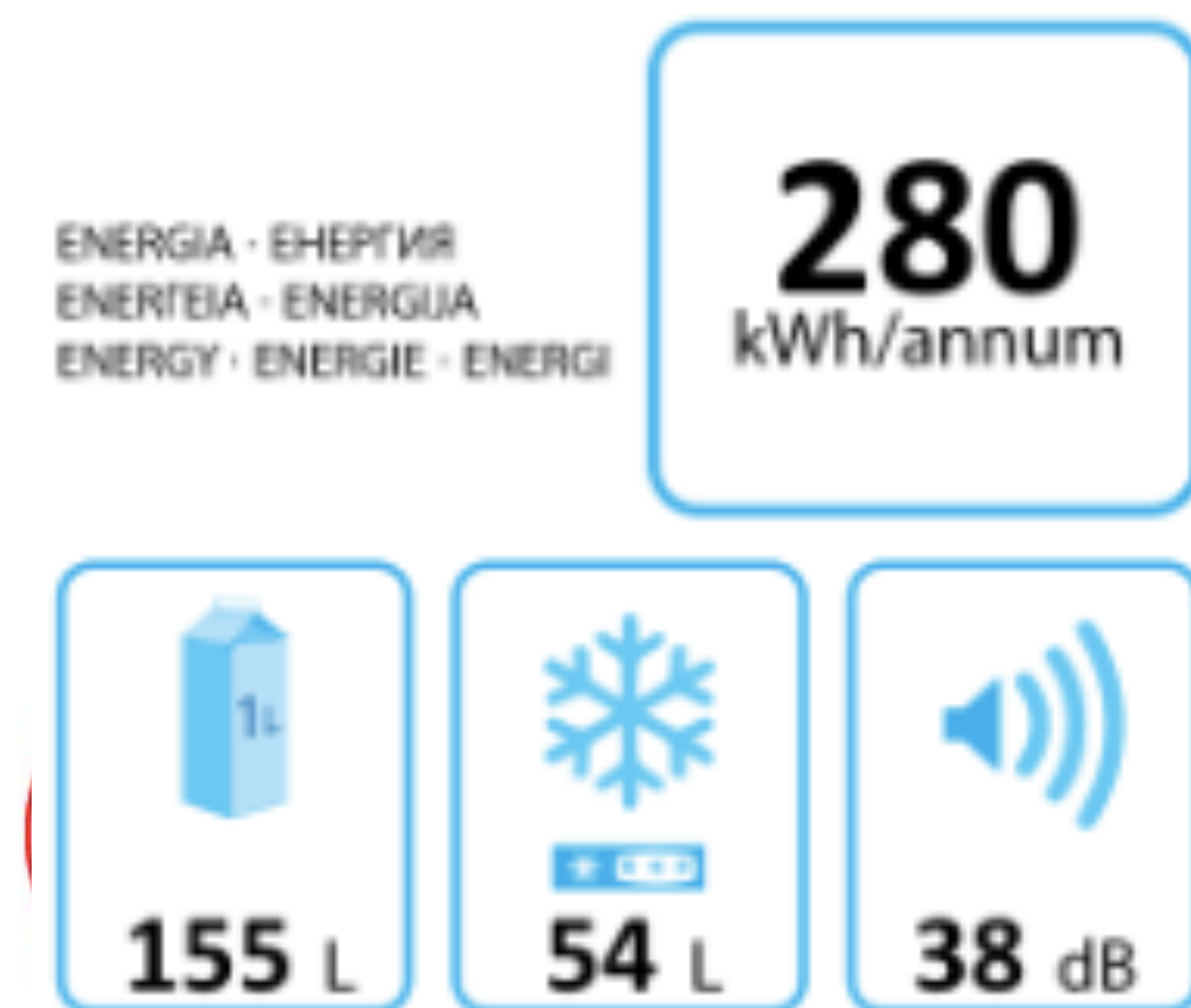
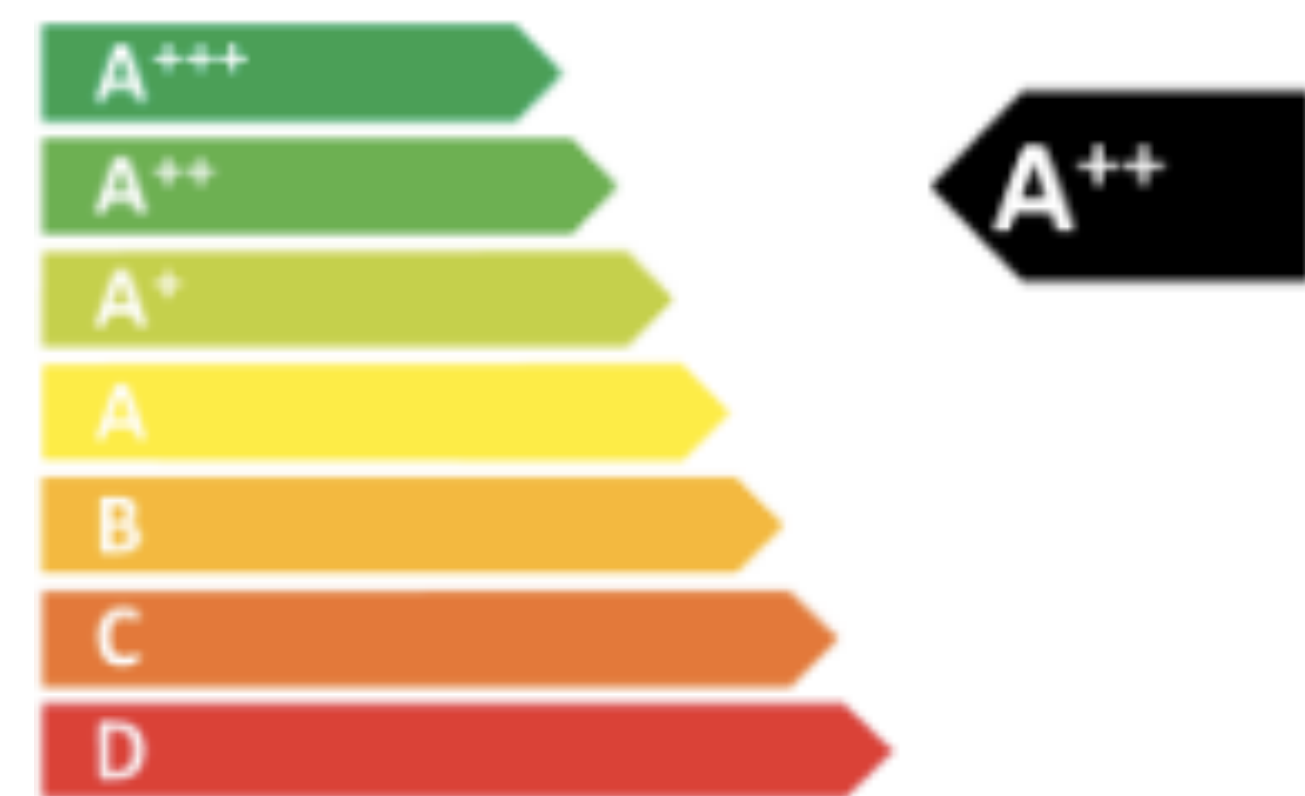
- Facebook's Free Basics
 - ➔ 0-rated content (free usage)
 - ➔ 3-months break even
- The con's of Free Basics
 - ➔ every click goes to Facebook
 - ➔ Net-neutrality
- HAN port
 - ➔ who owns my power consumption?
 - ➔ cloud analysis?



**Premier Minister
Narendra Modi (India)**

“no to
Free Basics”
we have been
colonised once

Towards Measurable Privacy - Privacy Labelling



- “Measure, what you can measure - Make measurable, what you can’t measure” - Galileo
- Privacy today
 - based on lawyer terminology
 - 250.000 words on app terms and conditions
- Privacy tomorrow
 - A++: sharing with no others
 - A: ...
 - C: sharing with
- The Privacy label for apps and devices



Appfail Report - Threats to Consumers in Mobile Apps

The Norwegian Consumer Council analysed the terms of 20 mobile apps. The purpose is to uncover potential threats to consumer protection hidden in the end-user terms and privacy policies of apps.

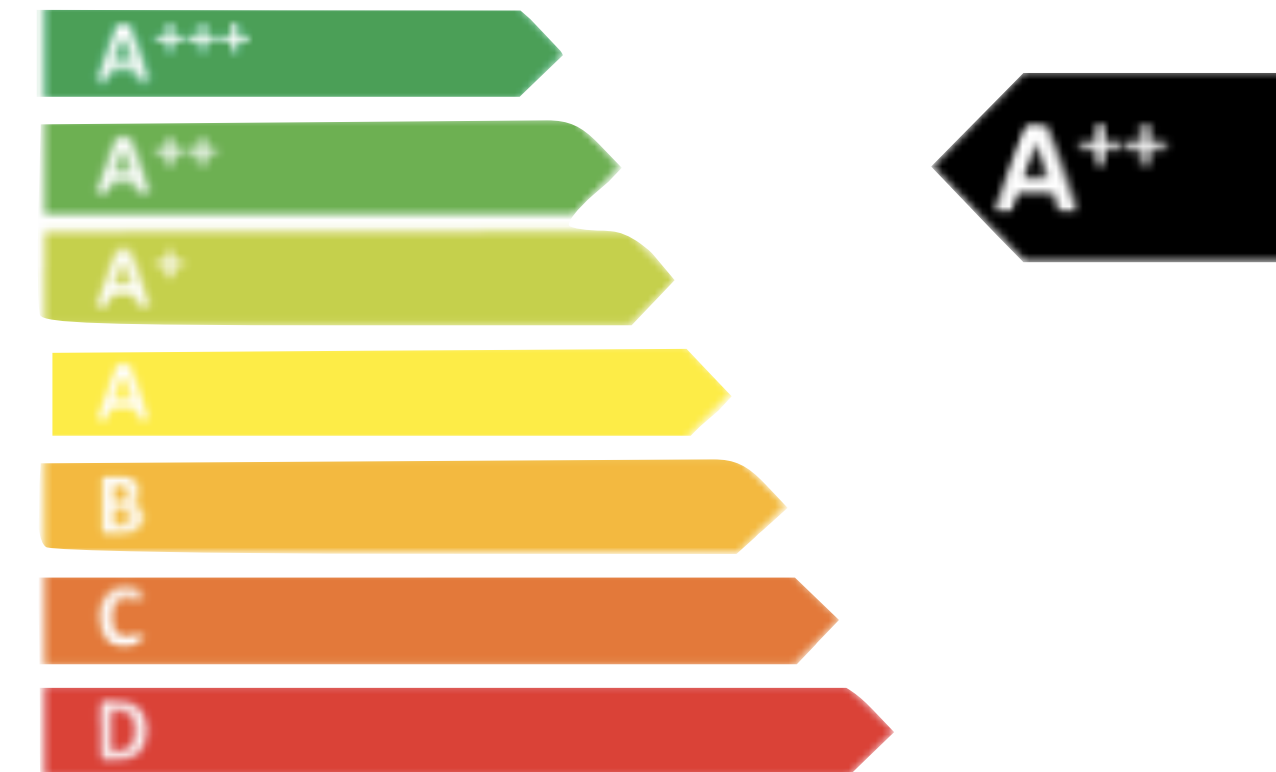
Conclusions

- Home is the battlefield
 - ➔ Smart Home/Offices
 - ➔ Novel services: Control, Alarm, Health
 - ➔ Specific requirements for security, privacy
 - ➔ HAN port for continuous power monitoring
 - ➔ identification of user behaviour
- Collaborative approach for a (more) secure society
 - ➔ “the cloud is not the answer” - distributed security
 - ➔ partnership for security: threats, measures, counter activities
- Measurable Security and Privacy for IoT
 - ➔ Industrial impact: Security Centre for Smart Grid
 - ➔ Privacy labelling for apps and devices

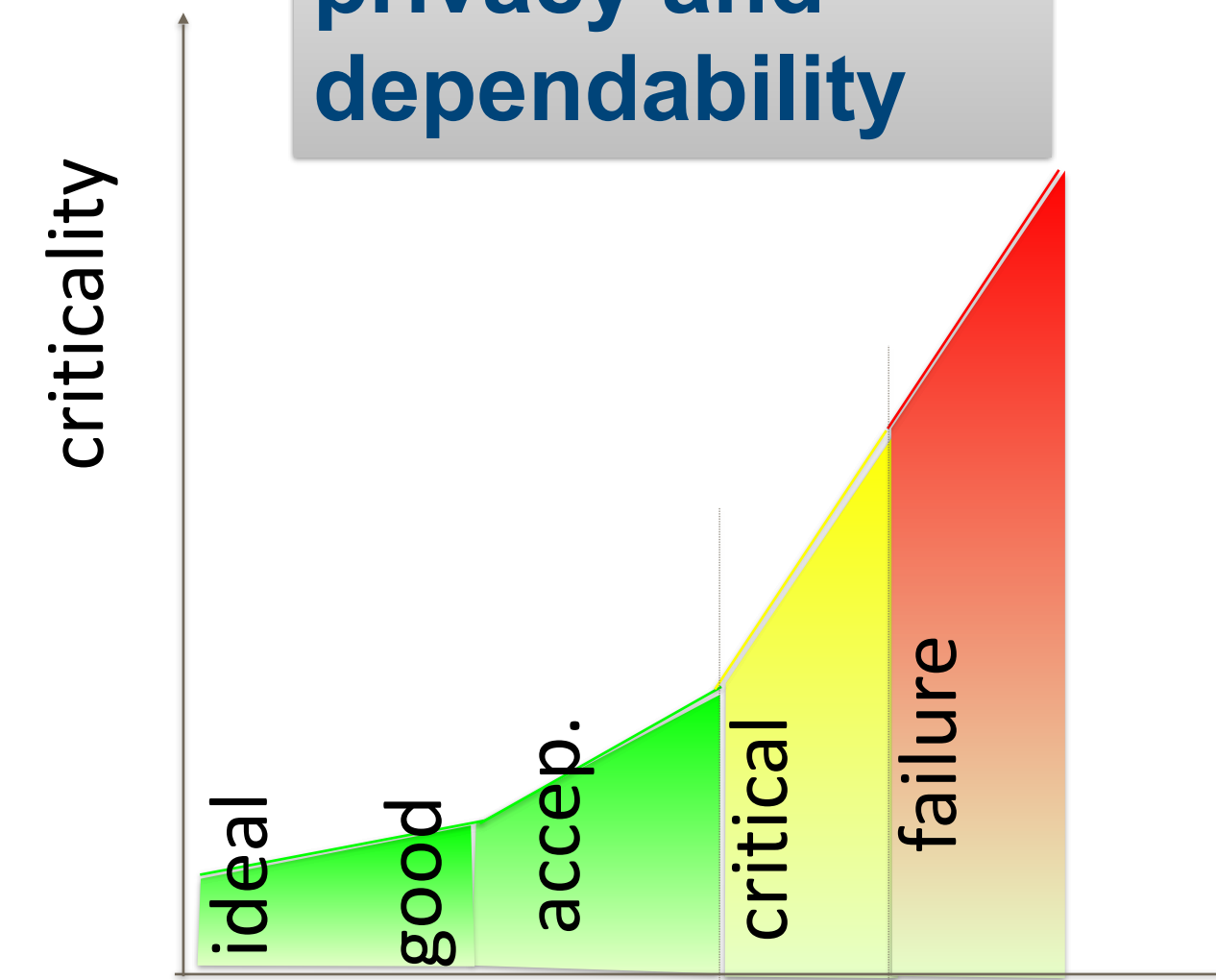


Innovation ecosystem for the IoT
Reducing the digital gap

Privacy Labels



**Measurable:
security,
privacy and
dependability**



Logic: Centralised ↔ Fog
Smart Meter: Information ↔ Control