# Internet of Tomorrow

## Julien Carre
EMEA Business Development Manger MPU

JUN 2015

*freescale*™

# Secure Embedded Processing Solutions *for the*

# INTERNET *of* TOMORROW

*The Internet of Tomorrow is the **advancement** of the Internet of Things (IoT) where **secure solutions exist across every touch point**, from end node to the network to the cloud.*

**freescale** ™

# ... On The Way and Partly Already Here



50 BILLION

25 BILLION

12.5 BILLION

World Population

# Connected Devices

6.3B | 6.5B | 6.8B | 7.2B | 7.6B

| <1x | 1x | 2x | 3.5x | 6.5x | # Connected Devices/Person |

2003 | 2008 | 2010 | 2015 | 2020
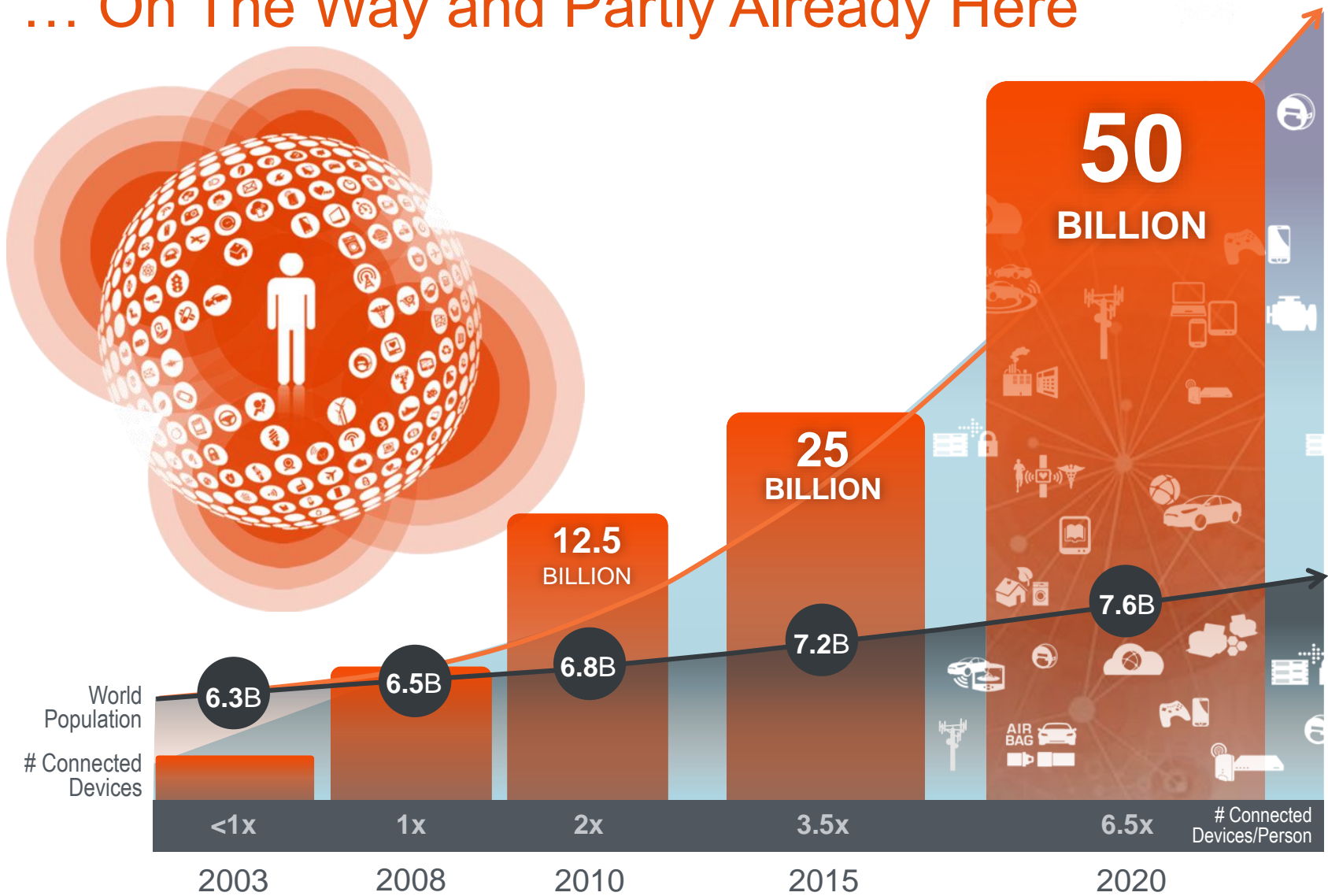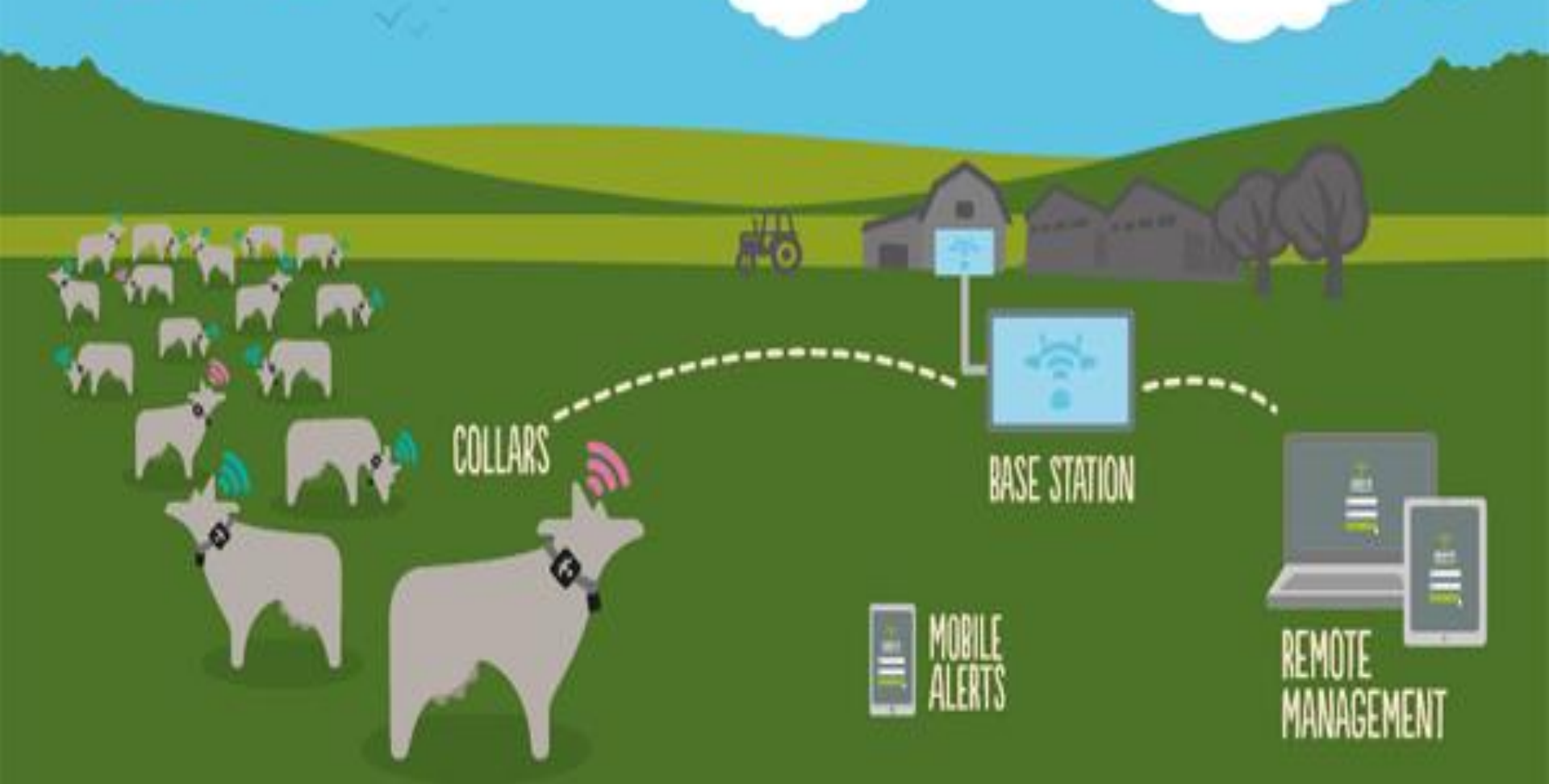
# Everything gets Connected… Really EVERYTHING

Venture capitalists have invested US $4.8 in a business that uses wireless connected collars that signal when cows are in heat

COLLARS

BASE STATION

MOBILE ALERTS

REMOTE MANAGEMENT

# IoT is Driving New Technology and Business Paradigms

- **S**ensing, **E**fficient, **N**etworked, **S**ecure, **E**verywhere. Tilting the direction of technology development and adoption, with significant implications for customers and also silicon vendors

  **Five verticals** get the most focus **–** While IoT will be found everywhere, 5 verticals are early in the adoption curve and offer a large market opportunity and the possibility for significant profits: Wearable Devices, Connected Cars, Connected Homes, Connected Cities, and the Industrial Internet.

| | Wearables | Home | City | Auto | Industrial | Scale |
|---|---|---|---|---|---|---|
| Timing | | | | | | |
| Market size ($) | | | | | | More Significant |
| Profitability | | | | | | |
| Semiconductor content | | | | | | Less Significant |
| Networking content | | | | | | |

# Our Products Power the Internet of Tomorrow
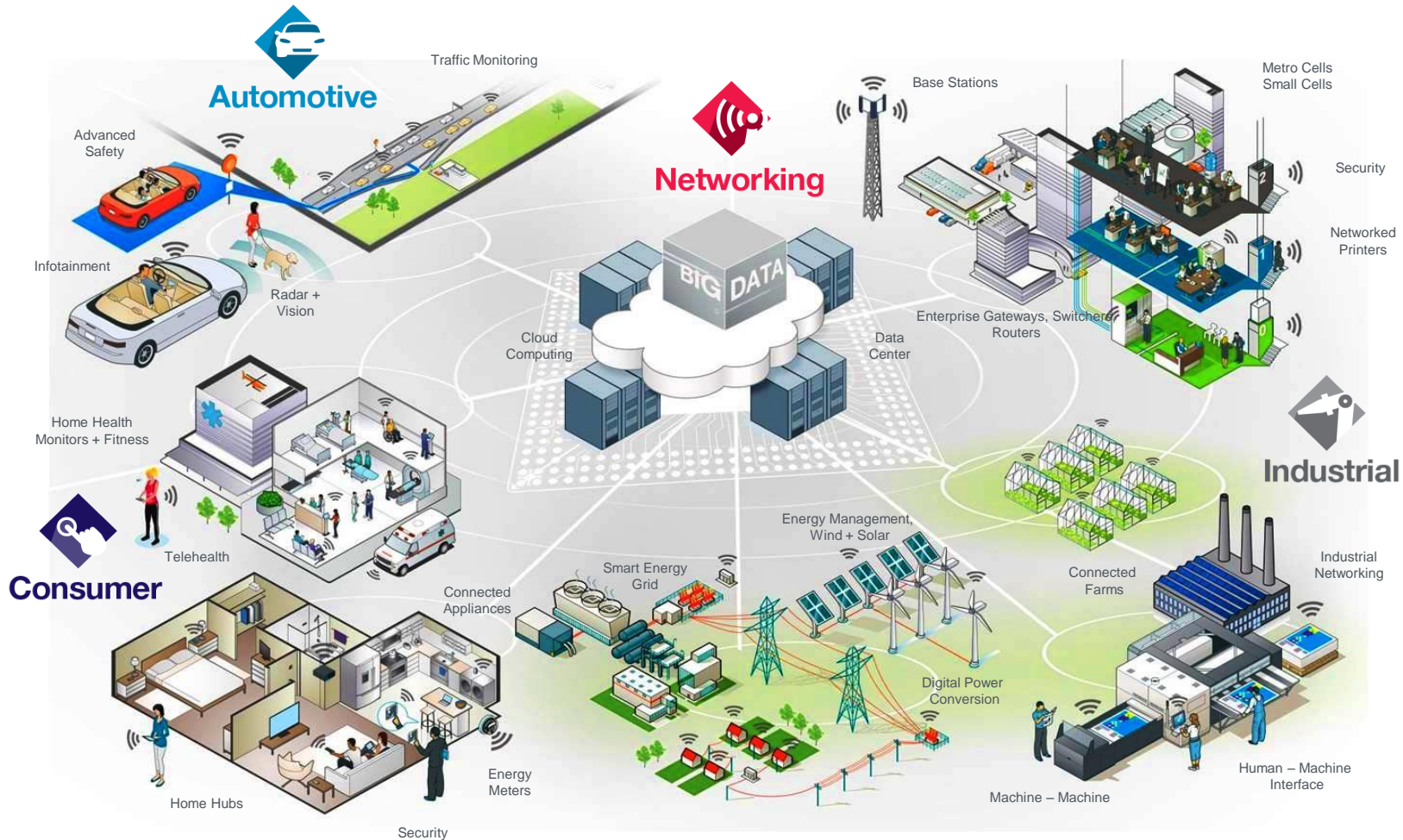


**Microcontrollers | Digital Networking | Auto MCU | Analog and Sensors | RF**

# Freescale IoT Solutions Continuum



**QorIQ**

**MCU**

**Multicore Communications Processor**

**Multicore Communications Processor/ Crypto Processor**

**Edge Nodes**

**PAN/LAN Connectivity**

**Gateway**

**WAN Connectivity**

**Cloud**

**Sensing**

Pressure        Accelerometer
Altimeter       Magnetometer
Temperature   Gyroscope

**Connectivity**

NFC        ZigBee®    WiFi®
6LowPAN   GPS         RFID
Sub-Gig    BT/BTLE    Cellular
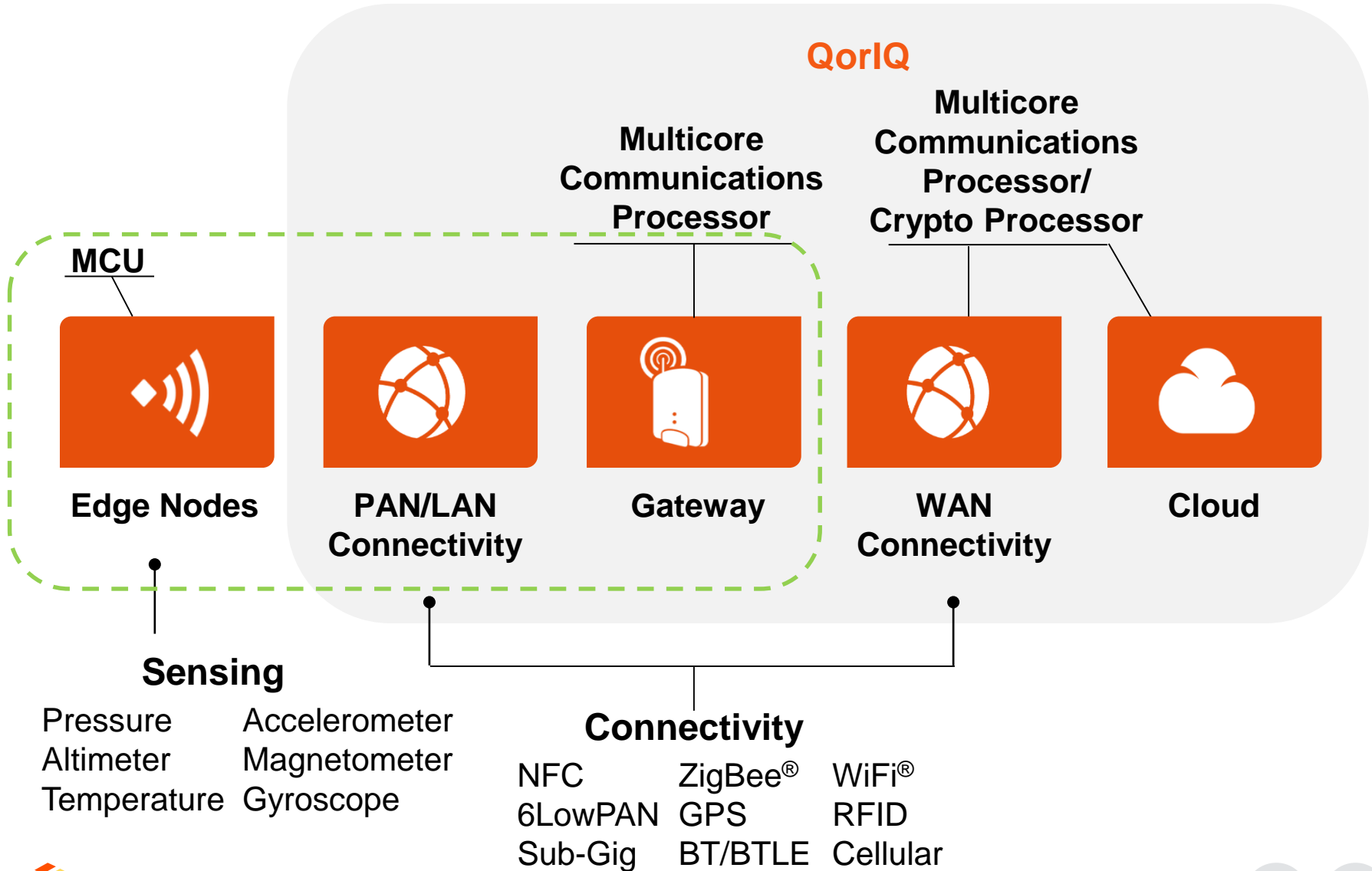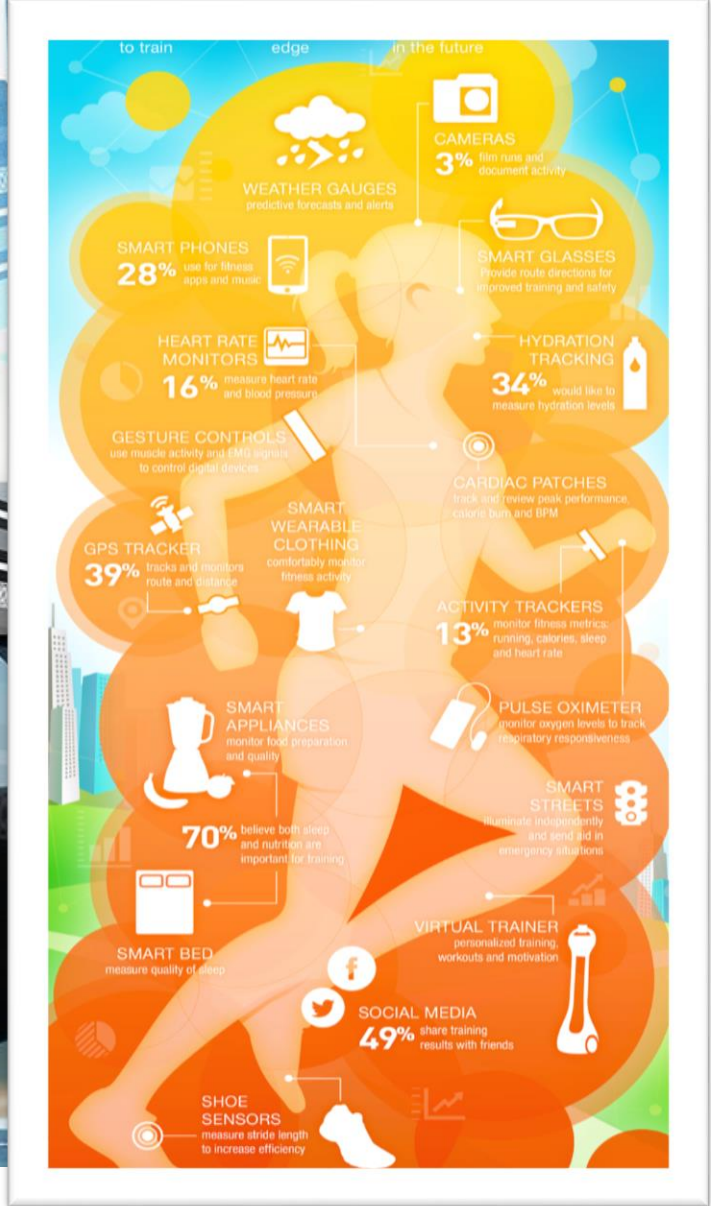
# Automotive will be Second Largest Generator on the IoT

**CLOUD**

ITS
Big Data

Wi-Fi, 3G, 4G, ...

**V2I CLOUD**

Collision
Avoidance

DSRC

Advise: tyre pressure, brake wear, service intervals, insurance & tolls services

Entertain: dig radio, connected games, streaming video, internet/phone services

Assist optimized routing, blue wave, optimum speed, e-brake lights, OTA software updates

Control: emergency braking, adaptive cruise control, road geometry tracking

# Simplified Autonomous Vehicle Model

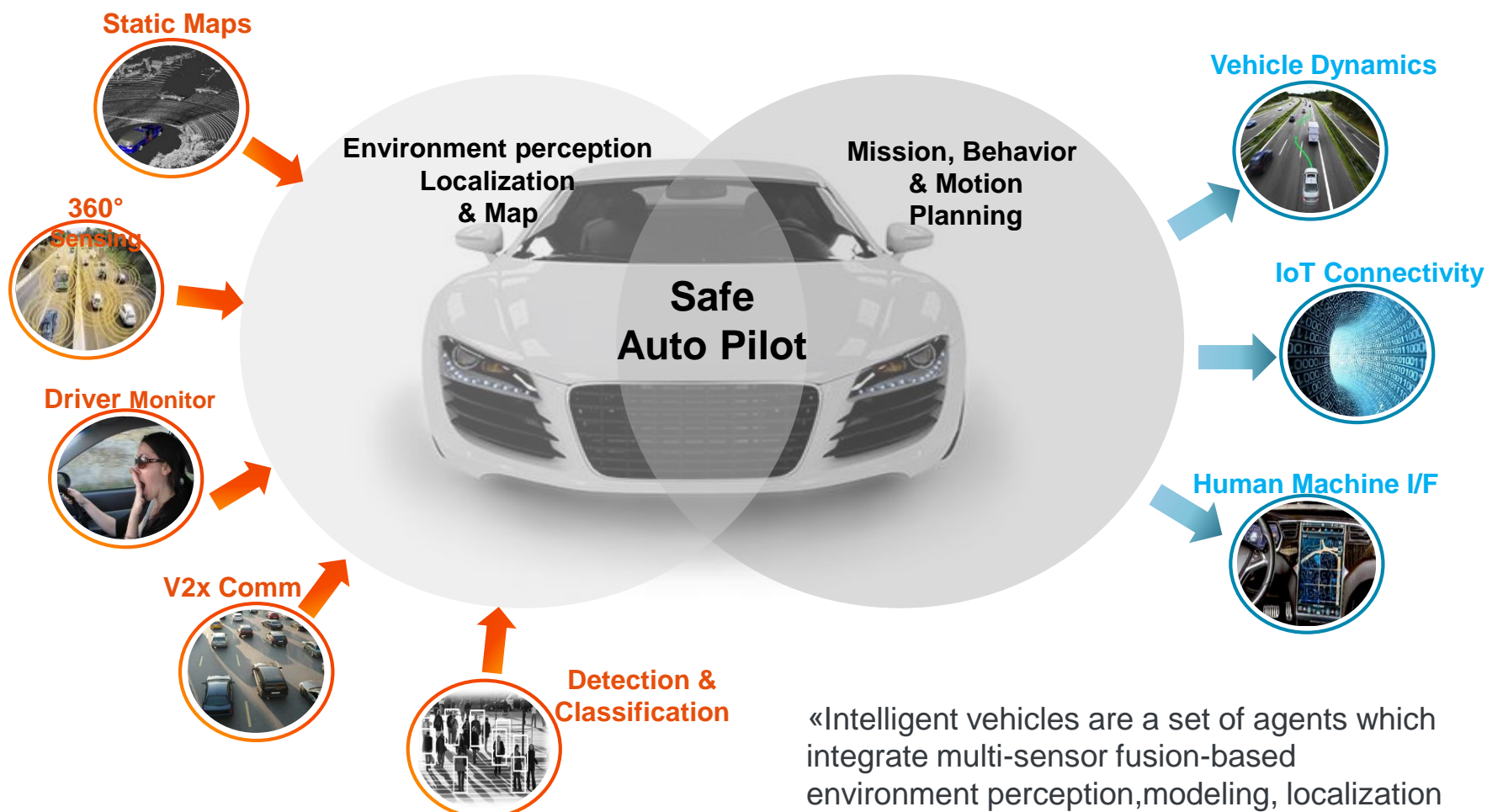

**Static Maps**

**360° Sensing**

**Driver Monitor**

**V2x Comm**

**Detection & Classification**

**Environment perception Localization & Map**

**Safe Auto Pilot**

**Mission, Behavior & Motion Planning**

**Vehicle Dynamics**

**IoT Connectivity**

**Human Machine I/F**

«Intelligent vehicles are a set of agents which integrate multi-sensor fusion-based environment perception, modeling, localization and map building, path planning, decision making and motion control.»
Prof. Cheng - 2011

freescale™

# Smart Factory - Industry 4.0



- Communication of M2M and machine-to-product all in interaction with people

- Connected objects trigger and deliver information and data for decisions.

- Processing and distribution of information in real time

# Home Automation



**Lighting** HVAC Motor Control **Scenes** Entertainment **Appliance** Mobile Internet Control
*Security* Surveillance *Sprinkler* Alarm Timer **Energy Saving**

# IoT Challenge for Semiconductors

More connectivity, more data means:

✓ **INCREASED SECURITY REQUIREMENTS**

✓ **ADDS SOFTWARE COMPLEXITY**

✓ **REQUIRES MORE PERFORMANCE**

✓ **REQUIRES MORE POWER**
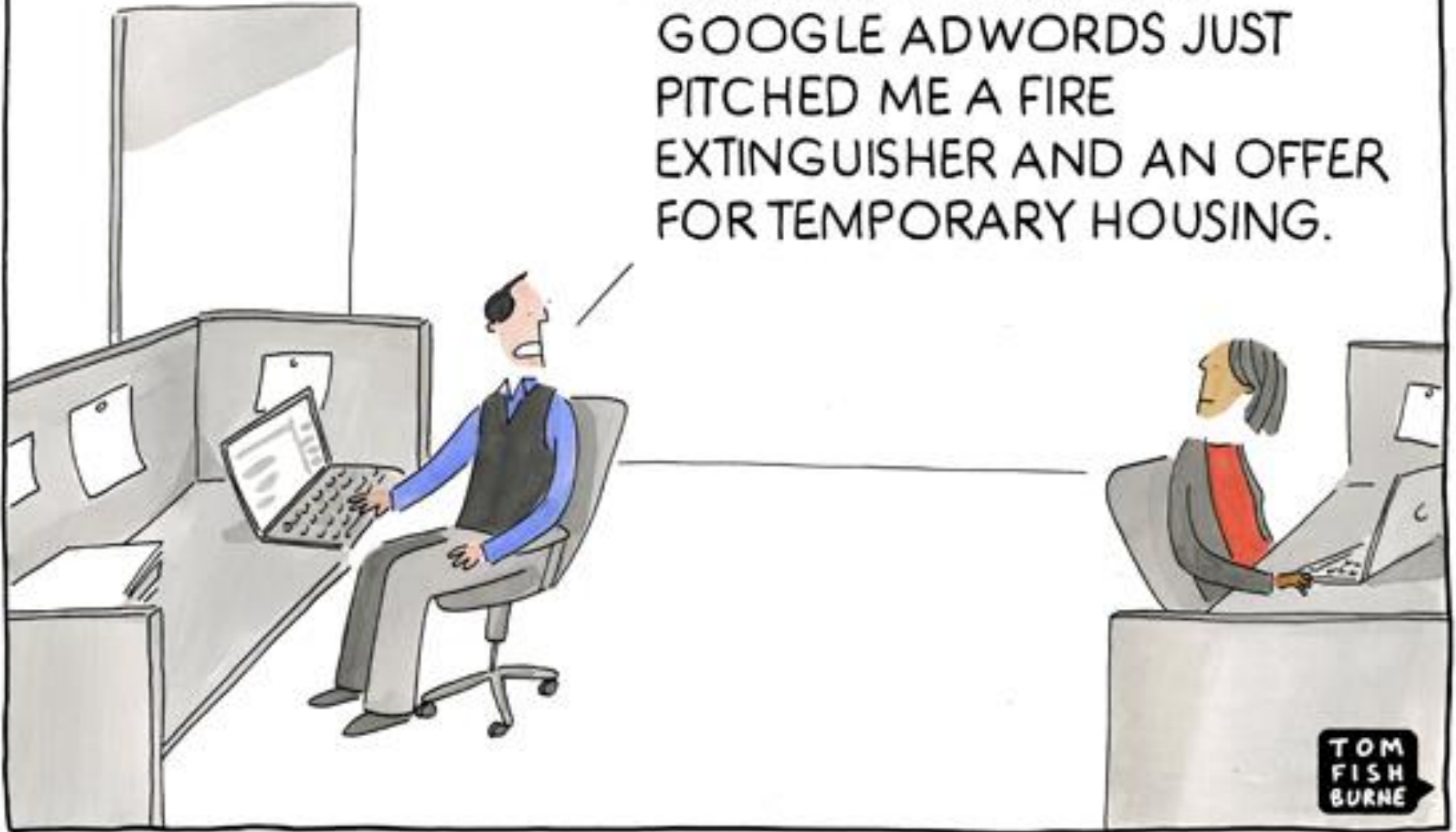
*The implementation of security varies by area.*

We optimize the workloads produced by this Big Data explosion

We continue to shrink power envelopes, and optimize performance / power ratios

We continue to expand hardware-level security, and increase product lifecycles and reliability

# End Node Security
## Interconnected (IoT) Devices

**90%** of interconnected devices collected **Personal Data**

**70%** have serious vulnerabilities to attacks**

**70%** of devices were unencrypted**

FTC looking at IoT security legislation***

**5X** number of connected devices by **2020***

2015

2020

More **unmanned** (IoT End Nodes) than **manned** internet connections (PC, Smartphone)
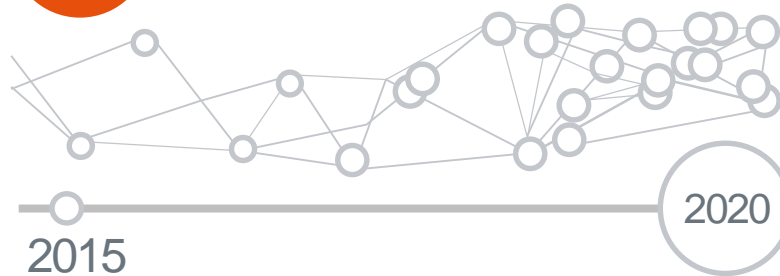
*Gartner excluding PC/ Smartphones     **From a recent study by HP     *** FTC report Jan 27th

# Internet of Things Nodes are Insecure



Early morning motorists got a shock yesterday when digital car park signs were tampered with by computer hackers and were left displaying an obscene message.



BLAST THE HORN, CONTINUING EVEN AFTER CAR TURNED OFF

PREVENT CAR FROM POWERING DOWN, DRAINING BATTERY

CHANGE SPEEDOMETER AND GAS GAUGE AT WILL

ABRUPTLY TIGHTEN DRIVER'S AND PASSENGER'S SEAT BELT

CAUSE ENGINE TO ACCELERATE (CAN BE OVERRIDDEN WITH THE BRAKE)

TURN HEADLIGHTS ON OR OFF WHEN LIGHTS LEFT ON AUTO

DISABLE POWER STEERING OR JERK THE WHEEL

SLAM ON BRAKES AT ANY SPEED

Tests revealed that the Hub was passing unencrypted data to the control device without authentication. ......
Anybody network could detect the hub and run commands.
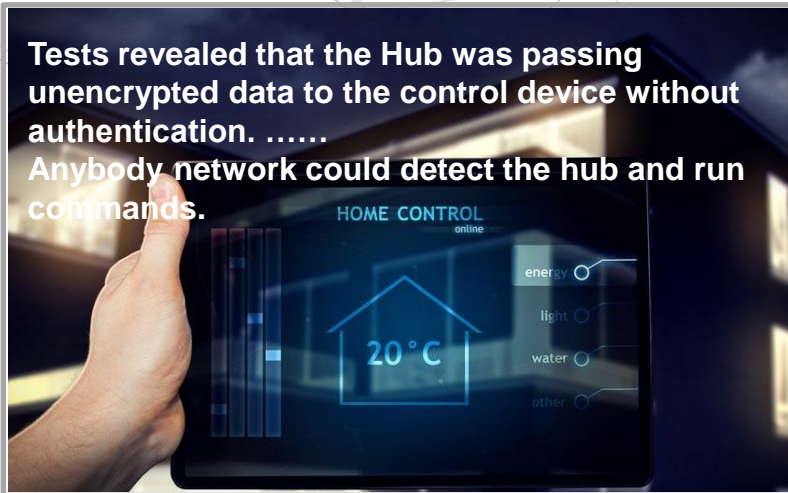


Researchers at the University of Texas have succeeded in hijacking a 213-foot yacht as it sailed from Monaco to Rhodes on the Mediterranean Sea, by overriding its GPS signals

*freescale*™

Industrie 4.0 – the internet has come to the factory **and so have the attackers**

"Security budget slide despite 48% increase in cyber attacks"

"PwC estimates that the average cost of managing and mitigating breaches rose to $2.7m per incident…"

"But the numbers of reported security incidents increased 48 per…"

SERVICE & MAINTENANCE
KINRIG

**ZEIT ONLINE** | DATENSCHUTZ

IT-SICHERHEIT

**Blackout**

Ein Hacker brauchte nur zwei Tage, um die Kontrolle über die Stadtwerke in Ettlingen zu übernehmen. Er zeigte: Die Stromnetze in Deutschland sind nicht sicher.

von Christiane Grefe | 10. April 2014 - 08:00 Uhr

**heise Security**

Security ▸ News ▸ 7-Tage-News ▸ 2013 ▸ KW 12 ▸ Botnetz scannt das Internet mit Hilfe von gehac...

**News** **Hintergrund** **Erste Hil**

19.03.2013 12:01

« Vorige | Nächste »

**Botnetz scannt das Internet mit Hilfe von gehackten Endgeräten**

Ein bislang unbekannter Hacker hat eine Art Volkszählung des Internets umgesetzt: Für den Internet Census 2012 infizierte er cirka 420.000 schlecht geschützte Embedded Devices mit der nach seiner Auskunft harmlosen Botnetz-Software Carna. "Schlecht geschützt" bedeutet in diesem Fall, dass entweder gar keine Logindaten waren oder Standardwerte wie "root:root" oder...

# Security: What to Achieve

**Authentication**

I can prove to another party that I am Lutz and only Lutz

**Non-repudiation**

I can send a message, but cannot later claim that I did not send it.

**Validation**

I can send a message, and can guarantee that it was not altered during transmission

**Secrecy**

I can send a message and know that, even if it is intercepted, it cannot be read

**Protection**

I want my equipment to prevent compromises in security

# Security: What we Want to Achieve

**Authentication**

I can prove to another party that I am User 12345 and only User 12345

**Non-repudiation**

I can send a message, but cannot later claim that I did not send it.

**Validation**

I can send a message & guarantee it was not altered in transmission

I can run firmware and guarantee that it has not been altered

**Secrecy**

I can send a message and know that, even if it is intercepted, it cannot be read

**Protection**

**My equipment must:**
- Prevent compromises in security,
- Detect if system is tampered with,
- Store secret keys

| Asymmetric Ciphers 'Public Key' | Hashes & secure boot | Symmetric Ciphers | Hardware |
|---|---|---|---|

**freescale**™

# Freescale Understands Security

Experience in developing security IP & providing certified security solutions for networking & industrial markets

## Proven Security Expertise

40+ years of experience developing Information security solutions

150+ security patents

5000+ man years and $1.7 B invested to date

Dedicated security technology Centers of Excellence

Broad portfolio of cryptography and platform assurance IP.

## Cutting Edge Security IP & Product Portfolio

Cryptography (message encryption, decryption and authentication)

Trust Architectures (secure boot, anti-cloning)

Content Inspection (intrusion detection and prevention)

Patented hardware engines for security, deep packet inspection, and pattern match

Support for all known cipher suites, FIPS140-2 certifiable

Efficient, scalable solutions in all processor families

.

## Robust Tools & Solid Ecosystem Partner Solutions

Extensive Tool Suite (hardware and software) available for customer evaluation

VortiQa software toolsuite for control centre, monitoring control and home gateway applications

Certified, Third-party software suite

Driving Standards like Thread

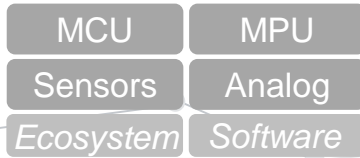freescale™

# Freescale IoT Security Solutions

Secure storage
Secure debug
Secure clock

HW firewalls
HW random number generation
HW cyrptographic accelerators

High assurance boot
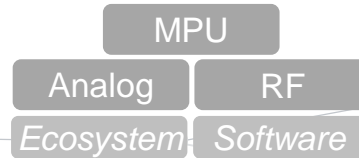Trusted execution
Tamper detection

**Trust** Architecture

**Trust** Architecture

**Trust** Architecture

| MCU | MPU |
|-----|-----|
| Sensors | Analog |
| *Ecosystem* | *Software* |

| MPU |
|-----|
| Analog | RF |
| *Ecosystem* | *Software* |

| MPU |
|-----|
| Analog |
| *Ecosystem* | *Software* |

End Node — Gateway — Cloud

Cryptographic
Security Protocols

Cryptographic
Security Protocols
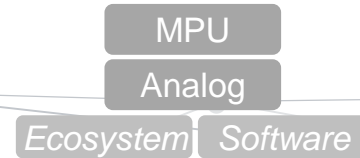
*freescale*™

# Example: Microcontroller System Security Considerations

HW random number generation

Memory protection unit

Protected flash memory

LAN, PAN, WAN

Encrypted communications

Integrated FLASH

Peripherals

CPU

SRAM

Restrict external code accesses

Tamper detection, secure RTC

**Kinetis MCUs Enable**
- Node Authentication
- IP protection
- Secure Communication
- Tamper protection

HW cryptographic acceleration

Unique chip identifier

Secure Key storage, unique chip ID

# Freescale Enabled Devices
## Industrial Automation



**Arcturus uCP1020**

**Dual-core, QorIQ P1020 processor running at 800 MHz**

Power to aggregate device communication from a remote site, using VPN-level secure connectivity.



**IoT Gateway Reference Design**

**LS1021A-IoT gateway reference design based on the QorIQ LS1021A processor**

Multi-service secured industrial IoT Gateway for building and factory automation and smart energy data concentrators.



**Spiri Programmable Flying Robot**

**i.MX 6 applications processor**

Airborne robot to survey terrain, detect land mines, water plants, report the news and even save a few lives along the way.
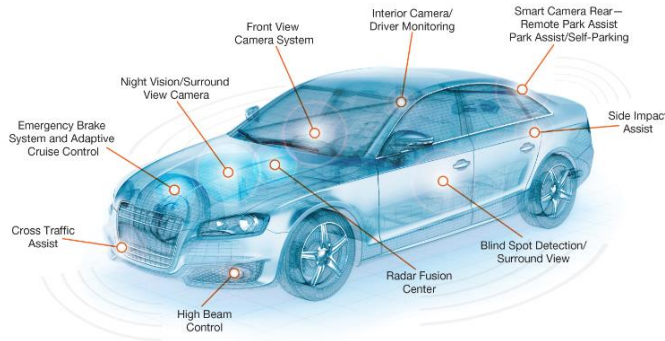
# Freescale Enabled Devices
## Automotive



**Digital instrument cluster**

**i.MX 6 applications processor running INTEGRITY RTOS**

An ideal platform for automotive OEMs and Tier 1s looking to combine ISO 26262 safety certification with high performance, advanced 2D and 3D graphics.



**Demo: In Car Secure Network**

**MPC5748G microcontroller, Hardware Security Module (HSM) embedded in MPC5748G MCU**

Secure transfer of data to and from the vehicle is critical for safe and reliable operation.



**Demo: In Car Secure Network**

**MPC5748G MCU, Hardware Security Module (HSM) embedded in MPC5748G MCU**

The gateway module's central microcontroller needs to have robust on-chip security capabilities.

# Freescale Enabled Devices
## Home Automation



**Smoke and Carbon Monoxide Detector:**

**Kinetis KL1x general purpose MCU**

Motion control light nightlight with remote smoke and carbon monoxide detector.



**2 way audio 720P IP security camera**

**i.MX28 applications processor**

Remote video monitoring via a Wi-Fi enabled camera, cloud-based streaming video service, and a mobile app



**Big AssFan - Haiku® with SenseME**

**Kinetis K series microcontrollers**

Ceiling fan to think and make decisions to keep you comfortable automatically:

# Freescale Enabled Devices
## Wearables



**Microsoft Band**

**Kinetis K24
Microcontrollers,
Cortex M4 Low Power**

First device powered by
Microsoft Health, helps you
achieve your wellness goals
by tracking your heart rate,
steps, calorie burn, and sleep
quality.



**SmartBackpack**

**Freescale FRDM-FXS-
MULTI-B board attached
to the FRDM-KL26Z and
several additional
Freescale sensors**.

Monitor your devices
without opening a zipper.
The AMPL mobile app
displays real-time battery
levels and allows you to
adjust charging priorities.
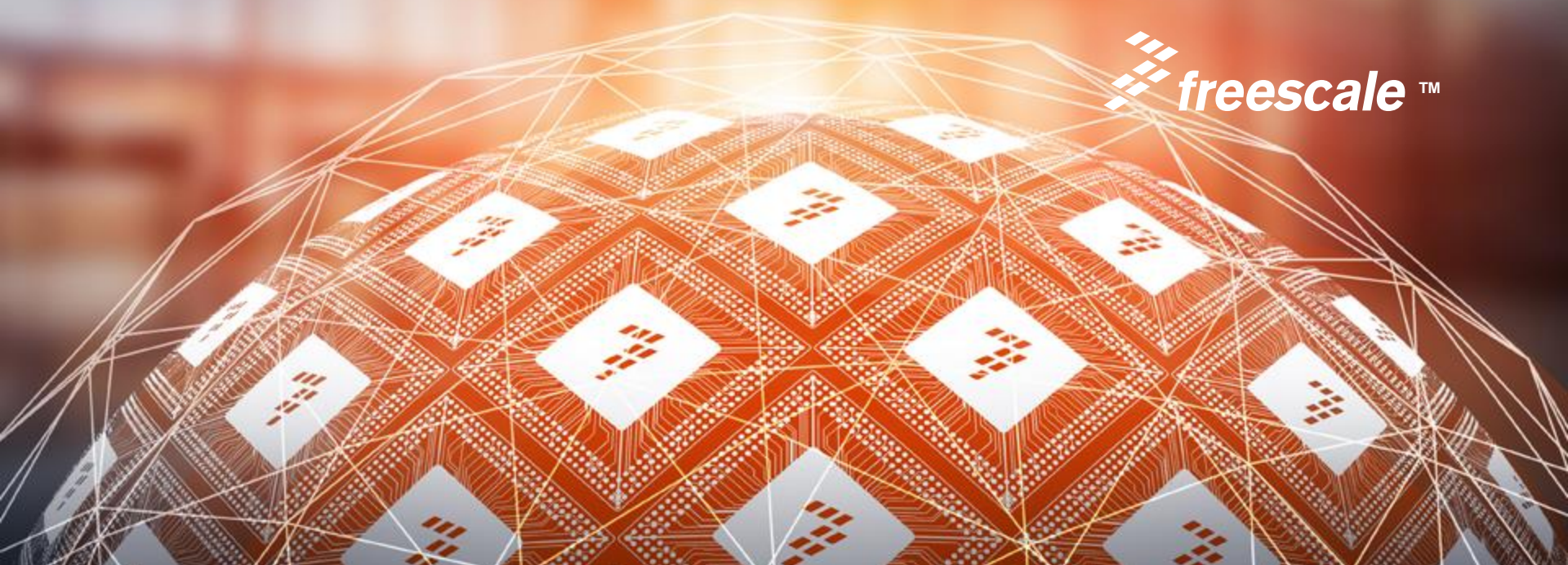


**Orcam**

**i.MX6 Quad Application
Processor**

OrCam is an intuitive portable
device with a smart camera
designed to assist people who are
visually impaired..

Secure Embedded Processing Solutions for

**INTERNET** *of* **TOMORROW**

*freescale* ™

www.Freescale.com