

Project	IEEE 802.24 Vertical Applications Technical Advisory Group	
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Source	802	Bob Heile
Re:	<i>What Happens When Net Neutrality and the Internet of Things Collide?</i>	
Abstract	IoT in respect of IEEE 802	
Purpose	IoT overview and where IEEE 802 stands	
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What Happens When Net Neutrality and the Internet of Things Collide?

Briefing from the IEEE

25 September 2015

Agenda

- Introduction—*Karen Bartleson, IEEE Standards Association Past President*
- IEEE Internet of Things (IoT) Initiative—*Geoff Mulligan, IEEE IoT Initiative*
- IEEE P2413 and IEEE Internet Initiative—*Oleg Logvinov, Chair, IEEE Internet Initiative and IEEE P2413 Working Group*
- IEEE 802 IoT activities—*Bob Heile, Founding Member, IEEE 802.11 and IEEE 802.15 Working Groups*
- IoT and Net Neutrality: Is There a Conflict?—*Richard Bennett, Former Vice-Chair, IEEE 802.3 1BASE5 Task Group*
- Q&A
- Conclusion—*Karen Bartleson*



IEEE Internet of Things (IoT) Initiative

Geoff Mulligan

Chairman LoRa Alliance, Founder/Exec Dir IPSO Alliance

Creator 6LowPAN

Former Presidential Innovation Fellow – Cyber-Physical Systems

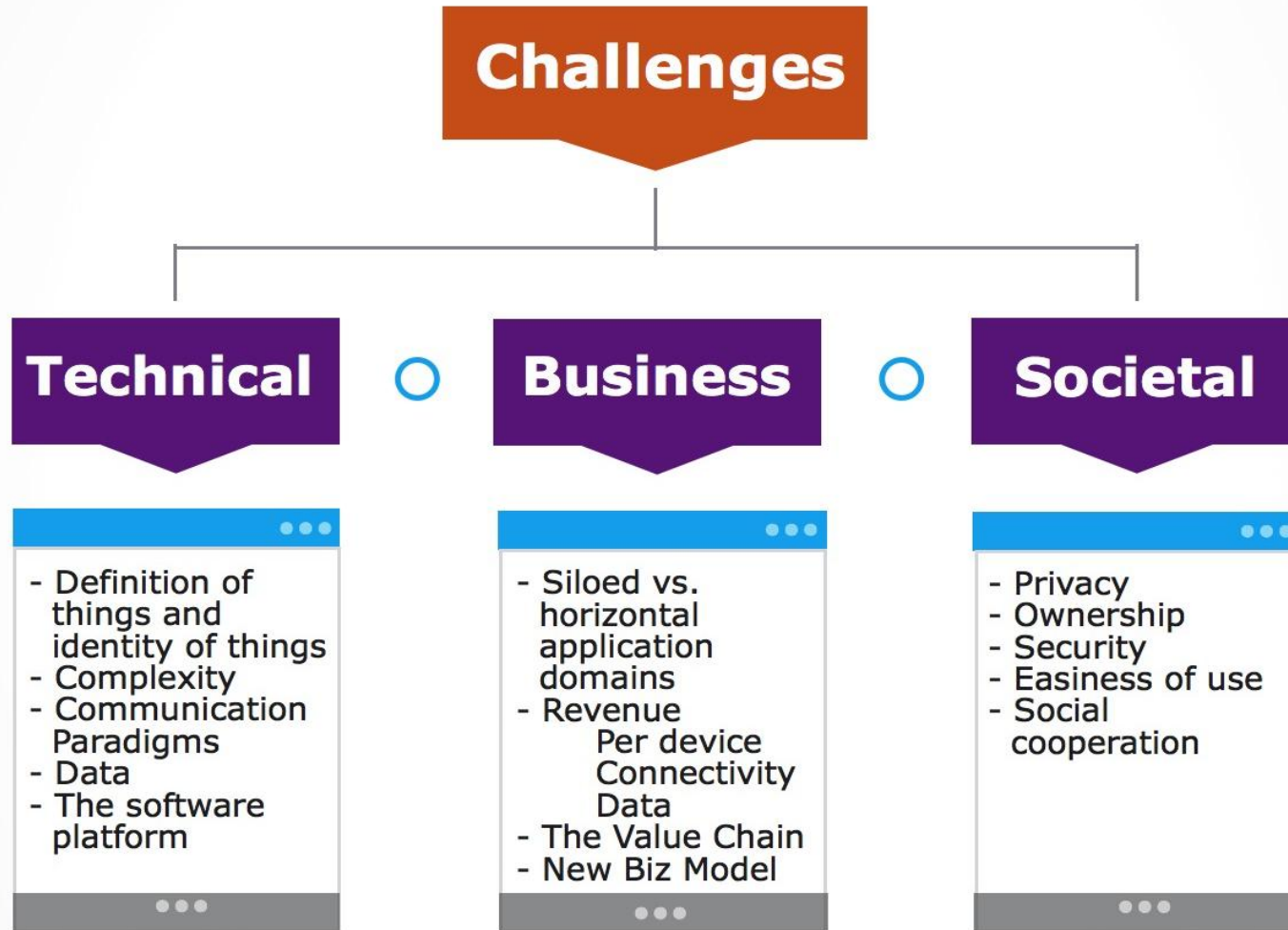
The Global Internet of Things

The sweeping convergence of technologies, markets, applications, and the Internet through the IEEE Future Directions Internet of Things (IoT) Initiative



Helping Accelerate Deployments & Adoption Rates

IEEE IoT is providing a robust platform for solving issues in these areas



IEEE IoT Brings People Together: Events

IEEE World Forum IoT Conference 2014

- ▣ Inaugural event March 2014; Seoul, South Korea
- ▣ Attendees and Representation from 60+ global organizations



IEEE World Forum
on Internet of Things
14-16 December, 2015 // Milan, Italy

IEEE.org | IEEE Xplore Digital Library | IEEE Communications Society | IEEE Spectrum Online | More IEEE Sites

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KEYNOTE SPEAKER:
Vinton G. Cerf

CALL FOR SUBMISSIONS >> COMMITTEE >> MEDIA CENTER >>

- IEEE World Forum IoT Conference 2015
- 14-16 December 2015; Milan, Italy
- <http://www.ieee-wf-iot.org/>

Multitude of IoT Alliances and SDOs

Alliances

Allseen, IIC, IPSO, LoRa, OIC, OMA, Thread, Zigbee, ZWave

SDOs

IEEE, IETF, ETSI, ISO, IEC, ITU

It is necessary to bring some order to this or fail because of FUD.

Some Top Issues

- Interoperability
- Privacy AND Security (not the same thing)
- Identity
- Life-cycle Management
- Data Ownership
- Net-Neutrality



IEEE Internet Initiative

Oleg Logvinov

Chair, IEEE Internet Initiative

Chair, IEEE P2413 Working Group

Director, Special Assignments, I&PC Division, STMicroelectronics

Creating an Ecosystem Through Standards: IEEE P2413 and IEEE 802

P2413

This draft standard defines an architectural framework for the Internet of Things (IoT), including descriptions of various IoT domains, definitions of IoT domain abstractions, and identification of commonalities between different IoT domains.

802

This collection of working groups are defining the lower layers for interoperable networked devices that can support the IoT.

From Internet of Computers to IoT

- New technology policy challenges are emerging in cybersecurity, privacy and Internet governance
- Ongoing Internet innovation, sustainability and market growth depend on informed Internet policy
- Effective Internet public policy relies on sound, neutral technical guidance



Connecting Technical and Policymaking Communities

- ▶ The IEEE Internet Initiative connects the technical community to policymaking for Internet governance, cybersecurity and privacy, both at a global and local level in order to:
 - Inform debate and decisions
 - Ensure trustworthy technology solutions and best practices
- ▶ The IEEE Internet Initiative facilitates the engagement of technology, industry and policy experts in a neutral environment for the collective benefit of all stakeholders





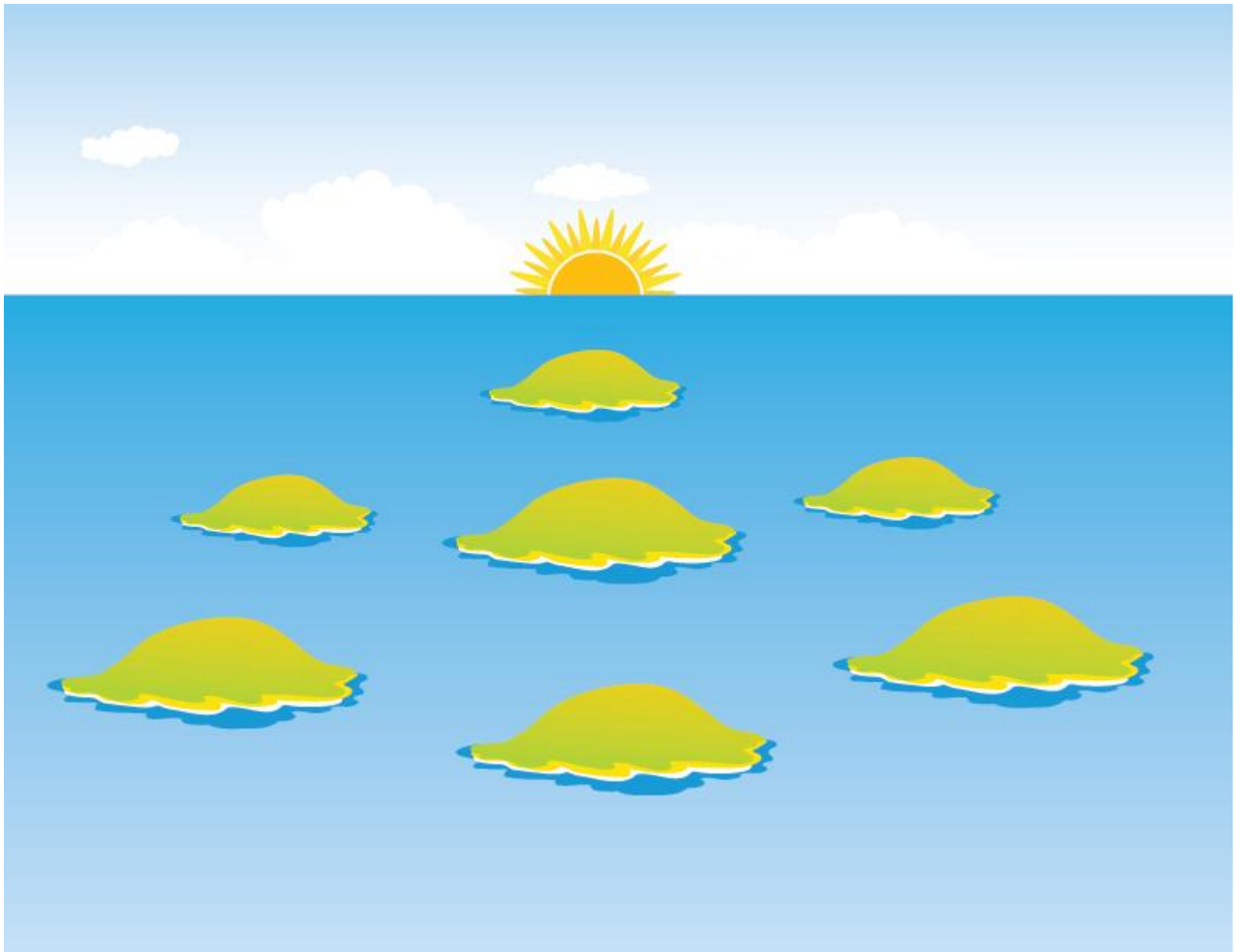
IEEE P2413 Draft Standard for an Architectural Framework for the IoT

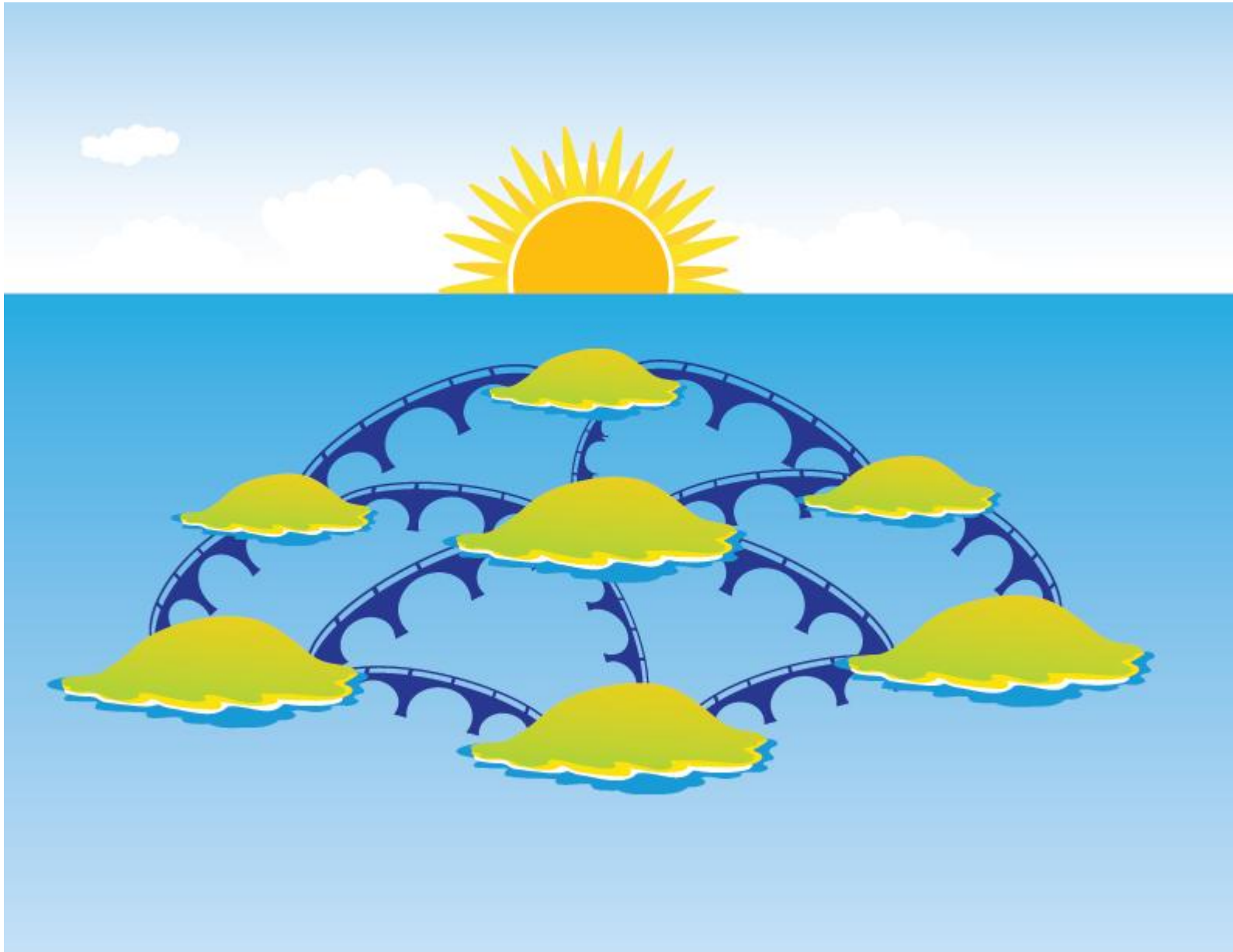
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Chair, IEEE Internet Initiative

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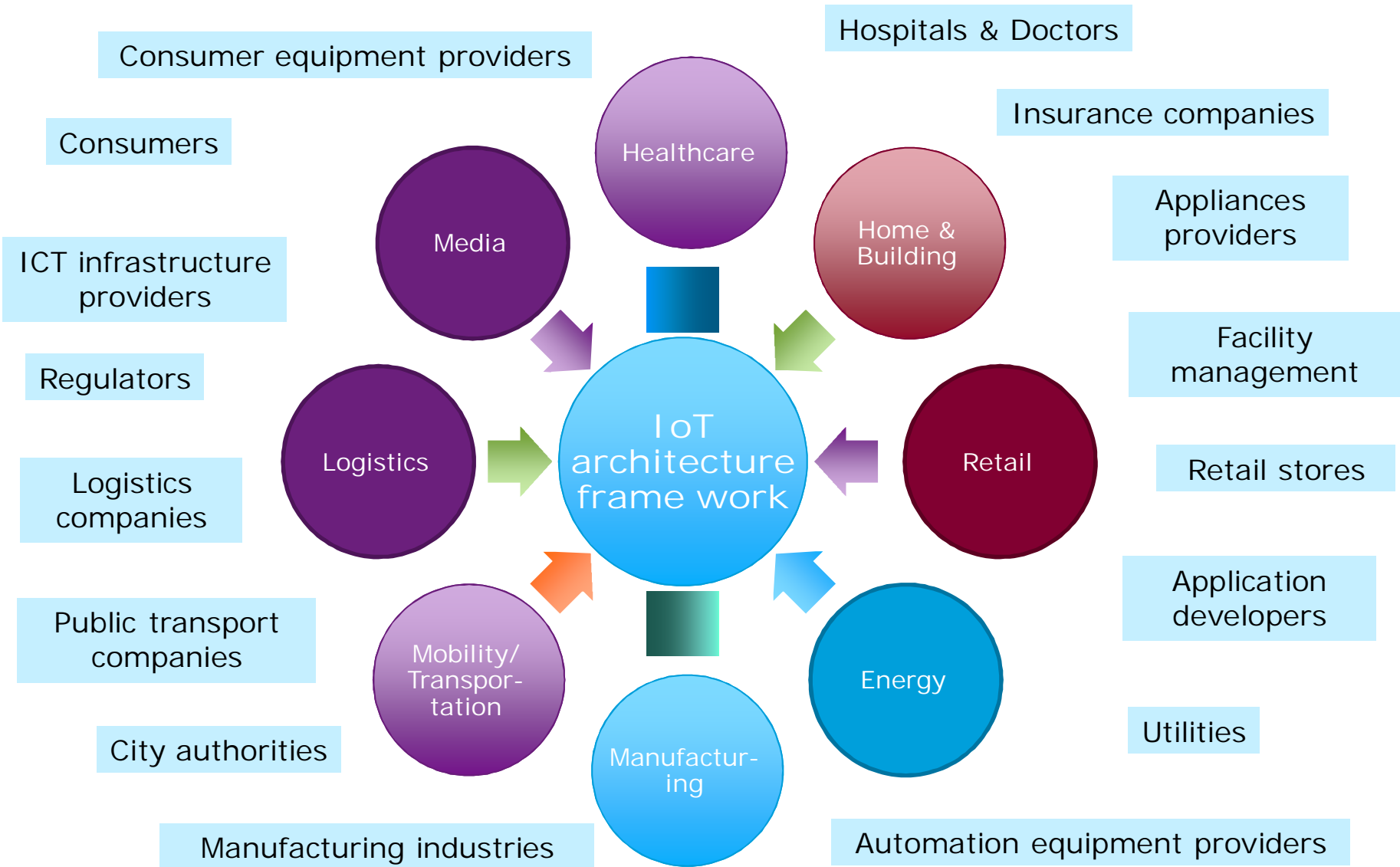


The Birth of IEEE P2413

- P2413 is an outgrowth of a multi-year series of IoT Standards workshops and roundtables to understand requirements by vested stakeholders in the evolving IoT environment.
- P2413 was initiated through the guidance of the IEEE-SA's Industry Strategic IoT Team with a focus to integrate market needs with the developing IoT technology landscape.
- The IEEE-SA Corporate Advisory Group (representing 200+ industry members) provides sponsorship for P2413 to maintain a balanced focus on industry / market / technology and standards eco-system requirements within the development framework.

IEEE P2413 Goals

- Accelerate the growth of the IoT Market by enabling cross-domain interaction and platform unification through increased system compatibility, interoperability and functional exchangeability
- Define an IoT architecture framework that covers the architectural needs of the various IoT Application Domains
- Increase the transparency of system architectures to support system benchmarking, safety, and security assessments
- Reduce industry fragmentation and create a critical mass of multi-stakeholder activities around the world
- Leverage the existing body of work

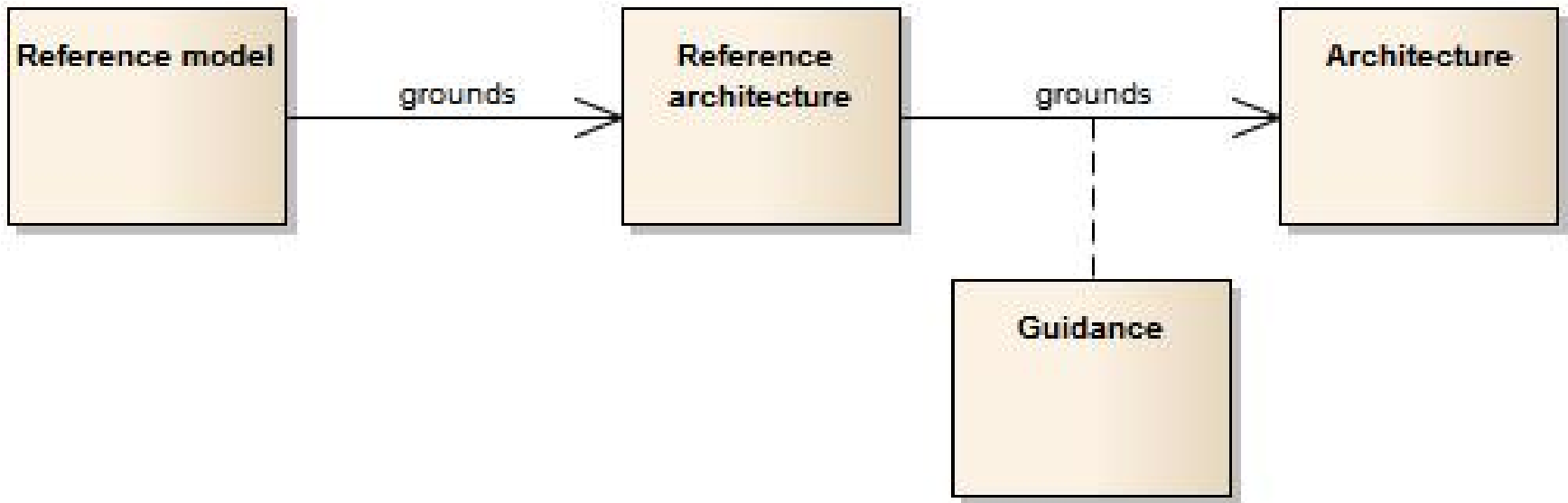


*due to the diversity of IoT application areas only selected domains and stakeholders are shown

IEEE P2413 Scope

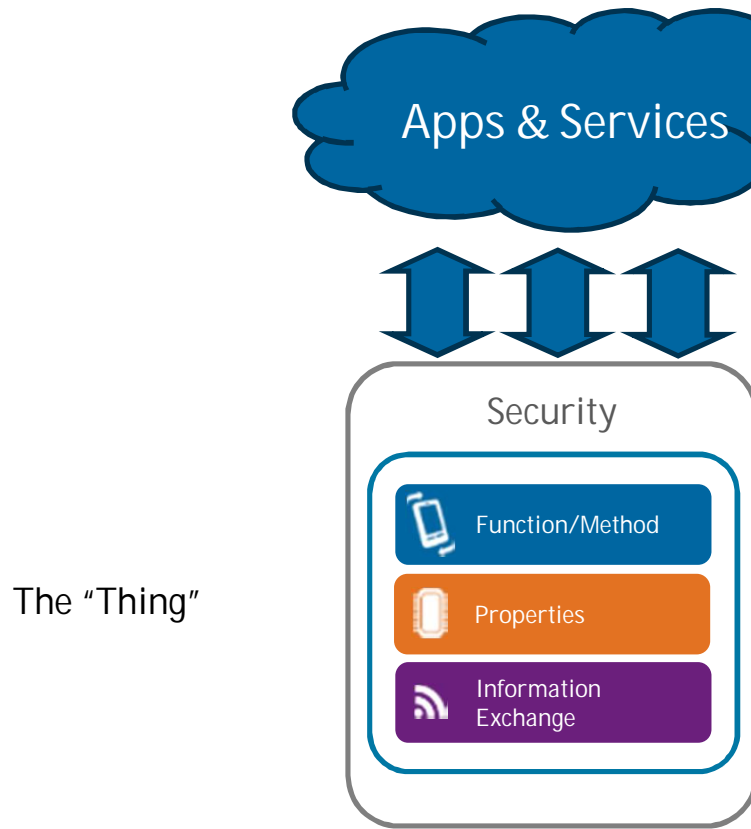
- This standard defines an Architectural Framework for the IoT, including descriptions of various IoT domains, definitions of IoT domain abstractions, and identification of commonalities between different IoT domains.
- The Architectural Framework for IoT provides:
 - reference model that defines relationships among various IoT domains (e.g., transportation, healthcare, etc.) and common architecture elements
 - reference architecture that:
 - builds upon the reference model
 - defines basic architectural building blocks and their ability to be integrated into multi-tiered systems
 - addresses how to document and mitigate architecture divergence.
 - blueprint for data abstraction and the quality "quadruple" trust that includes protection, security, privacy, and safety.

IEEE P2413 Structure



IEEE P2413 Definitions

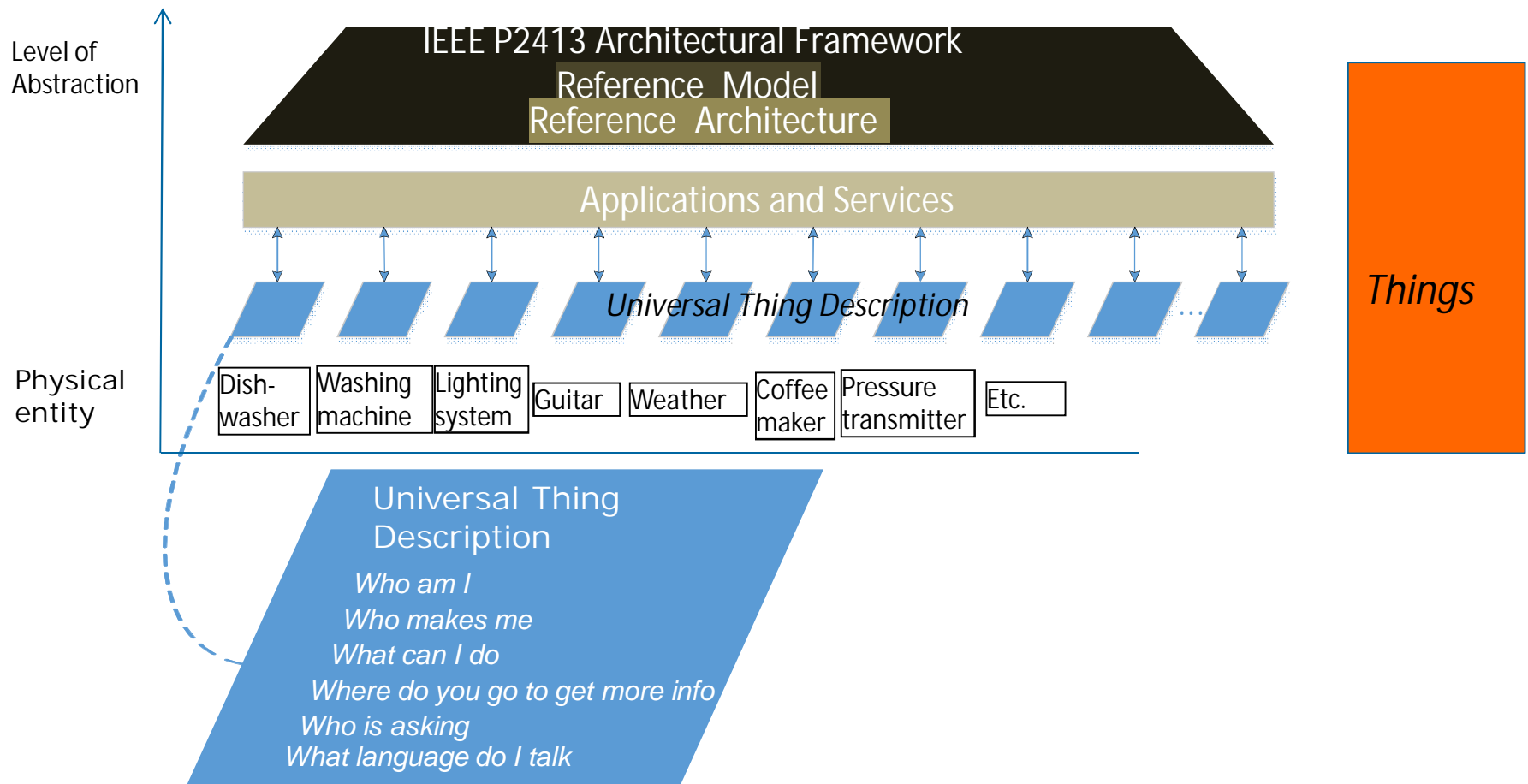
- The Group accepted the definition of the “Thing”:



Notes:

- Things, Apps, and Services can be integrated into what would be abstracted as a “Thing”
- Information exchange could be “horizontal” (subscribe/publish as an example) or vertical, or both
- Properties could be real or virtual

IEEE P2413 Levels of abstractions



IEEE P2413 Membership

1. Cisco Systems
2. dZhON Pty. Ltd.
3. Emerson
4. EPRI
5. General Electric
6. Hitachi, Ltd.
7. Honeywell International
8. Huawei Technologies
9. Infocomm Development Authority (IDA)
10. Intel
11. Institute for Information Industry (III)
12. Kaspersky Lab
13. NIST
14. Qualcomm Inc.
15. Renesas
16. Rockwell Automation
17. Schneider Electric
18. Senslytics
19. Siemens AG
20. SIGFOX
21. STMicroelectronics
22. Toshiba Corporation
23. Wipro
24. Yokogawa Electric Corporation
25. ZTE

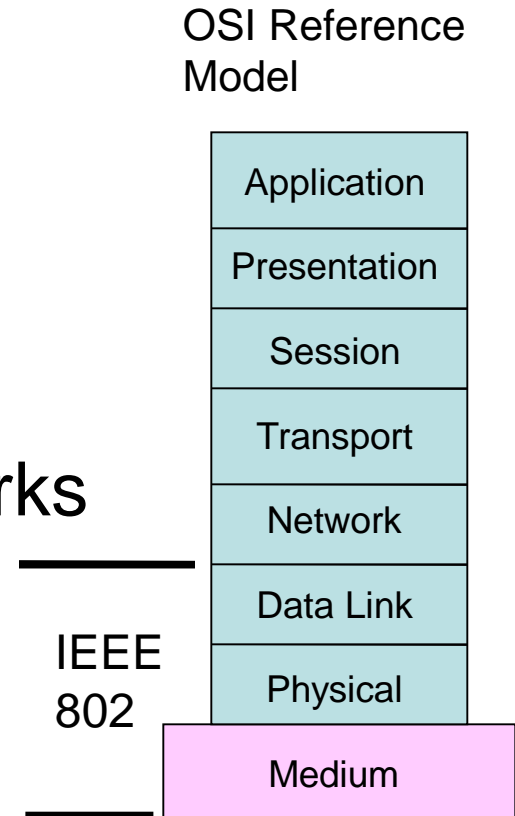


IEEE 802 IoT Activities

Bob Heile, Chair IEEE802.15

What IEEE 802 Is--

- IEEE Project 802 LAN/MAN Standards Committee (aka IEEE 802 or LMSC)
 - Develops standards for Local and Metropolitan Area Networks
 - Mainly for link and physical layers of the network stack
 - Started work in March 1980



IEEE 802 Organization

EXECUTIVE COMMITTEE (EC)

CHAIR
Paul Nikolich

Working Group/TAG Chairs

802.1
High Level
Interface
Glenn Parsons

802.3
Ethernet
David Law

802.11
WLAN
Adrian
Stephens

802.15
WPAN
Bob Heile

802.16
BWA
Roger Marks

802.18 TAG
Radio Regulatory
Mike Lynch

802.19
Coexistence
Steve
Shellhammer

802.21
Media indep.
handover
Subir Das

802.22
WRAN
Apurva Mody

802.24
Vertical
Applications
Tim Godfrey

Privacy
Recomendation
Study Group
Juan Carlos Zuniga

Hibernating WG Chairs (non voting)

802.17
Resilent Packet
Ring
John Lemon

802.20
MBWA
Radhakrishna
Canchi

Appointed Officers

1st VICE CHAIR
Pat Thaler

2nd VICE CHAIR
James P.K. Gilb

EXECUTIVE SEC
Jon Rosdahl

RECORDING SEC
John D'Ambrosia

TREASURER
Clint Chaplin

Appointed Officers (non voting)

**MEMBER
EMERITUS**
Geoff Thompson

DISBANDED

802.2 LLC

802.6 DQDB

802.9 ISLAN

802.14 CATV

802.4 Token Bus

802.7 Broadband TAG

802.10 Security

802.23 Emergency Services

802.5 Token Ring

802.8 Fiber Optic TAG

802.12 Demand Priority

All those dots....decoder ring

- 802.1 Bridging and Architecture – generally the top of the link layer
- 802.3 Ethernet
- 802.11 Wireless LAN (WLAN)
- 802.15 Wireless Specialty Networks (WSN)
- 802.16 Broadband Wireless Access (BWA)
- 802.18 Radio Regulatory TAG
- 802.19 Coexistence
- 802.21 Media Independent Handover
- 802.22 Wireless Regional Area Networks (WRAN)
- 802.24 Smart Grid TAG



What IEEE 802 Has Done

- IEEE 802 is probably best known for:
 - Ethernet (802.3)
 - WiFi (802.11)
 - Bluetooth (802.15.1)
 - And to a rapidly growing degree, 802.15.4 used by multiple IoT Industry initiatives such as Thread, Wi-SUN, and ZigBee, to name a few.



IEEE 802 IoT Activities-Overview

- As a general statement, most all networking technologies have potential use somewhere in the Internet of Things including all those developed in IEEE 802.
- Beyond that, 802 has (and continues) to work on several projects seeking to address specific IoT problems/needs in an optimal way
- While IoT is most strongly associated with wireless communications, wired is also an essential component
- The following slides highlight a few of both in 802

IEEE 802 IoT Activities

A word about Wired v. Wireless

- The whole of any networking solution can't work without a core infrastructure any more than leaves can work without the branches and trunk of the tree under them.
- Wired (i.e. copper and fiber) infrastructure, be it twig or trunk is an essential element of IoT as a system.
- 802.3 is dedicated to providing that core infrastructure.

IEEE 802 IoT Activities-802.1

- 802.1 is working on a local addressing project (802c) to deal with scaling to much larger numbers of ports to handle the expected large numbers of things
- 802.1 is also working on Privacy issues (802E)-- specifically looking at Privacy concerns applicable to Internet protocols and IoT, and will be providing suggestions on how IEEE can help address them.
- The 802E work is also relevant to projects like 802c (local address usage) and to new groups that are starting to take privacy recommendations into account for defining requirements of new wireless technologies for IoT.

IEEE 802 IoT Activities-802.3

- 802.3 is working on single pair systems to provide lower cost wired connections for IoT especially for things on vehicle platforms.
- From a legacy perspective, 802.3 has defined Power over Ethernet (PoE) and Power over Data Links (PoDL, pronounced "poodle") for single pair, both of which are useful for powering things in a wired IoT
 - The P802.3bt DTE Power via MDI over 4-Pair will provide at least 49 Watts.
 - For example, LED lighting can get both power and control over the Ethernet.
- Additionally, 802.3 provides
 - the backbone infrastructure for the Internet including IoT
 - the (ever improving) wired connections for end stations
 - the main method to avoid the security and spectrum utilization issues of wireless IoT connections

IEEE 802 IoT Activities-802.11

- 802.11ah is intended specifically to address IoT “sensor” like devices. Areas of optimization include:
 - Operating in the 900 MHz frequency band, it achieves longer range, but provides relatively low data rates suitable for IoT
 - Achieving enhanced power-savings based on better coordination between AP and sensor device
 - Efficiently supporting short data exchanges since data exchanges in an IoT network are typically short.
 - Operating efficiently when there is a large imbalance between AP and non-AP device transmit power and receive sensitivity.

IEEE 802 IoT Activities-802.11

- Additionally there is a “Long-range, Low-power” initiative in 802.11 (currently in its very early days)
 - Will look to extend the range and reduce power consumption, both of which are important for IoT devices
 - It is too early to know what technical approaches will be used, but it is likely to be an optional feature added to 802.11ax, which will be the next “must have” release (i.e. after 802.11ac).
 - Will likely build on the OFDMA features of 802.11ax to provide long range and low power using narrow channels and other PHY techniques.

IEEE 802 IoT Activities-802.15

■ 802.15.4 was developed specifically for IoT.

It provides:

- A very low energy per payload bit ratio (ie very battery or harvested energy friendly)
- Data rates appropriate for IoT rather than streaming HD video
- Very low cost to implement as a consequence
- Support for easy mesh networking
- Support for location based services
- Widely adopted by multiple IoT centric Industry Groups such as Thread, Wi-SUN, and ZigBee

IEEE 802 IoT Activities-802.15

- 802.15.7 is a standard for Optical Wireless Communications. It provides
 - A simple secure non RF method for Things to communicate, particularly mobile devices
- 802.15.10 Layer 2 Routing. It provides
 - An integrated layer 2 method to mesh network in 15.4, essential for large scale self organizing IoT networks
- Plus many more targeted IoT optimization projects

IEEE 802 IoT Activities-Other Areas

- 802.16 is crafting a proposal to apply the 4G WirelessMAN-OFDMA standard to narrowband applications relevant to smart grid and other utility IoT applications.
- IEEE 802 and IETF are collaborating on Internet Privacy
 - With new technologies showing up (e.g. IoT, wearables, etc.), users will become more prone to privacy attacks
 - Privacy concerns are therefore more and more relevant when defining new technologies and regulations to protect users of these new technologies.
 - Goal of this collaboration is to make the Internet more secure and protect users against criminal, commercial or national entities performing illegal or privacy-unfriendly practices.

IEEE 802 IoT Activities-Conclusion

- This is just the tip of the iceberg in a large body of IoT applicable networking work ongoing in IEEE 802.
- Bottom line: In addition to what it has already done and continues to do, IEEE 802 is highly responsive to the market and will efficiently produce high quality technical specs in response to IoT market drivers.



Net Neutrality and IoT: Is there a conflict?

Richard Bennett
Founder, High Tech Forum
Visiting Fellow, American Enterprise Institute
IEEE Standards Veteran

IoT Poses a Number of Challenges

- ▶ Security
- ▶ Privacy
- ▶ Commercial Relationships
- ▶ Network issues:
 - Performance (capacity, loss, delay)
 - Reliability (MTTF & MTTR)
 - Economics
 - Coverage
 - Upgrade cycle

IoT Applications are diverse

- Traditional Internet applications are highly uniform from the traffic perspective
 - Class 1: File transfers, web sites, and video streaming
 - Class 2: Real-time conferencing, Skype, Telepresence
- Net neutrality addresses intra-class discrimination, but leaves inter-class discrimination open
- IoT adds new classes:
 - Real-time control and reports
 - Logging, other modes not well understood

Defining Net Neutrality

- ▶ *Network Neutrality, Broadband Discrimination* posits two zones of network operation:
 - QoS discrimination permitted inside broadband networks
 - Discrimination is not permitted through Internet
- ▶ This distinction is now widely accepted:
 - Majority's Internet regulation bills ban paid prioritization
- ▶ But we have a boundary problem:
 - Specialized Services, Non-BIAS data service exceptions

Boundary Questions

- ▶ How do policy makers protect traditional apps while enabling new classes of apps?
- ▶ Can networks satisfy emerging requirements by focusing on capacity (“speed”) alone?
- ▶ Is there friction between capacity & QoS/QoE?
- ▶ Does a QoS market encourage scarcity?
- ▶ Suggestion: Quality is the fundamental network service, and adverse impact is the fundamental risk.

Q&A

□ Thank you for your interest in this briefing!