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Standard for an Architectural Framework for the Internet of Things

IEEE P2413

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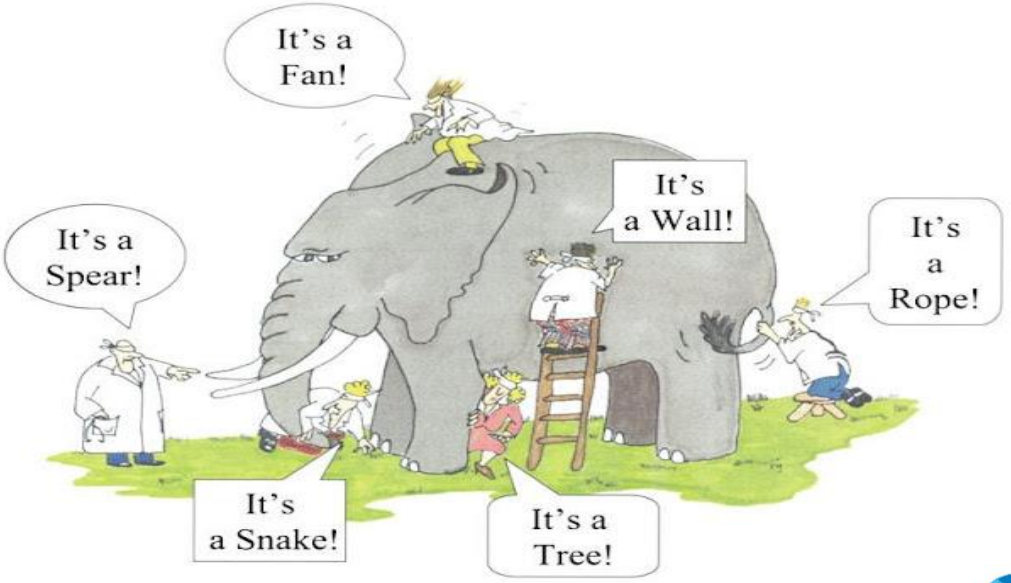
IEEE GlobeCom
Austin, Texas
December, 2014

IoT – The Internet of Things

A Concept viewed from multiple perspectives

but dependent on the integration and evolution of multiple technologies



IoT Definitions

Varied But Consistent:
Globally integrated technology delivering integrated services

IEEE-SA

- **IoT refers to any systems of interconnected people, physical objects, and IT platforms, as well as any technology to better build, operate, and manage the physical world via pervasive data collection, smart networking, predictive analytics, and deep optimization.**

JTC 1

- **An infrastructure of interconnected objects , people, systems, and information resources together with intelligent services to allow them to process information of the physical and virtual world and to react.**

ITU-T

- **A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies**

IETF

- **A world-wide network of interconnected objects uniquely addressable, based on standard communication protocols**

Gartner

- **The Internet of Things is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.**

IoT:
The Timing is Right

IoT concept began when more "things or objects" were connected to the Internet than people, and challenges to global implementation began to be addressed.

25 billion active devices connected to the Internet by 2015 and

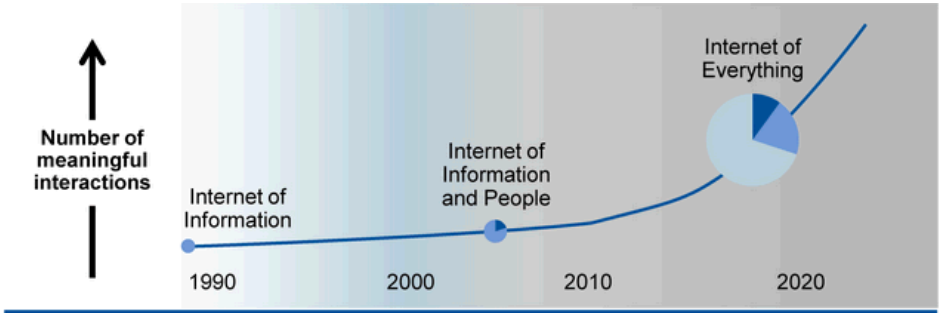
50 billion active / 300 billion passive devices by 2020

(excluding further rapid related advances in Internet or device technology)

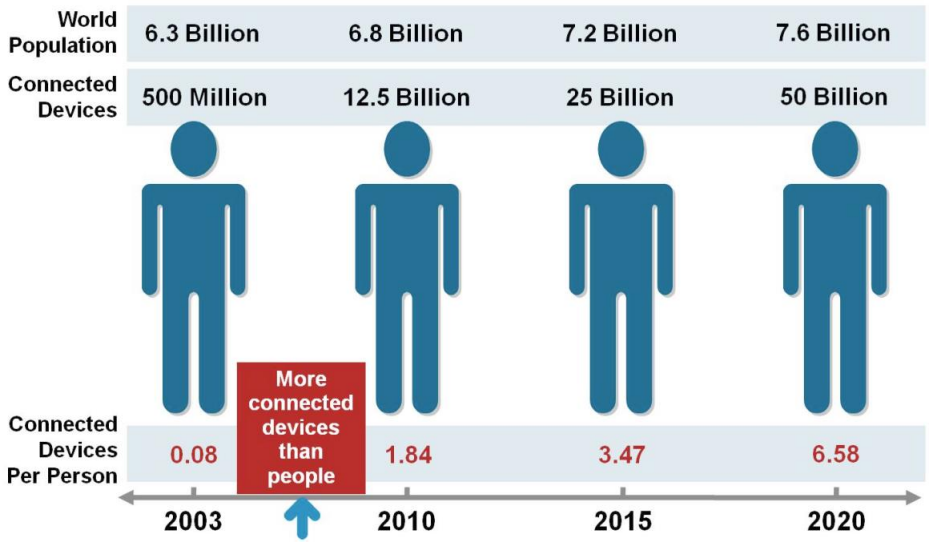
"THREE" challenges to moving forward with a productive IoT environment

- Pervasive Connetivity => IPv6
- Sensor energy => Power Sustainability
- **Standards => architecture , security, privacy, analytics(big data), communications, distributed intelligence, and domain integration.**

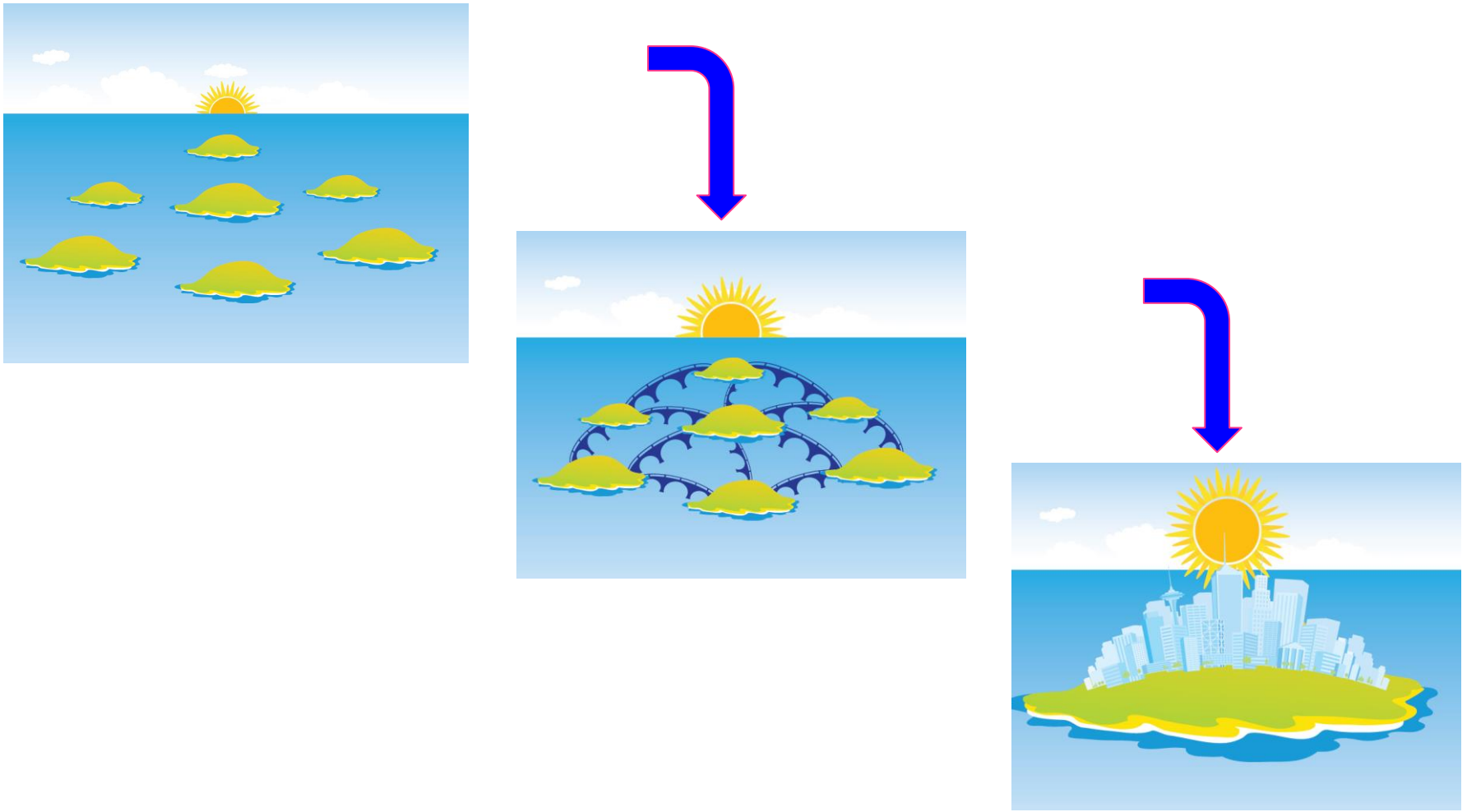
IoT Projections Support a Pervasive and Ubiquitous Environment



Key milestones	> 50% of Internet connections are things	Things create more traffic than information and people
Number of permanently Internet-connected devices	> 15 billion	> 30 billion
Number of intermittently Internet-connected devices	> 50 billion	> 200 billion
Volume of traffic from things	Minority	Majority



IoT: The Infrastructure Supporting Intelligent Evolution - Independent Domains to Integrated Domains to Integrated Environments



IoT Becomes the Future –
Standards & Technology Integrated with Global Priorities Become the Pathway to the Marketplace Acceptance

Technology and Application Alignment

Integrated Cross Domain Implementation Platforms

Regional / Governmental / Regulatory Priority Coordination

Recognized "Secondary" markets driven by big data re-use and data analytics

Customer and Consumer Confidence

The Birth of the 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-SA Internet of Things

IEEE Internet of Things

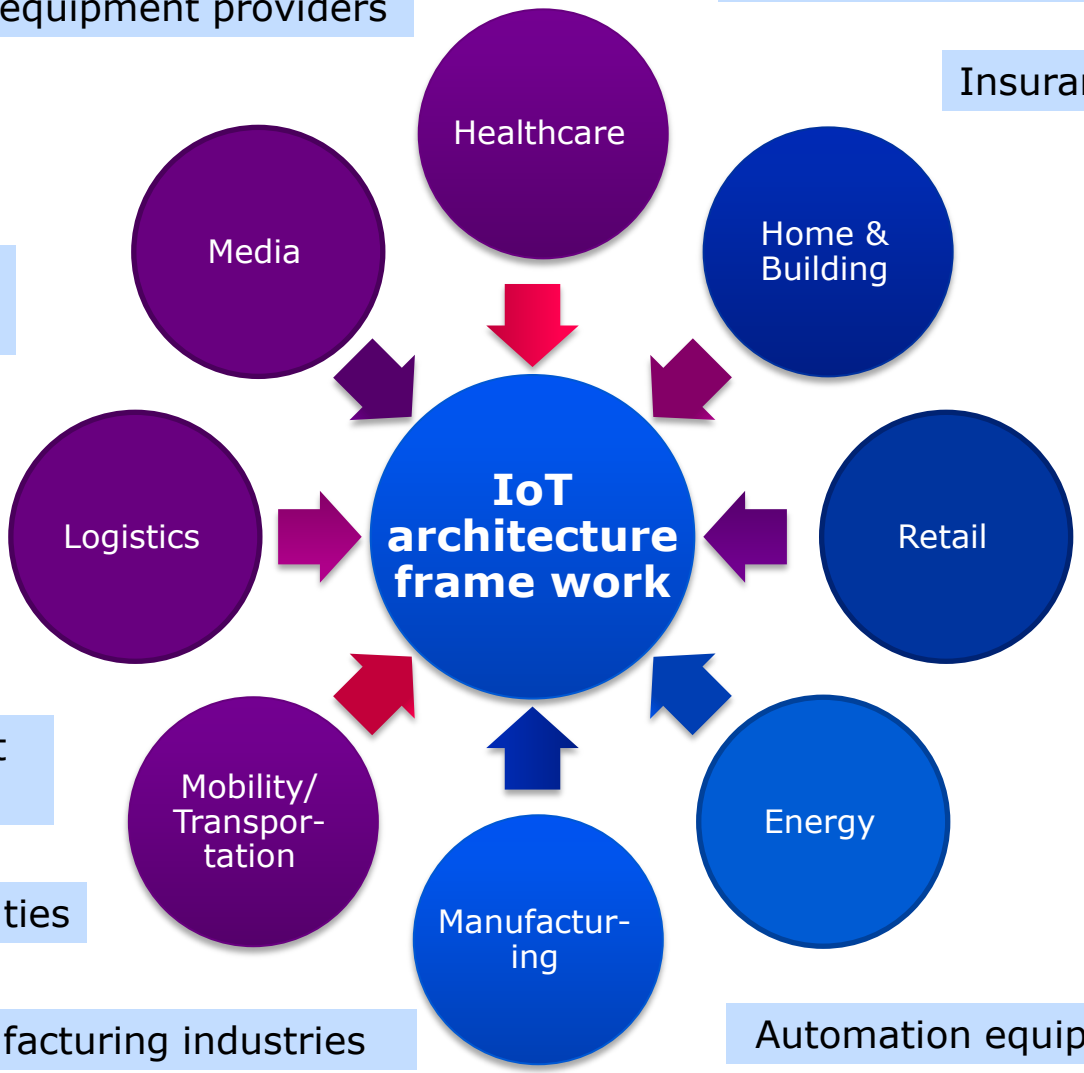
Worldwide IoT Workshops

- 2012: Beijing, China and Milan, Italy
- 2013: Shenzhen, China and Mountain View, CA, USA
- 2014: IEEE IoT World Forum, Seoul, Korea (6-8 Mar)
- 2014: 18-19 September in Mountain View, California

Hosting IoT industry roundtables and webinars

- 2012: Milan Roundtable
- 2013: Roundtables in Korea and USA
- 2014: Webinars introducing IEEE P2413
- 2014: Industry roundtables in US, Europe, and Asia

IoT Application Domains & Stakeholders*



Consumer equipment providers

Consumers

ICT infrastructure providers

Regulators

Logistics companies

Public transport companies

City authorities

Manufacturing industries

Hospitals & Doctors

Insurance companies

Appliances providers

Facility management

Retail stores

Application developers

Utilities

Automation equipment providers

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

IEEE P2413 Purpose and Motivation

- The Internet of Things (IoT) is a key enabler for many emerging and future "smart" applications and technology shifts in various technology markets. This ranges from the Connected Consumer to Smart Home & Buildings, E-Health, Smart Grids, Next Generation Manufacturing and Smart Cities. It is therefore predicted to become one of the most significant drivers of growth in these markets.
- Most current standardization activities are confined to very specific domains and stakeholder groups. They therefore represent islands of disjointed and often redundant development. The architectural framework defined in this standard will promote cross-domain interaction, aid system interoperability and functional compatibility, and further fuel the growth of the IoT market.

IEEE P2413 Goals
A Market Driven Architecture

- 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

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.

P2413 Methodology

Identify commonalities within verticals and potentially among certain verticals

Address relationships among security requirements, energy efficiency during data transmission (communication), service requirements, application aware routing (including security requirements), versus underlying network technologies.

Link features and components in existing standards to a top-down view of relevant IoT aspects, features and components, embodied in an IoT architectural framework.

Identify design choices for IoT .

Match requirements within a specific domain structures to relevant design choices.

Develop domain profile structures, and liaise with vertical standards groups to evaluate areas such as data models.

Bridge and leverage standardization landscape, identifying relevant features and functionalities in other standardization related activities.

IEEE P2413 External interactions

- For a unified IoT Architectural Framework it is essential to interact with standardization activities for IoT-based vertical applications to
  - Cover the various applications, their requirements and specific IoT functionalities in the IoT Architectural Framework
  - Ensure that the framework can be referenced by these standardization activities
- Besides interactions with standardization activities within IEEE, P2413 will strive to establish liaisons with other standardization bodies.
- An initial set of liaisons will include IEEE 802.24, IEC SG8, and oneM2M

IEEE P2413 Membership

- Alcatel-Lucent
- Broadcom Corporation
- Cisco Systems
- dZhON Pty. Ltd.
- Emerson
- General Electric
- Hitachi, Ltd.
- Huawei Technologies
- Infocomm Development Authority (IDA)
- Institute for Information Industry (III)
- Marvell Semiconductor, Inc.
- Oracle
- Qualcomm Inc.
- Rockwell Automation
- Schneider Electric
- Siemens AG
- STMicroelectronics
- Toshiba Corporation
- Wuxi Sensing Net Industrialization Research Institute
- Yokogawa Electric Corporation
- ZigBee Alliance

IEEE P2413 Organization

- To accelerate the development process P2413 has launched a number of Sub-Working Groups and Ad Hocs and is evaluating future liaisons.
  - Sub-Working Groups:
    - Scope and Applicability
    - Standardization Landscape
    - Networking
  - Ad Hocs
    - oneM2M review
- Work completion timeline: 2016

IEEE P2413 Working Group Meetings

- First WG Meeting:
  - 10-11 July 2014
  - Hosted by Siemens in Munich, Germany
- Second WG Meeting:
  - 16-17 September 2014
  - Hosted by STMicroelectronics in Santa Clara, CA USA
- Third WG Meeting:
  - Teleconference, 28 October 2014
- Fourth WG Meeting:
  - Teleconference, December 2014
- Fifth WG Meeting:
  - 22-23 January in Taipei
- Sixth WG Meeting:
  - 27-28 April, Europe
- Seventh WG Meeting:
  - August, USA (TBD)

P2413 – Conclusions

- P2413 recognizes the evolving transformational integration and convergence across technology and application domains.
- P2413's goal is to provide an extensible integrated architectural framework that will continue to evolve and unify the standards creation effort.
- P2413 will continue to deepen industry engagement by leveraging global IoT workshops, webinars, roundtables and other tools of the IEEE IoT Initiative.
- P2413 is an open community and all are welcome to participate and to share perspectives on addressing and preparing for the inter-connected world of 2020.

Thank You!

Join us!

Join the IEEE P2413 Working Group
http://grouper.ieee.org/groups/2413/

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