# Internet of Things for the Smart Home

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ARM

**CIR Smart Homes & Cleanpower 2013**
**www.hvm-uk.com**

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# Merging of Our Digital and Physical Worlds



Mobile Computing

Connectivity

Intelligent "Things"

Servers

Wireless Infrastructure

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# Connected Intelligence

Human interface
Location aware
MEMS sensors

Smart energy
Power management
Servers, Industrial
Appliances

Smart homes
Security, Safety
Automotive
Electric vehicles

Health
Fitness
Medical devices

Sensing, processing, controlling, automating, communicating, connecting

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"…These [IoT] products become platforms for new business services, and with these additional services you can also generate new revenue streams. Either you do this yourself or somebody else will do it…"
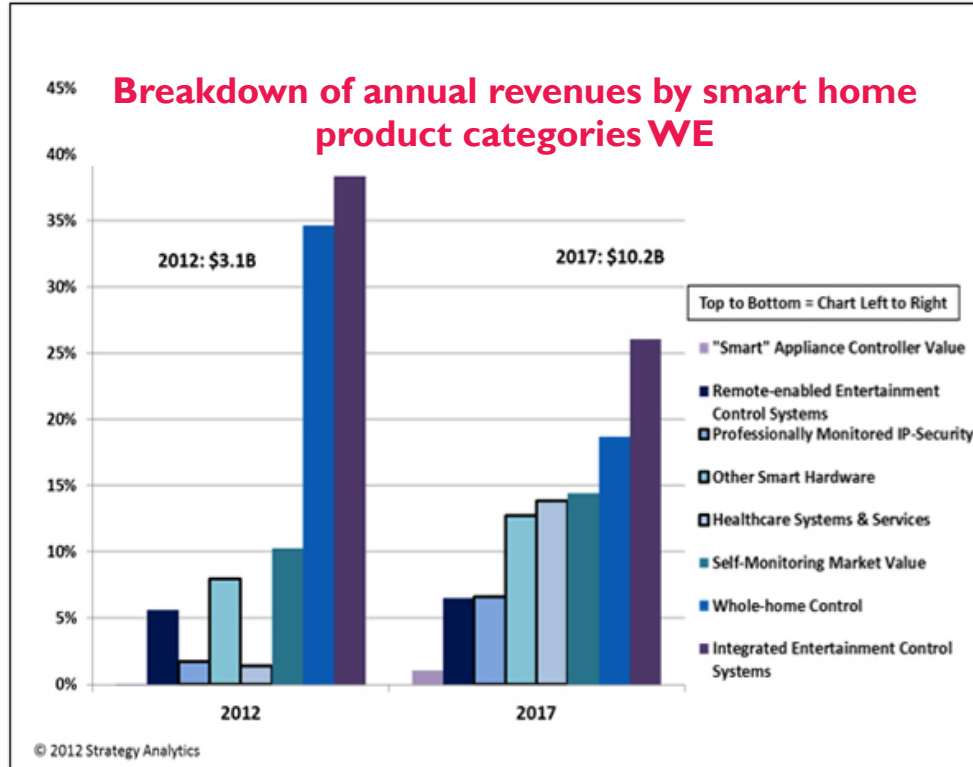
*Stefan Ferber, director for communities and partner networks for the Internet of Things and services, Bosch Software Innovations*

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# Local Wireless Will Drive IoT



Source: Ericsson

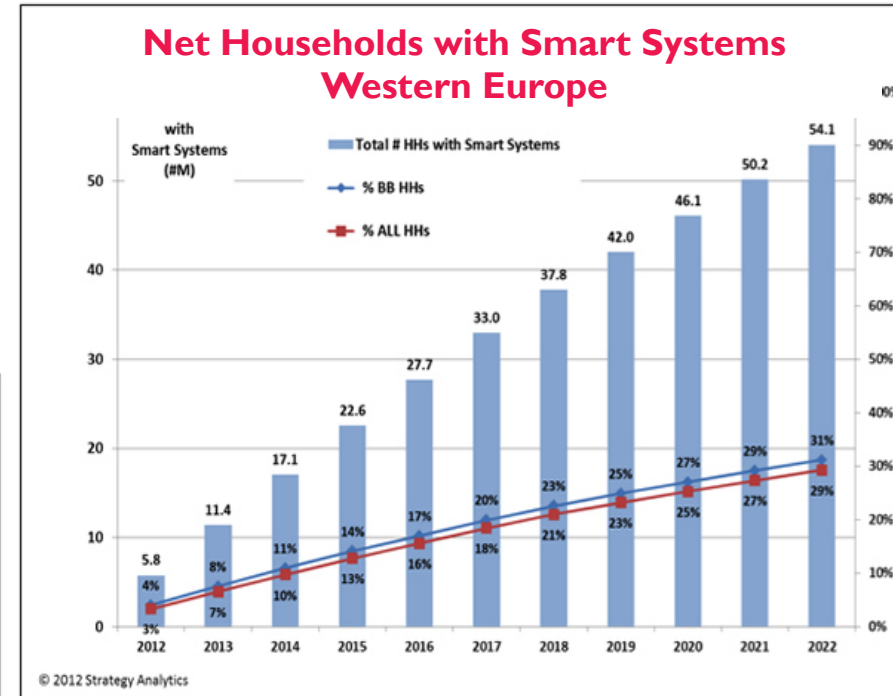THE ARCHITECTURE FOR THE DIGITAL WORLD®

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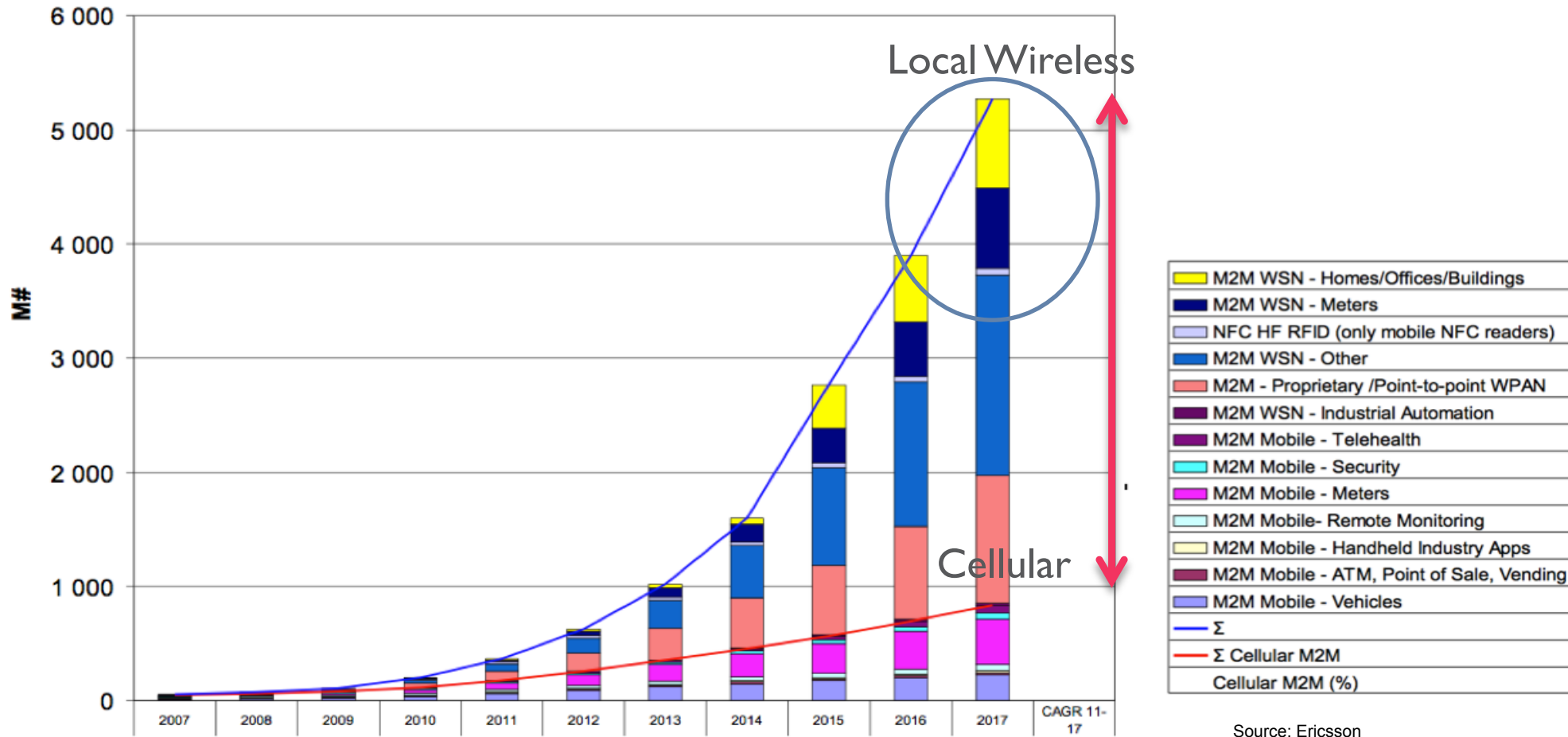
# Smart home Growth

- In 10 years 30% of broadband households will have a smart system

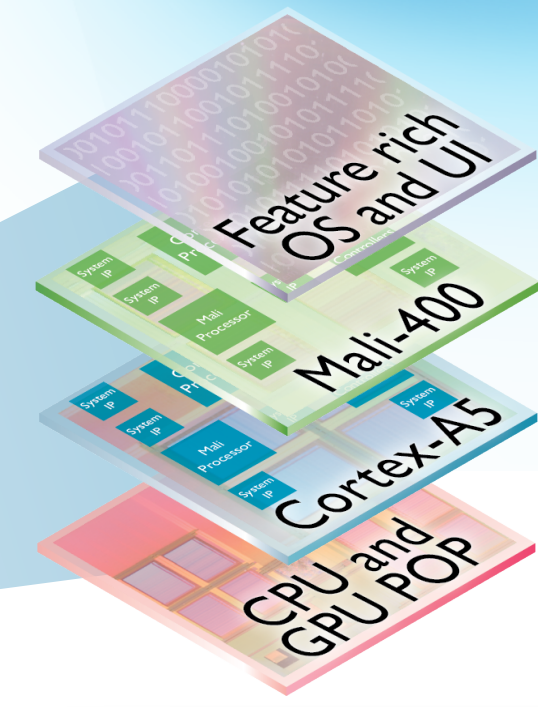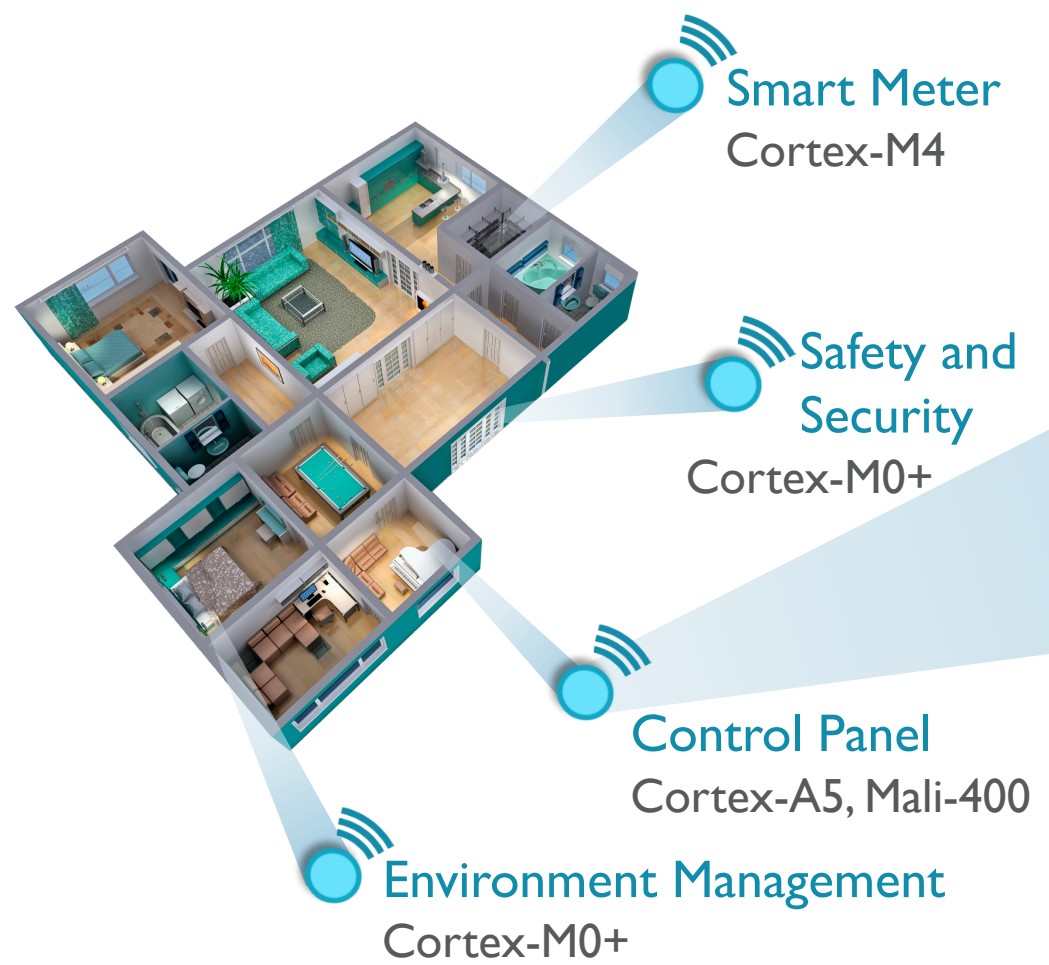- Approximately 65% of households will have multiple systems by 2017.

**Net Households with Smart Systems Western Europe**



*Source: Strategy Analysis*



**Breakdown of annual revenues by smart home product categories WE**

2012: $3.1B

2017: $10.2B

Top to Bottom = Chart Left to Right

- "Smart" Appliance Controller Value
- Remote-enabled Entertainment Control Systems
- Professionally Monitored IP-Security
- Other Smart Hardware
- Healthcare Systems & Services
- Self-Monitoring Market Value
- Whole-home Control
- Integrated Entertainment Control Systems

© 2012 Strategy Analytics

*Source: Strategy Analysis*

- By 2017, revenues > US$10 billion

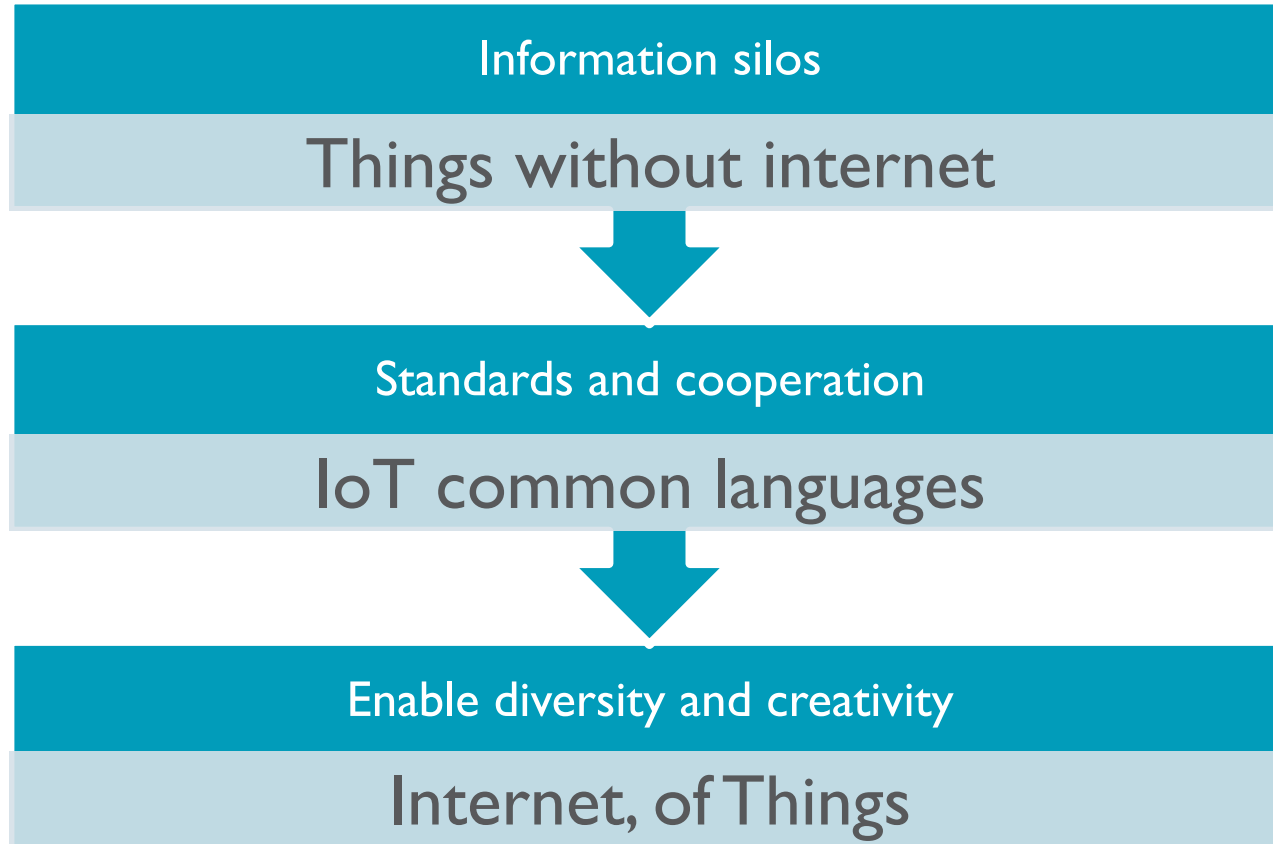- 2 controls on top: professionally-installed integrated entertainment and whole-home.

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# Enabling Smarter Homes

**Smart Meter**
Cortex-M4

**Safety and Security**
Cortex-M0+

**Control Panel**
Cortex-A5, Mali-400

**Environment Management**
Cortex-M0+

Feature rich OS and UI

Mali-400

Cortex-A5

CPU and GPU POP

Most integrated building management HMI solution

**Trends** — Intuitive technology

**Challenges** — Low system and maintenance costs

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# Obstacles: Interoperability

Information silos

Things without internet

Standards and cooperation

IoT common languages

Enable diversity and creativity

Internet, of Things

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# Big Data Starts with Little Data

**Internet of Things**

**Reach**

Scale Needs Standards
Sharing   Needs Trust
Trust Needs Security

**The future**

Open Data
and Objects

Smart
Everything

Sensors  & Actuators
Networks

**Today**

Applications

Mobile internet

Internet / broadband

M2M

SaaS

Fixed Telephony Networks

Mobile Telephony

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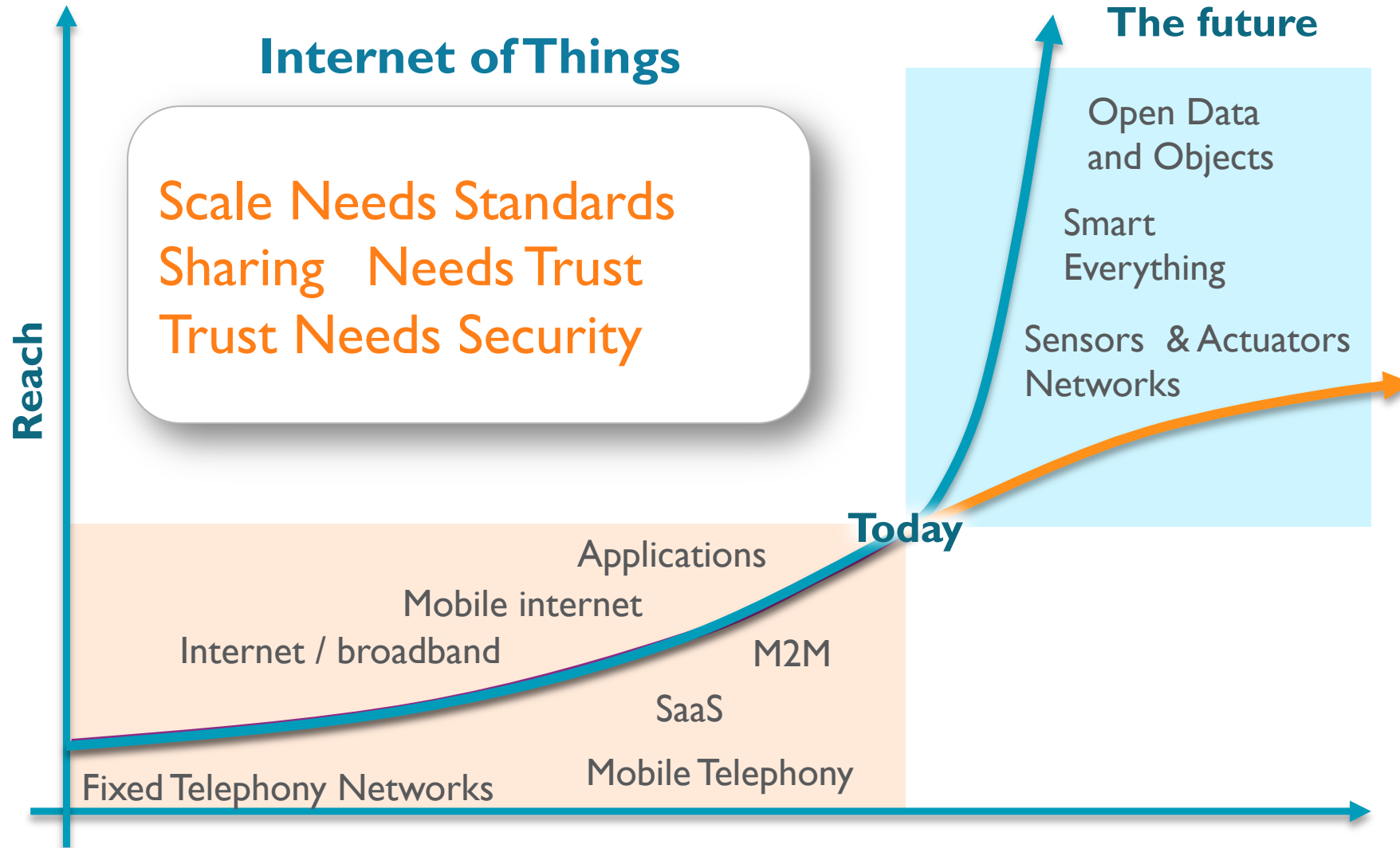
# Evolution from M2M to IoT

M2M

Internet of Things

Big Data

Web

Little Data

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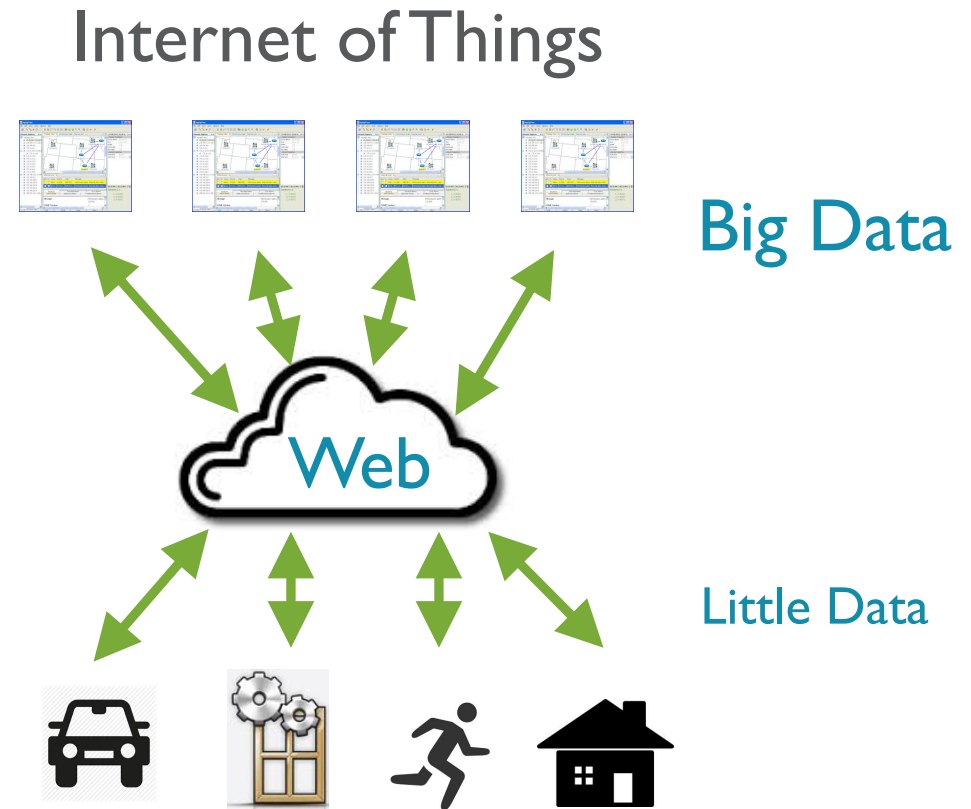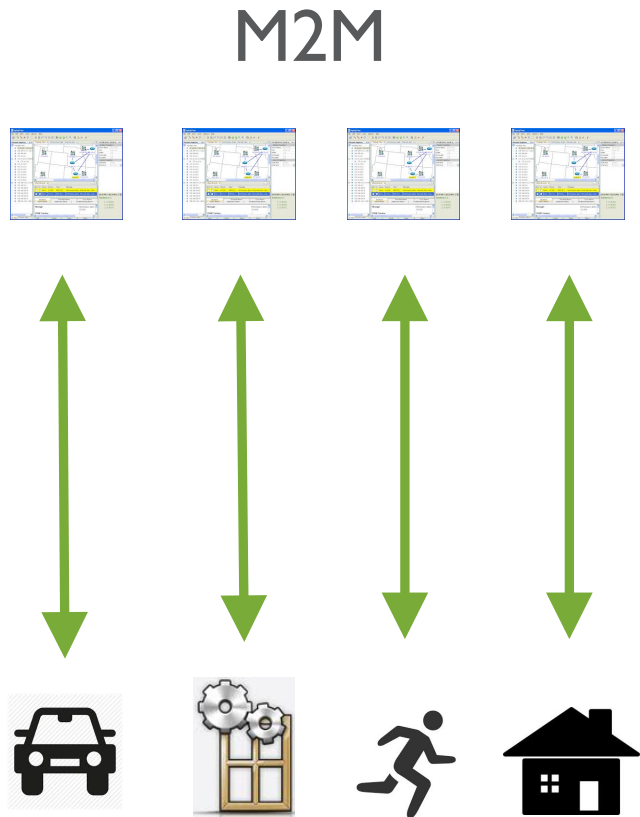
# About Sensinode

## Vision

The Internet of Things (IoT) is the next evolution of the Internet where devices of all types and capabilities are connected through Internet Protocol and Web Services

## Mission

Create value for customers and partners through innovative software solutions that enable the Internet of Things by optimizing the way businesses and consumers collect, manage and leverage information

## Heritage

- Leading supplier of end-to-end SW solutions for M2M applications since 2005

- Led the creation of 6LoWPAN and CoAP – essential technologies for the IoT

- Key player and contributor to all major IoT-relevant standards bodies

- Headquarters in Finland with business development and sales in San Diego, CA

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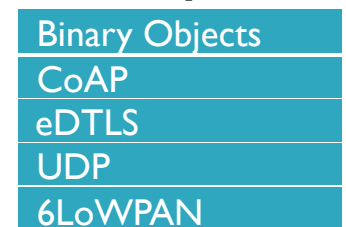
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# IoT standards

- **Scalable, secure, standards based**
  - Architected 6LoWPAN and CoAP standards
  - Key contributor to the IETF, ZigBee IP, ETSI and OMA

- **From the cloud to the tiniest of nodes**
  - Optimized firmware that can fit on Cortex-M devices
  - Cost-effective, energy efficient, secure

- **NanoService now accessible via mbed**
  - Enabling faster proliferation of open IoT standards

**100s – 1000s of bytes**

| |
|---|
| XML |
| HTTP |
| TLS |
| TCP |
| IP |

Web Services today

**10s of bytes**

| |
|---|
| Binary Objects |
| CoAP |
| eDTLS |
| UDP |
| 6LoWPAN |

Internet of Things

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# Key Standardization Activities

- IETF
  - IPv6 and 6LoWPAN networking
  - Web of Things (REST for IoT, CoAP, Resource Directory etc.)
  - Security (DTLS, TLS, Cipher suites)

- OMA / IPSO Alliance
  - OMA Lightweight Device Management (Based on CoAP)
  - IPSO Web Objects

- ZigBee
  - ZigBee IP - An open-standard 6LoWPAN stack for Home Area Networks
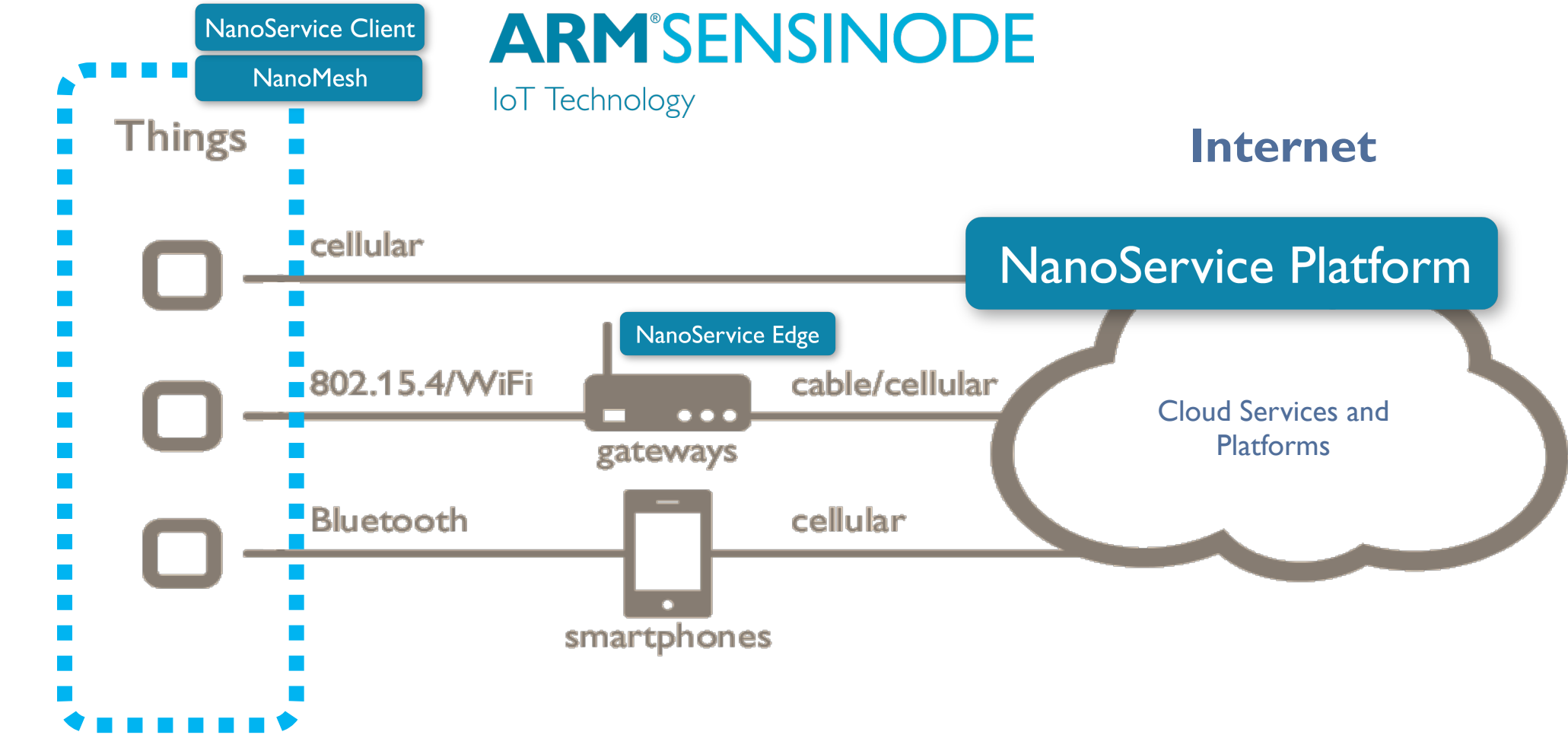  - ZigBee IP NAN – 6LoWPAN stack for Sub-GHz large area applications

- OneM2M
  - Ongoing work on M2M system standardization (CoAP, HTTP binding)

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# Connecting Cortex-M Processors to the Cloud



**NanoService Client**

**NanoMesh**

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IoT Technology

Things

**Internet**

cellular

**NanoService Platform**

**NanoService Edge**

802.15.4/WiFi          cable/cellular

Cloud Services and
Platforms

gateways

Bluetooth          cellular

smartphones

**ARM®MBED™**
IoT Development Platform

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# Cloud-based home/enterprise automation

**Little Data** ⟶ **BIg Data**

**Connected Home Gateway**
- Multi-Technology
- Multi-Tenant

**Will-Pay-For Applications** (illustrative)
- Home automation
- Home "Dashboard"
- Location based DR control
- Remote Energy Management

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IoT Technology

**Internet**

**NanoService Platform**

**ZigBee SEI or SE2**

*Networking Technologies*
**6LoWPAN, Wi-Fi, ZigBee, HomePlug, PLC**

**Backhaul**
- Broadband
- Cellular

**Sensinode M2M Backend Platform**
- Easy integration of in-home devices
- Securely exchange data & web resources
- Device control
- Highly scalable

**Web Applications**

**UTILITY**

**USER**

**SERVICE PROVIDER**

**VALUE PROPOSITION**

**USER**

- Data / Analytics
- Value added services
- Customer care cost savings
- reduce churn

- Access / Use / Control
- Monitor
- Reduce Costs

**SMART HOME** | **CLOUD** | **CONNECTIVITY**

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# Efficient nodes

## 1.9 billion

ARM Cortex-M devices shipped in 2012
by leading semiconductor companies

MCUs    radios    sensors

ARM Cortex-M0+
Freescale Kinetis KL02
1.9 mm x 2.0 mm

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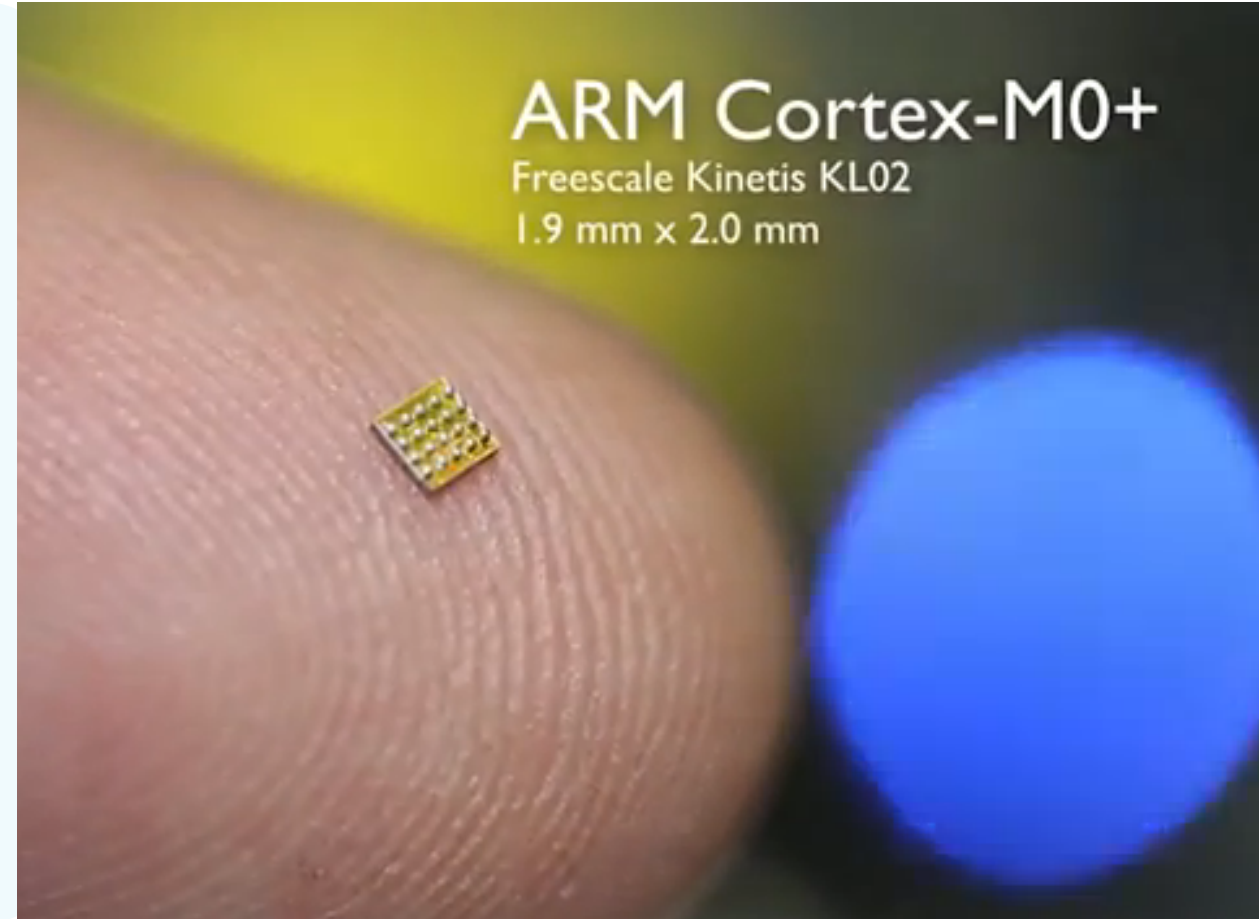
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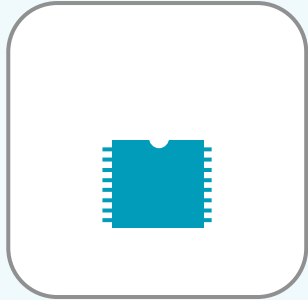
# ARM Innovation Enables Opportunity

Massive opportunity in the Smart Home

Innovation driven by diversity,
built on standards

ARM ecosystem uniquely positioned to
tackle the challenges

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Silicon Partners

Connected Community

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