

# Connectivity in IoT

Ubiquitous, reliable and secure networking  
for smart environments

Thomas Soederholm

Director of Business Development

ANT Symposium 2018

IoT

Internet of Things

The network of  
physical devices

Collect

Connect

Exchange

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# Beyond



Desktops



Laptops



Smart phones



Tablets

# Traditionally “Dumb”



Speakers



Lights



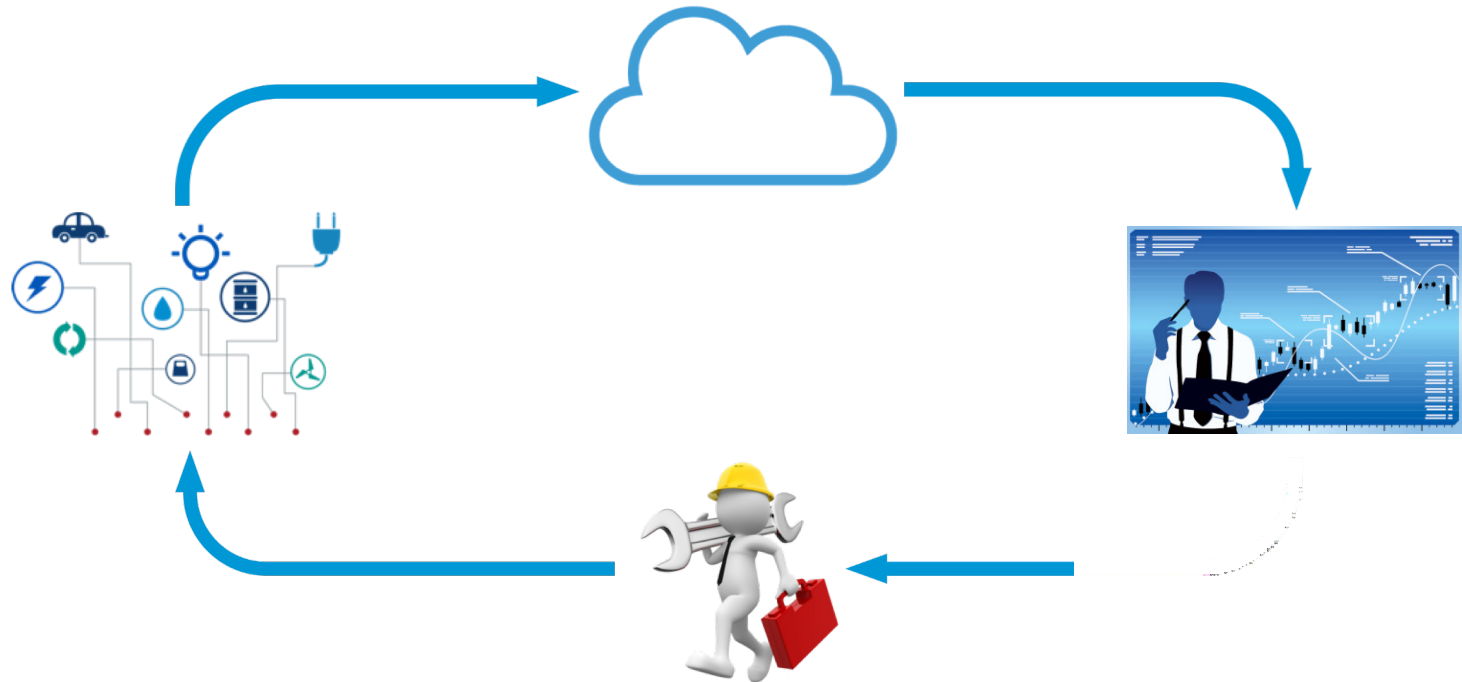
Clothes



Garbage cans



# Remote Monitoring & Control



## Consumer



Smart home  
Elder care

## Commercial



Building automation  
Medical and health care  
Transportation

## Industrial



Manufacturing  
Agriculture

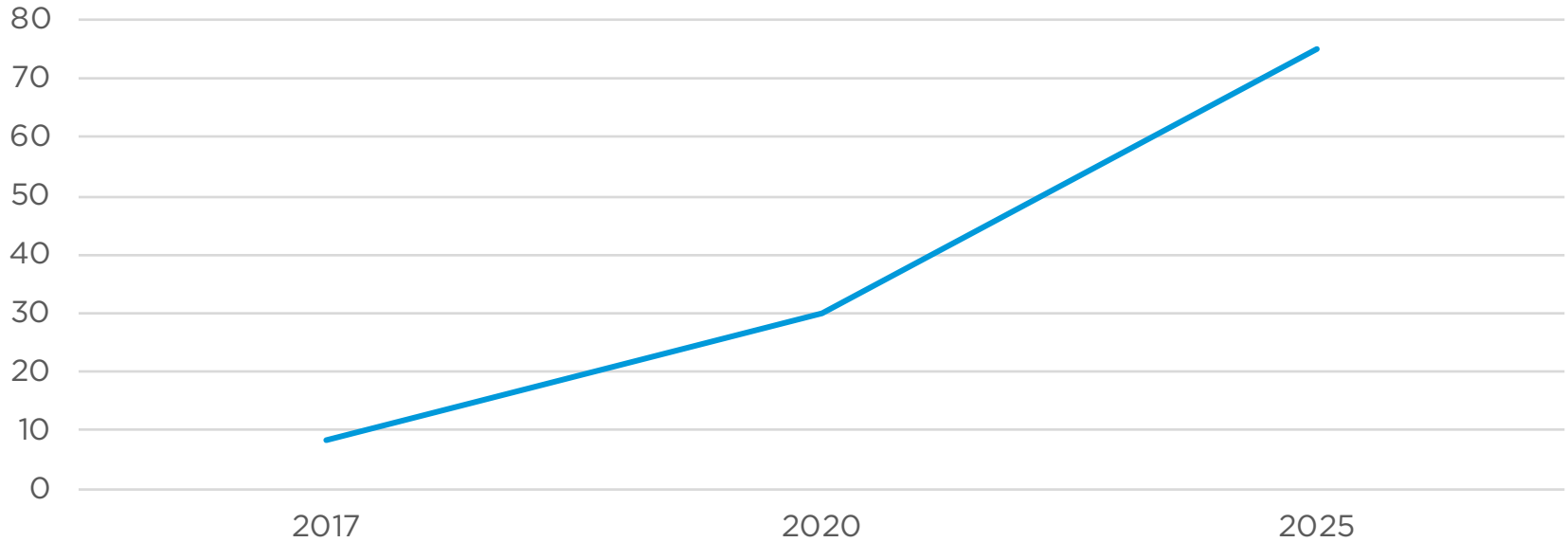
## Infrastructure



Smart city  
Energy management  
Environmental monitoring

# Analytical Market Projections

IoT devices in billions





**One Hundred Billion Dollars**

# Growth Catalysts

Conservation  
of energy



Preserve environment  
Cost savings

Regulatory  
initiatives



Smart meters in 80%  
of all European  
homes by 2020

Aging  
population



Living independently

Technology  
evolution



Phones and tablets  
Voice assistants  
AR/VR  
A.I.

Build it,  
and they will come

“A lot of times, people  
don't know what they want  
until you show it to them.”

Steve Jobs

# Barriers for adoption



Unclear

value propositions

# ABB Ability and Cassia



- Long range Bluetooth
- Machine health monitoring
- Sensor network
- Results
  - Downtime reduced by 70%
  - Motor lifetime extended by 30%
  - Energy consumption cut by 10%



Platform  
fragmentation

# Standards & Technology Platforms

**NB-IoT**







Privacy

&

Security





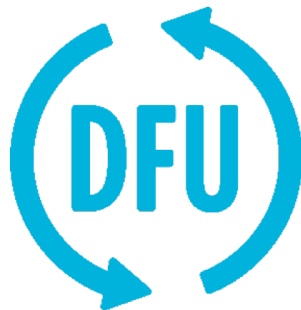
# Security and Privacy Risks

Security



Poorly secured IoT devices

Updates



No regular device updates

Privacy



Leaking personal data

# Security and Privacy Risks

Electricity



Transportation



Financial Services



Other  
considerations

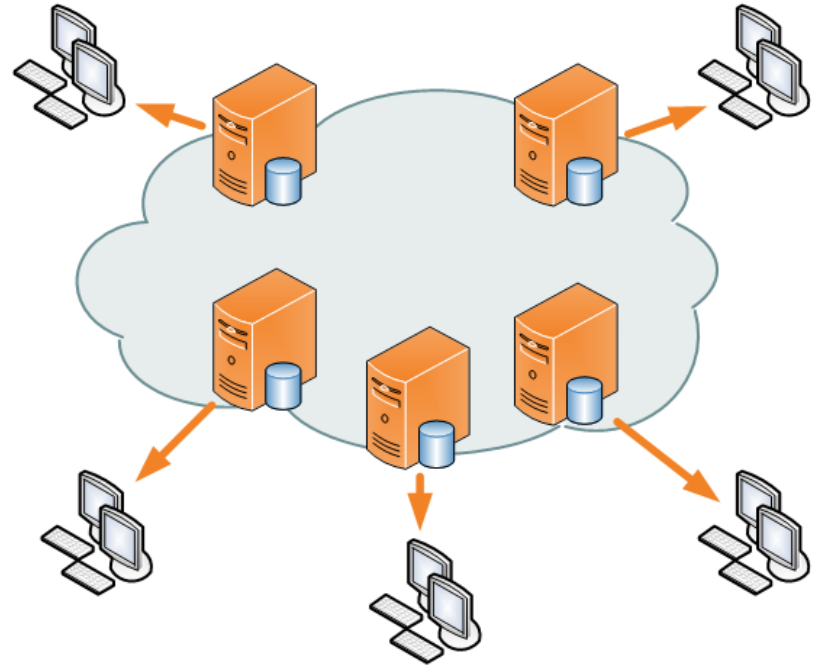
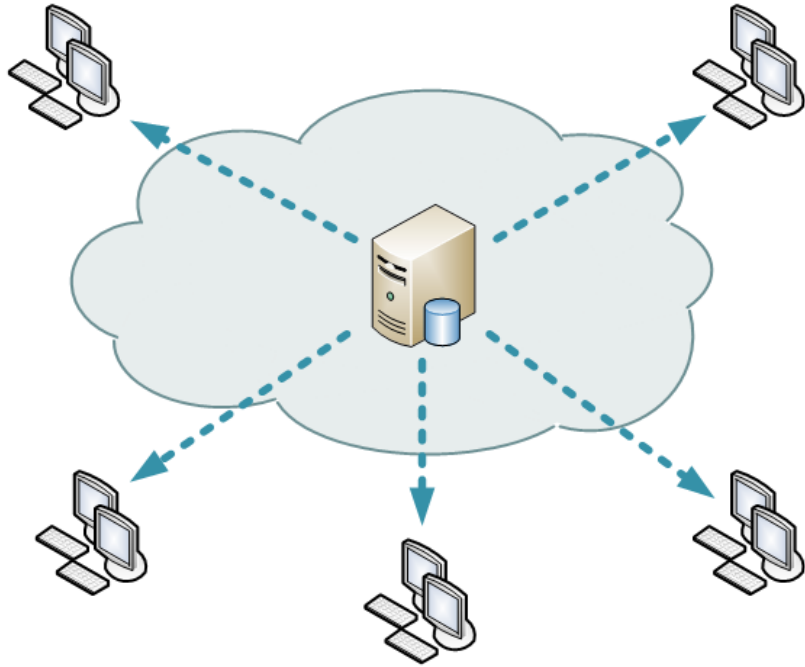
Big Data vs A.I.

Cloud computing

vs

Edge computing

# Where to put the Processing Power?



# Benefits of Edge Computing

Decrease amount of data transferred

Reduce latency

Improve quality of service

No single point of failure

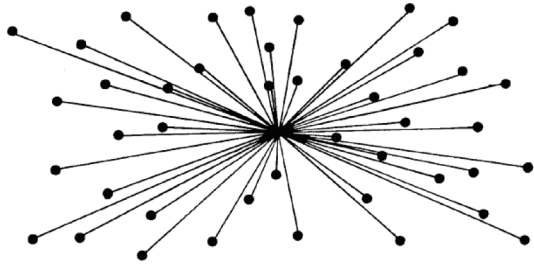
Reduce network electricity and cooling cost

Send information,  
not data

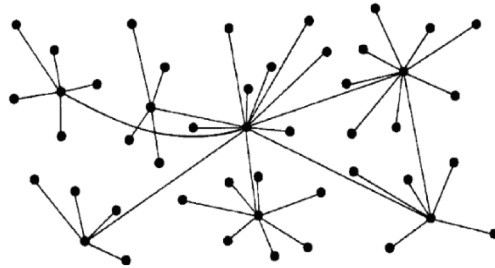


Network structure

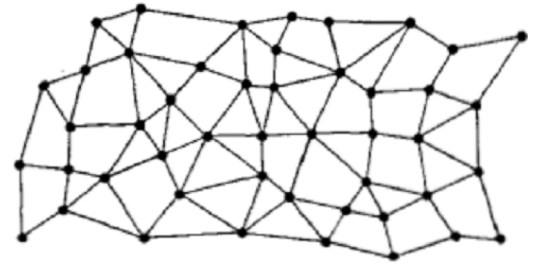
Centralized



Decentralized

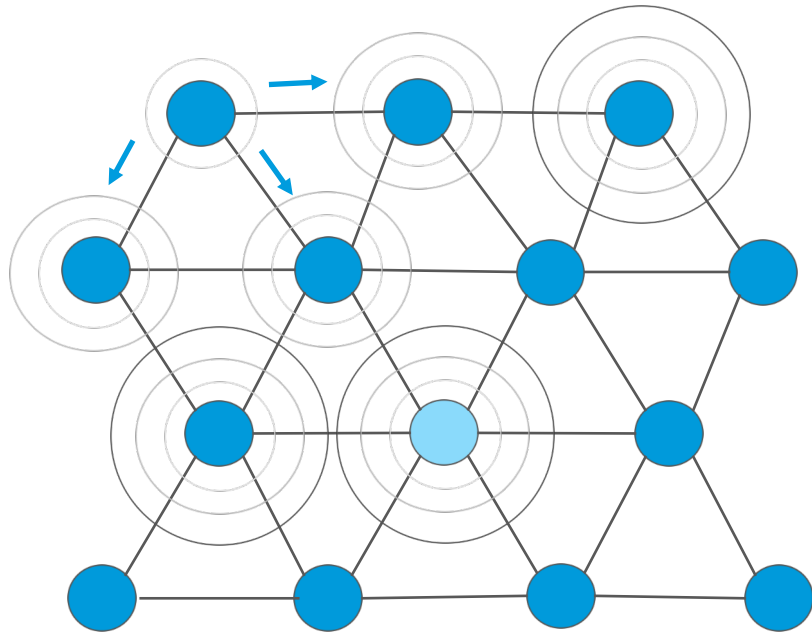


Distributed

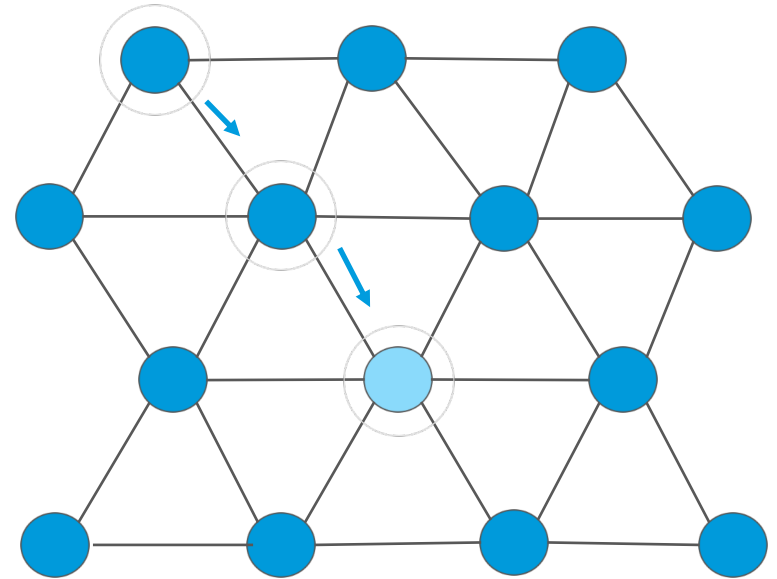


MESH

Flooding



Routing





Paul Baran (1926-2011)

IP

# Internet Protocol

There's no place like

**127.0.0.1**

- IP all the way to the end node?
- Built in security at network layer
- Well established
- Basis for the Internet
- IPv4
- IPv6
- 6LoWPAN
- Thread

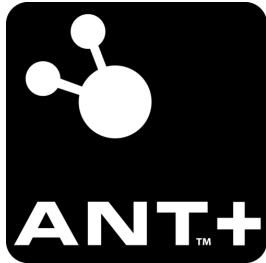
# Choosing a wireless standard



# Choosing a Wireless Standard



- Availability
- Interoperability
- Smart phone connectivity
- Commissioning
- Security
- Over The Air Updates
- Network latency
- Processing and battery power



Apple HomeKit

Google Nest

Amazon



Requirements

for

success

Interoperability

# Interoperability

Multimode Connectivity Platform

Combo solutions

Connecting to existing infrastructure

Multiple eco systems

Smart phone  
connectivity

Bluetooth

Low Energy



Commissioning

Out of band  
pairing

# Out of Band Pairing



- NFC
- Simple
- Secure
- No physical interface required

Security

Over

The

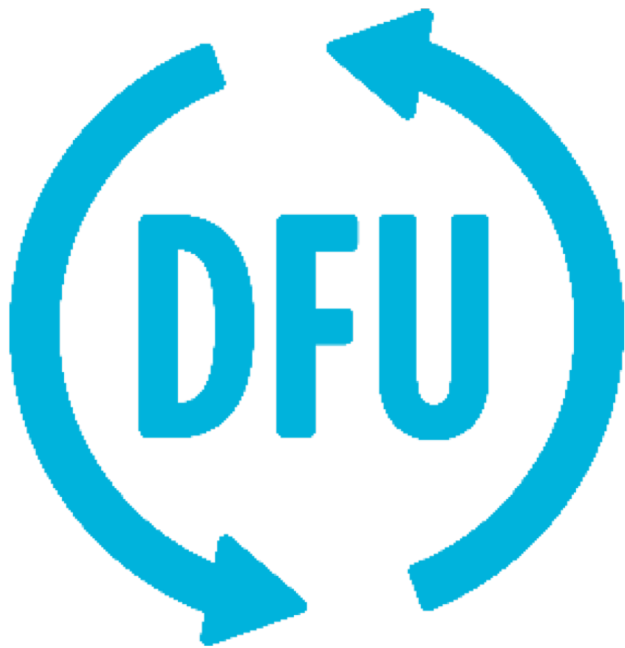
Air

Device

Firmware

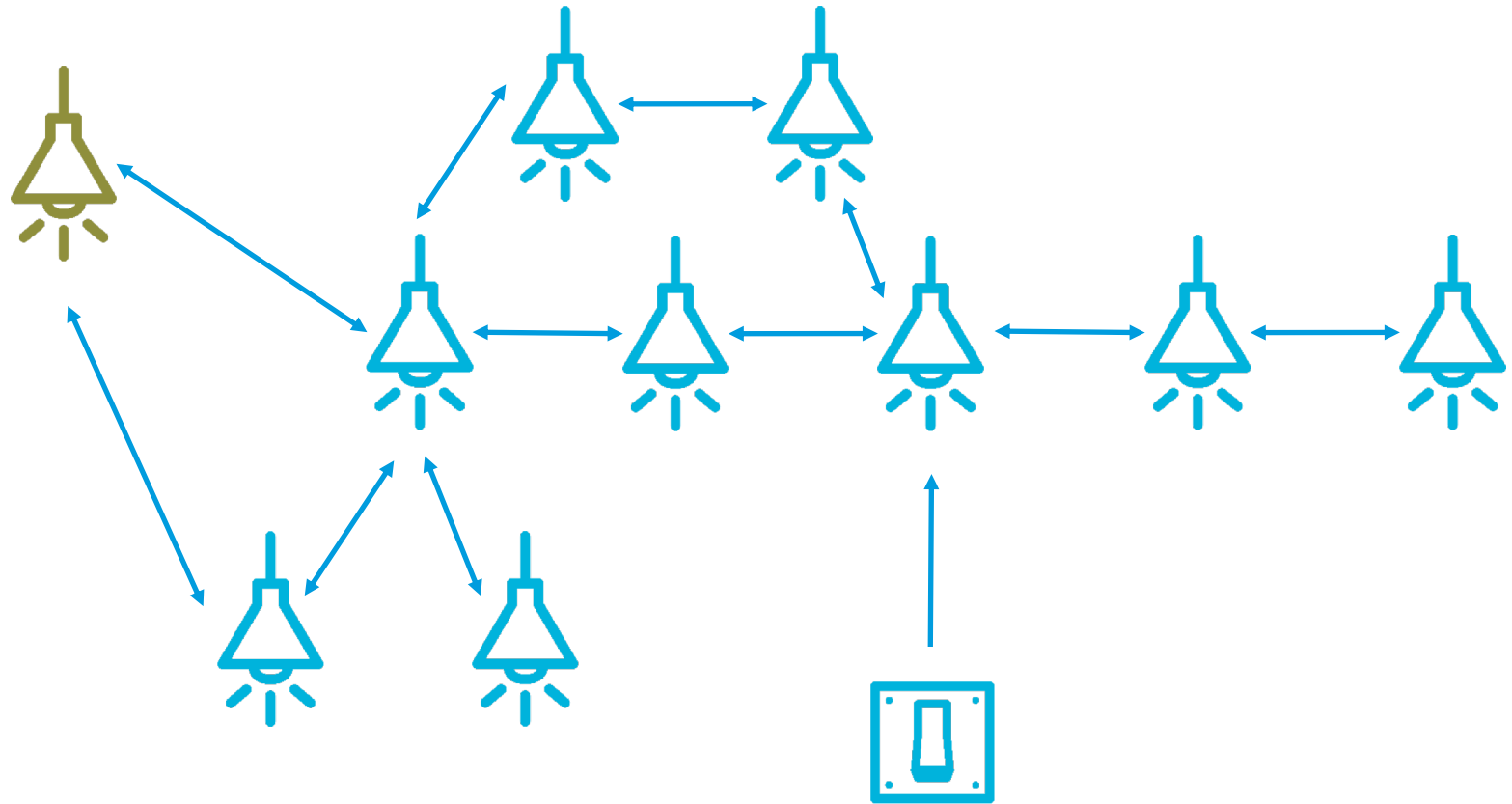
Updates

# OTA DFU



- Security patches
- Bug fixes
- Firmware updates
- Add new features
- Add value
- Extending life time
- Ensuring a good user experience

Low latency







Battery friendly

# Battery Friendly



- Radio
- Application controller
- Protocol
- Features
- Through put
- Output power

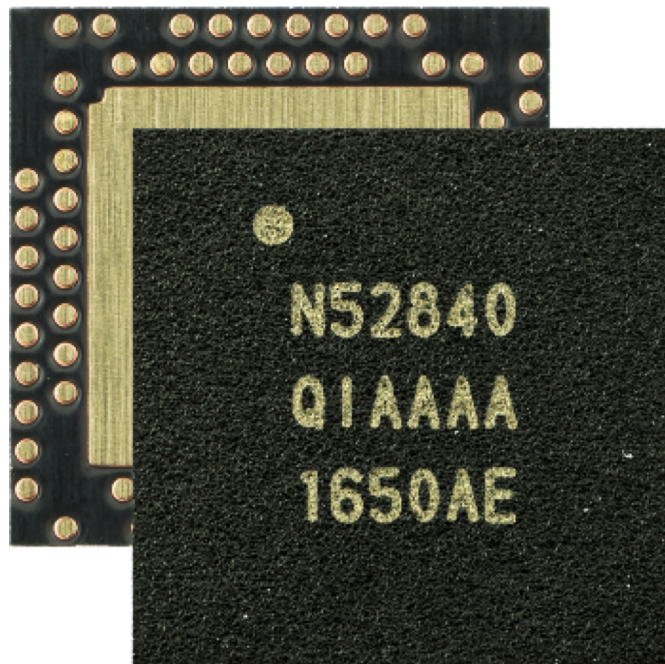


- Interoperability
- Security
- Processing power
- Network structure
- Protocol standards
- Phone connectivity
- Comissioning
- Device firmware updates
- Through put, range, latency, power
- ...



One-Stop-Shop





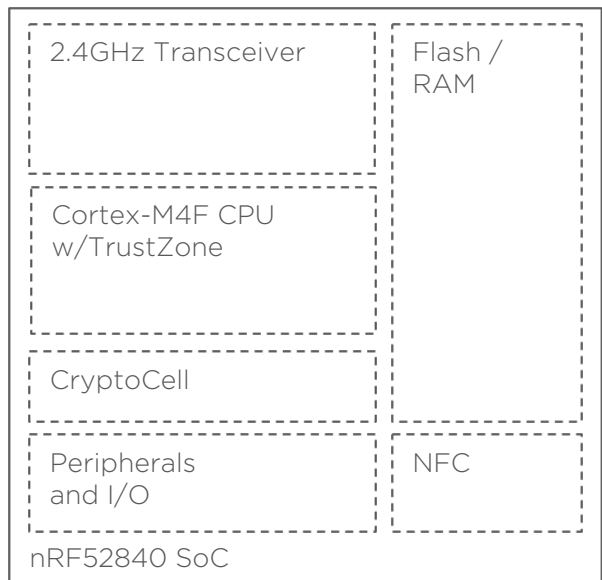
N52840

Q1AAA

1650AE



# nRF52840



- 2.4GHz tranceiver
- Support for IEEE 802.15.4
- NFC radio
- ARM® Cortex M4F
- 1M Flash memory
- 256K RAM
- ARM® Cryptocell
- Multiple peripherals and I/O

# Broad Connectivity Support



Full featured ANT stack



Full BT5 certified platform



Thread 1.1 certified platform



Zigbee 3.0 certified platform



NFC TAG type 2 and type 4 stacks

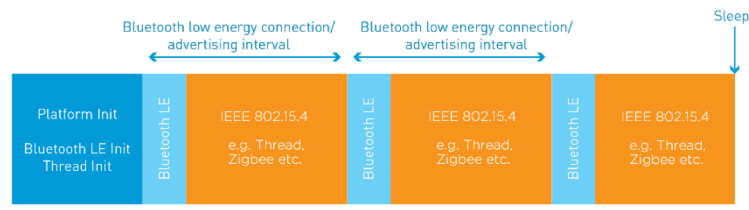
# Built in Support for Multiprotocol

## Switched multiprotocol



Non concurrent protocol  
No interference between protocols  
Simplest

## Dynamic multiprotocol



Concurrent operation  
Radio hardware is time-sliced between protocols  
Careful design to minimize interference between protocols

# Powerfull Combinations



Smart phone  
connectivity

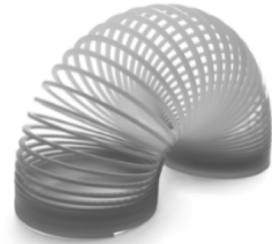
# Gold Standard



Mature



Reliable



Flexible



Interoperability

Secure

OTA DFU

# Massive Leap Forward in Security



Hardware accelerated cryptography

- Ciphers, key exchange and data integrity
- All relevant standards
- Performance and power

Stream Cipher: Cha Cha, MAC: Poly1305, Key Agreement: SRP, AES: FIPS 197, NIST SP 800-38-A, NIST SP 800-38B, NIST SP 800-38C, ISO/IEC 9797-1, Hash: FIPS 180-3, RFC2104, RSA: PKCS#1, Diffie-Hellman: ANS X9.42, PKCS#3, ECC: ANS X9.63, IEEE 1363, ANS X9.62, Ed25519, Curve25519, FIPS-186-4, NIST SP 800-56A, rev.2, TRNG: NIST 800-90B3, AIS-31, PRNG: AIS-20, General: FIPS 140-2

50X  
Cipher and data integrity

10X  
Key exchange



Hardware support for secure boot

- Corner stone of advanced device security
- Establishes “root of trust”
- Protection of secure keys



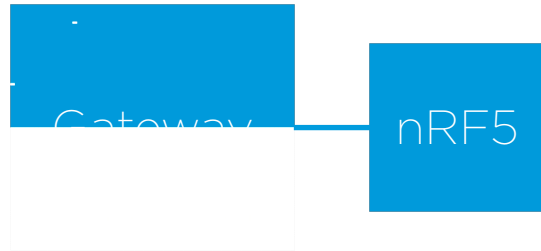
# Serialization

## 3<sup>rd</sup> Party MCU



- Existing or specialized application
- DALI, DMX, 0-10V
- General Purpose MCU

# Gateway



- Gateway to Internet
- Ethernet or WiFi capable
- Application processor

# Rigado Cascade-500



lights



controls



sensors

## RIGADO EDGE CONNECTIVITY SOLUTIONS FOR **SMART BUILDINGS**



### **CONNECTIVITY**

Bluetooth 5 . 802.15.4  
WiFi. Ethernet . LTE

### **FLEXIBILITY**

customizable hardware  
and edge computing power

### **SECURITY**

secure updating at scale  
for devices in the field



cloud services



devices



applications

Cellular

Low Power

Cellular

# Match Made in Heaven

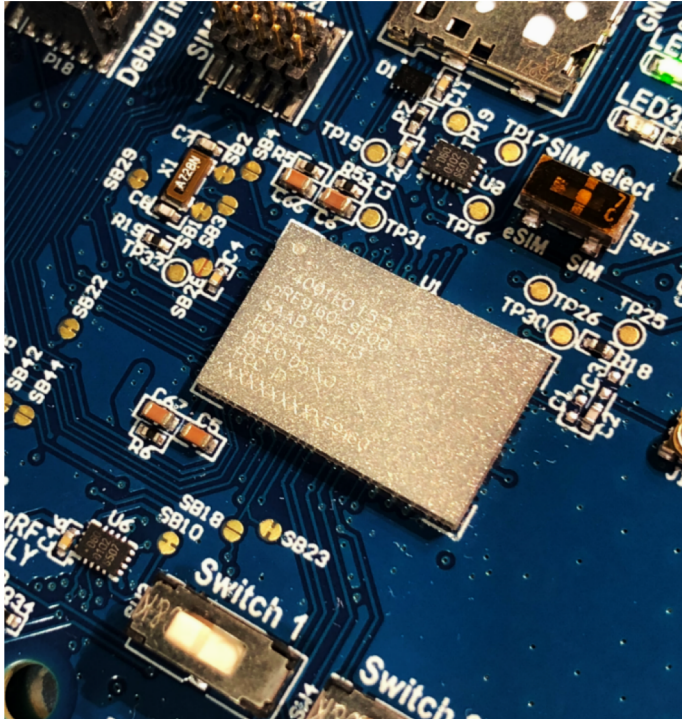


Seasoned cellular R&D team  
Experts in their field



Low power expertise  
Broad market engagement model

# nRF91 Platform

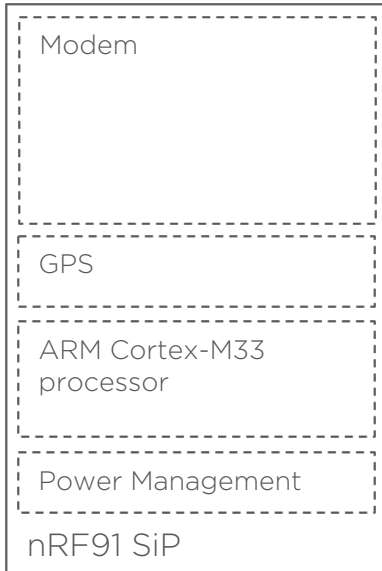


- Designed and optimized for IoT
- Low power
- High level of integration
- Ease of use



Cellular  
made easy

# nRF91 System in Package (SiP)



- Cellular baseband modem
- ARM Cortex M33
- GPS
- Power management

# nRF91 System in Package (SiP)

## Modem

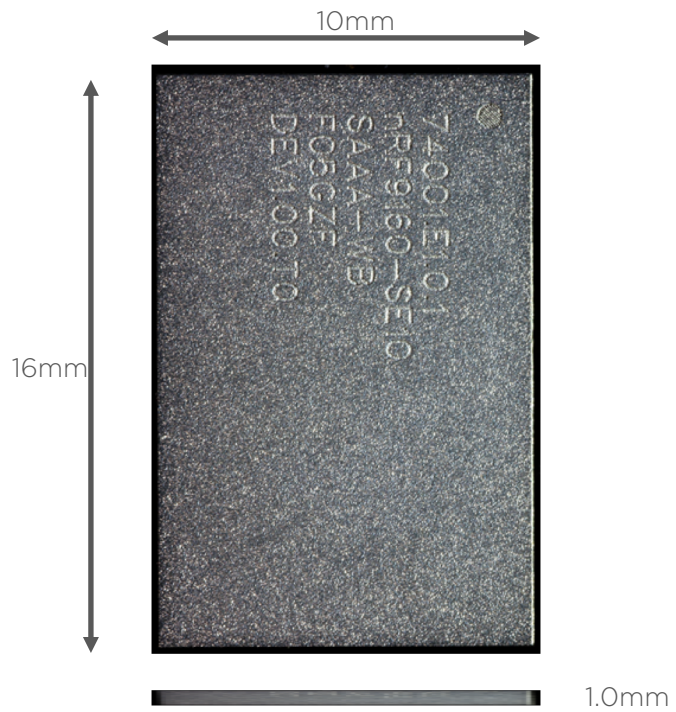
LTE-M and NB-IoT  
Multi-band operation  
23 dBm output power  
UICC interface

## Application controller

ARM Cortex M33  
Dedicated Flash & RAM  
Arm® CryptoCell® & TrustZone®  
Multiple peripherals and I/O

## GPS

Assisted GPS receiver  
Optimized for tracking

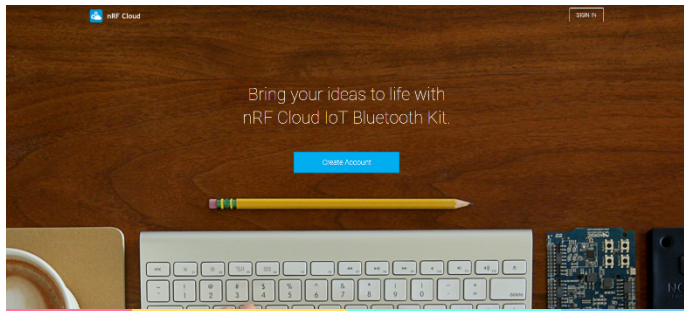


# nRF91 as a Cellular Gateway



- Coexistence interface
- Short range distributed network
- Cellular gateway
- Dev kit with nRF52840

# nRF Cloud



- IoT platform extension
- Built on AWS
- Both nRF52 and nRF91

Easily connect & configure your  
Bluetooth IoT prototype in the cloud.



#### Connect

Use your PC, iPhone or Android phone to connect your Bluetooth-enabled Nordic DevKit device to the cloud.



#### Configure

Control device settings and notifications from the cloud—no coding required. Plus, automatically install firmware updates.



#### Monitor

Track live data, record historic data and receive alerts in real time on the cloud with intuitive interface.



#### Share

Collaborate on projects by adding team members to your account. Present proof of concept ideas. Share results with anyone.

# Complete Solution



- Hardware
- Software
- Development kits
- Software development kit
- Apps
- Application code examples
- Cloud

From dream  
to reality

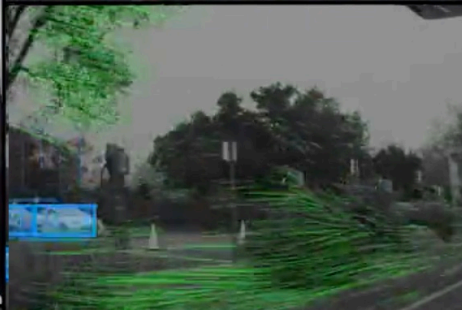
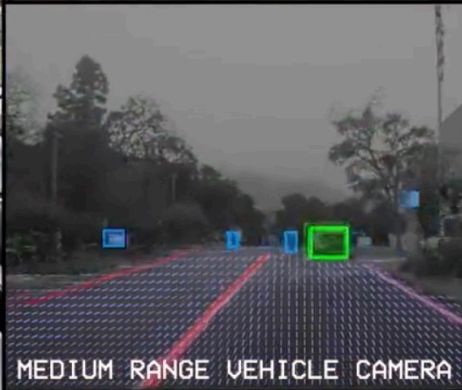
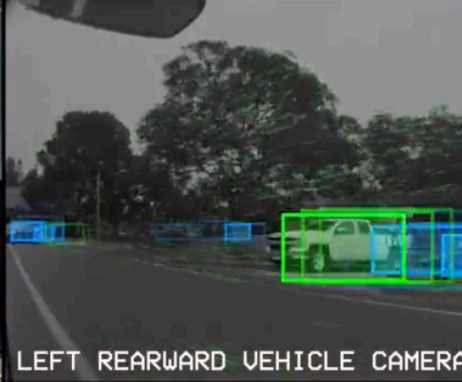
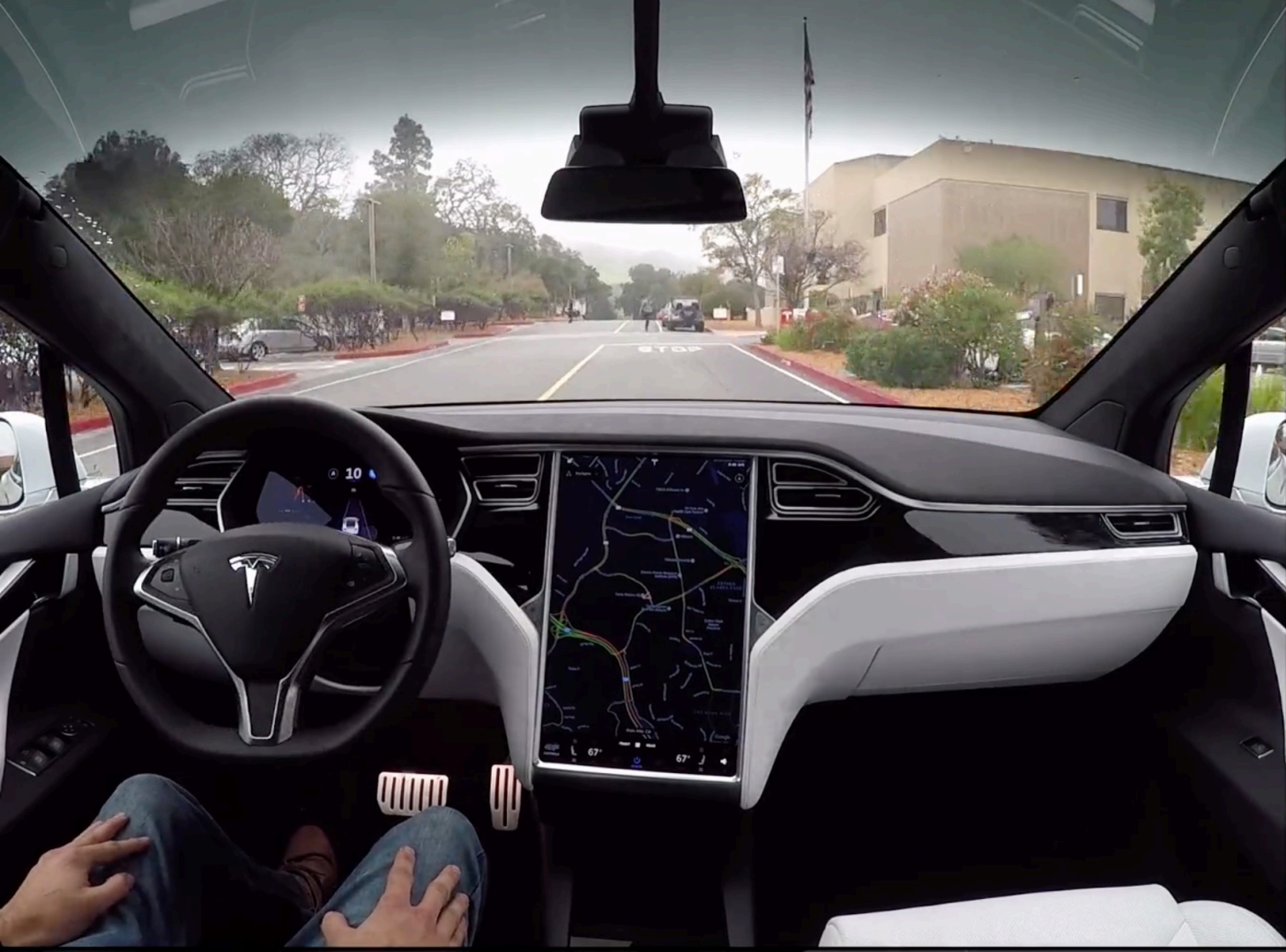






amazon




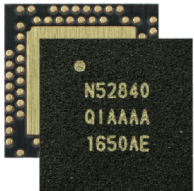













“I see change.

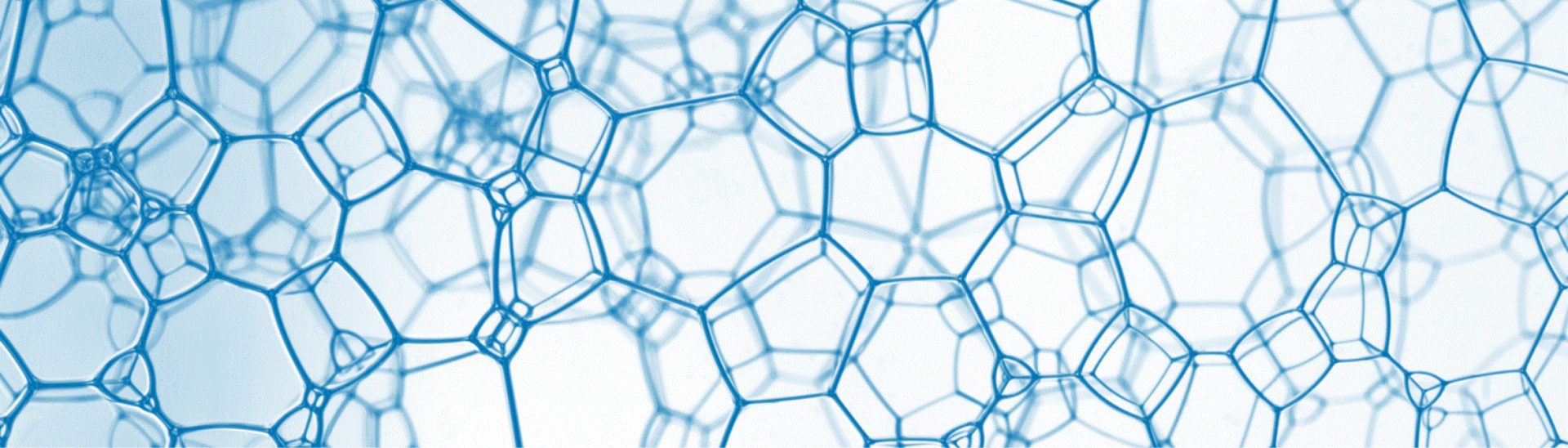
I embody change.”

Vinnie Jones

# @Nordic we Aim to Lead on Technology

	GPS			
				NB-IoT
				

IoT



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Ubiquitous, reliable and secure networking  
for smart environments

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