Reduce Cost and Complexity of M2M and IoT Solutions via Embedded IP and Application Layer Interoperability for Smart Objects

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www.ipso-alliance.org

IPSO Alliance – "Building a Smarter World through the Internet of Things"™

About IPSO

- The IPSO Alliance serves as a resource center and thought leader for the various communities seeking to establish IP as the foundation for connecting objects, and addressing application needs to turn the objects into Smart Objects.

- The IPSO Alliance is a global collaborative forum, including many Fortune 500 high tech companies, each a leading player in their industry segment. The IPSO Alliance provides a foundation for industry growth by providing education, promoting the industry, generating research, and creating a better understanding of IP and its role in the Internet of Things.

Vision

"Building a Smarter World through the Internet of Things"™

Connecting people, businesses and environments securely and efficiently

Goals

- Promote IP
- Invest in innovation
- Uphold Standards
- Interoperability

M2M Market – A status

- A market still fragmented
  - Vertical solutions
  - Proprietary IT & solutions
  - Technology fragmentation

- Ongoing transition toward horizontal systems
  - Technologies allowing more re-use (devices/applications) are finally available
    - Their deployment will reduce Capex/Opex & TTM
  - Emerging M2M standards are going in this direction, e.g. OMA Lightweight M2M (LWM2M), oneM2M and ETSI M2M

- New challenges are emerging
  - How to manage - and extract value from - huge amounts of data generated by a large number of M2M connected devices
    - Impact: data access, storage, processing, etc…
  - Need to appropriate open applications and development tools
  - Easy integration of the devices and their data into backend systems
  - Application layer interoperability

A Key Technology: The IP Protocol Suite

- The IP protocol suite has proven capabilities of being able to run over any network, securely, and with rapid and ever-innovative applications
  - Open standards
  - Ubiquitous
  - Highly scalable and large address space with IPv6
  - Independent of the physical layer
  - Re-use existing tools, knowledge, protocols, and infrastructure
  - Security protocols already available
- IP for Smart Objects is now possible even in the most constrained environments
  - The IP Stack requires only 4k of RAM, less than 32K of Flash
- Hardware and software available from many vendors
- Embedded RESTful environment available

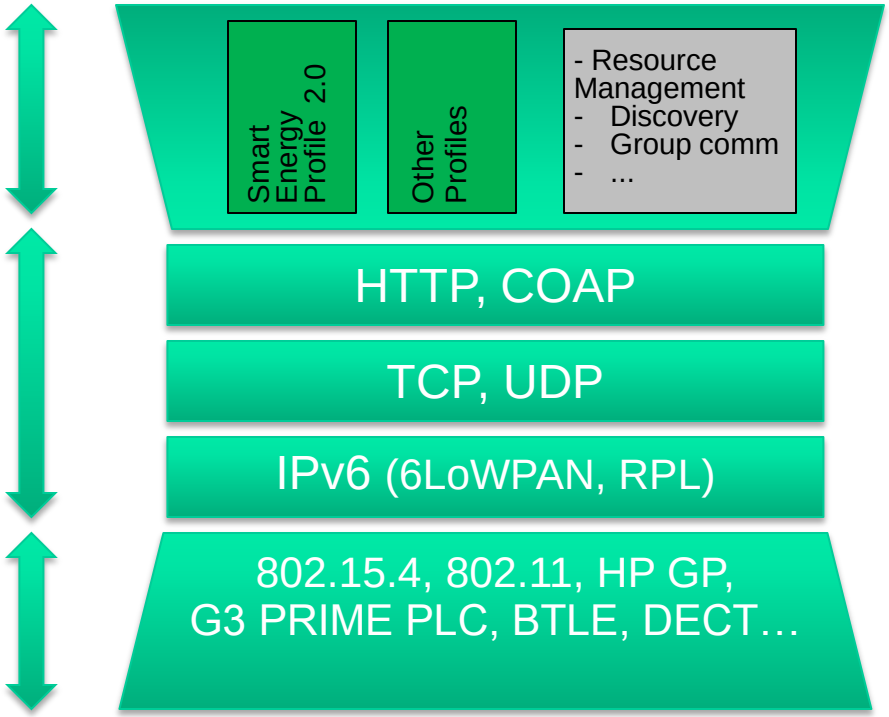
Convergence Towards All-IP

Vertical markets profiles opportunities

Complementary services, e.g. resource discovery

IP stack has become the universal technology for networking and applications

PHY/MACs will remain in continuous evolution based on application and regulatory needs



The IP for Smart Objects Toolbox

- Over the past few years the IETF has developed the needed standards enabling IP based applications on smart objects

- **6LoWPAN** – An adaptation layer to transport IPv6 over low power wireless communication links (RFC 6282 for 802.15.4), support for other links (e.g. DECT ULE, BTLE) is under development at the IETF

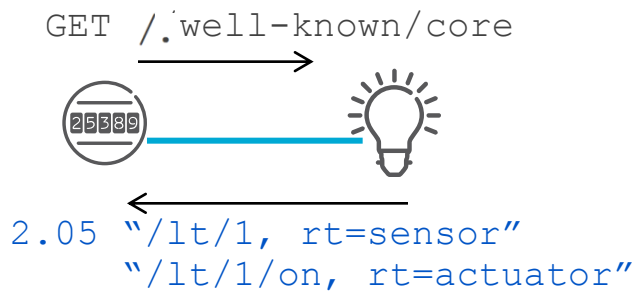
- **RPL** – An IPv6 routing protocol for Low-Power and Lossy Networks (standardized as RFC 6550 (and related), Adopted by SEP 2.0, WAVENIS, P1901.2)

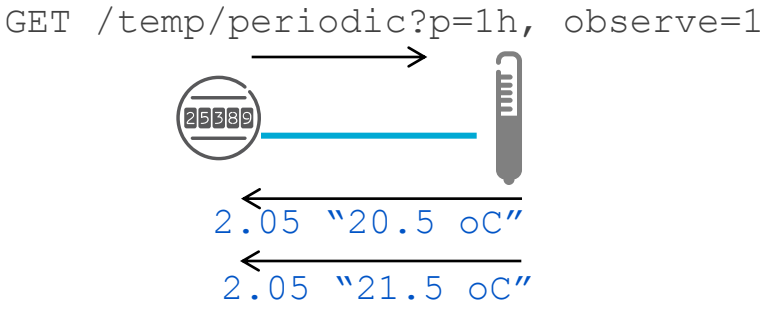
- **Security** – Proven protocols, available at multiple layers above IP, enabling end-2-end security, e.g. TLS and DTLS

- **CoAP** – An application layer protocol for resource-constrained internet devices: new protocol, RESTful, designed for simplified integration of smart objects with the web → Final draft submitted to IESG for publication

Other IETF CoRE work

- CoRE link format
  - Specifies how to link IoT resources
  - Provides a mean for CoAP clients to discover IoT resources on CoAP servers
  - RFC 6690
- Resource Directory
  - Allows CoAP devices to register themselves providing their capabilities
- Observations
  - Allows a client to request data from a server upon a condition or periodically
- HTTP-CoAP mapping guidelines
  - Contains recommendations on how to map or proxy between HTTP and CoAP



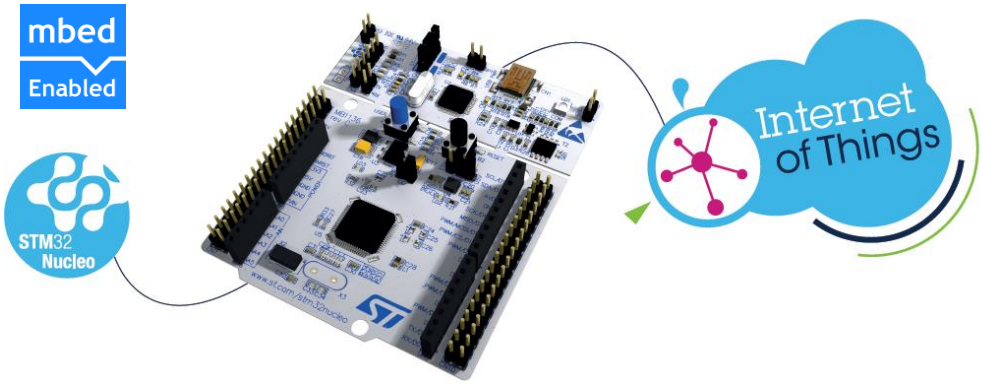


The prospect of Embedded Web Services

- IP-based connectivity is in place
  - Scale of economy, CAPEX and OPEX
  - Helps avoid fragmentation
  - Application independence
- Some legacy application profiles are still carried over to IP
- Ease application development and Smart Objects integration
  - Avoid the carry-over and build on the Web paradigm
  - Use Embedded Web Services in the smallest device
  - Reduce costs
  - Makes programming of IoT devices a commodity
  - Eases application integration e.g. towards enterprise systems
    - Invite to Open Innovation
  - Empower the 10000s of web developers out there to go IoT
    - Make available simplified templates and open APIs
    - IoT App Stores around the corner

Examples of Smart Objects building blocks

STM32 Nucleo
open development platform



STM32 Nucleo boards leveraging ARM® mbed™ and Arduino ecosystems to accelerate software and hardware development
http://www.st.com/stm32nucleo
http://www.st.com/stm32contest

ST NewsBite/Press release:
http://www.st.com/web/en/press/en/p3526
http://www.st.com/web/en/news/n3534

BlueNRG Bluetooth® low energy wireless network processor
http://www.st.com/bluenrg

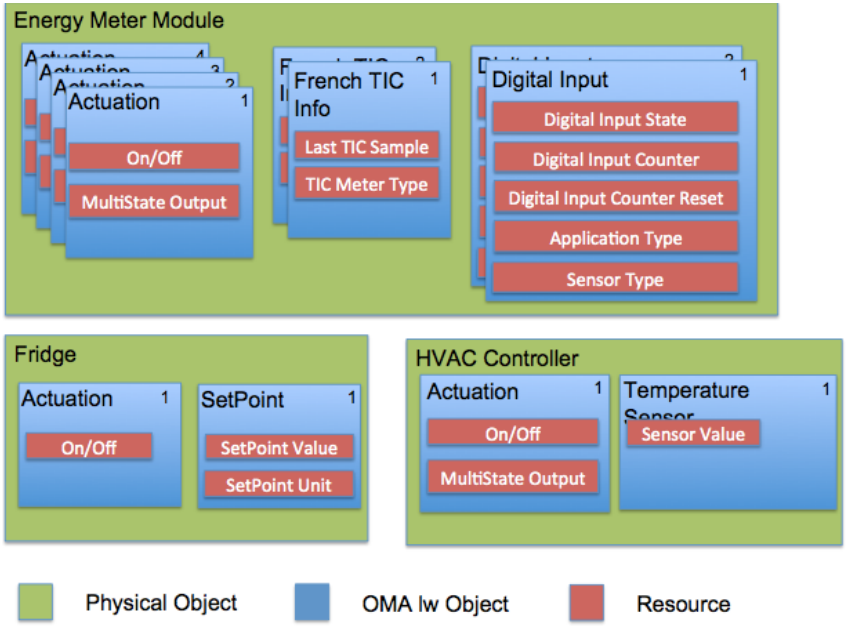
SPIRIT1 Low data rate, low power Sub 1GHz transceiver
www.st.com/spirit-x2

Application Level Interoperability

- IP-based communications for Smart Objects are in place, the next step is application level interoperability
- Interoperability between end devices and web applications
- Allows decoupling of devices from dedicated application services
- Repurposing and multi-purposing of devices, reusability of application software
- Interoperability across platforms and M2M protocols
- Enables developers of embedded device and web services to focus on the value endpoints

IPSO Smart Objects

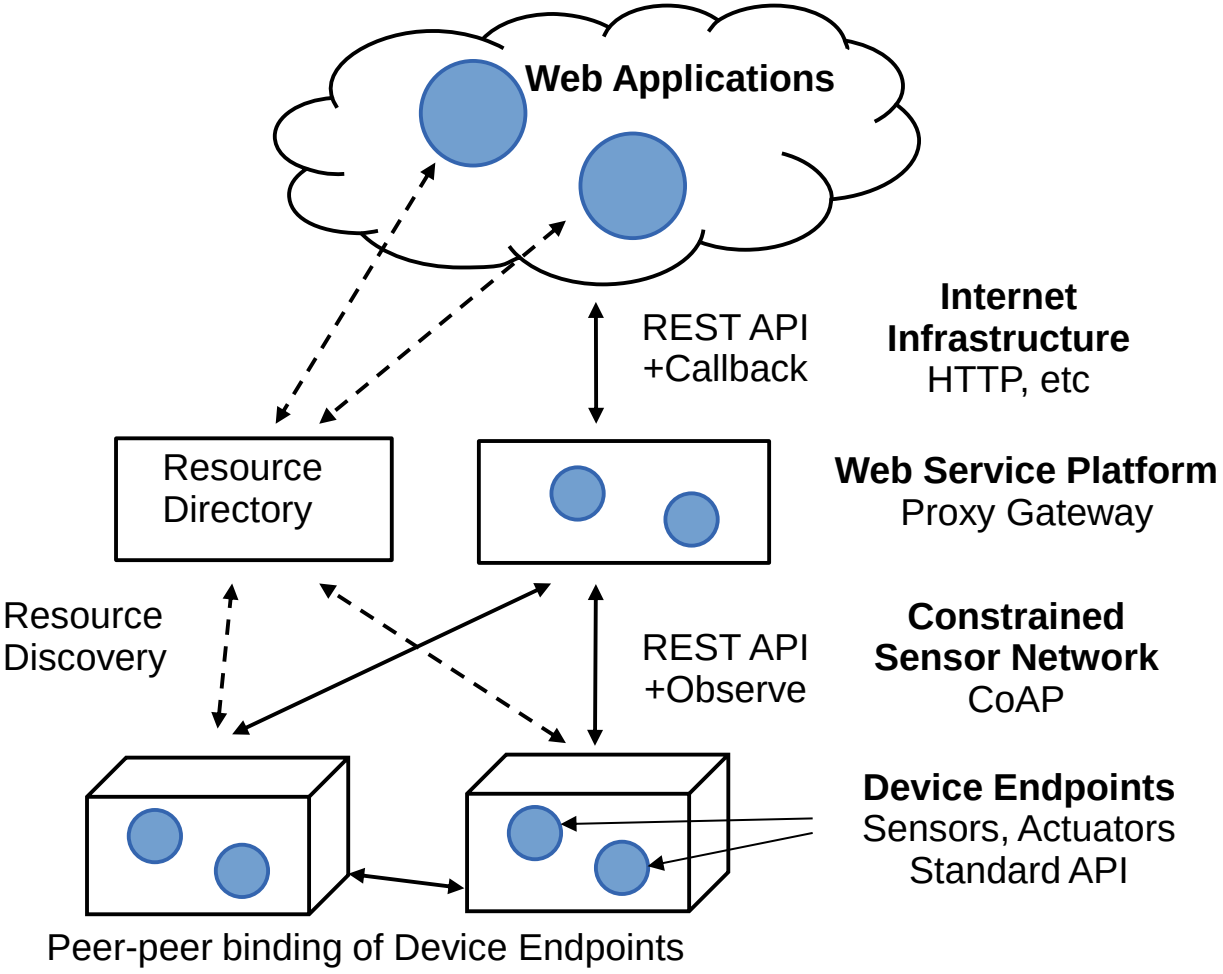
- Provides a framework for Application Level Interoperability
- Builds common definitions of web objects for use with standard web protocols (CoAP, HTTP)
- Defines reusable resources and objects that map to physical sensors, actuators, objects
- Compatible with OMA Lightweight M2M standard for management objects and registration of Resource, Object model



Examples of Objects

Source: IPSO Smart Objects Committee

Reference Architecture



Source: IPSO Smart Objects Committee

Standards Update

- The IETF is working on a lightweight variant of HTTP, called **Constrained Application Protocol** or **CoAP**. The first RFC related to CoAP, RFC 6690, has been published. Additional documents, such as the main protocol specification, are in their final stages of publication at the CoRE WG.
- **oneM2M**, the Global Partnership developing standards for Machine-to-Machine (M2M) communications enabling large-scale implementation of the Internet-of-Things (IoT), confirmed plans at its 10th Technical Plenary meeting to release its initial specifications in August 2014. (April 2014)
- The Open Mobile Alliance (**OMA**) has recently ratified the **Lightweight M2M** (**LWM2M**) standard specification. It is a new, technical industry standard for a communication mechanism between M2M devices and M2M service platforms. This standard is based on protocol and security standards from the IETF (February 2014)
- The **Smart Energy Profile 2.0** Application Protocol was ratified in April 2013 by the ZigBee and HomePlug Alliances . It was also adopted by the IEEE (2030.5-2013)

IPSO Smart Objects Committee

- **New IPSO Committee** launched in March 2014
- Chairs: Zach Shelby, Michael Koster (ARM) and Jaime Jimenez (Ericsson)
- Background
  - Data semantics are important for building M2M or IoT systems, and are key in the interoperability of devices and services.
  - With the spread of end-to-end IP and efficient web protocols like CoAP, there is now a need for general data semantics that can be used for IoT with constrained devices.
- Key tasks
  - Define and publish Smart Object technical guidelines for use over web standards by IPSO members and the Internet of Things in general.
  - Work with the IETF, OMA and other SDOs to coordinate the promotion and use of Smart Objects.

IPSO Reference Architecture Committee

- **New IPSO Committee** launched in April 2014
- Chair: Matt Gillmore (Itron)
- Background
  - The IPSO Alliance Reference Architecture Group is tasked with defining the essential elements required to create an Internet Protocol enabled Smart Object
  - The group will provide a collection of essential requirements and a list of protocols required to produce a Smart Object
- Key tasks
  - Deliver minimum requirements/recommendations for IP enabled Smart Objects
  - Develop judging criteria for the IPSO Challenge

IPSO CHALLENGE

- The IPSO Alliance hosts an annual competition – **the IPSO CHALLENGE** – to encourage innovation around IP-enabled smart objects for the Internet of Things

- The competition seeks innovative concepts in interfaces, interactions, and applications showcasing the use of the Internet Protocol (IP) in sensor/control and machine-to-machine (M2M) applications enabling the IoT

- The 10 finalists of the 2014 edition have been recently announced, they will demonstrate their solutions at Sensors Expo

http://www.ipso-alliance.org/ipso-alliance-announces-semi-finalists-in-iot-competition

- The top three most innovative IP-based solutions will be announced on **June 25, 2014** and will receive monetary awards

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Google
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sensus
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SYNAPSE
TAMPERE UNIVERSITY OF TECHNOLOGY
United Technologies Research Center

Summary

- The IP protocol suite is the way to lower deployment and operational costs, and faster time-to-market for M2M and IoT markets
- The IP for Smart Object “toolbox” along with technologies fostering application layer interoperability are available
- IPSO Alliance is open for participation
- Follow us on Facebook, Twitter, and Linked-In

Promoting the use of IP in networks of Smart Objects

and

Enabling the Internet of Things

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