



# INTERNET DAS COISAS?



Prof. Alessandro Ferreira da Cunha  
**e-mail:** alessandro@techtraining.eng.br  
**msn:** afcunha01@gmail.com  
**skype:** alessandroferreiradacunha  
[www.techtraining.eng.br](http://www.techtraining.eng.br)

- REVOLUÇÃO DO SÉCULO 21
- DEFINIÇÃO DO ITU
- LIVROS GRATUITOS
- APLICAÇÕES
- COMO FAZER IOT
- O QUE FALTA FAZER
- NANO COMPUTADORES
- VIRTUAL KEYBOARD
- MINHA IOT - MINHA VIDA!

## The Computer for the 21<sup>st</sup> Century

Author: Mark Weiser  
Palo Alto Research Center (PARC)  
*Scientific American*, September 1991, pgs. 94-104  
<http://www.ubiq.com/hypertext/weiser/SciAmDraft3.html>

# The Computer for the 21st Century

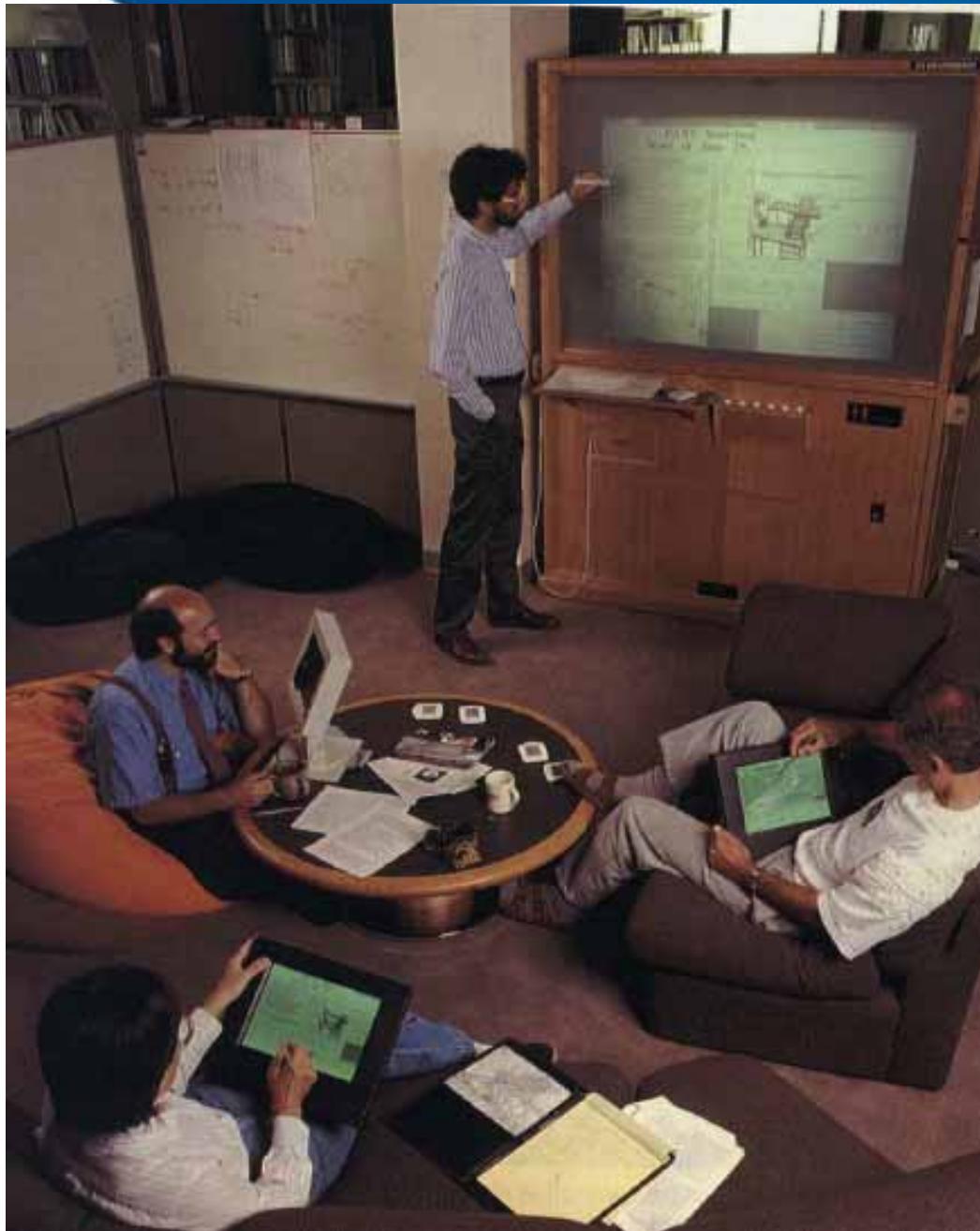
*Specialized elements of hardware and software,  
connected by wires, radio waves and infrared, will be  
so ubiquitous that no one will notice their presence*

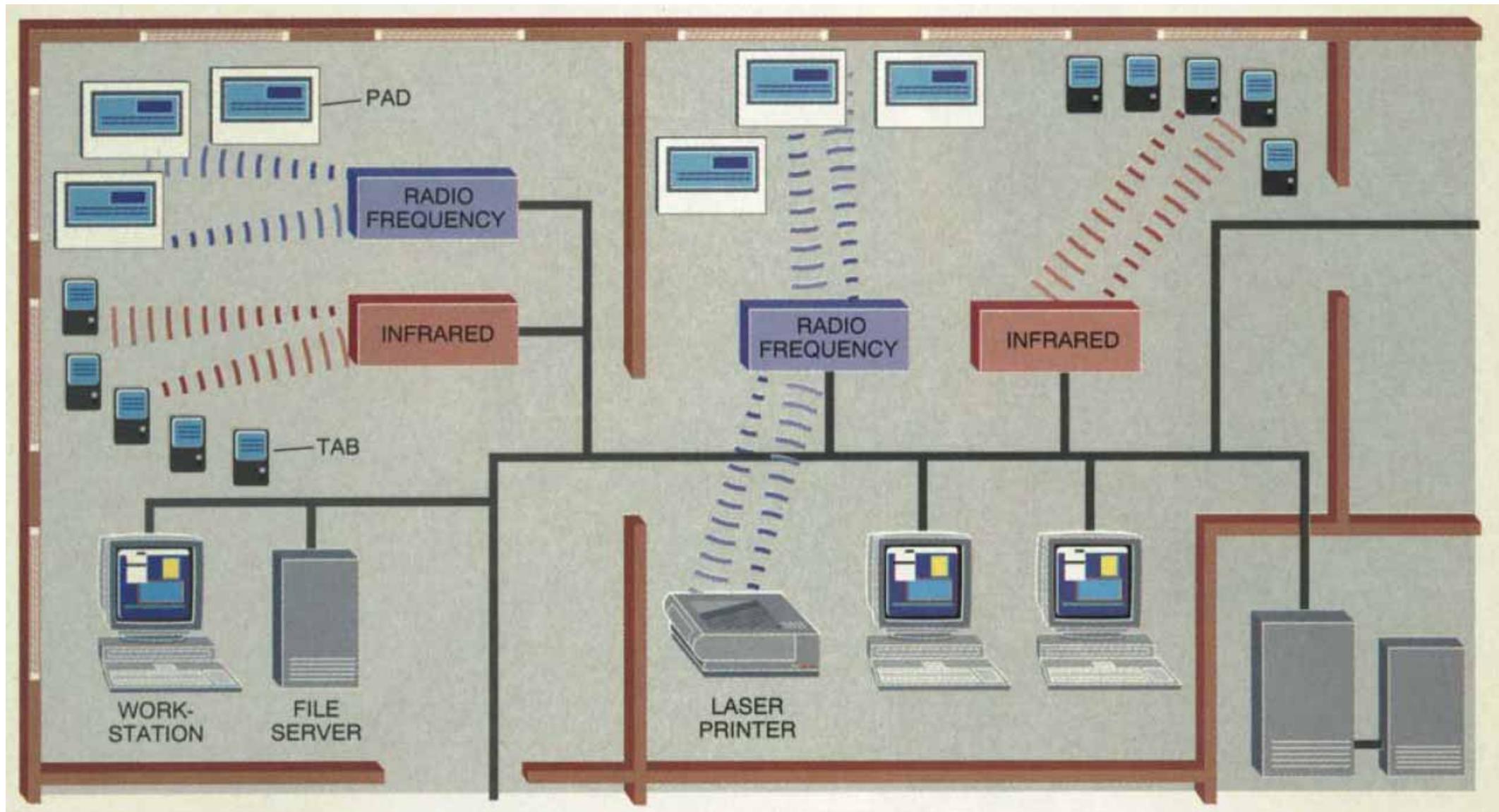
by Mark Weiser

“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”

As tecnologias mais profundas são aquelas que desaparecem. Tecem-se no tecido da vida cotidiana, até que são indistinguíveis a partir dele.

# A REVOLUÇÃO DO SÉCULO 21





O CONCEITO DA INTERNET DAS COISAS IRÁ MUDAR O MUNDO TOTALMENTE.

Antes da  
internet das coisas

Depois da  
internet das coisas

É DO SUPORTE?  
MEU AR  
CONDICIONADO  
NÃO TÁ  
GELANDO.

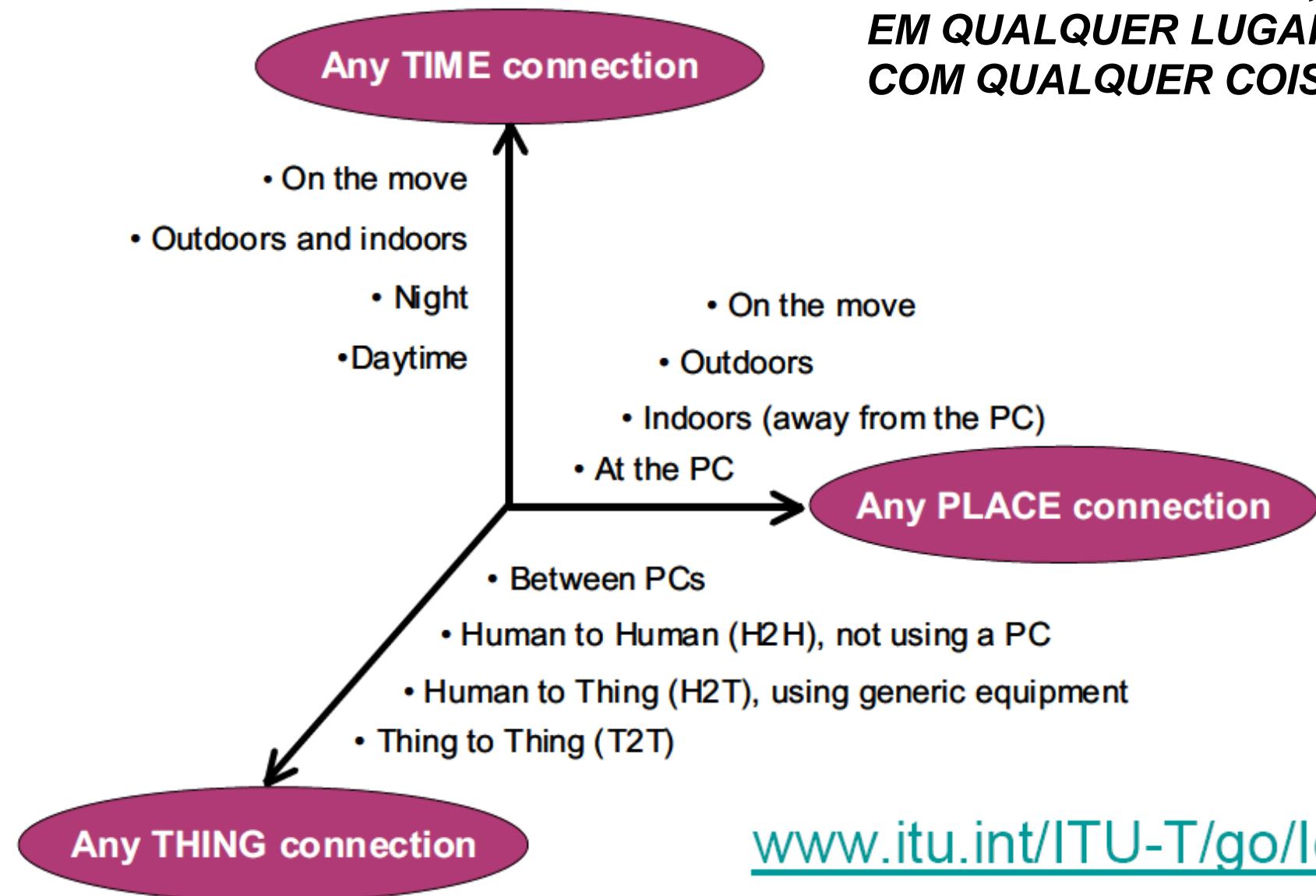


É DO SUPORTE?  
MEU AR  
CONDICIONADO  
NÃO TÁ  
CONECTANDO.



OU TALVEZ NÃO MUIDE  
TANTO ASSIM.

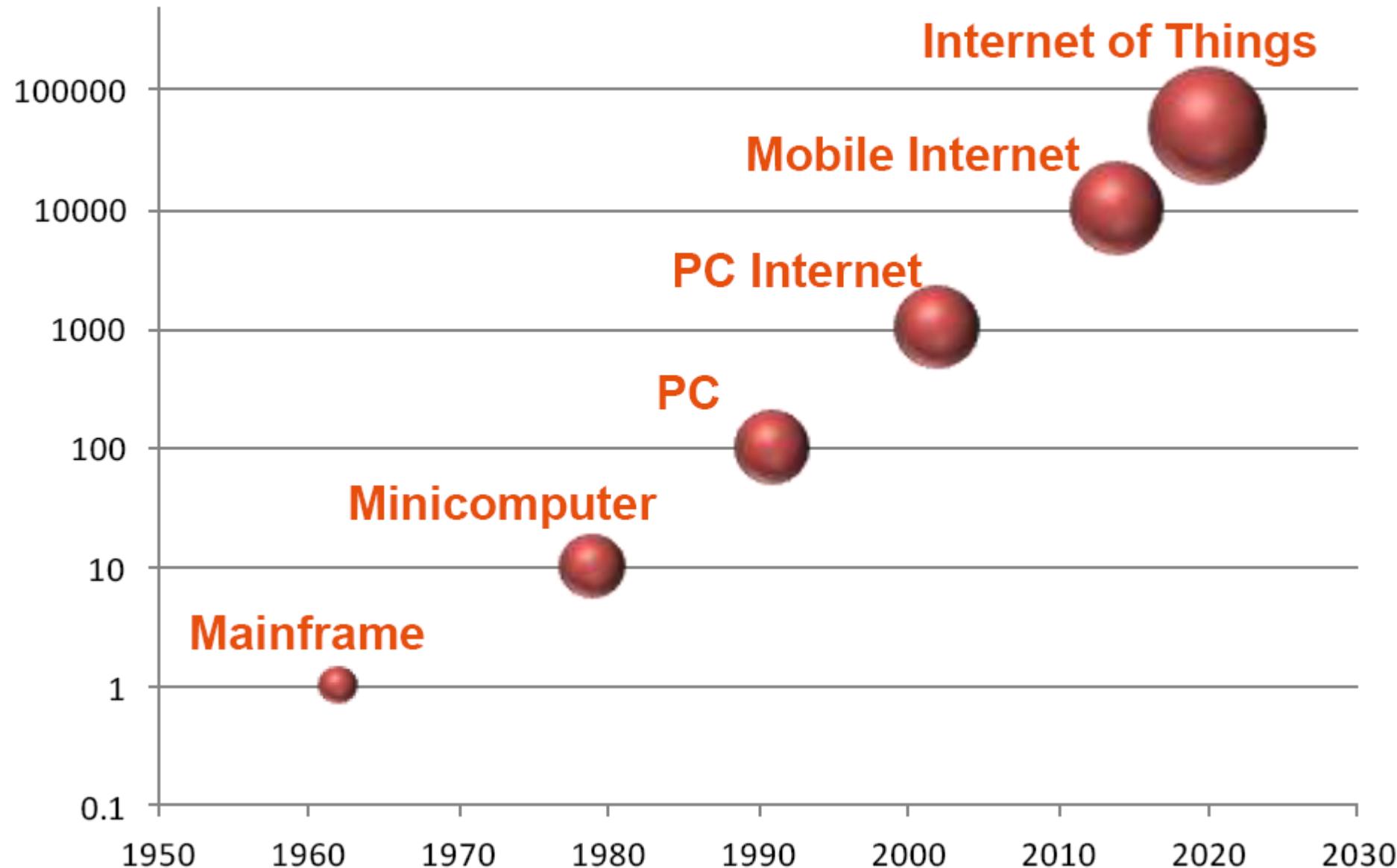
**Figure 1 – A new dimension**

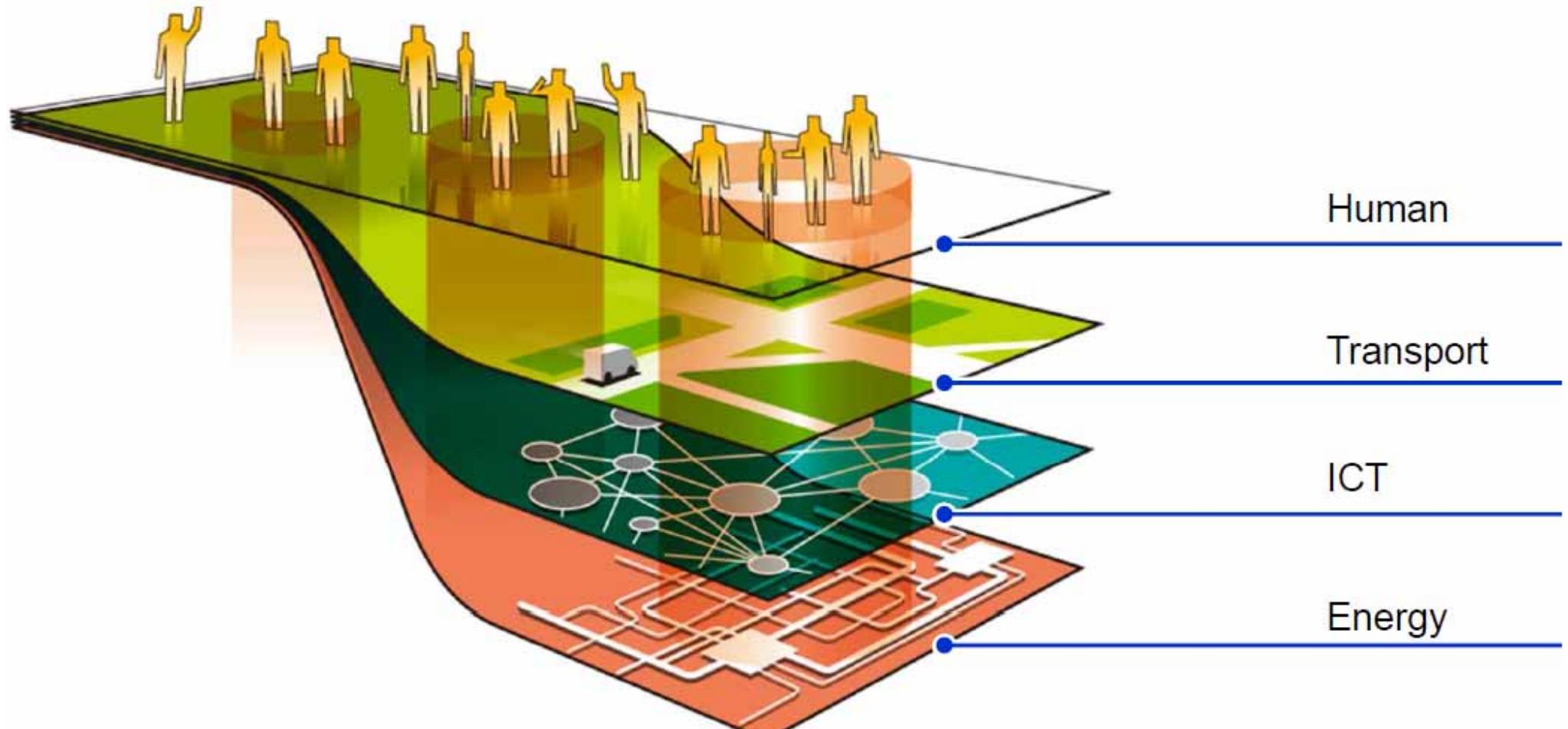


*More things are connecting to the Internet than people — over 12.5 billion devices in 2010 alone. We will have 50 billion devices connected by 2020.*

Cisco's Internet Business Solutions Group

## Millions of Devices between 1960-2020







2007  
**0.62 Devices/House**

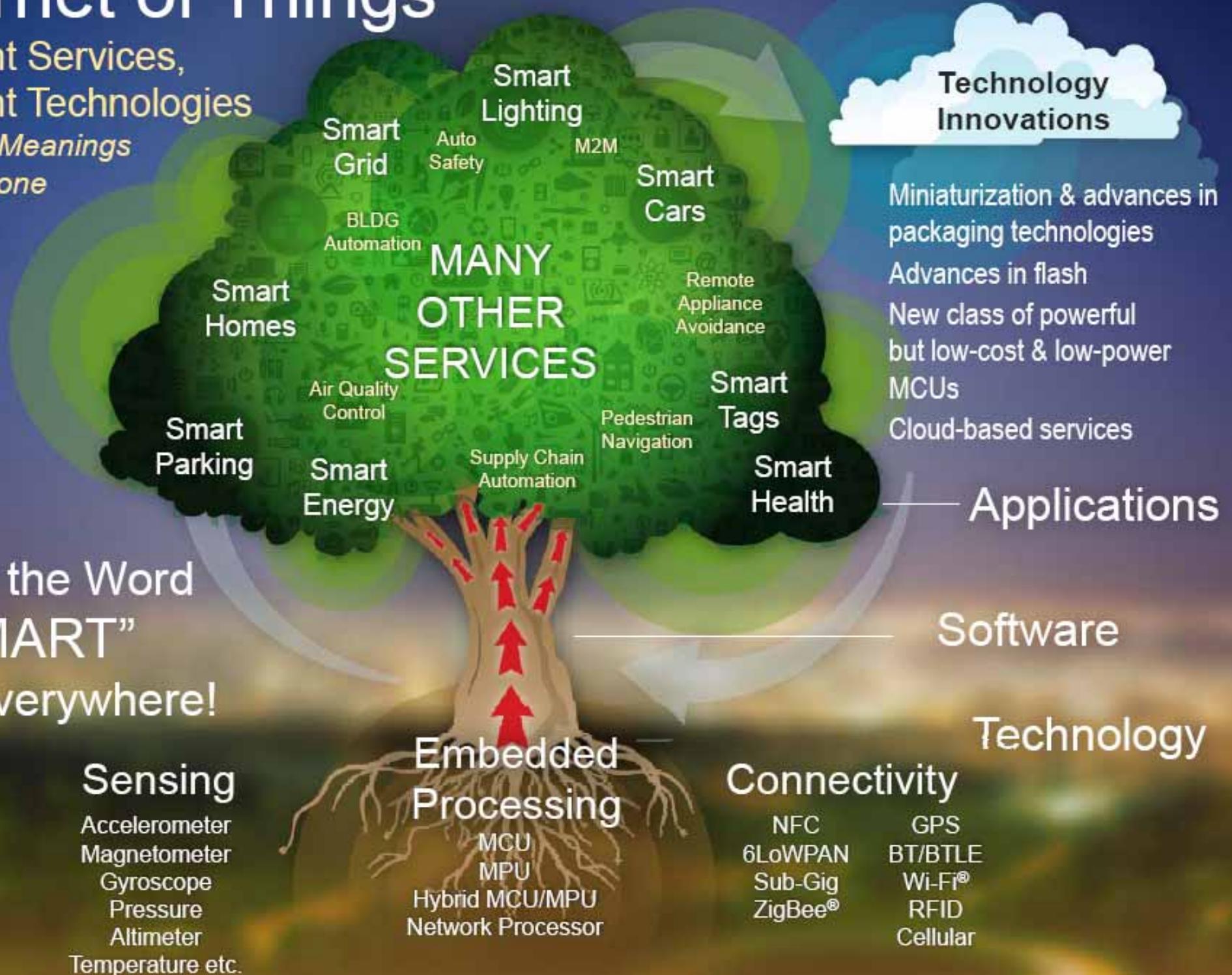


2014  
**10.5 Devices/House**

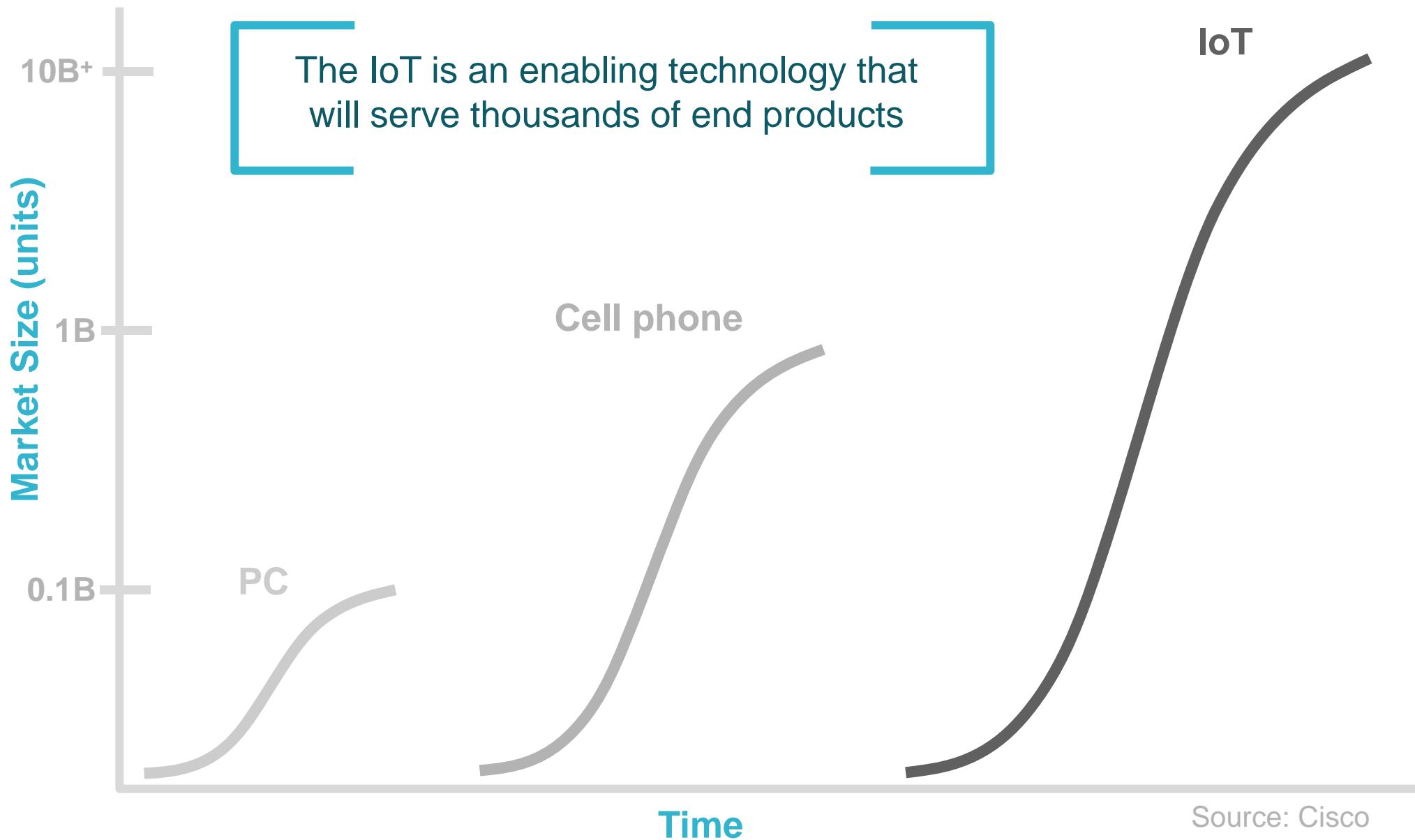
**In 7 years we own 17x more internet connected devices.**

# Internet of Things

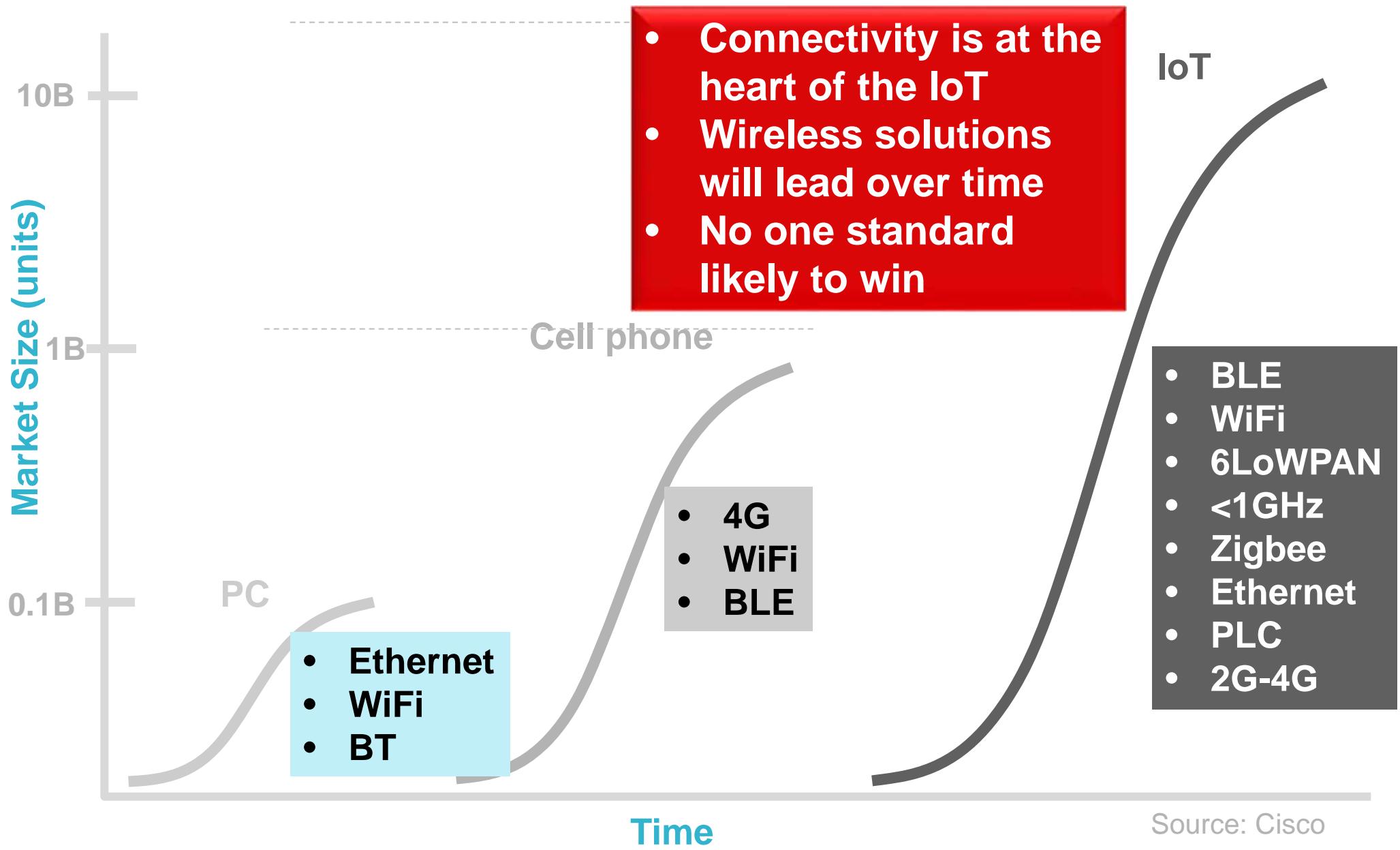
Different Services,  
Different Technologies  
*Different Meanings  
for Everyone*



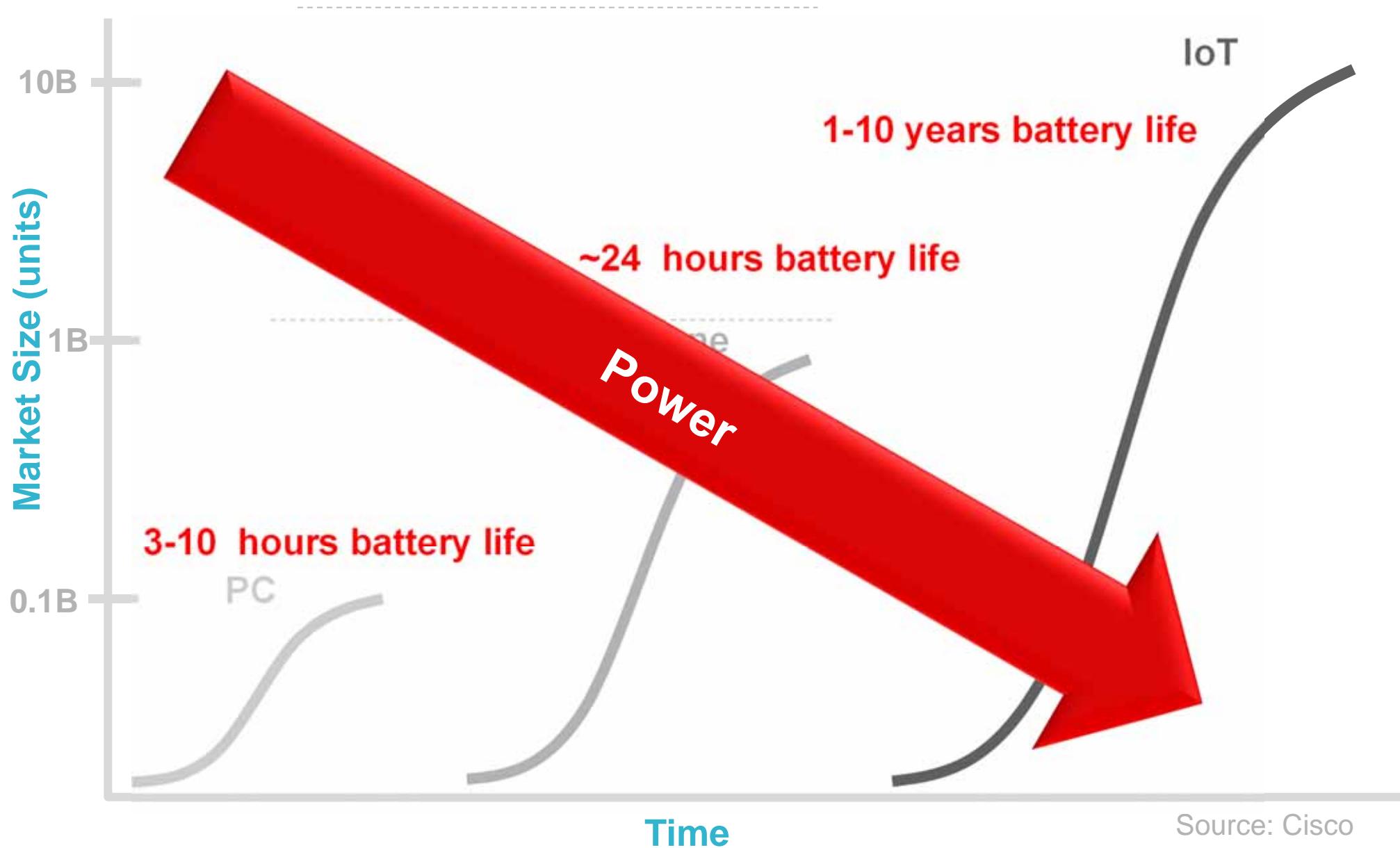
# Why the IoT is attractive



# IoT – Connectivity at the heart



# IoT – Power is key



## Dispositivos conectados causaram desperdício bilionário

O motivo do desperdício é o fato de os dispositivos não contarem com gerenciamento econômico de carga elétrica quando estão em modo de espera

Lucas Agrela, de **Info**

Compartilhar 24

Tweetar 66

+1 2

Share 1

Marcos Santos/USP Imagens

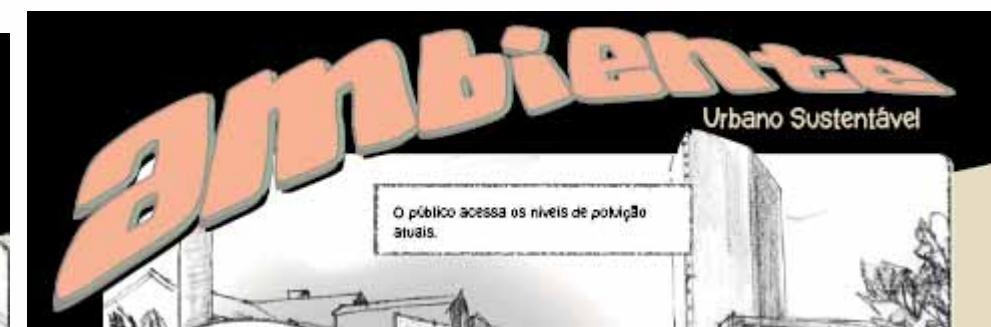


Smartphones: 400 terawatts foram gastos por dispositivos que não conservam a carga de forma

<http://exame.abril.com.br/tecnologia/noticias/dispositivos-conectados-causaram-desperdicio-de-bilhoes>

INSPIRANDO A

# INTERNET DAS COISAS!



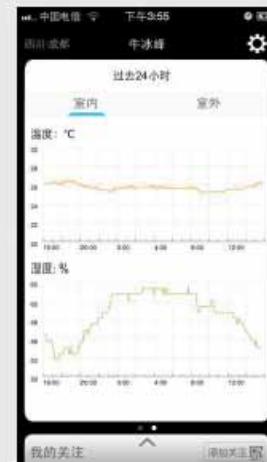




Remotely Monitor  
Your Readings

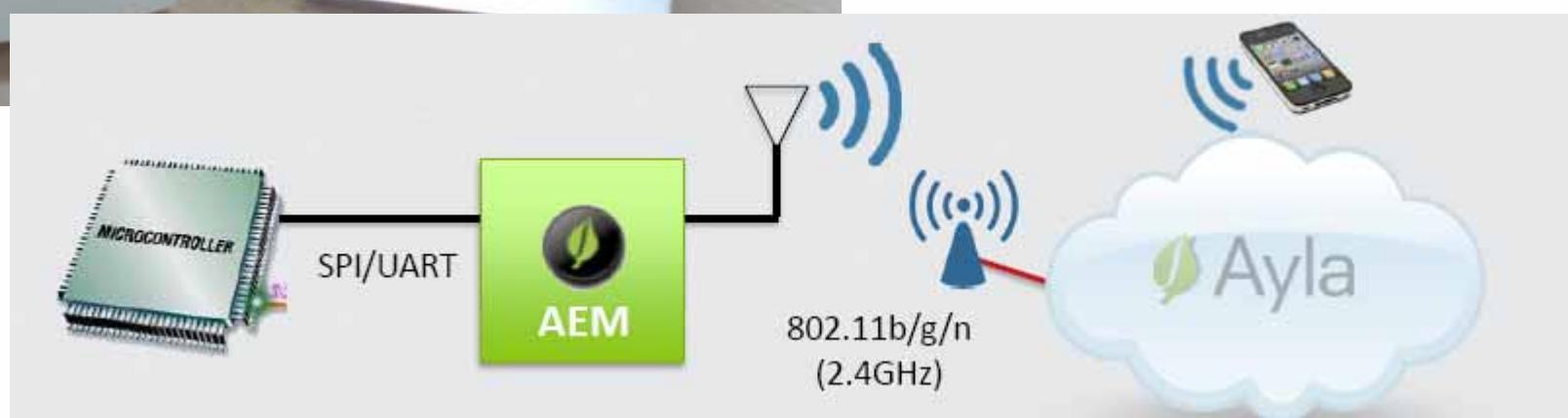


Follow Friends  
Readings



View Historical  
Data

我的关注	添加关注
牛冰峰	24.1°C/23.4°C
新浪气象站	27.5°C/27.1°C
四川成都	28.5°C/28.3°C
alicaceres	26.5°C/22.8°C
小楼ElaiNe	26.5°C/29.1°C
水洋	29.3°C/26.7°C



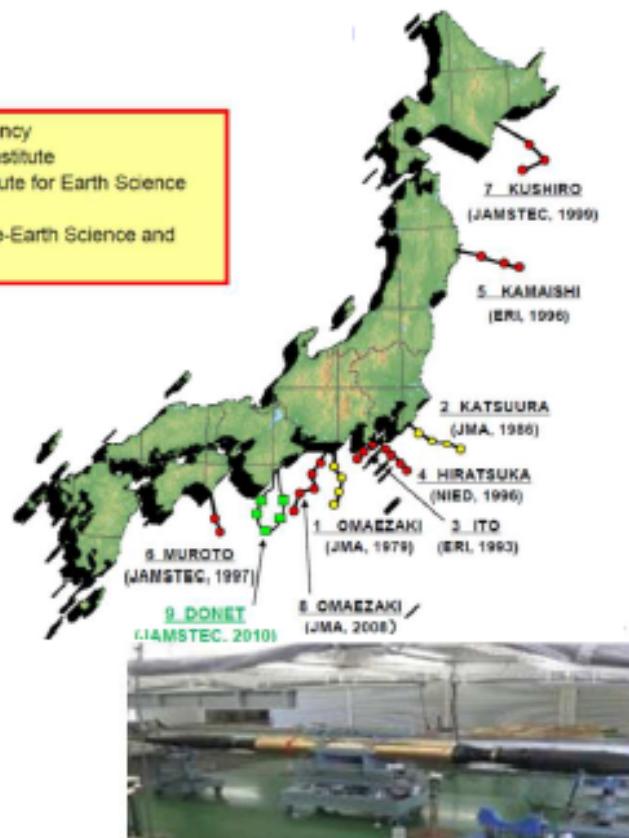
## Ocean Bottom Observation System (OBOS)

### System Owners

JMA	: Japan Meteorological Agency
ERI	: Earthquake Research Institute
NIED	: National Research Institute for Earth Science and Disaster Prevention
JAMSTEC	: Japan Agency for Marine-Earth Science and Technology

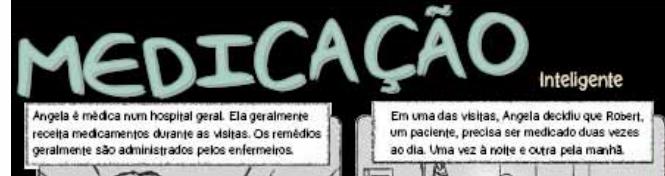
### Note:

- In-Line (Digital)
- In-Line(Analog)
- NODE (Digital)

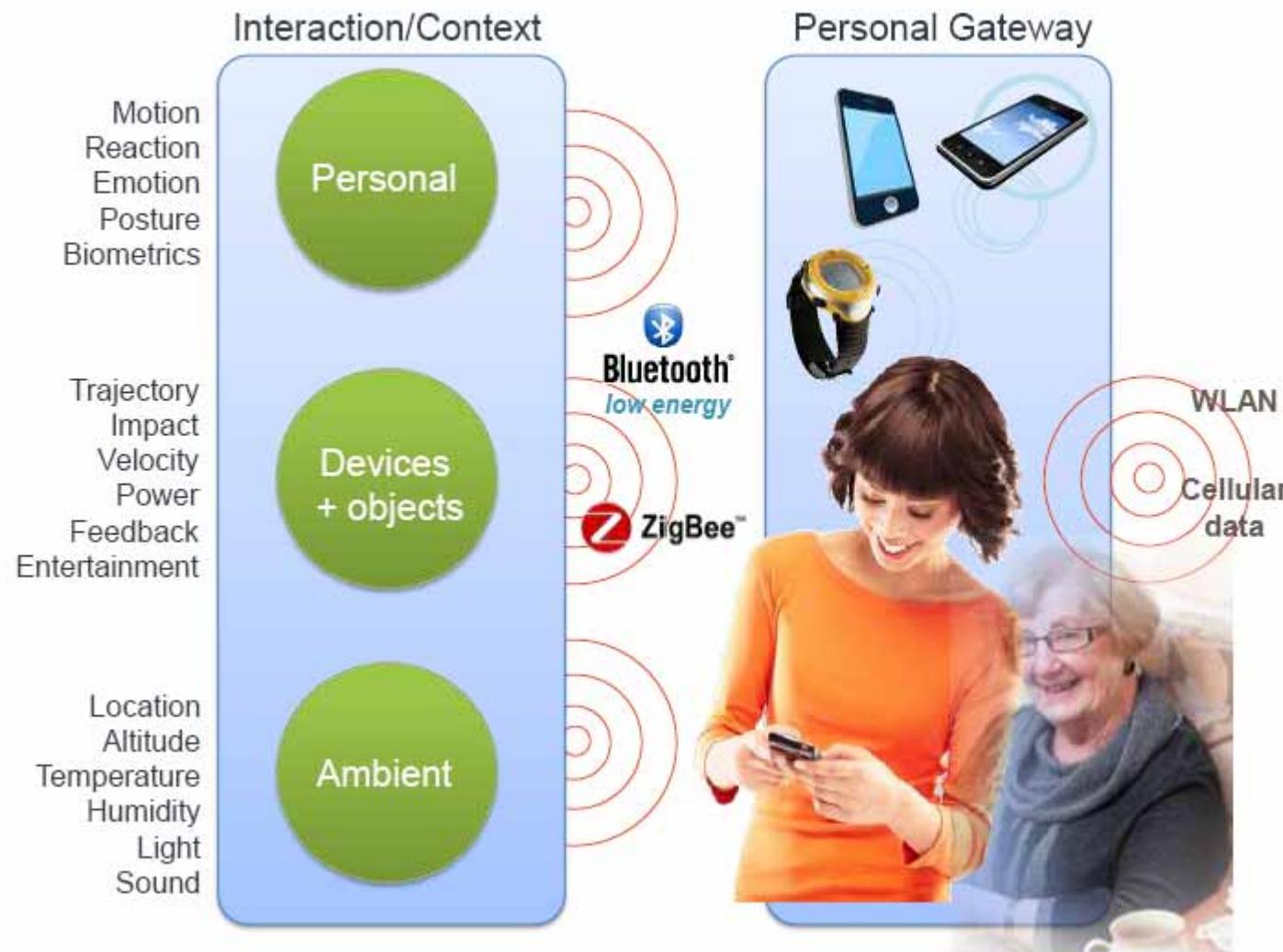


- 9 NEC supplied OBOS to date
- New 3yr plan starting 2012
- Over 5,000km of Submarine cable
- 150 Undersea seismometers

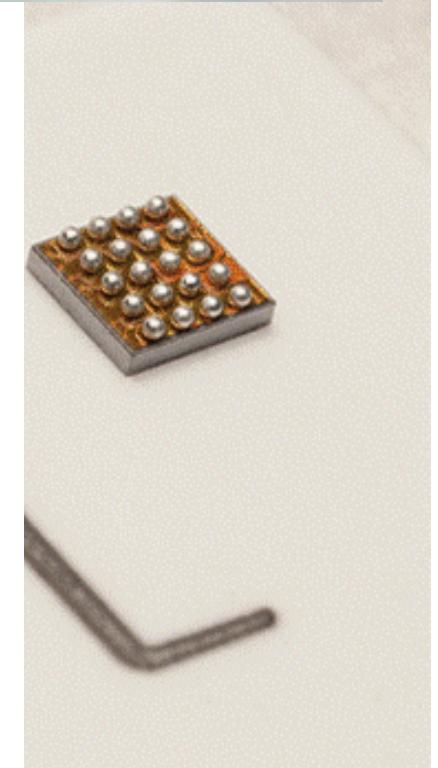
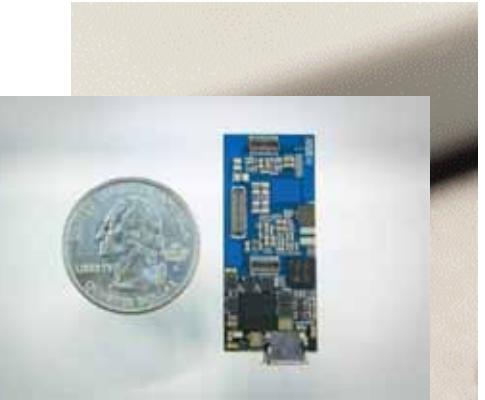




It's a connected world fostering quality of life.



# Wearable Market: Diverse Usage Models



## Wearables is Not Just Smart Watches...



Wearable Ring Scanner



Headset Running Voice Recognition



Nymi, Heart-rate Based Password Authentication



Kiwi Wearables – Personal Tracker



Headset Computer



Fitness/  
Activity Monitors



Smart Glasses



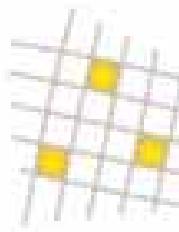
Angel – first open sensor for health and fitness



Bone Conduction Bluetooth headset cap



Virtual Reality Headset



# STREETLINE

CONNECTING THE REAL WORLD



## Streetline Sensors and Network Technology



**Patented, proven occupancy detection sensors**

- Surface and embedded
- Proven snow deployment
- 4-5 year battery life
- dual detection – magnetometer & light
- Sensors field programmable
- Easy to deploy 400-500 day (Siemens)



**Payment Integration**

- Coin operated meter sensor
- Credit card meter API integration
- Mobile phone payment integration
- Actuation of coin meter with mobile

**Scalable Multi-Hop**

- 2<sup>nd</sup> Generation mesh network
- Dust/Linear Technology technology
- Redundant networks
- Constant monitoring



<http://www.streetline.com/>

## The Streetline Platform

Mobile Apps



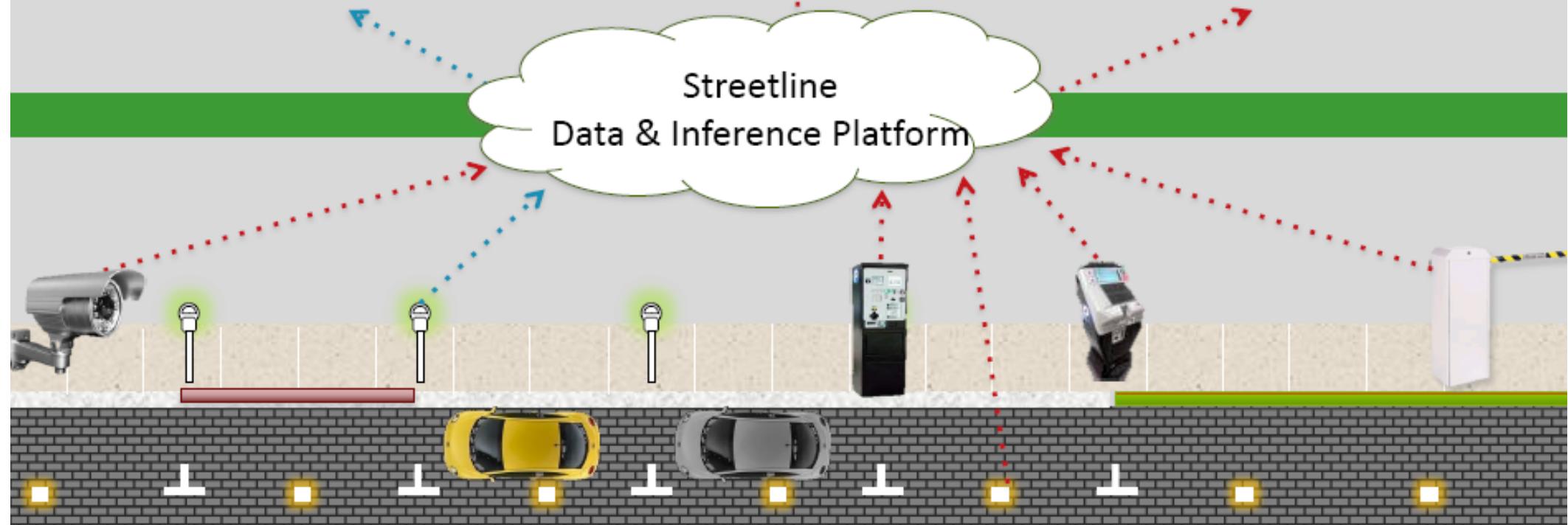
Web Apps  
& Analytics



Data & APIs

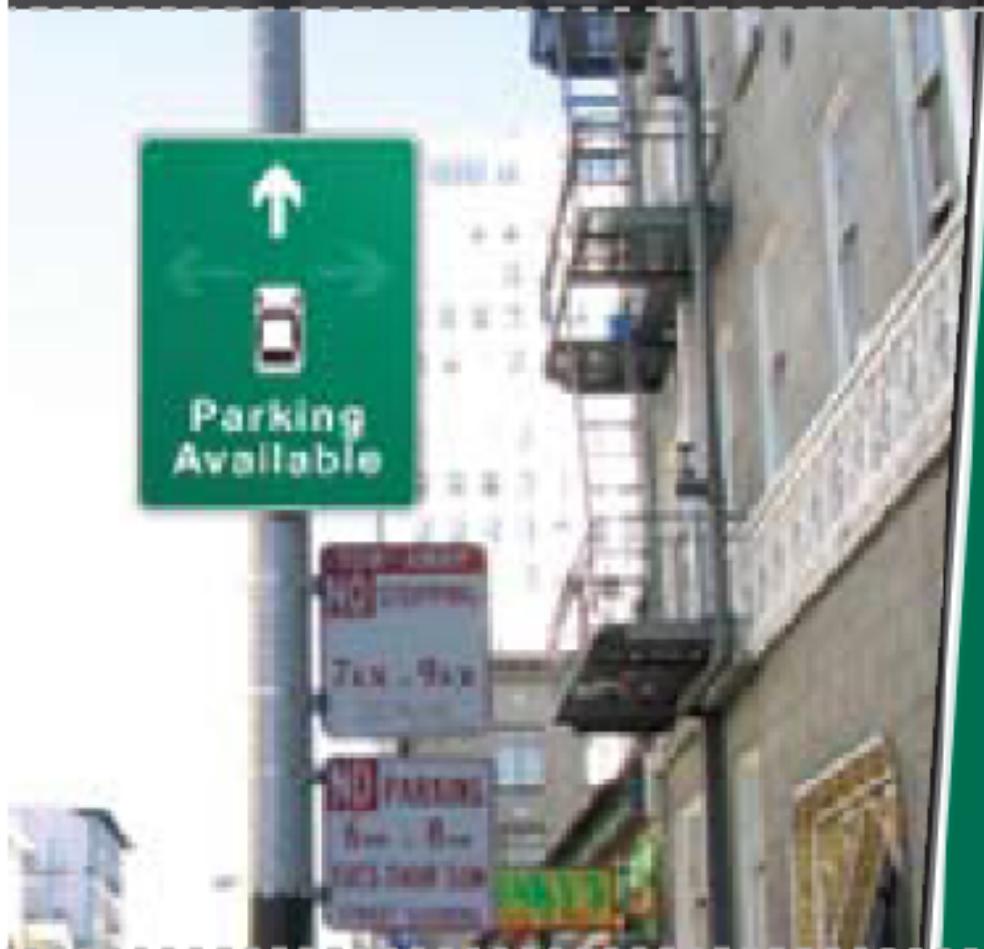


Streetline  
Data & Inference Platform





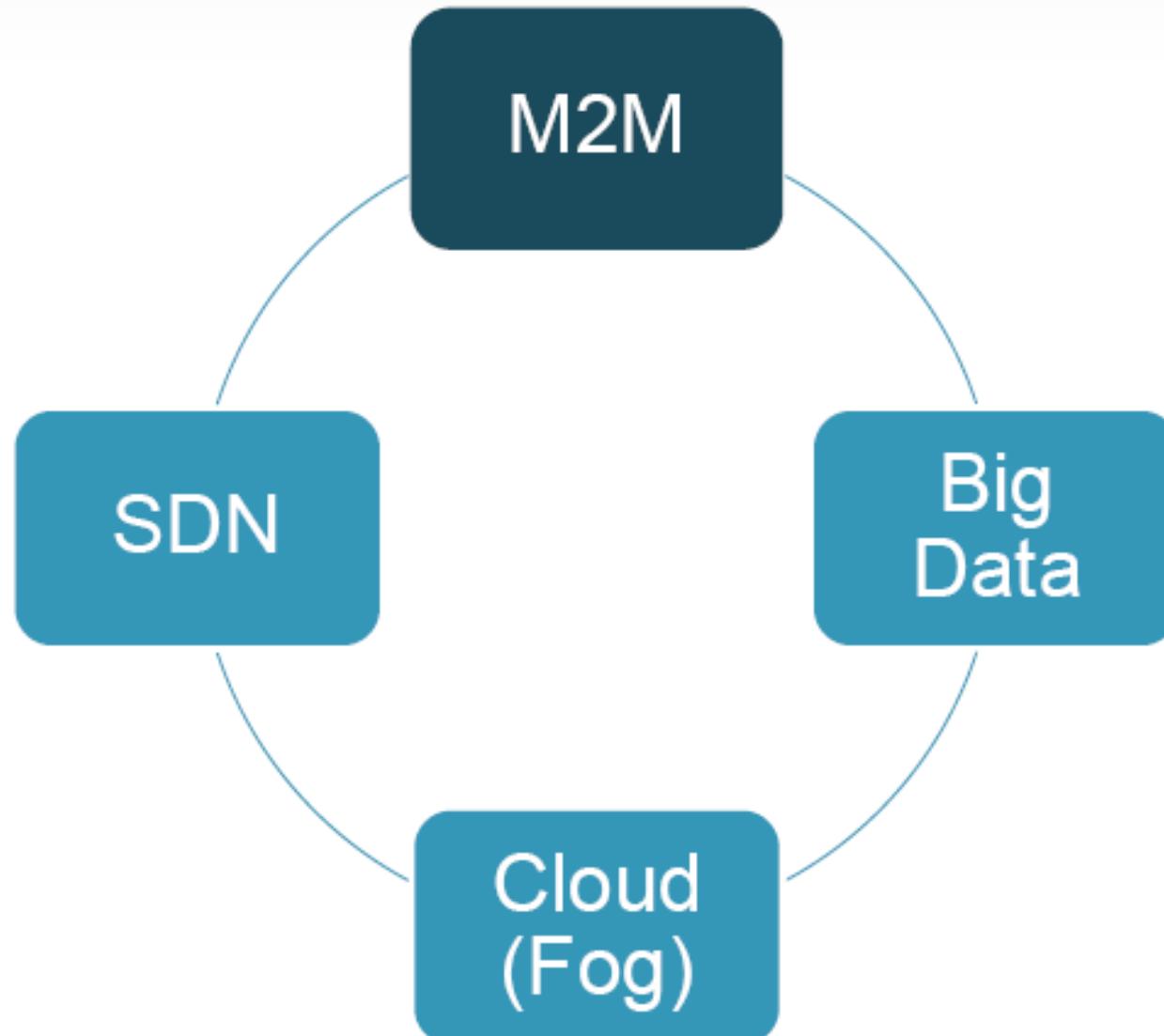
# Variable Message Sign



- 5 minute install
- 2 to 3 year battery life

- Reflective display
- Networked

## Agenda: IoT Combines Four Megatrends



# Facebook processes more than 500 TB of data daily

The site manages millions of photos and processes billions of likes each day. That's a whole lot of sharing.

by Donna Tam  @DonnaYTam / August 22, 2012 2:02 PM PDT

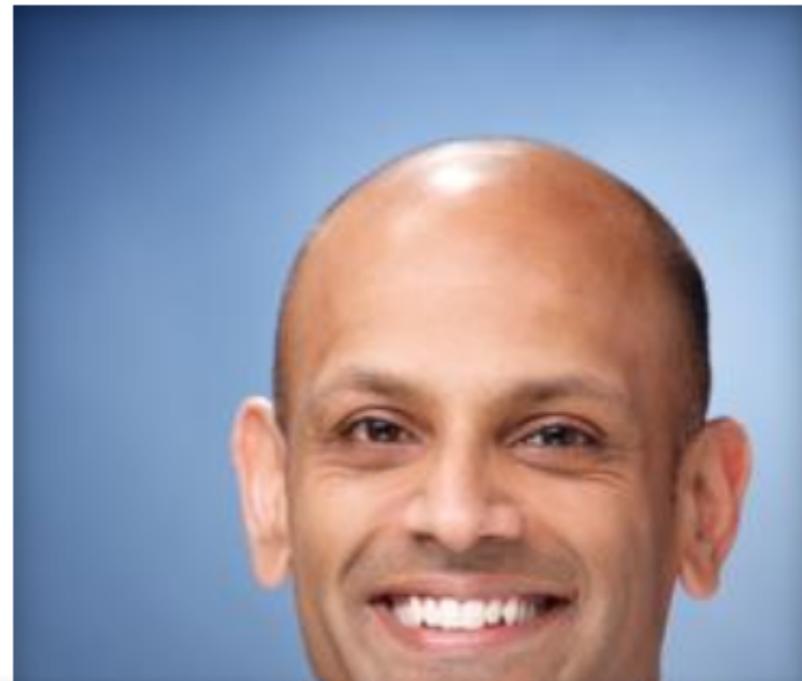


Since Facebook uses this data to build its user experience, it wants teams from across the company -- whether they sell ads or build functions -- to be able to access any of the data as needed.

Parikh said this keeps the creation and improvement of Facebook features as fast as possible.

A function like friend recommendations, for example, needs constant data updates, so that when you add a new friend, you see those connections immediately, Parikh said.

These nearly real-time efforts apply to most



# Google Processing 20,000 Terabytes A Day, And Growing

Posted Jan 9, 2008 by [Erick Schonfeld \(@erickschonfeld\)](#)

Comment 0 Like 0 Tweet 0 Share 0

A recent [white paper](#) by some Google engineers puts some numbers around the massive amount of computation that Google does every day to index the Web, process search results, and serve up ads, among other things. As of last September, Google was processing 20,000 terabytes of data (20 petabytes) *a day*. This large-scale computing capability is a big part of Google's competitive advantage over Yahoo, Microsoft, and everyone else.

[Niall Kennedy](#) reports the breakdown of how Google's large-scale computing has grown, and estimates that hardware cost for each large-scale computing job (known as MapReduce) is about \$1 million. The number of such jobs grew nearly an order of magnitude (10X) between 2004 and 2006, and then another order of magnitude a year and half later. See the chart below:



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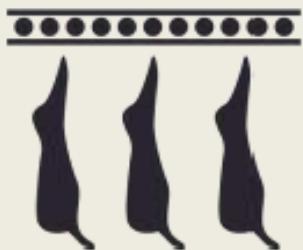
## Industry 4.0: Germany Leading Manufacturing IoT

### The Four Stages of the Industrial Revolution



First mechanical loom  
1784

1. Industrial revolution follows introduction of water- and steam-powered mechanical manufacturing facilities



First production line,  
Cincinnati slaughterhouse  
1870

2. Industrial revolution follows introduction of electricity-powered mass production based on the division of labor



First programmable logic controller (PLC), Modicon 084  
1969

3. Industrial revolution uses electronics and IT to achieve further automation of manufacturing



4. Industrial revolution based on Cyber-Physical Systems

End of 18<sup>th</sup> century

Start of 20th century

Start of 1970s

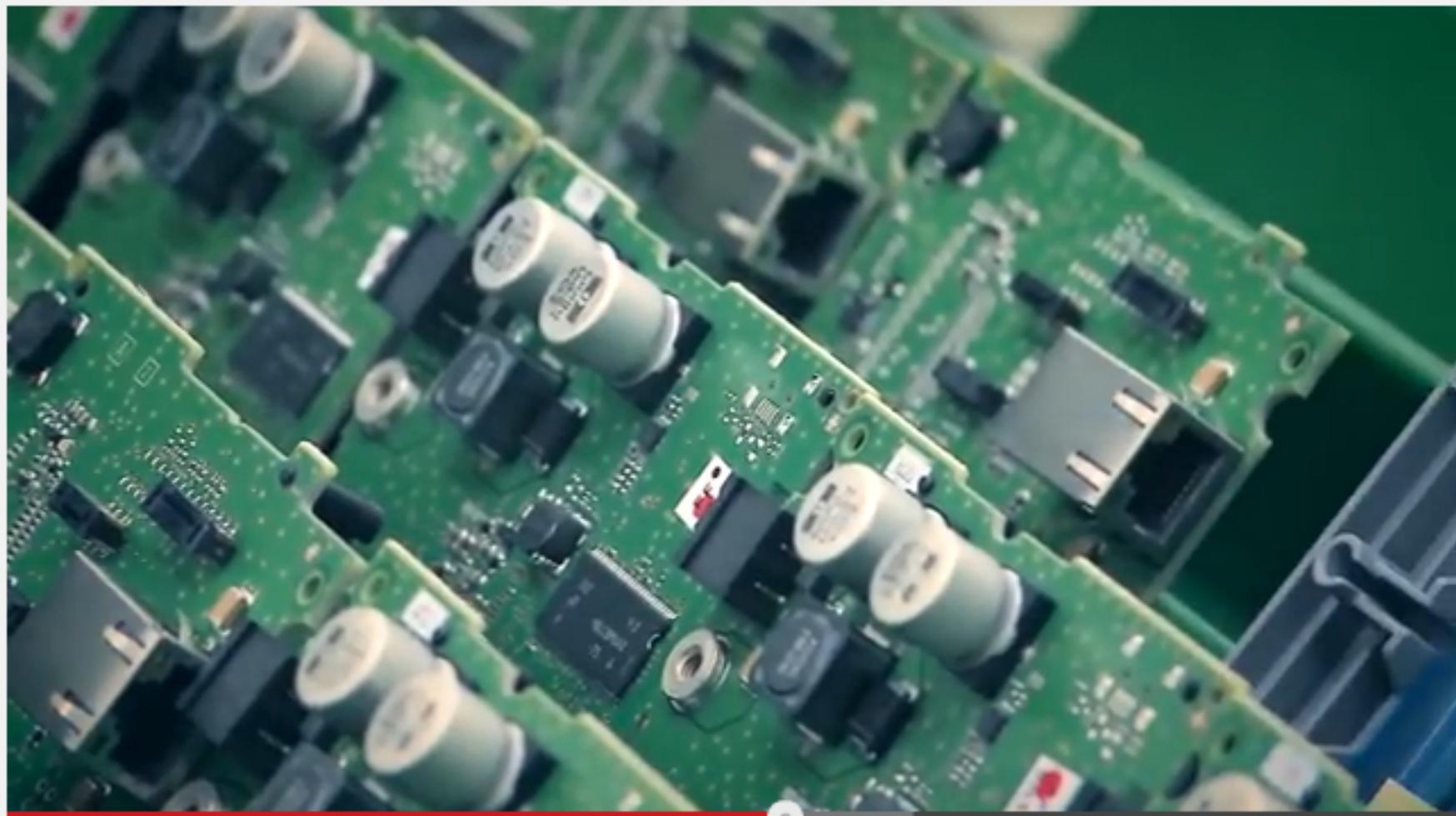
Today

Time →

Complexity ↑

**Complexity and Productivity Growing**

siemens industry 4.0



2:59 / 5:34



Industrie 4.0 - The Fourth Industrial Revolution

**1. PADRONIZAÇÃO**

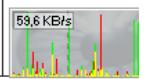
**2. GOVERNO (REGULAMENTAÇÃO)**

**3. SEGURANÇA**

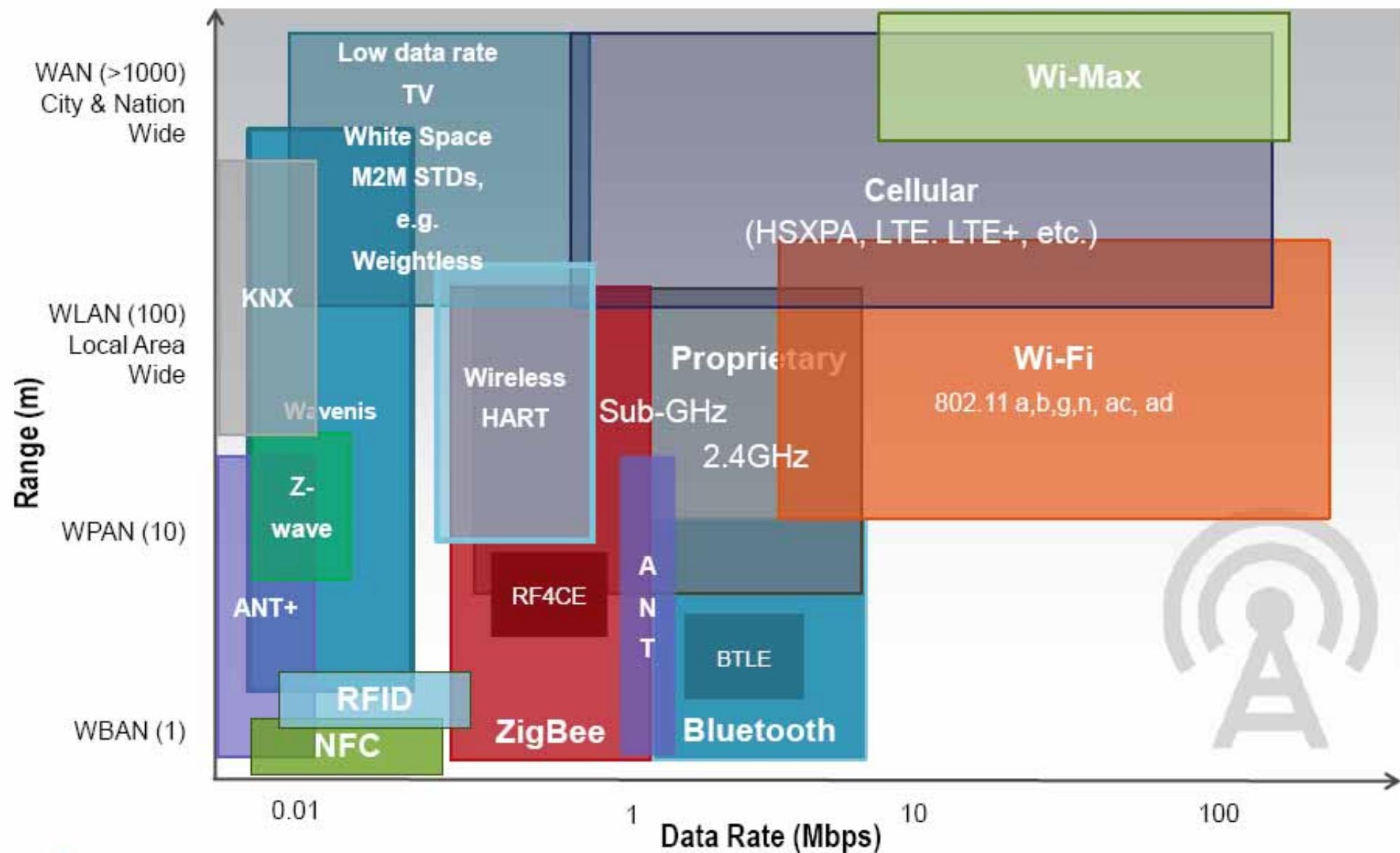
**4. MÃO DE OBRA QUALIFICADA**

# IoT standardization landscape



	NFC	RFID	Blue-tooth®	Blue-tooth® LE	ANT	Proprietary (Sub-GHz & 2.4 GHz)	Wi-Fi®	ZigBee®	Z-wave	KNX	Wireless HART	6LoWPAN	WiMAX	2.5–3.5 G
Network	PAN	PAN	PAN	PAN	PAN	LAN	LAN	LAN	LAN	LAN	LAN	LAN	MAN	WAN
Topology	P2P	P2P	Star	Star	P2P, Star, Tree Mesh	Star, Mesh	Star	Mesh, Star, Tree	Mesh	Mesh, Star, Tree	Mesh, Star	Mesh, Star	Mesh	Mesh
Power	Very Low	Very Low	Low	Very Low	Very Low	Very Low to Low	Low-High	Very Low	Very Low	Very Low	Very Low	Very Low	High	High
Speed	400 Kbs	400 Kbs	700 kbs	1 Mbs	1 Mbs	250 kbs	11-100 Mbs	250 kbs	40 Kbs	1.2 Kbps	250 kbs	250 Kbs	11-100 Mbs	1.8-7.2 Mbs
Range	<10 cm	<3 m	<30 m	5-10 m	1-30 m	10-70 m	4-20 m	10-300 m	30 m	800 m	200 m	800 m (Sub-GHz)	50 km	Cellular network
Application	Pay, get access, share, initiate service, easy setup	Item tracking	Network for data exchange, headset	Health and fitness	Sports and fitness	Point to point connectivity	Internet, multimedia	Sensor networks, building and industrial automation	Residential lighting and automation	Building automation	Industrial sensing networks	Senor networks, building and industrial automation	Metro area broadband Internet connectivity	Cellular phones and telemetry
Cost Adder	Low	Low	Low	Low	Low	Medium	Medium	Medium	Low	Medium	Medium	Medium	High	

## Today's Wireless Landscape: Interoperability Nightmare



## What is the Internet of Terror?

- Networked, Embedded Systems
- Ubiquitous
- Combinations of various systems
- *"Things aren't just victims, they're aggressors."*

### Trend Net “Security” Camera

- Surveillance Camera
- Meant to protect homes and businesses but...
- Connect to <http://192.168.1.11/anony/mjpg.cgi>
- Completely open to anyone who can reach the IP address
- Exposed in 2012
- Site still lists “critical firmware update”

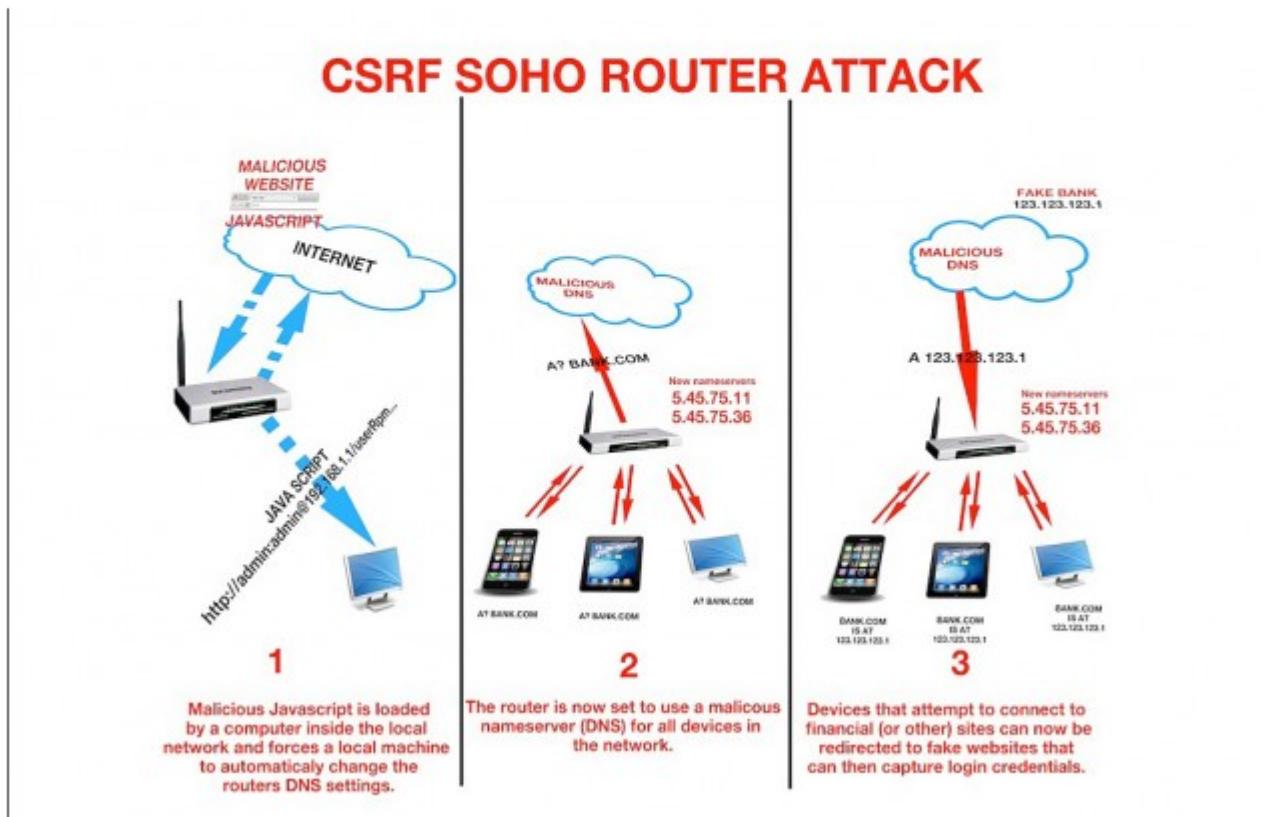
## Hackers hijack 300,000-plus wireless routers, make malicious changes

Devices made by D-Link, Micronet, Tenda, and TP-Link hijacked in ongoing attack.

by Dan Goodin - Mar 3 2014, 4:42pm HB

BLACK HAT | WIRELESS

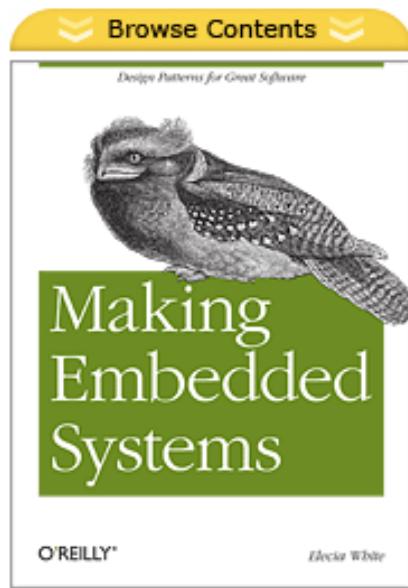
114



[Enlarge](#) / Three phases of an attack that changes a router's DNS settings by exploiting a cross-site request vulnerability in the device's Web interface.

# What marketing won't tell you about the Internet of Things

## *Elecia White*



### Making Embedded Systems

Design Patterns for Great Software

By Elecia White

Publisher: O'Reilly Media

Released: October 2011

Pages: 330



[Read 7 Reviews](#) | [Write a Review](#)

Interested in developing embedded systems? Since these systems require a disciplined approach to programming, this book cultivates a host of good development practices, based on and new patterns unique to embedded programming.

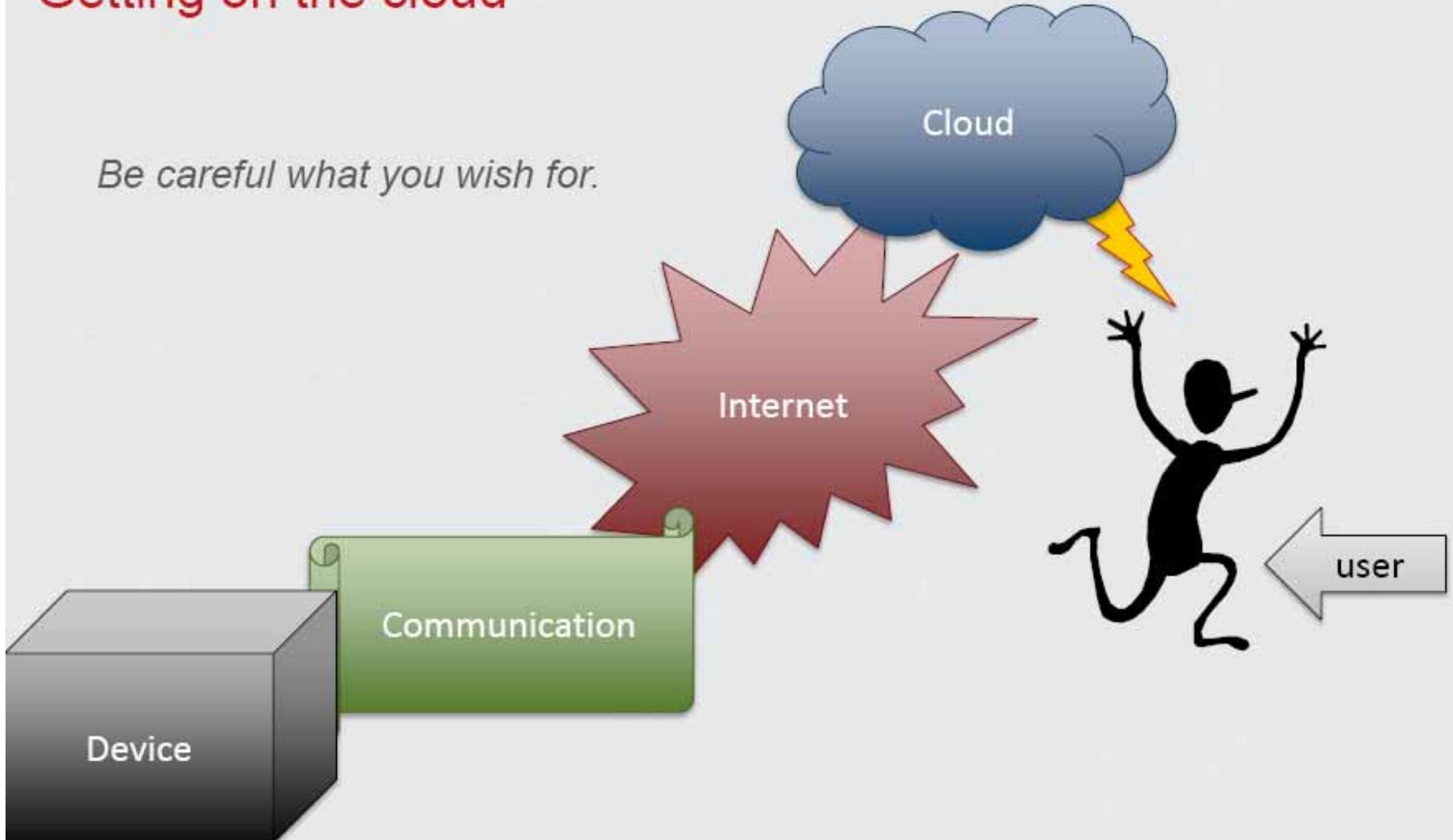
[Larger Cover](#)

[Full description](#)



## Getting on the cloud

*Be careful what you wish for.*



# The Mobile Hub Revolution

## Personal Area Networking



Voice/Audio  
2Mbps – AAA battery  
Apple MFI needed

## Local Area Networking



WAN access  
100Mbps / 5GHz

## Wide Area Networking



Voice / Data access  
High speed mobile internet  
Cloud access



Bluetooth Low Energy  
Data logging / sensors  
1Mbps – coin cell battery  
Open - No MFI



Mobile hot spot



WiFiDirect™  
mobile to mobile



Miracast™  
mobile to TV / Car



Proximity  
sensors



Wearable  
sensors



Fitness & Health



Dual mode BT / BLE  
Data concentrators  
Universal Smartphone  
connectivity



Sensors/Accessories  
Coin cell battery  
Interchangeable  
products



Seamless pairing  
Easy setup



Remote Control



Auto. Infotainment



Monitoring  
Sensors

# Smart Energy Management

*End to end need for Wireless Connectivity*

## Use It



Motors



Appliances



Heat Cost Allocators



Smart Thermostats



ZigBee™



LoWPAN



Sub-1GHz

Sensors, concentrators

Very low power, long range, usable on new and retrofit equipments

## Move It



Real-Time Monitoring

Transmission & Distribution



## Make It



Distributed (Local)  
Renewable (Clean)  
Conventional (Fossil)



Bluetooth®  
SMART

Sensors, concentrators  
Very low power, short range



Sensors, relays

Very low power, short range



Smart Meters

2-way  
Price signaling  
Demand response  
Supply response



Home Gateways



Energy harvesters



Lighting



HVAC



Public Lighting



Gateways, sensors,  
end devices

High throughput, mid range

# Cloud Connectivity – the Internet of Things

## The Nodes



## The Hubs



Mobile Hub



Wi-Fi Access Point

## The Cloud



IP back-bone



Bluetooth®

Bluetooth®  
SMART

Bluetooth®  
SMART READY

Low Power Connectivity

1000s of new end equipments that can remotely connect to the cloud



Embedded Connectivity

1000s of end equipments that can directly connect to the cloud enabling new usage



ZigBee™

IEEE  
802.15.4



LoWPAN

Sub-1GHz

Heterogeneous RF protocols unified through Gateways.  
1000s of existing and new end equipments cloud connected



Mesh Gateway



## Do you have the skillset?

Deep experience in embedded devices, optimization and resource management  
C/C++ on ARM Cortex-M\*



Wireless communication expert w/ understanding of stack integration and debugging (i.e. TCP/IP with wireshark), optimal RTOS configuration.

Communication

System administration (high uptime!) who develops front and back end software.  
Required expertise in PHP, database administration.

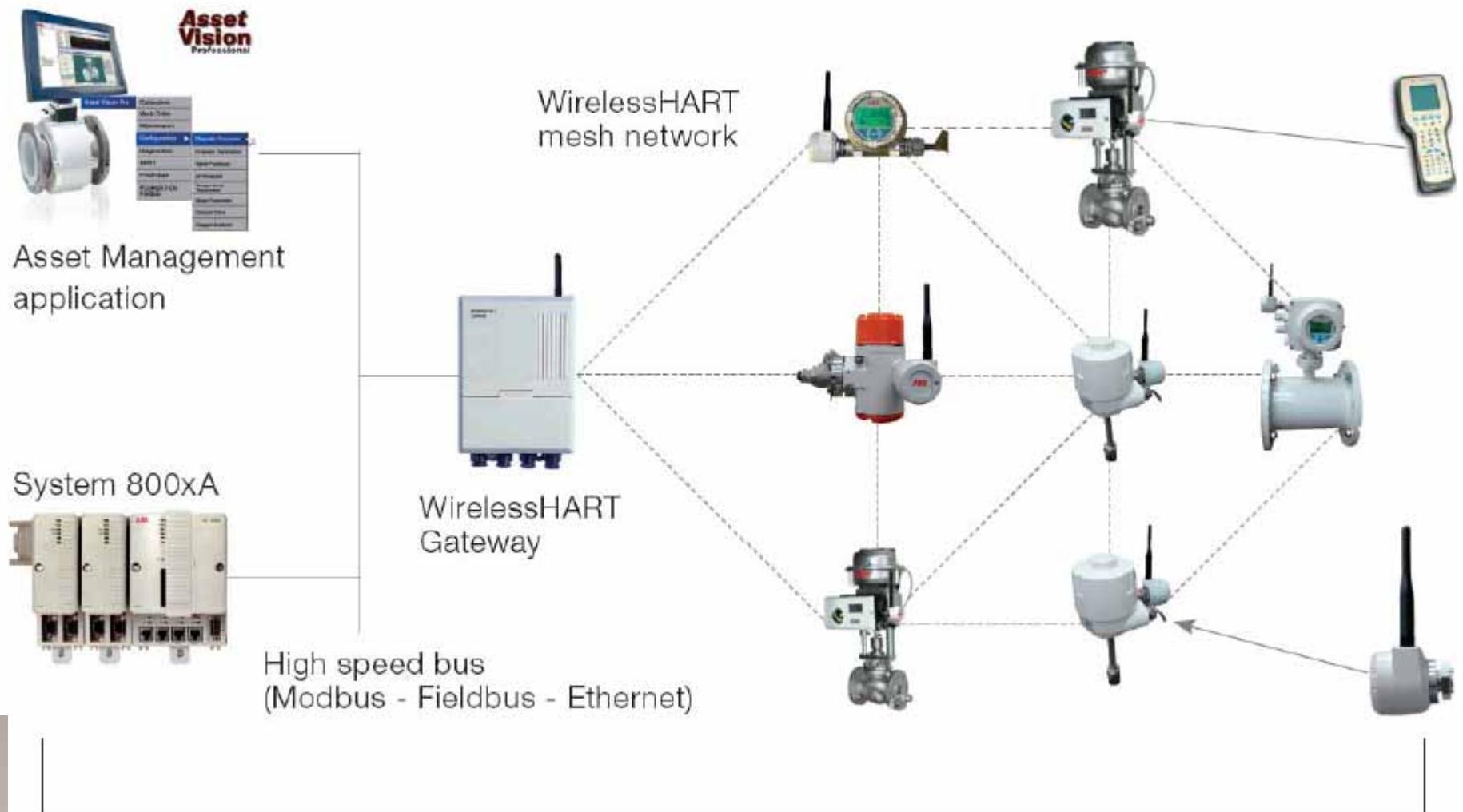


Internet

Expert with protocol development in non-robust environment, experience with creating secure, tokenized channel.  
Able to build service/daemon for each OS

User interface specialist, expert in HTML, CSS, Ajax. Must have developed successful Android and iOS apps.





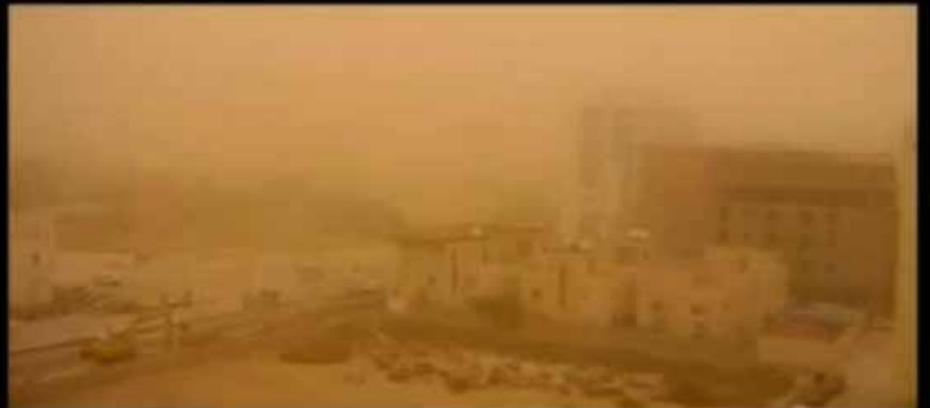
Kristofer S.J.Pister  
University of California, Berkeley

-48 °F with a wind chill of -70 °F Wireless Transmitter  
on the North Slope of Alaska



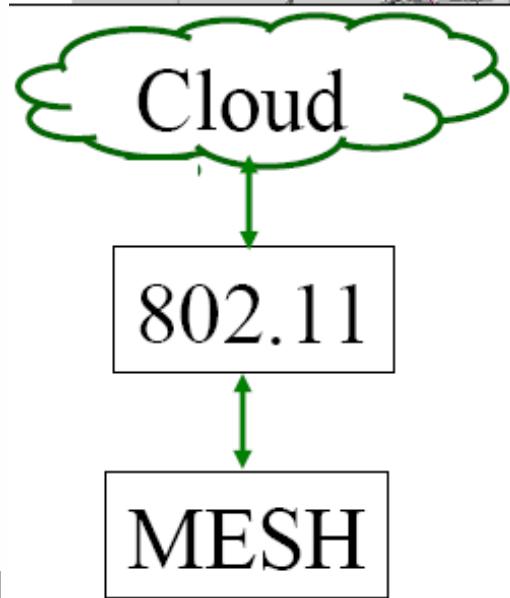
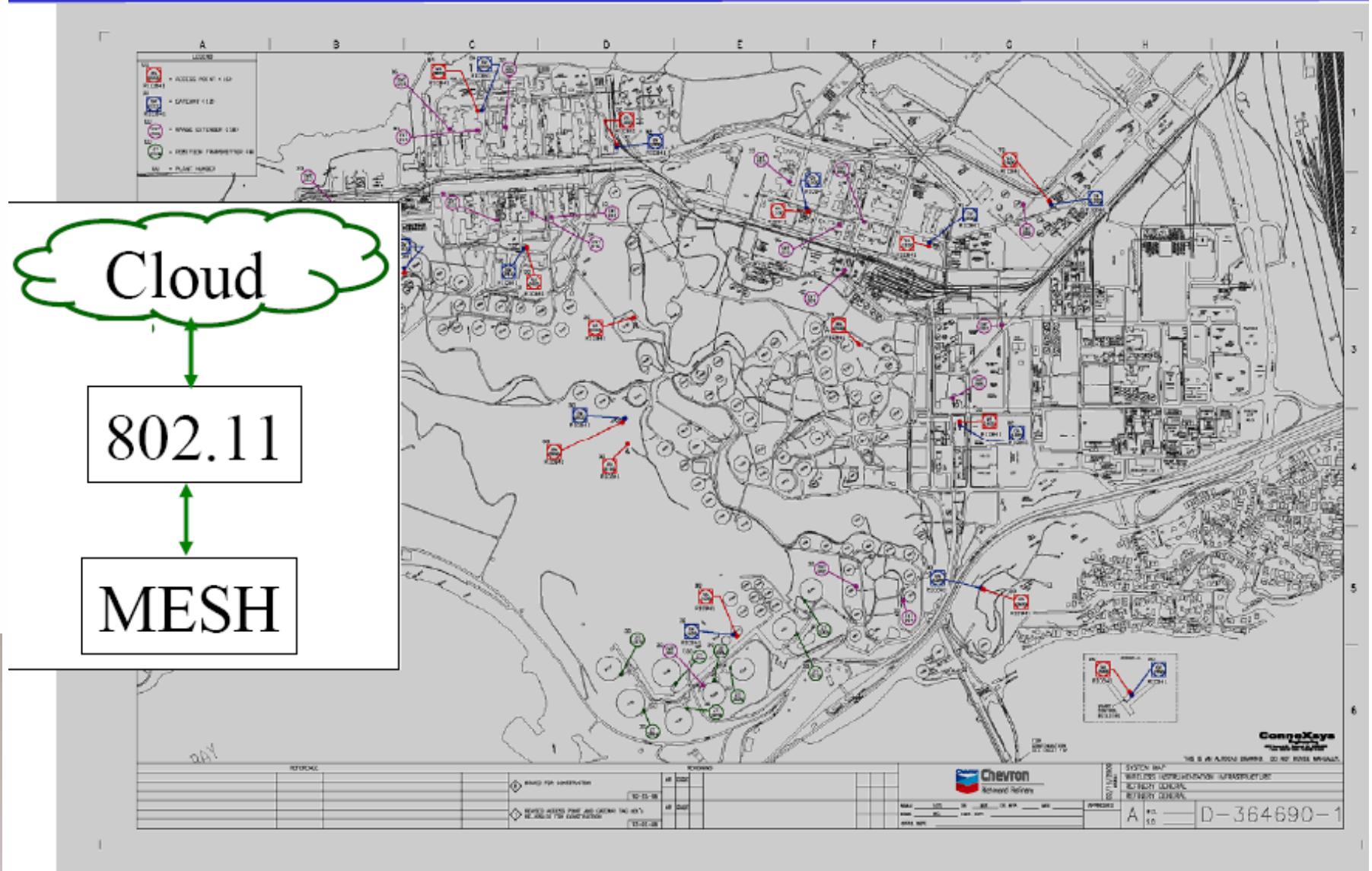
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## Middle East Desert Sand Storms

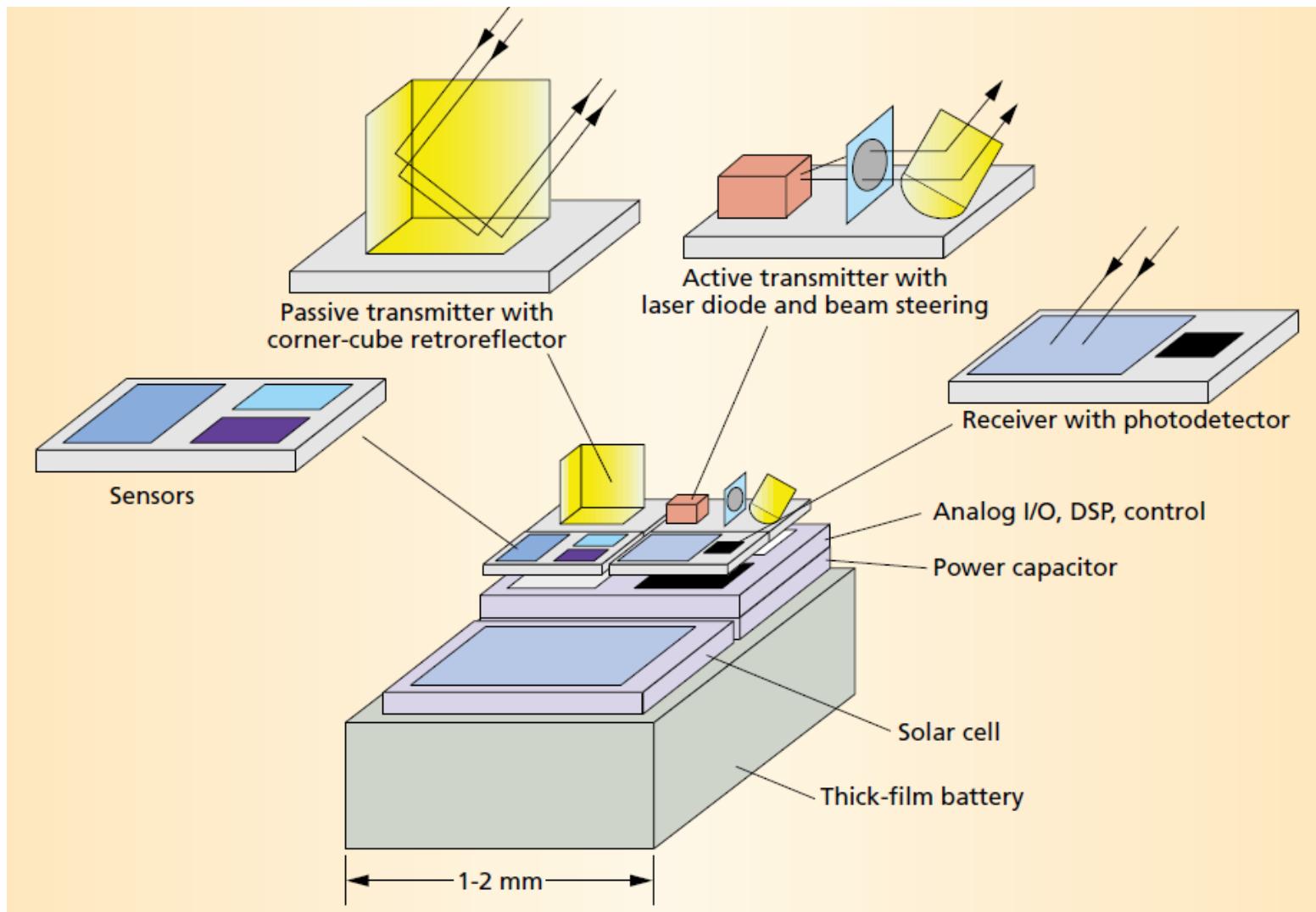


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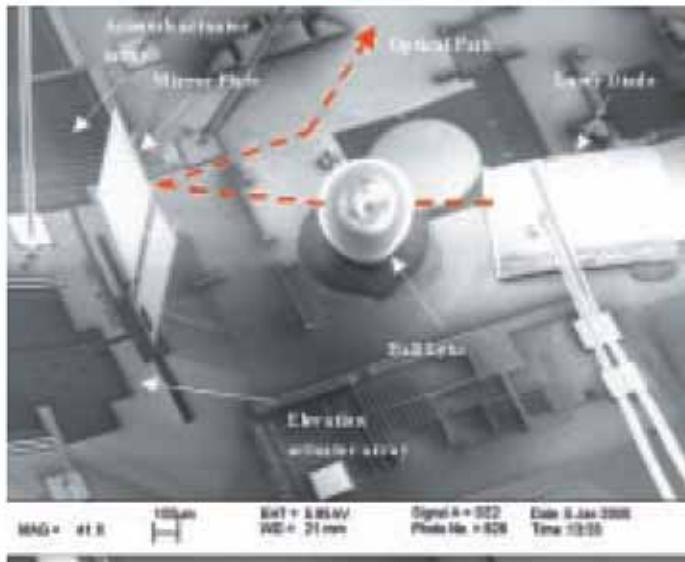
## Richmond Refinery Wireless Umbrella



3 km<sup>2</sup>, 90% coverage



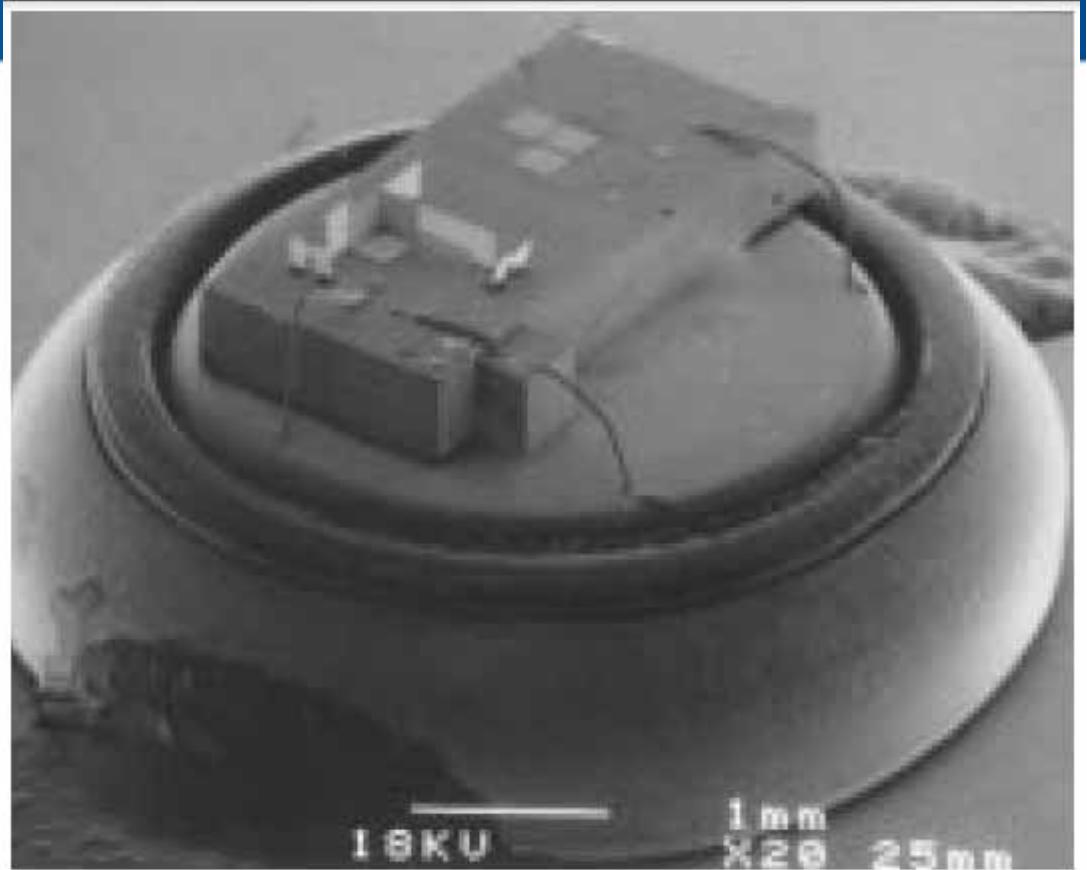
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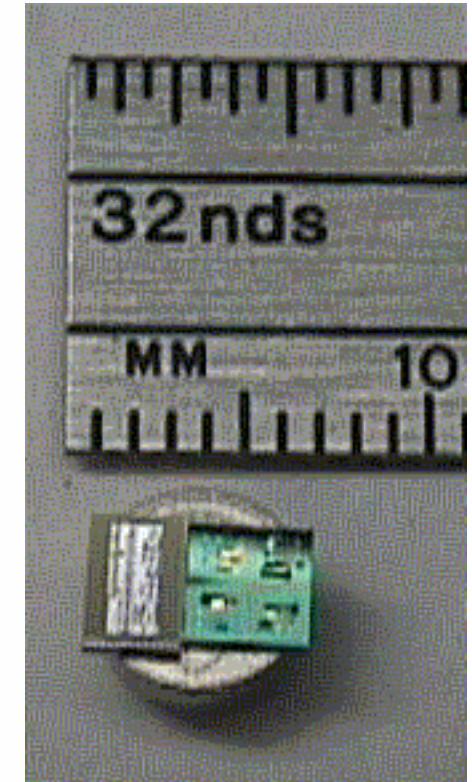
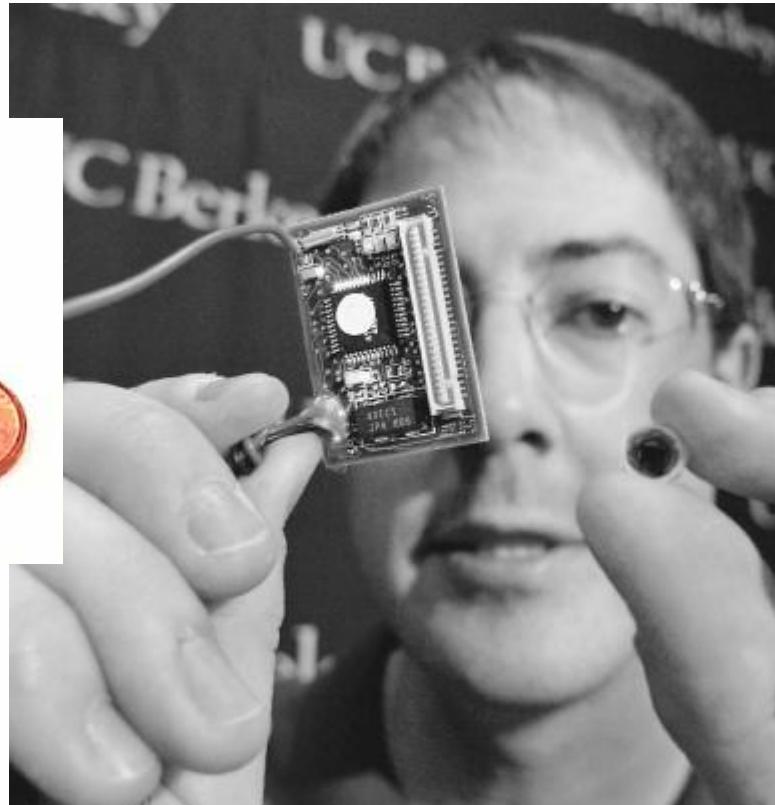
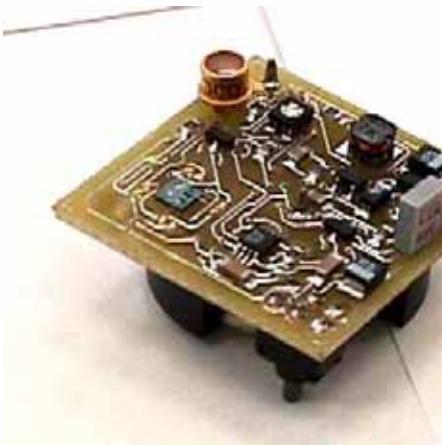
*Figure 5. Scanning electron micrograph of first-generation steered agile laser transmitter. The microscope's chip combines a laser diode and ball lens with a micromachined two-degree-of-freedom beamsteering mirror. The optical path runs from the top of the laser diode's front facet, through the ball lens, reflects off the left-hand mirror plate, then finally reflects off the substrate before leaving the chip.*



Kristofer S.J.Pister  
University of California, Berkeley



*Figure 3. Autonomous bidirectional communication mote with a MEMS optics chip containing a corner-cube retroreflector on the large die, a CMOS application-specific integrated circuit (ASIC) for control on the 300 × 360 micron die, and a hearing aid battery for power. The total volume is 63 mm<sup>3</sup>.*

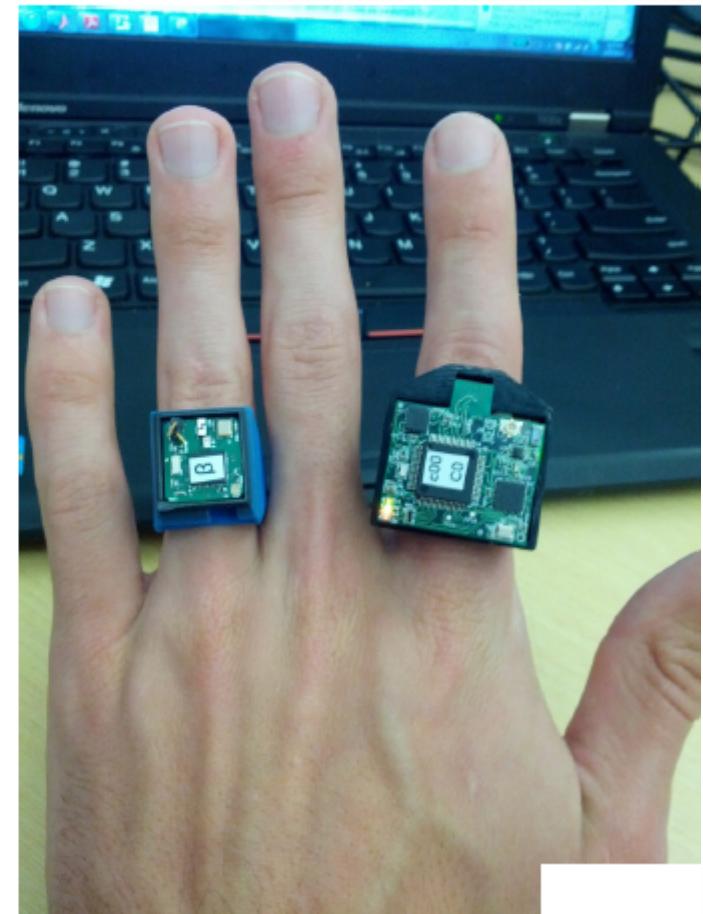


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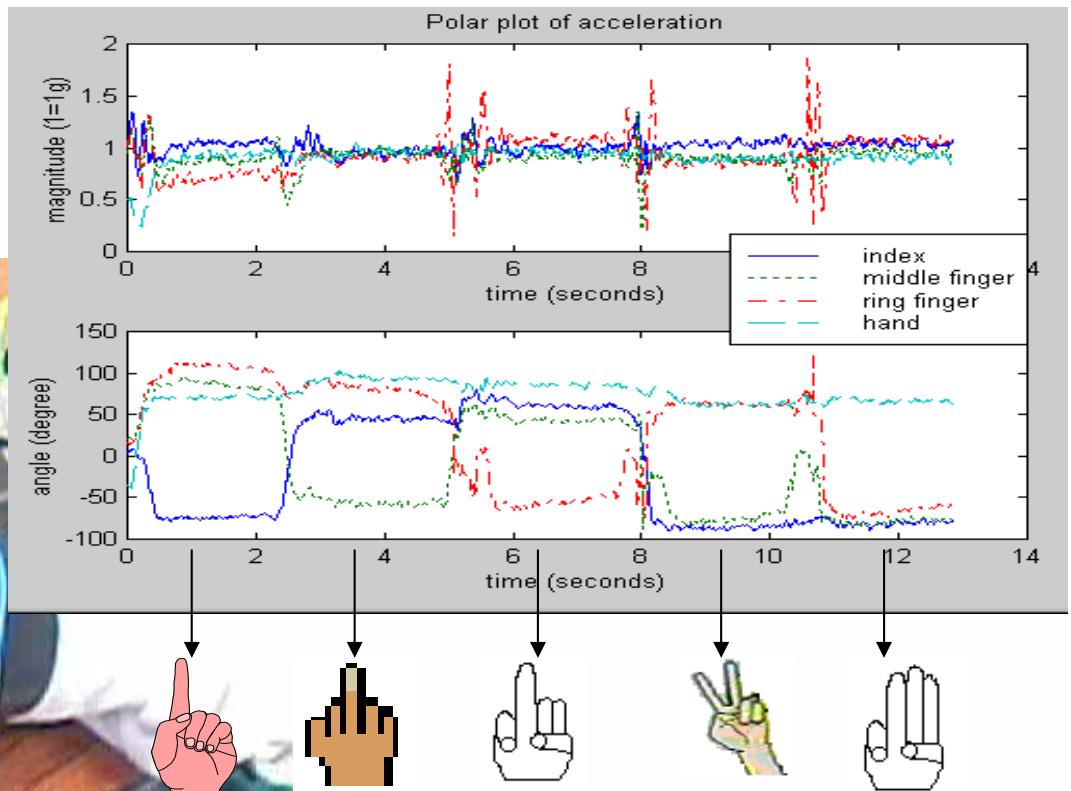
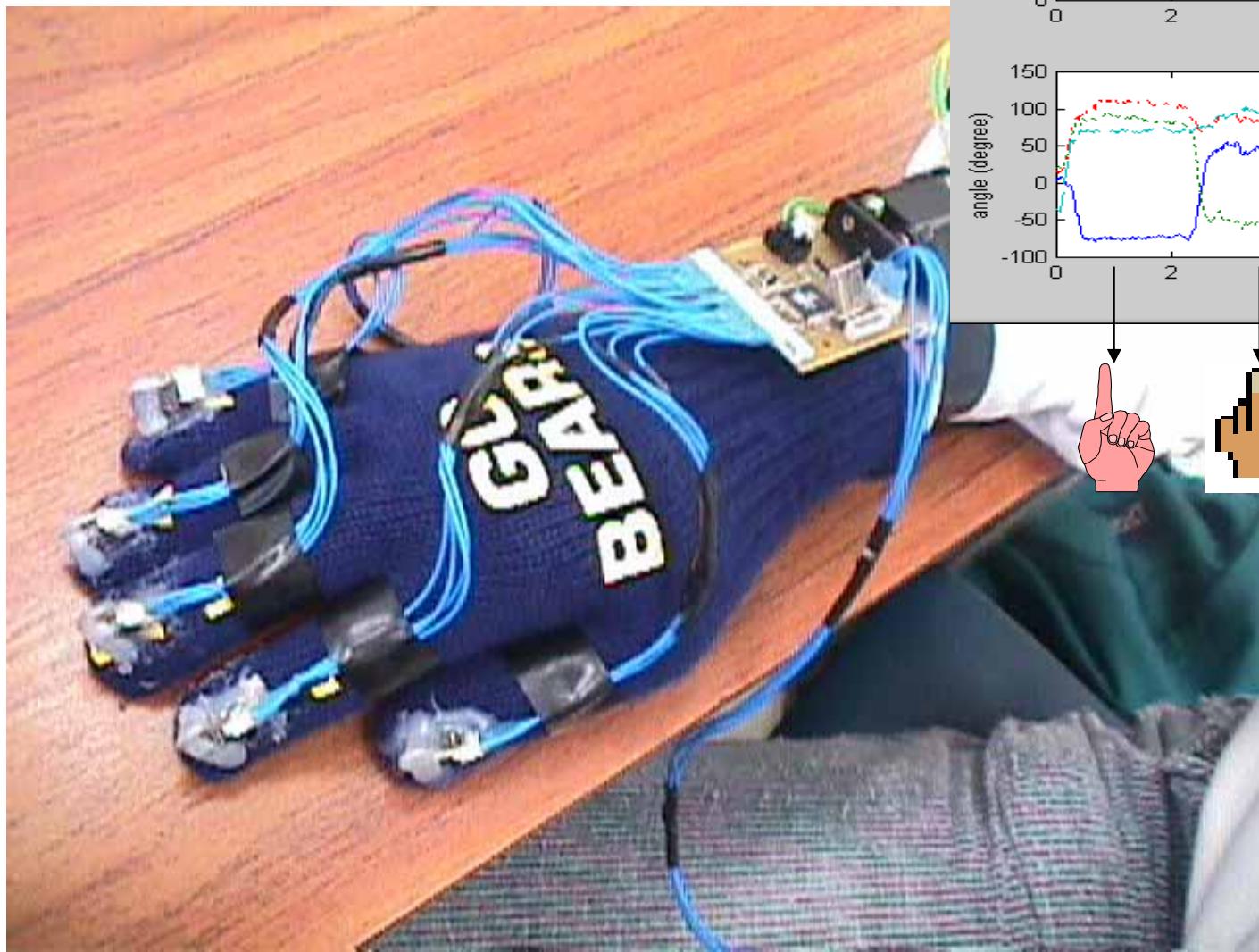
<http://www.redicecreations.com/specialreports/smardustbig.jpg>



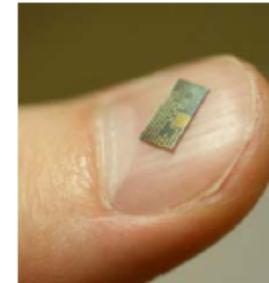
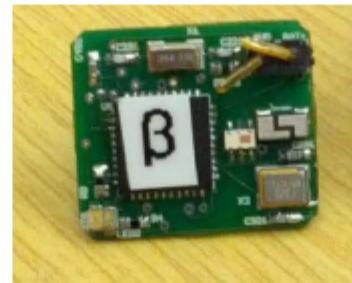
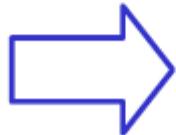
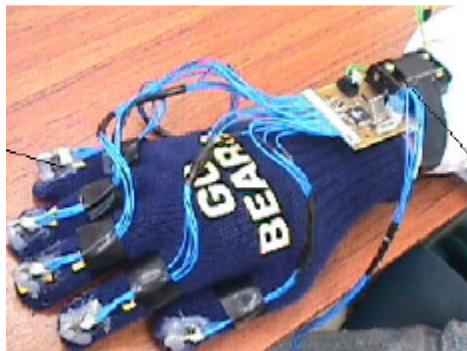
- *Guidance and Inertial Navigation Assistant*
- 9 axis IMU
- Ring form factor
  - Ring GINA
- Bluetooth GINA



# Computadores do tamanho de um grão de poeira



- Single chip mote
  - Finger tip accelerometers
  - Virtual keyboard
- ...and beyond



# "Internet das Coisas" torna-se objeto de política pública

26/05/2014 02h00



389



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OUVIR O TEXTO

Mais opções

O BNDES (Banco Nacional de Desenvolvimento Econômico e Social) realizou há pouco no Rio o seminário Internet das Coisas: Oportunidades da Nova Revolução Digital para o Brasil.

O termo "internet das coisas" é gozado. Ele sintetiza a tendência de que tudo, absolutamente tudo, tende a se conectar à internet. Da geladeira ao ar-condicionado, do carro às próprias estradas, passando por plantas, animais, pessoas e produtos.

É gozado também o uso do termo "nova revolução". E também o fato de ter sido organizado pelo BNDES. É possível que a "internet das coisas" seja responsável pelo surgimento da nova onda de empresas bilionárias. Por isso, o tema já virou política pública em outros países há tempos. Na China, há mais de dez anos a política industrial do país foca-se nele, com vultosos recursos.



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Comunicações



O Programa Inova Telecom é uma iniciativa conjunta do Ministério das Comunicações (MC), do Ministério da Ciência, Tecnologia e Inovação (MCTI), do Ministério da Saúde (MS), do Banco Nacional do Desenvolvimento - BNDES e da Financiadora de Estudos e Projetos (Finep), com a finalidade de coordenar as ações de fomento à inovação e aprimorar a integração dos instrumentos de apoio disponíveis para investimentos no setor de telecomunicações.

O objetivo do Inova Telecom é apoiar Planos de Negócio que contemplem inovação nas empresas brasileiras do setor de telecomunicações, incentivando seu adensamento e ampliando sua competitividade.

[http://www.finep.gov.br/pagina.asp?pag=inova\\_telecom](http://www.finep.gov.br/pagina.asp?pag=inova_telecom)

Instituição	Instrumento	Valor (R\$ milhões)
Finep	Crédito Reembolsável	550
	Não Reembolsável	40
	Subvenção Econômica	30
	Renda Variável	300
BNDES	Crédito Reembolsável Não Reembolsável Renda Variável	500
MS	Não Reembolsável	80







Prof. Alessandro Ferreira da Cunha  
**e-mail:** [alessandro@techtraining.eng.br](mailto:alessandro@techtraining.eng.br)  
**msn:** [afcunha01@gmail.com](mailto:afcunha01@gmail.com)  
**skype:** [alessandroferreiradacunha](skype:alessandroferreiradacunha)  
[www.techtraining.eng.br](http://www.techtraining.eng.br)