CANTO‘s 33rd Annual General Meeting & Mini Expo
Willemstad, Curacao
29-31 January 2017

The Internet of Things (IoT)

An Overview & the Security Implications

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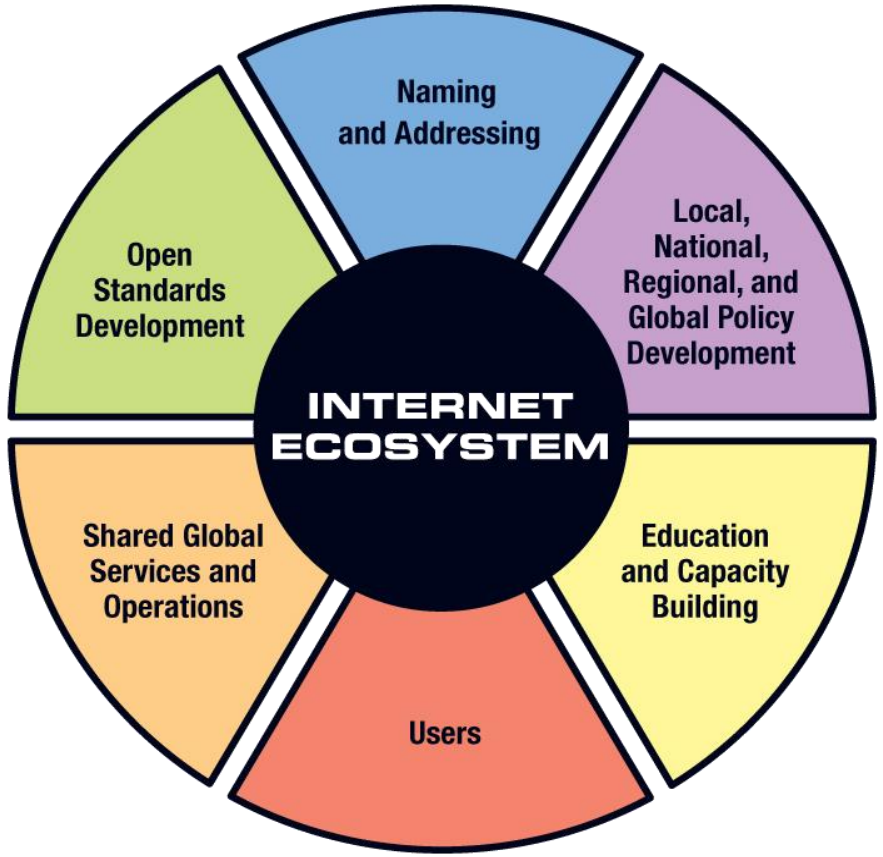
Agenda

- About the Internet Society (ISOC)
- How is the Internet Governed/ The Ecosystem
- The Internet’s “Three Operational Layers”
- IoT Overview: concepts and drivers
- Closing Thoughts

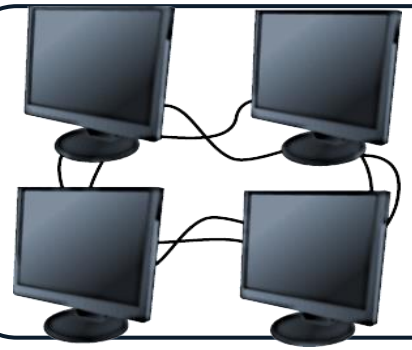
About the Internet Society

How is the Internet Governed?


Naming
and Addressing
Local,
National,
Regional, and
Global Policy
Development
Education
and Capacity
Building
Users
Shared Global
Services and
Operations
Open
Standards
Development
INTERNET
ECOSYSTEM

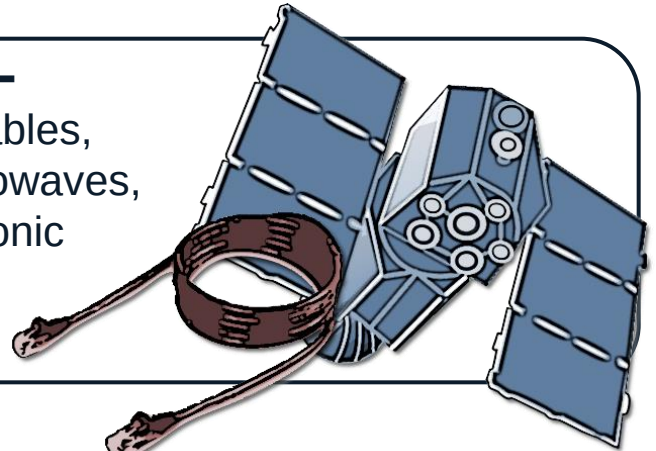
Internet's Three Operating Layers

Content and applications standards (HTML, XML, Java) – Promotes creativity and innovation in applications leading to email, World Wide Web, ebanking, wiki, Skype, Twitter, Facebook, Yahoo, Google, YouTube and much more



Internet protocols and standards (TCP/IP, DNS, SSL) – TCP/IP, controls traffic flow by dividing email and web data into packages before they are transmitted on the Internet

Telecommunications infrastructure – Physical network made up of underwater cables, telephone lines, fiber optics, satellites, microwaves, wi-fi, and so on Facilitates transfer of electronic data over the Internet



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IoT Overview: Concepts & Drivers

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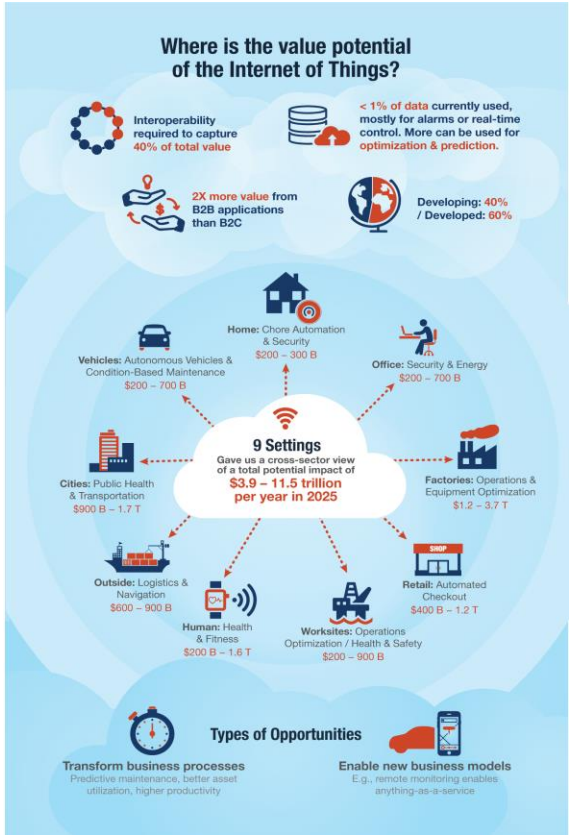
US San Francisco Bay Area Chapter

Internet of people

What is IoT really?

One view, from McKinsey Global Institute:



- **Despite the buzz, no single definition!**

refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention.

- **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!

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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)

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If it's not new, why now?:

A Confluence of Market Trends

IoT Challenges

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Key IoT Challenges

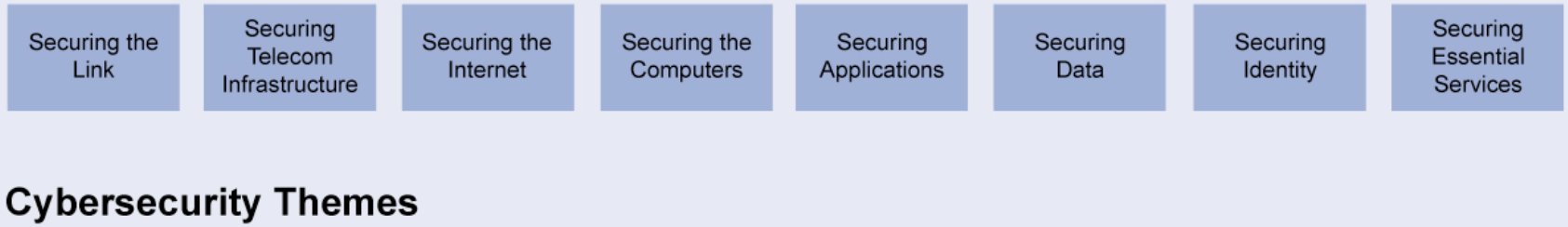
- SECURITY
- PRIVACY
- INTEROPERABILITY AND STANDARDS
- LEGAL, REGULATORY AND RIGHTS
- EMERGING ECONOMIES AND DEVELOPMENT

Security

Cyber Security Themes

- *Digital security risk management:*
  - Understanding digital security and stakeholders' responsibility;
  - Developing a national strategy;
  - Engaging with other stakeholders;
  - Cultivating international co-operation and mutual assistance.

- *Because the scope of cybersecurity is so broad, it is helpful to break it down into these categories*



Cybersecurity Themes

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*
- Single telecoms infrastructure? (Single Point of Attack!!)

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

Fostering Confidence / Protecting Opportunities	*Opportunities* for individuals, business, economy and and society will only be realized if there is *confidence* in the Internet, systems, and technologies (including IoT).
Collective Responsibility	No security threats or solutions exist in isolation. Requires collective responsibility, a common understanding of problems, shared solutions, common benefits, and open communication channels.
Uphold Fundamental Properties and Values	Security solutions should be fully integrated with the important objectives of preserving the fundamental properties of the Internet and fundamental rights.
Evolution and Consensus	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.
Think Globally, Act Locally	Creating security and trust requires different players (within their respective roles / responsibilities) to take action and close to where the issues are occurring.

See http://www.internetsociety.org/collaborativesecurity

Privacy

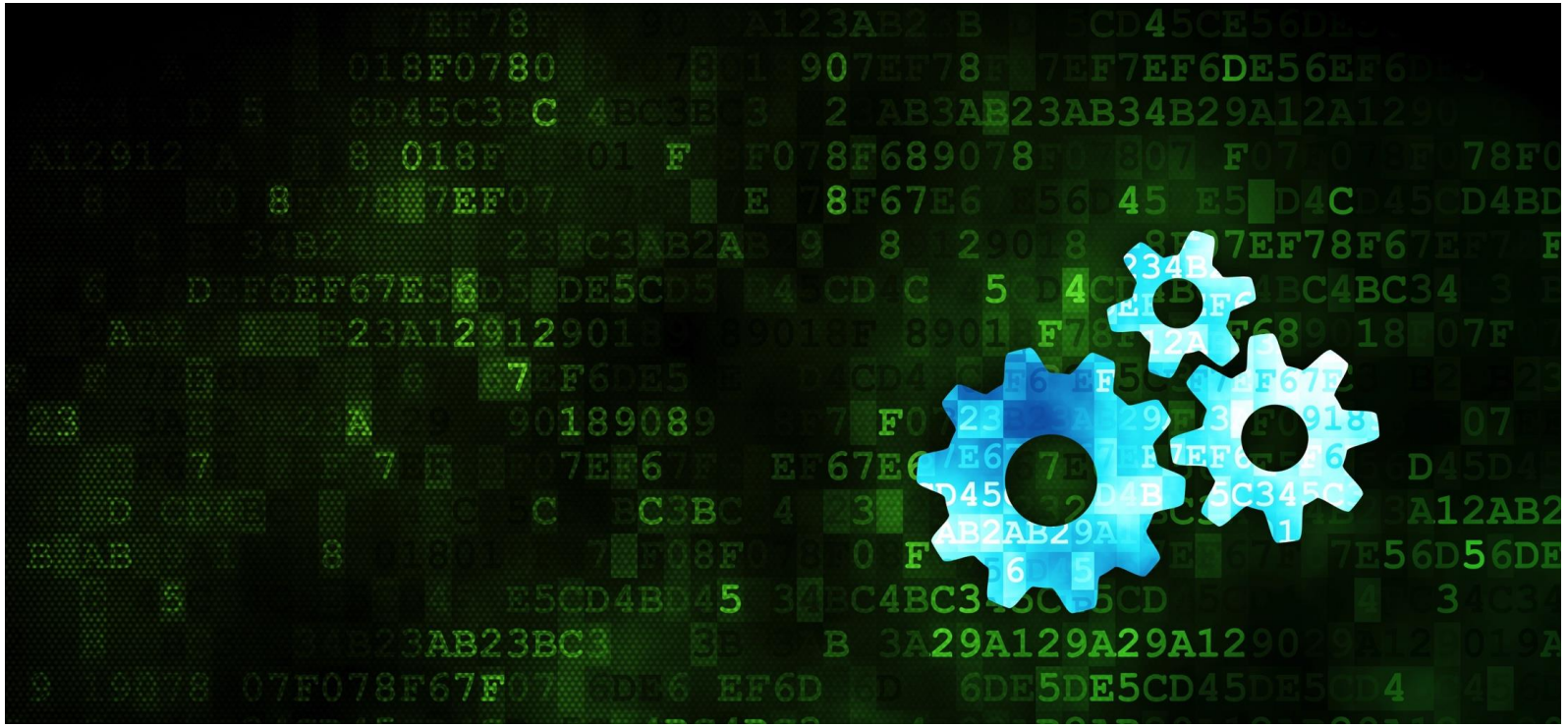
Privacy and IoT: Data is a Double-Edged Sword

- 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.

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

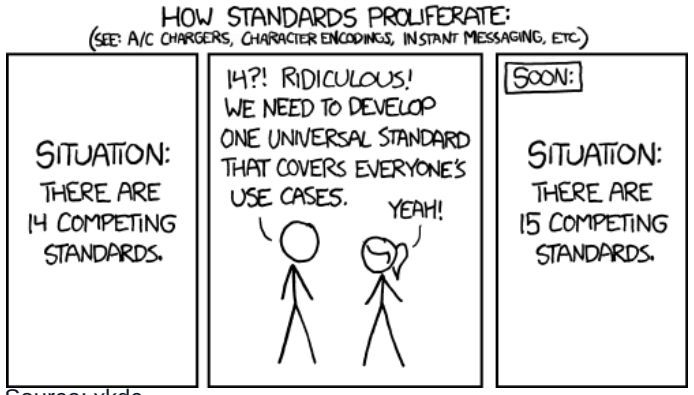
40% Interoperability is necessary to create up to 40 percent of the economic value generated by IoT
-- McKinsey Global Institute

Efficiency
Scale
Market Value

Interoperability / Standards Considerations

- Complex / Dynamic Service Delivery Chains and Use Cases
- Land Rush and Schedule Risk
- Proliferation of Standards Efforts
  - Industry coalitions, alliances, Service Data Objects(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



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Legal, Regulatory, and Rights Issues

Legal, Regulatory, and Rights Issues

- Data Protection and Cross border Data Flows
- IoT Data Discrimination
- IoT Devices as Aids to Law Enforcement and Public Safety
- IoT Device Liability
- Proliferation of IoT Devices Used in Legal Actions
- Regulatory, Legal, and Rights Issues Summary
  - Internet Society principles of promoting a user's ability to *connect*, *speak*, *innovate*, *share*, *choose*, and *trust* are core considerations for evolving IoT laws and regulations that enable user rights.

Emerging Economy and Development Issues

Emerging Economy and Development Issues

- **Infrastructure resources**
- **Investment**
- **Technical and Industry Development**
- **Policy and Regulatory Coordination**

Closing Thoughts

- IoT is happening now, with tremendous transformational potential
- But the challenges must be addressed to realize the opportunities and benef
  - 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.

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