

# The Internet of Things: An Overview

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## Setting the Scene

- About the Internet Society
- IoT Concepts & Drivers
- IoT Key Challenges
  - Security
  - Privacy
  - Interoperability

# About the Internet Society



# Who we are

Global not-for-profit organization, founded in 1992

Independent thought leader and advocate on issues impacting the Internet and its users.

Organization home of the Internet Engineering Task Force (IETF)



# Our Mission

To promote the open development, evolution, and use of the Internet for the benefit of all people throughout the world.

# Our Global Presence



NORTH AMERICA

EUROPE

THE MIDDLE EAST

AFRICA

ASIA

LATIN AMERICA/CARIBBEAN

116

Chapters  
Worldwide

80,000+

Individual Members

143

Organization  
Members

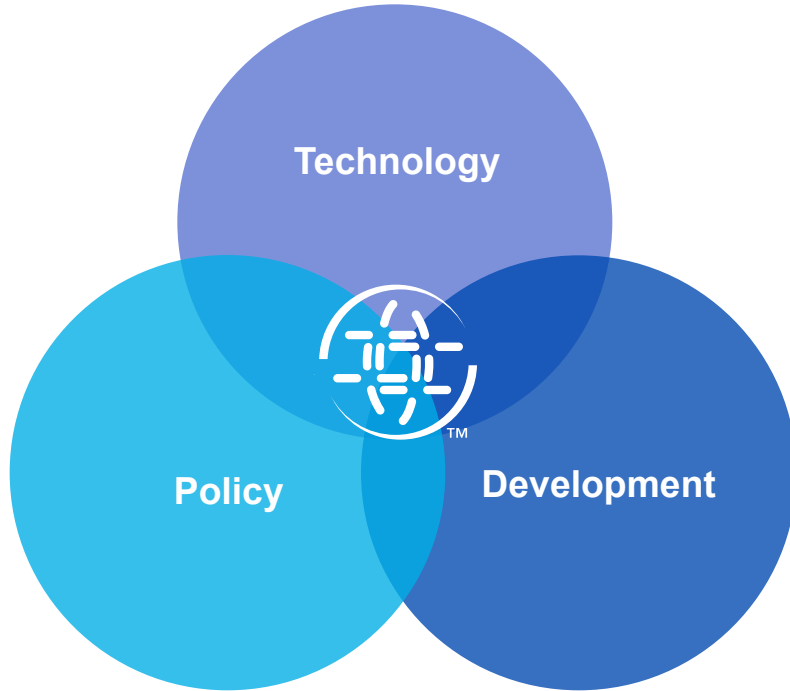
6

Regional  
Bureaus

21

Countries with  
ISOC Offices

# How We Work



We harness global expertise and work at the intersection of Internet:

- **policy**,
- **technology**, and
- **development**

## 2016 Agenda Focus:

- **Promoting Trust in the Internet**
- **Connecting the Unconnected**

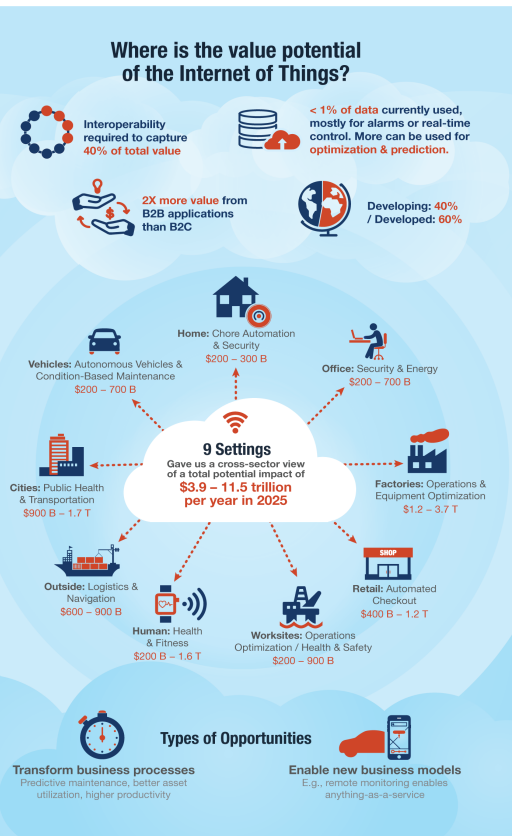
If you care about the Internet,  
join us!





# What is IoT really?

One view, from McKinsey Global Institute:



- **Despite the buzz, no single definition.**
  - Or agreed numbers, or categories, or taxonomies...
  - Different emphasis on different aspects of the concept
- **Functionally:** The extension of network connectivity and computing capability to a variety of objects, devices, sensors and everyday items allowing them to generate/exchange data, often with remote with data analytic/management capabilities.
- **As Value:** Data & what can be done with it.
- **As a Vision:** The realization of a ‘hyper-connected’ world.
  - This is why it matters.
  - This is why it’s hard.

# Computers, Networks, and “Things”

“Machine to Machine” (M2M)  
(~1970s +)



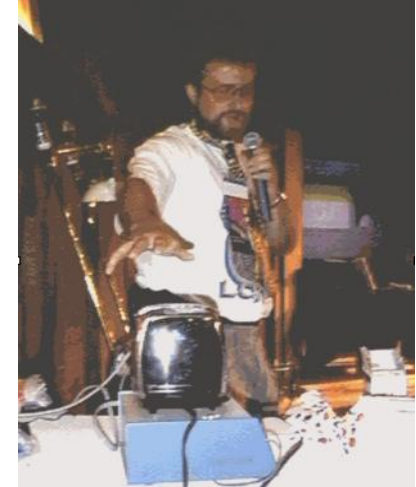
Internet of Things Beginnings



Carnegie Mellon Internet  
Coke Machine (1982, 1990)



Trojan Room  
Coffee Pot  
(first webcam)  
(1991)



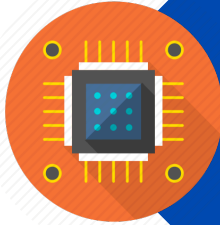
Internet Toaster  
(1990)

# If it's not new, why now?:

A Confluence of Market Trends



**UBIQUITOUS  
CONNECTIVITY**



**COMPUTING  
ECONOMICS**



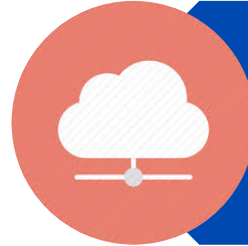
**ADVANCES IN  
DATA  
ANALYTICS**



**WIDESPREAD  
ADOPTION OF IP**



**MINIATURIZATION**



**RISE OF CLOUD  
COMPUTING**



# IoT Challenges



# Key IoT Challenges

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**SECURITY**

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**PRIVACY**

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**INTEROPERABILITY AND STANDARDS**

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**LEGAL, REGULATORY AND RIGHTS**

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**EMERGING ECONOMIES AND DEVELOPMENT**

# Key IoT Challenges



**SECURITY**



**PRIVACY**



**INTEROPERABILITY AND STANDARDS**



**LEGAL, REGULATORY AND RIGHTS**



**EMERGING ECONOMIES AND DEVELOPMENT**



# Security

A graphic illustration featuring three padlocks (two red, one blue) and a key, set against a background of binary code and hexadecimal strings, symbolizing digital security. The padlocks are arranged horizontally, with the central one being blue and the two flanking ones being red. A single key is positioned between the central blue padlock and the red one on its left. The background is a dark, textured surface with a grid of glowing blue and white characters, including binary digits (0s and 1s) and hexadecimal strings (e.g., 4A468400, D008C1, 444E1227, 0008C1, 4A468400, D008C1, 444E1227, 0008C1, 4A468400, D008C1, 444E1227, 0008C1). The overall aesthetic is high-tech and digital.

# Security Must be a Fundamental Priority

- Security is the most pressing and important IoT challenge for industry, users, and the Internet.
- Growth in devices increases the surface available for cyberattack
- Poorly secured devices affect the security of the Internet and other devices *globally*, not just *locally*.

***Developers and users of IoT devices and systems have a collective obligation to ensure they do not expose others and the Internet itself to potential harm.***



# A Spectrum of Unique Smart Object Security Challenges

- **Cost/Size/Functionality**
- **Volume of Identical Devices**
- **Deployment at Mass Scale**
- **Long Service Life**
- **No / Limited Upgradability**
- **Limited Visibility into Internal Workings**
- **Embedded Devices**
- **Physical Security Vulnerabilities**
- **Unintended Use & BYOIoT**

See also IETF RFC 7452 *Architectural Considerations in Smart Object Networking*

# Collaborative Security Approach:

## Developing Solutions in the Context of Principles

<b>Fostering Confidence / Protecting Opportunities</b>	<i>Opportunities</i> for individuals, business, economy and society will only be realized if there is <u>confidence</u> in the Internet, systems, and technologies (including IoT).
<b>Collective Responsibility</b>	No security threats or solutions exist in isolation. Requires collective responsibility, a common understanding of problems, shared solutions, common benefits, and open communication channels.
<b>Uphold Fundamental Properties and Values</b>	Security solutions should be fully integrated with the important objectives of preserving the fundamental properties of the Internet and fundamental rights.
<b>Evolution and Consensus</b>	Security solutions need to be flexible enough to evolve over time & responsive to new challenges. Focus needed on defining agreed problems and finding solutions, including incremental ones.
<b>Think Globally, Act Locally</b>	Creating security and trust requires different players (within their respective roles / responsibilities) to take action and close to where the issues are occurring.

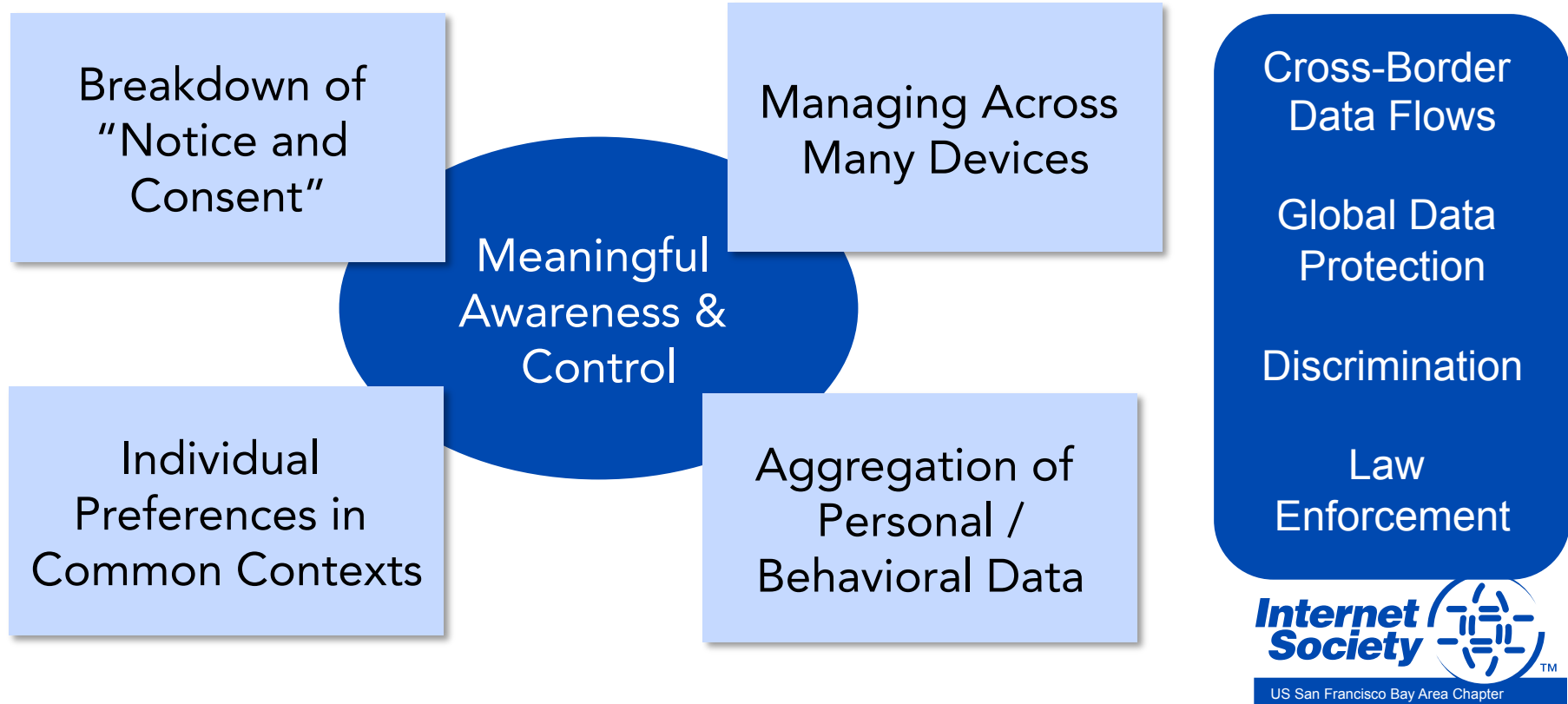
# Privacy



# Privacy and IoT: Data is a Double-Edged Sword

- The data streams /analytics that drive the value IoT can also paint very detailed and intrusive pictures of our lives.
- Expands the feasibility / reach of surveillance and tracking.
- Redefining the debate about privacy issues
  - Can dramatically change the ways personal data is collected, analyzed, used and protected.
- Implications on our:
  - Basic rights
  - Sense of personal safety and control
  - Ability to trust the Internet and devices connected to it.

# Different Dimensions of Privacy Challenges in IoT



# Enhancing Privacy in IoT

- ***Strategies need to be developed that respect individual privacy choices across a broad spectrum of expectations, while still fostering innovation in new technology and services.***
  - Traditional on-line privacy models may not fit.
- **Adapting/adopting basic privacy principles, such as:**
  - Transparency/Openness
  - Meaningful Choice
  - Data Minimization
  - Use Limitation
    - Among others..





# Interoperability & Standards



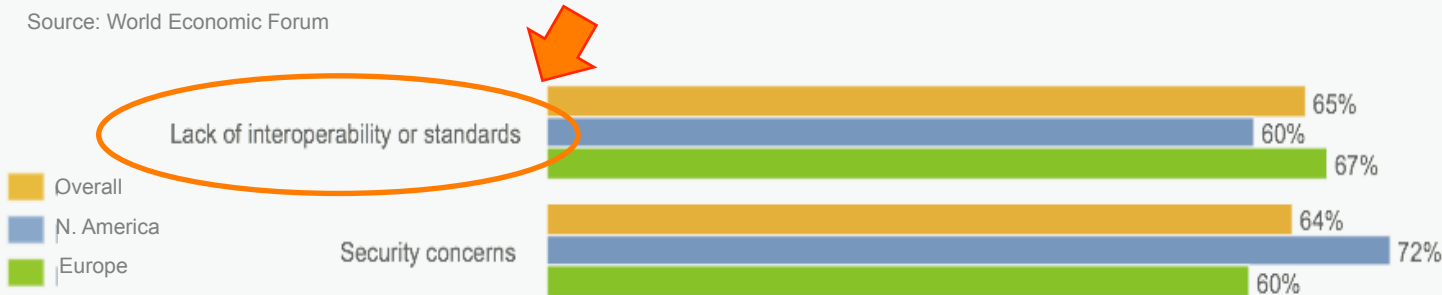
# I&S: Not Just a Tech Challenge, It's a Market Issue

**40%** Interoperability is necessary to create up to 40 percent of the economic value generated by IoT  
-- McKinsey Global Institute

Efficiency  
Scale  
Market Value

Q: What are the greatest barriers inhibiting business from adopting the industrial Internet?

Source: World Economic Forum

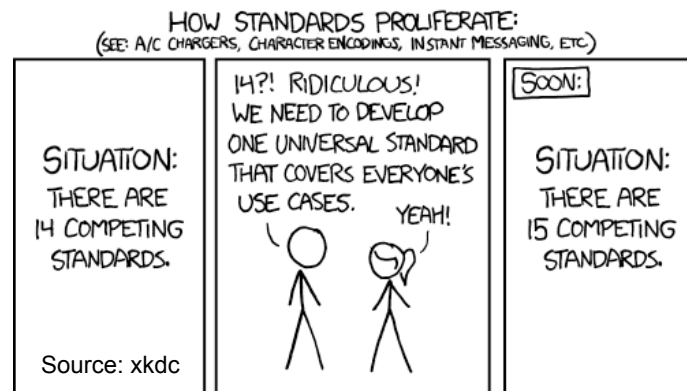




# Interoperability / Standards Considerations

- **Complex / Dynamic Service Delivery Chains and Use Cases**
- **Land Rush and Schedule Risk**
- **Proliferation of Standards Efforts**
  - Industry coalitions, alliances, SDOs, proprietary development etc.
    - Can overlapping efforts be avoided without undue coordination overhead?
- **Where is Interoperability Needed?**
- **Reusable Building Blocks**
- **Best Practices and Reference Models**

*Ultimately about advancing innovation and user choice*



# Closing Thoughts

- IoT is happening now, with tremendous transformational potential
- But the challenges must be addressed to realize the opportunities and benefits
  - Significant. Real. But not insurmountable
  - Solutions won't found by simply pitting promise vs. peril
- **It will take Informed engagement, dialogue, and collaboration** across a range of stakeholders to find solutions and to plot the most effective ways forward.



# Thank You

## ***The Internet of Things: An Overview***

*Understanding the Issues and Challenges of  
More Connected World*

<http://www.internetsociety.org/IoT>

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