

IEEE SDN-IoT Workshop

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Internet of Things – Introduction



The Internet of Things (IoT) is the network of physical objects that contains embedded technology to communicate and sense or interact with the objects' internal state or the external environment.*

IoT Business Opportunity

Predicted revenue verticals



- Interoperability required to capture 40% of total value
- < 1% of data from devices or sensors currently used (more can be used for optimization & prediction)

IoT Units Installed Base by Category

Category	2015	2016	2020
Consumer	3023	4024	13509
Business Cross Industry	815	1092	4408
Business: Vertical-Specific	1065	1276	2880
Grand Total	4902	6392	20797

IoT Players in the Value Chain – Industry Trends



IoT Consortiums Landscape





 Focuses on creating frameworks, use cases & test beds for real-world apps across various industrial environments



 Address need for a common M2M Service Layer that can be readily embedded within various hardware and software



 Alliance seeking to establish IP as basis for connection of Smart Objects

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Open Interconnect Consortium Evolved to Open Connectivity Foundation (OCF)

IoTivity Technology Stack – Technical View

IoT Profiles



- Common Solution
- Established Protocols
- Security & Identity
- Standardized Profiles
- Interoperability
- Innovation Opportunities
- Necessary connectivity

IoTivity Topologies Supported



Key Standards used in IoTivity



What's hindering IoT?



Software-Defined Networking (SDN) to IoT

Separation of Control and Data Plane Heterogeneity in IoT Networks Network controlled by SW Applications; suitable Lack of open IP-Based Connectivity; delay in IPv6 backbone for mobile network deployment • Uses general purpose hardware and commodity • Efficient protocol and topology to form Heterogeneous servers Mesh Networks • Enables automated, policy-based control of even Objects and protocols have specific design; forcing them to massive network fit with common and singular protocol not good option. **Abstraction of Network Devices** • Not reference by individual devices Plug-and-play set up of IoT devices • Automatic remediation of security threats cloud storag Software-defined things (SDT) **Big Data** statistics

Server Virtualization and Connections

- Cloud network; one server acting as multiple servers
- Architecture for network OS with service/application oriented namespace
- Between server: east-west traffic

Edge Computing and Analytics

- Individual nodes and sensors potentially could generate tons of data
- Provisioning of edge computing/analytics turn data into insights

Summary: SDN Benefits to IoT

Data Modeling and Parameters

- Connectivity, Robustness
- Real-time, Delay, Jitter, QoS
- Security, Reliability
- Dynamic Load Management: This enables operators to monitor and orchestrate automatic changes in bandwidth given overall network load. Ideal for global IoT providers readying for exponential increases in devices and data.
- Service Chaining: This enables operators to provision virtual security features like VPNs, firewalls and authentication and fix policy tolerances for performance in line with given subscriber's entitlements. Also, distribution possible for NAT, DPI, Access control etc.
- Bandwidth Calendaring: This allows operators to schedule when and how much traffic a customer or application will need at specific time. Applicable to IoT services as many devices send data periodically only.