



W3C TF-DI Meeting ISO/IEC/IEEE P21451-1-4

Sensei/IoT* 

**1st International Semantic Web 3.0 Standard
for the Internet of Things (IoT)**

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Chairman**

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Internet of Things (IoT)

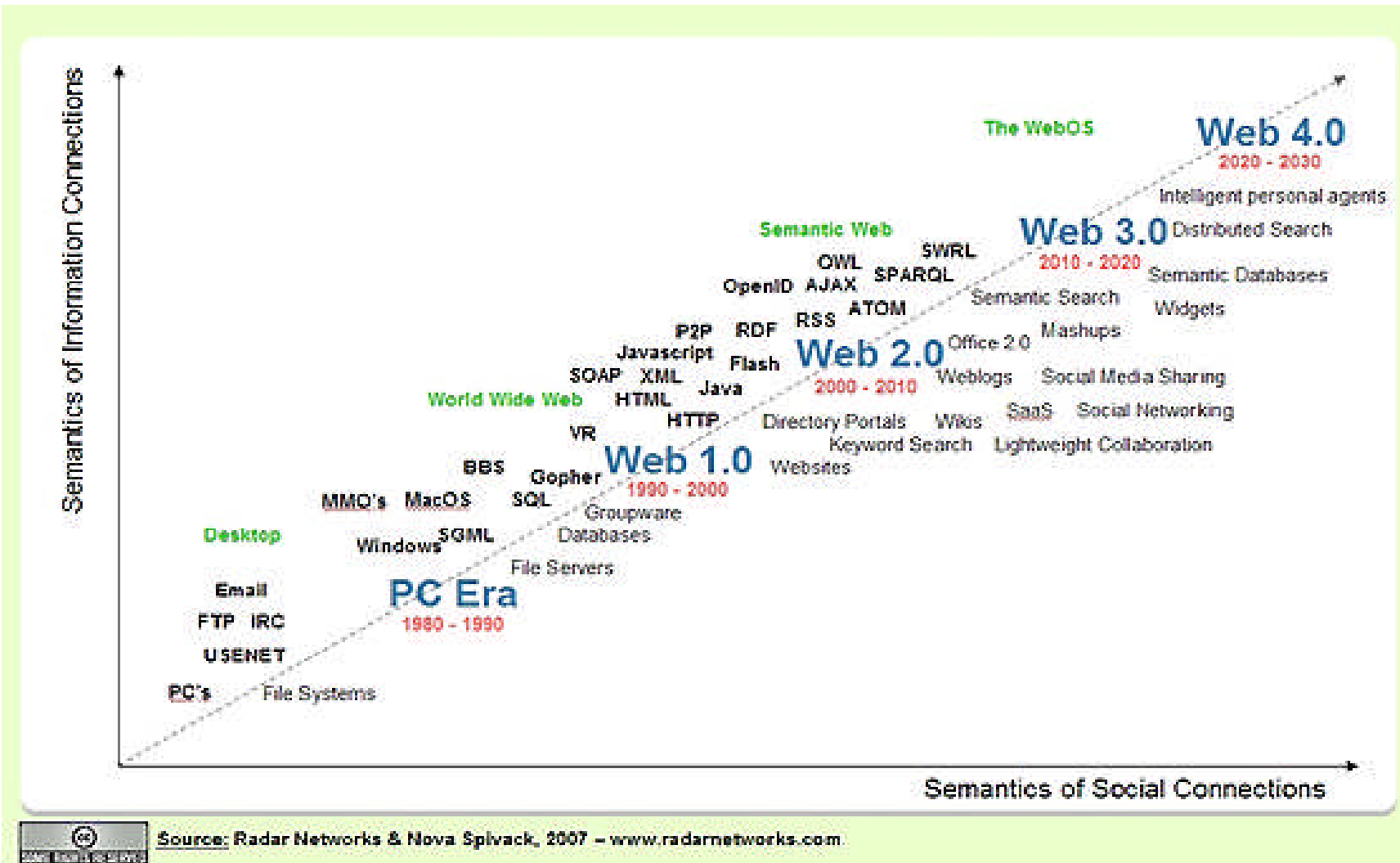


<http://www.sensei-iot.org>

Social Networking Driving the Evolution of the Internet



Semantic Web 3.0



**Social Media and Virtual Conferencing Systems use
eXtensible Messaging and Presence Protocol (XMPP)
billions of devices in use today**

- Facebook
- Twitter
- GoogleTalk
- MSN
- GotoMeeting
- WebEx
- Skype
- Yahoo

What is XMPP?

- **XMPP Standards Foundation (XSF)** is the foundation in charge of the standardization of the protocol extensions of eXtensible Messaging and Presence Protocol (XMPP), the open standard of instant messaging and presence of the IETF.

<http://www.xmpp.org>



IoT Protocols and Standards

- XMPP – (XSF, IETF, W3C, ISO, IEC, IEEE, uPnP)
eXtensible Messaging and Presence Protocol
- MQTT – (OASIS)
 - Message Queuing Telemetry Transport
- REST – (W3C)
 - Representational State Transfer
- CoAP – (IETF)
 - Constrained Application Protocol

ISO/IEC/IEEE P21451-1-4

Smart Transducer Interface Standard for Sensors, Actuators, and Devices eXtensible Messaging and Presence Protocol (XMPP) for networked device communications

- ISO/IEC WD 29161 - IoT Unique Identification
- XMPP is recognized by the IETF
- XMPP Extensions (XEPs) is open source from the XMPP Standards Foundation (XSF)
- XMPP offers assured interoperability, high scalability, and built-in security with capabilities that are technology agnostic and protocol independent allowing networked devices, users, and applications to exchange data.

ISO/IEC/IEEE P21451-1-4

- *Co-sponsored by*
- *Dr. Kang Lee, Chairman of IEEE TC-9 Sensor Technology, and*
- *Dan Kimball, Chairman of ISO/IEC JTC1 SC31 Packaging – Supply Chain Applications for Logistics and work on ISO/IEC 29161 Unique Identification for the Internet of Things.*

Sensei/loT*  XMPP

UNIVERSAL UNIQUE IDENTIFICATION

- ISO/IEC/IEEE P21451-1-4 will use a JID (EUI-64) which is a Universal Unique Identifier (UUID), defined in the draft ISO/IEC 29161 Automatic Identification for the Internet of Things developed by ISO/IEC/JTC1/SG31/WG6 Automatic Identification & Data Capture and ISO/IEC/TC122 Packaging and Internet of Things (IoT).
- **jid = [node “@”] domain [“/” resource {device}]**
- There are hundreds of ways to identify Things and ISO/IEC 29161 offers a unified approach.
- NOTE - EUI-64 is a IEEE SA 64-bit Global Identification.

- **Example:**



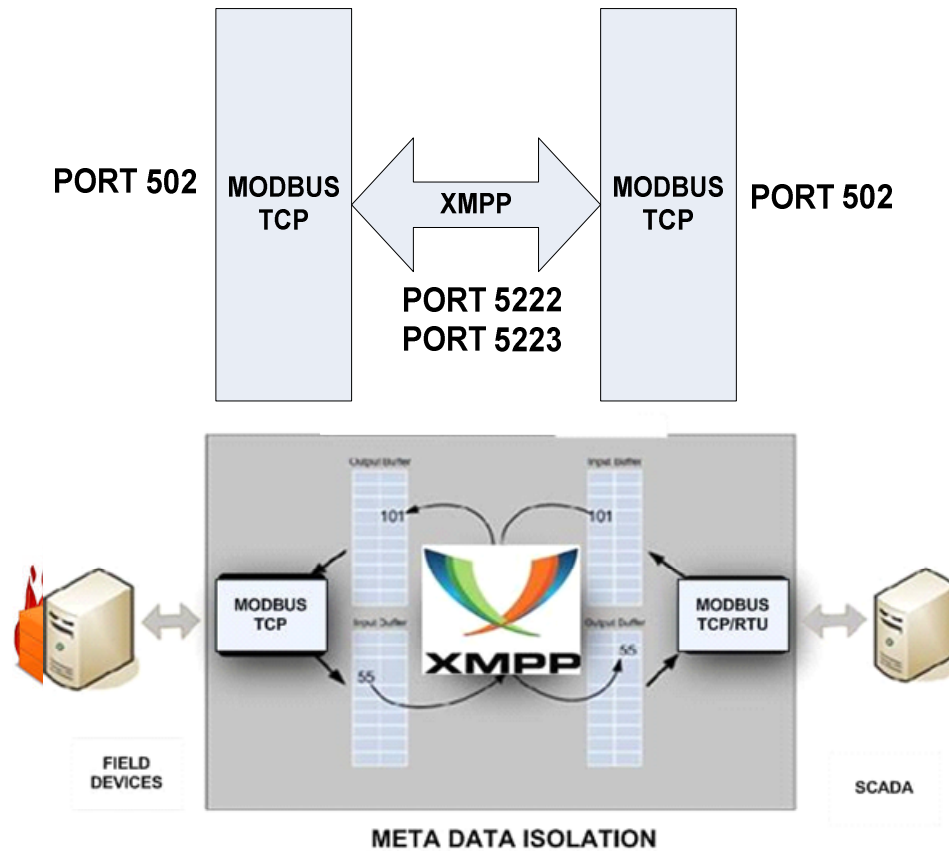
Sensei/IoT* Characteristics

- **Sensei/IoT*** is technology agnostic and protocol independent
- **Sensei/IoT*** uses Transport Layer Security (TLS) to encrypt data traffic which is built-in to the protocol
- **Sensei/IoT*** is firewall friendly utilizing port translation eliminating exposures common to use of Port 80
- **Sensei/IoT*** utilizes ***Semantic Web 3.0*** (XML metadata to provide a semantic conversation between devices)

Sensei/loT* Characteristics

- **Sensei/loT*** can utilize a Service Broker as an trusted intermediary to establish a trust relationship between users, applications, and devices
- **Sensei/loT*** can use an Identity Provider (IdP) to provide Single Sign On (SSO)
- **Sensei/loT*** end-to-end digital signing and encryption (RFC 3923) using Efficient XML Interchange (EXI)

Meta Data Isolation Protection Against Cyber-attack



IoT XEP's

ISO/IEC/IEEE P21451-1-4

Sensei/IoT* 
XMPP

XEP's for Sensor Networks

- XEP-0322 EXI Compression *
- XEP-0323-IoT-SensorData *
- XEP-0324-IoT-Provisioning *
- XEP-0325-IoT-Control *
- XEP-0326-IoT-Concentrators *
- XEP-0332-IoT-HTTP over XMPP *
- XEP-0336-Dynamic Forms *
- XEP-0337-Event Logging *
- XEP-0347-IoT-Discovery *
- XEP-0348-Signing Forms *
- XEP-0000-IoT-Battery Powered Sensors **
- XEP-0000-IoT-PubSub **
- XEP-0000-IoT-Multicast**
- XEP-0000-IoT-Events **
- XEP-0000-IoT-Interoperability**

Provisional URI Scheme IANA Registration

- Example:
- **iotdisco:SN=394872348732948723;MAN=www.ktc.se;
MODEL=IMC;#V=1.2;KEY=4857402340298342**
- Provides unique identification of the Thing
- Transport mechanism can be a QR-Code, RFID, or other matrix approach
- This capability can now allow use of “Thing Registries”

Examples of XMPP Messaging Request/Reply

ISO/IEC/IEEE P21451-1-4

Sensei/loT* 
XMPP

XEP-0347

Discovery (Request)

- **<iq type='get'**
- from='thing@example.org'
to='discovery.example.com'
id='info1'
<query xmlns='https://jabber.org/protocol/disco#info>
<identity category='gateway' type='ncap name='ncapid'/>
<feature var='urn:xmpp:iot:interoperability'/> REQ'D
<feature var='urn:xmpp:iot:sensordata'/> OPT
<feature var='urn:xmpp:iot:control'/> OPT
<feature var='urn:xmpp:iot:concentrators'/> OPT
<feature var='http://jabber.org/protocol/disco#info'/>
<feature var='http://jabber.org/protocol/disco#items'/>
<identity>
</query>
- **<iq**

XEP-0347

Discovery (Reply)

- **<iq type='result'**
 from='discover@discovery.example.com'
 to='thing@example.org'
 <accepted xmlns='urn:xmpp:iot:interoperability'
<iq type

XEP-0323

SensorData (Request)

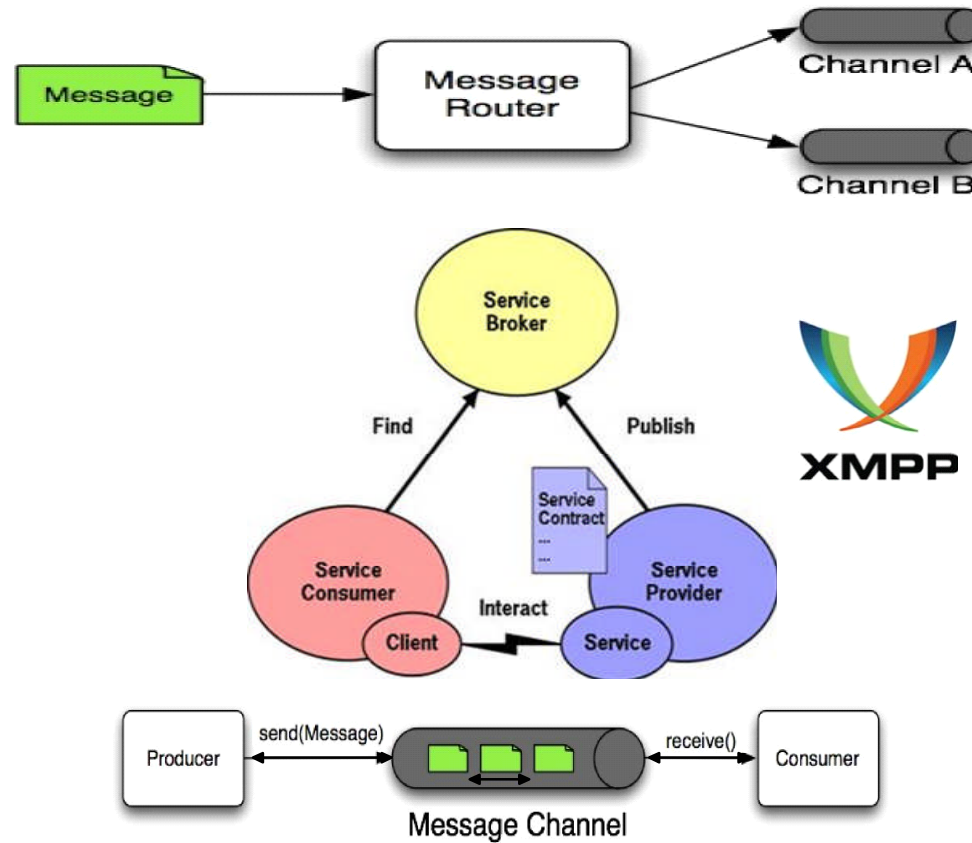
- `<iq type='get'`
 `from='requester@example.org'`
 `to='responder@example.org' >`
 `id='1'>`
 `<req xmlns='urn:xmpp:iot:sensordata' seqnr='1' identity='true'/>`
 `</iq>`

XEP-0323

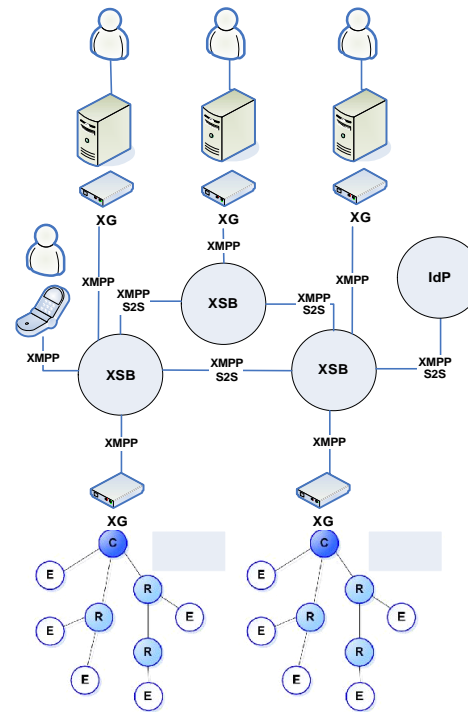
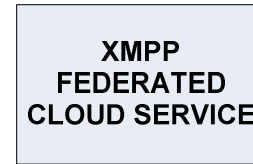
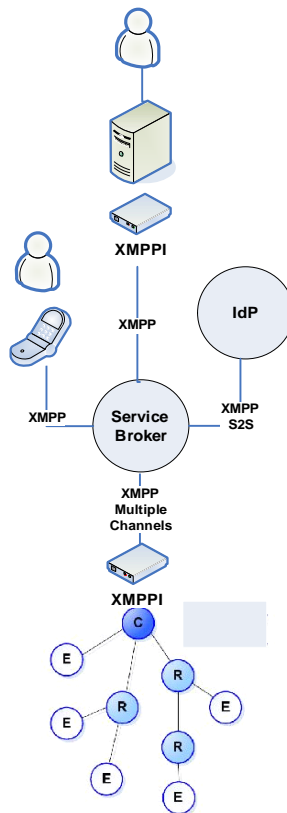
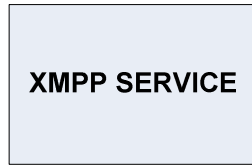
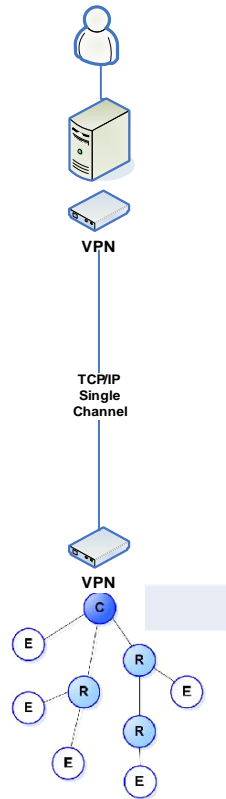
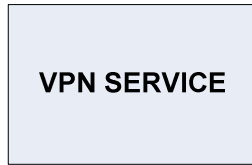
SensorData (Reply)

- **<message**
 from='responder@example.org'
 to='requester@example.org' >
 <fields xmlns='urn:xmpp:iot:sensordata' seqnr='1'
done='true'>
 <node nodeId='Device01'>
 <timestamp value='2013-03-07T16:24:30'>
 <string name='...ID' identity='true'
automaticReadout='true' value='1234567' />
 </timestamp>
 </node>
 </fields>
 </message>

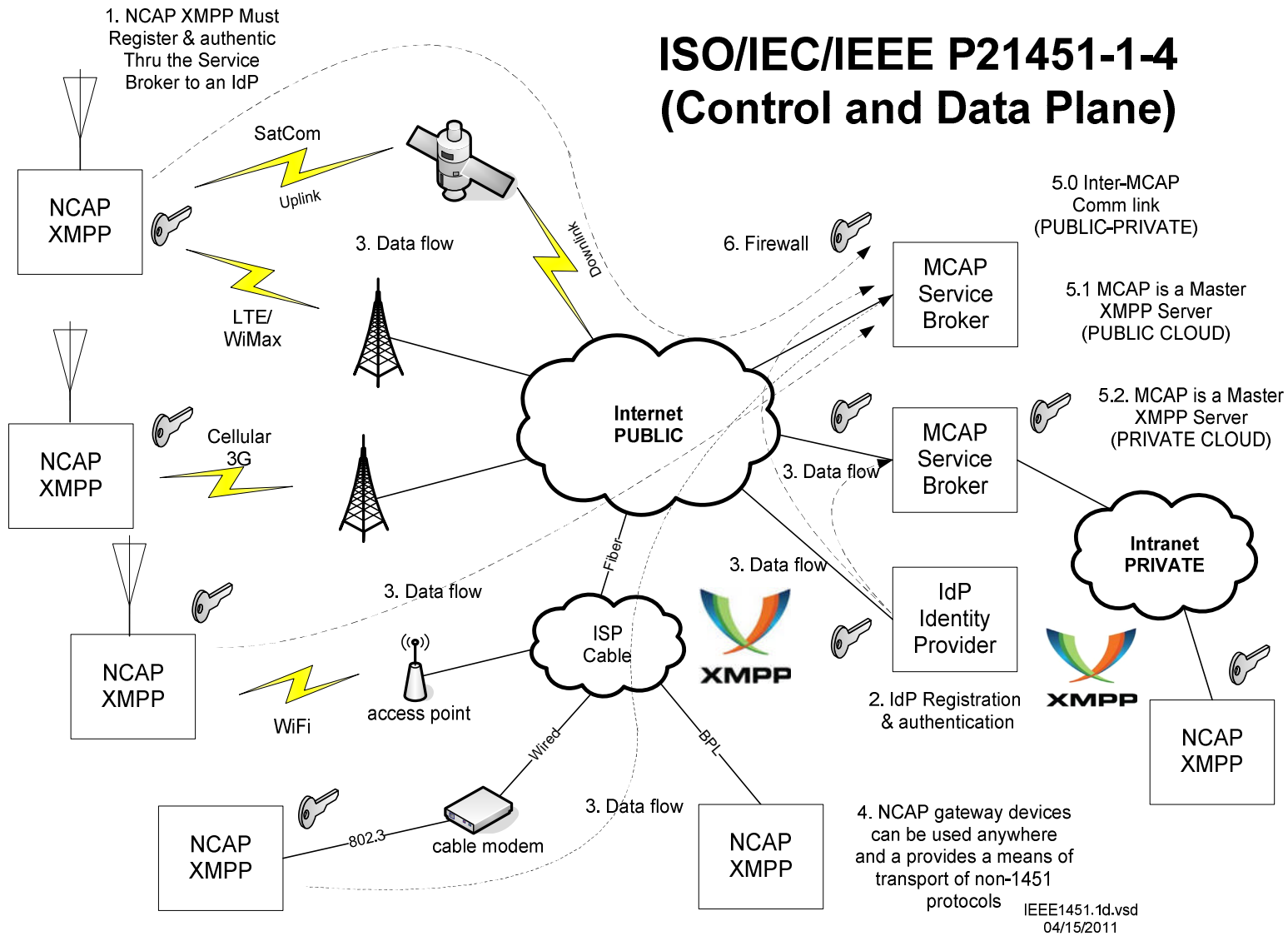
Service Oriented Architecture (SOA)



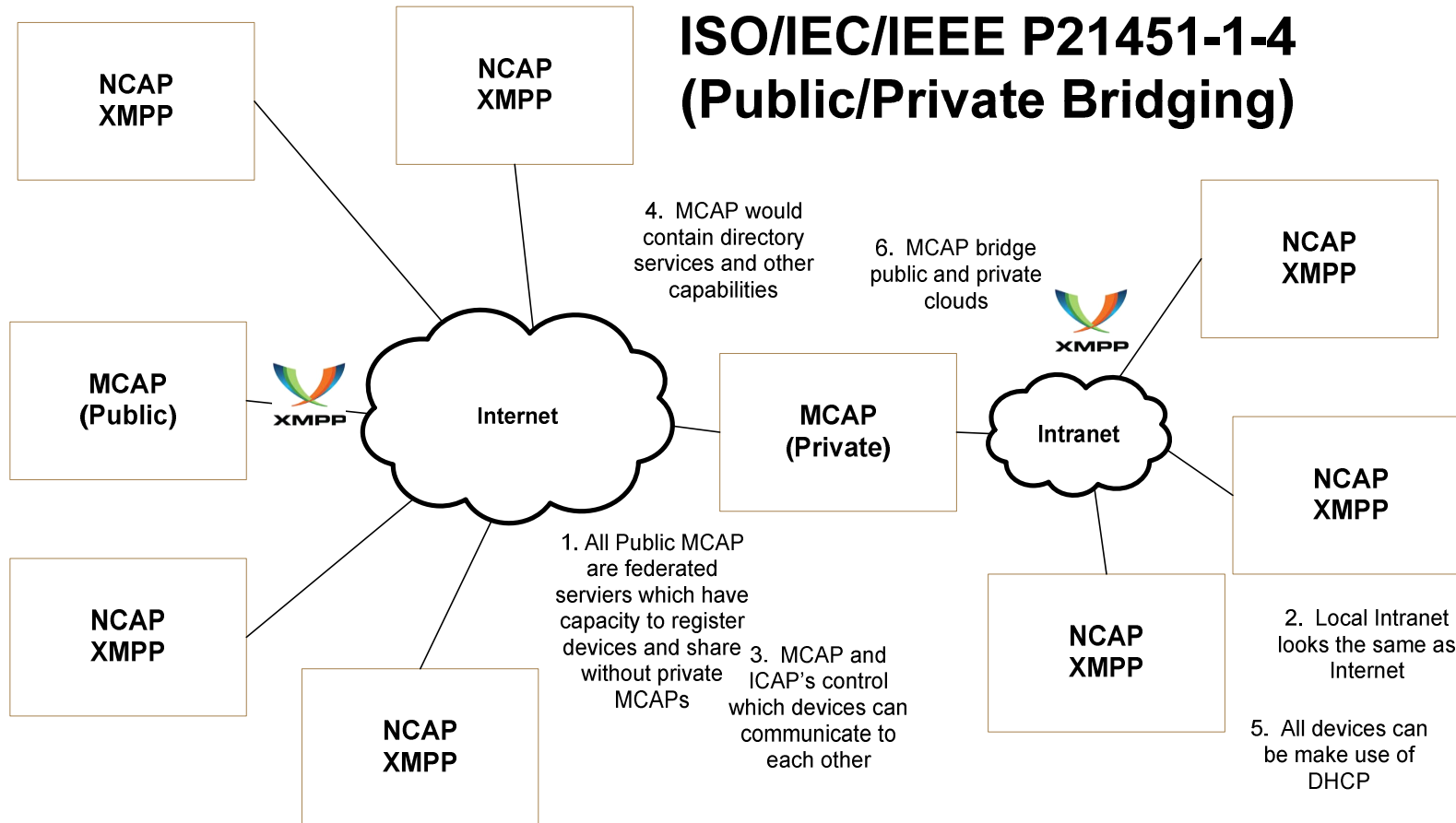
Scalability of Cloud Services



ISO/IEC/IEEE P21451-1-4 (Control and Data Plane)

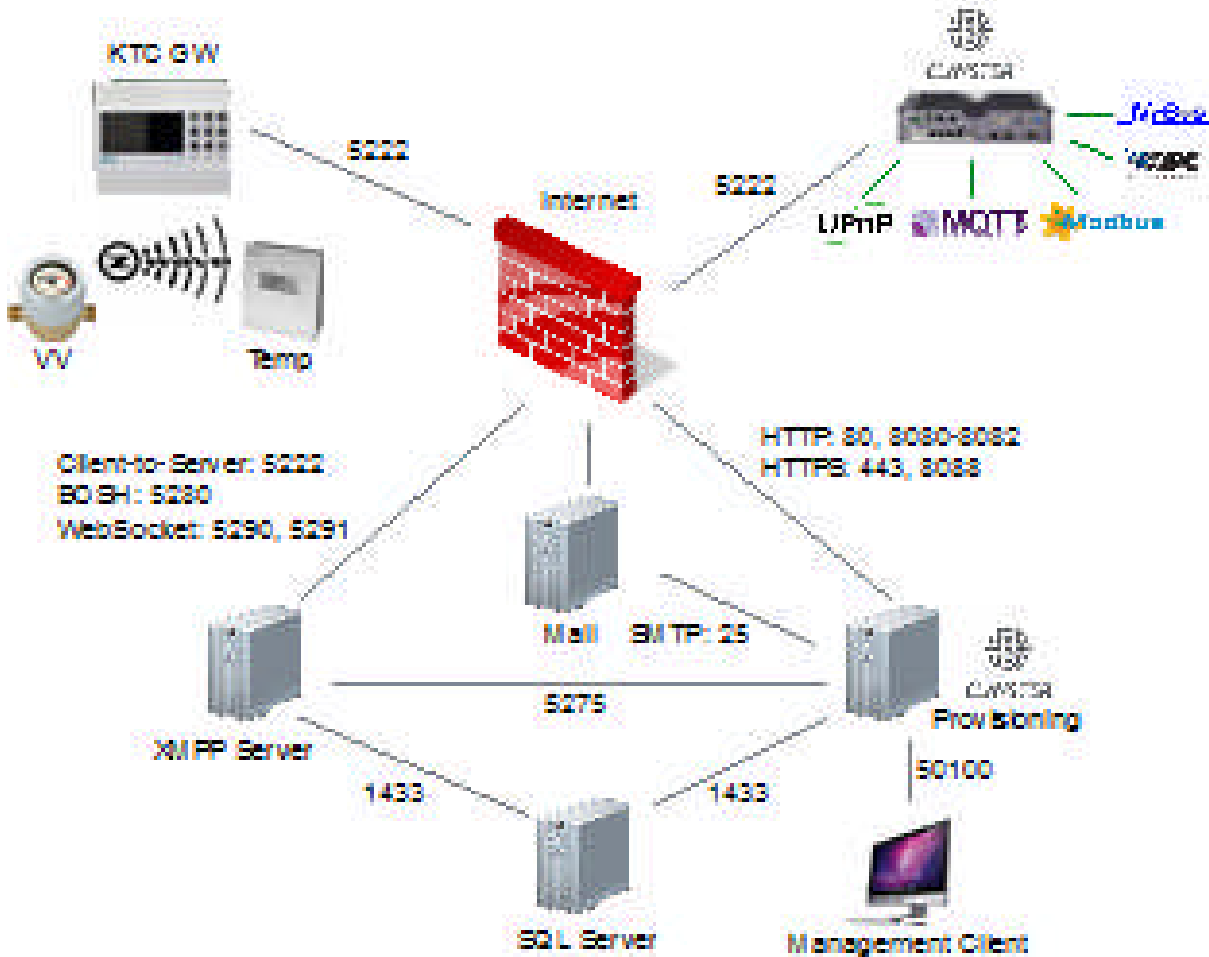


ISO/IEC/IEEE P21451-1-4 (Public/Private Bridging)



XEP-0324

IoT Provisioning



XEP-0332

HTTP over XMPP

- **Example:**

Website: <http://someserver.com/Index.html>

Server (JID): john.doe@somexmppserver.com

Provisional URI Scheme (PROPOSED):

`httpx://john.doe@somexmppserver.com/Index.html`

This capability allows HTTP services to be registered and protected via a XMPP transport from a server behind a firewall.

The XMPP protocol does not have the same problems with security as HTTP protocol requiring access to Port 80 thru a firewall.

It's a peer-to-peer protocol naturally allowing communication with applications and devices behind firewalls. It also includes advanced user authentication and authorization which makes it easier to make sure unauthorized access to private content is prevented.

XEP-0322

Efficient XML Interchange (EXI)

Stream Compression

The client will start communicating with a server using uncompressed XML fragments then the client will connect to the XMPP server and set the method for EXI.

Example:

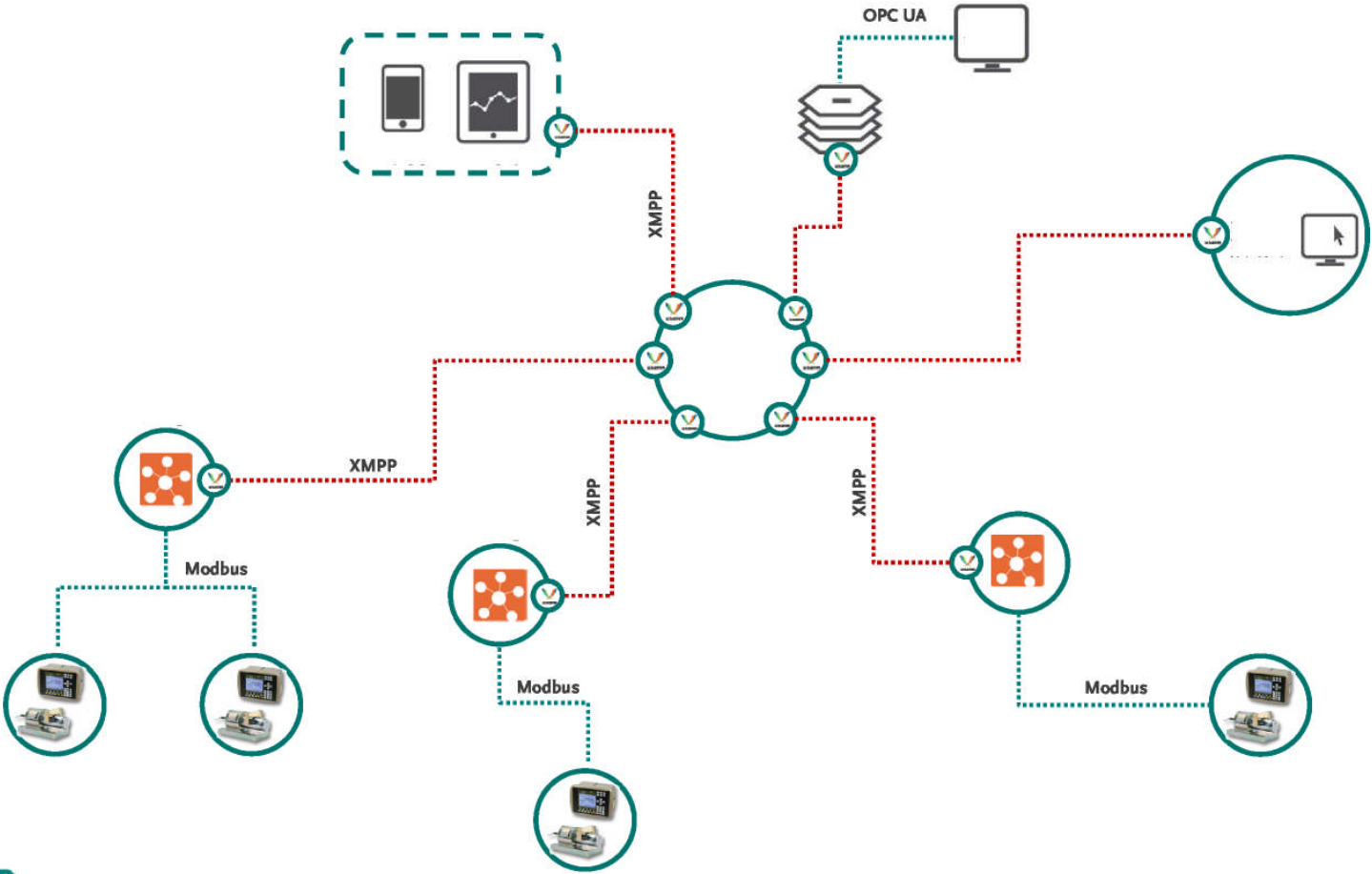
```
<stream:features>
  <starttls xmlns='urn:ietf:params:xml:ns:xmpp-tls'/>
  <compression xmlns='http://jabber.org/features/compress'>
    <method>zlib</method>
    <method>lzw</method>
    <method>exi</method>
    <method>exi:54321</method>
  </compression>
</stream:features>
```

XEP-0326

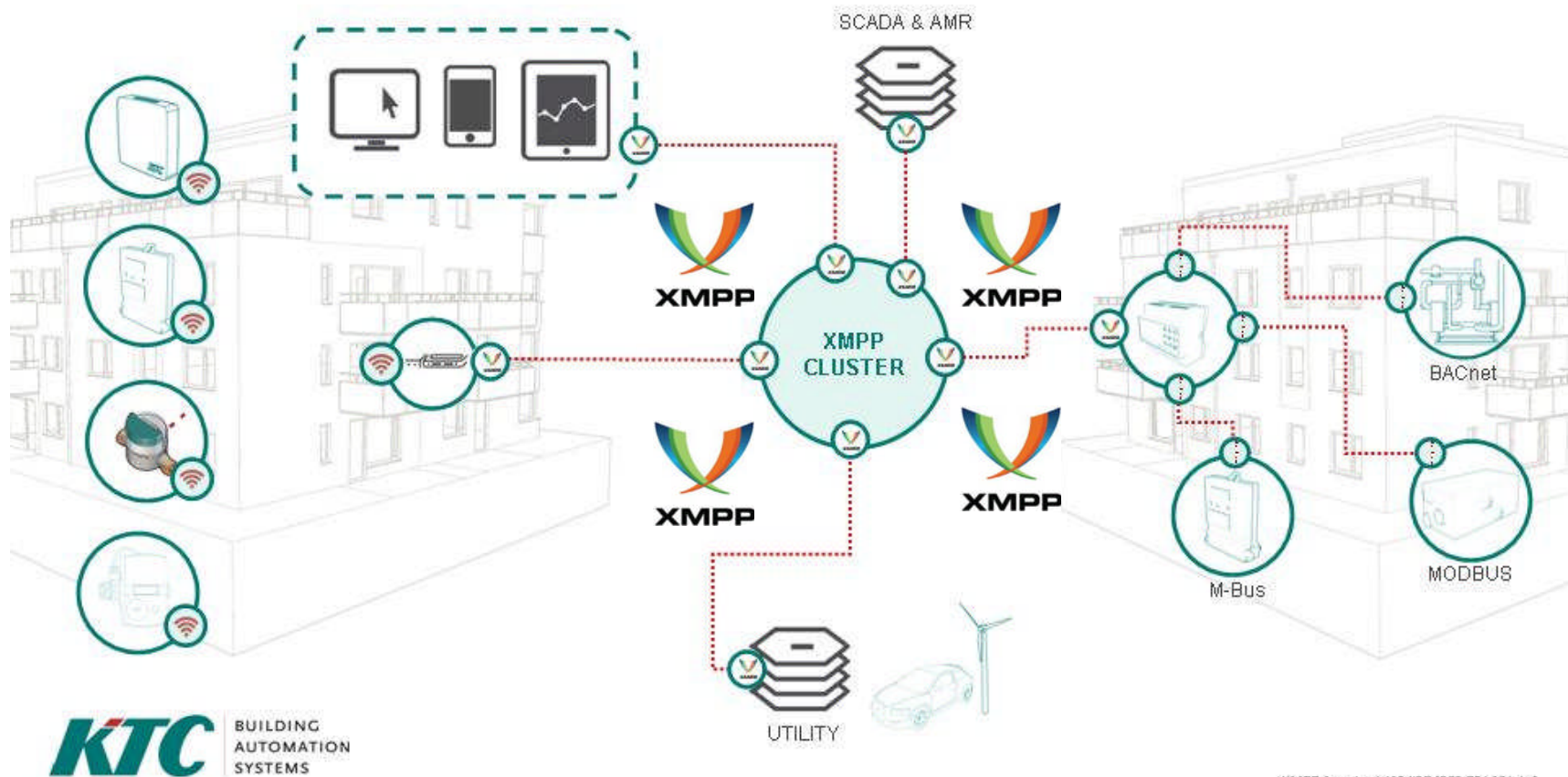
Concentrator

- Concentrators are devices in sensor networks, concentrating the management of a sub set of devices to one point.
- They can be
 - small (for example: managing a small set of sensors and actuators),
 - medium-sized (for example: mid-level concentrators, controlling branches of the network, islands, perhaps using separate communication protocols),
 - large (for example: entire sub-systems, perhaps managed by a separate child/partner organization) to
 - massive (for example: The entire top-level system, smart-grid, IoT network).

OPC UA and use of XMPP to provide a secure transport

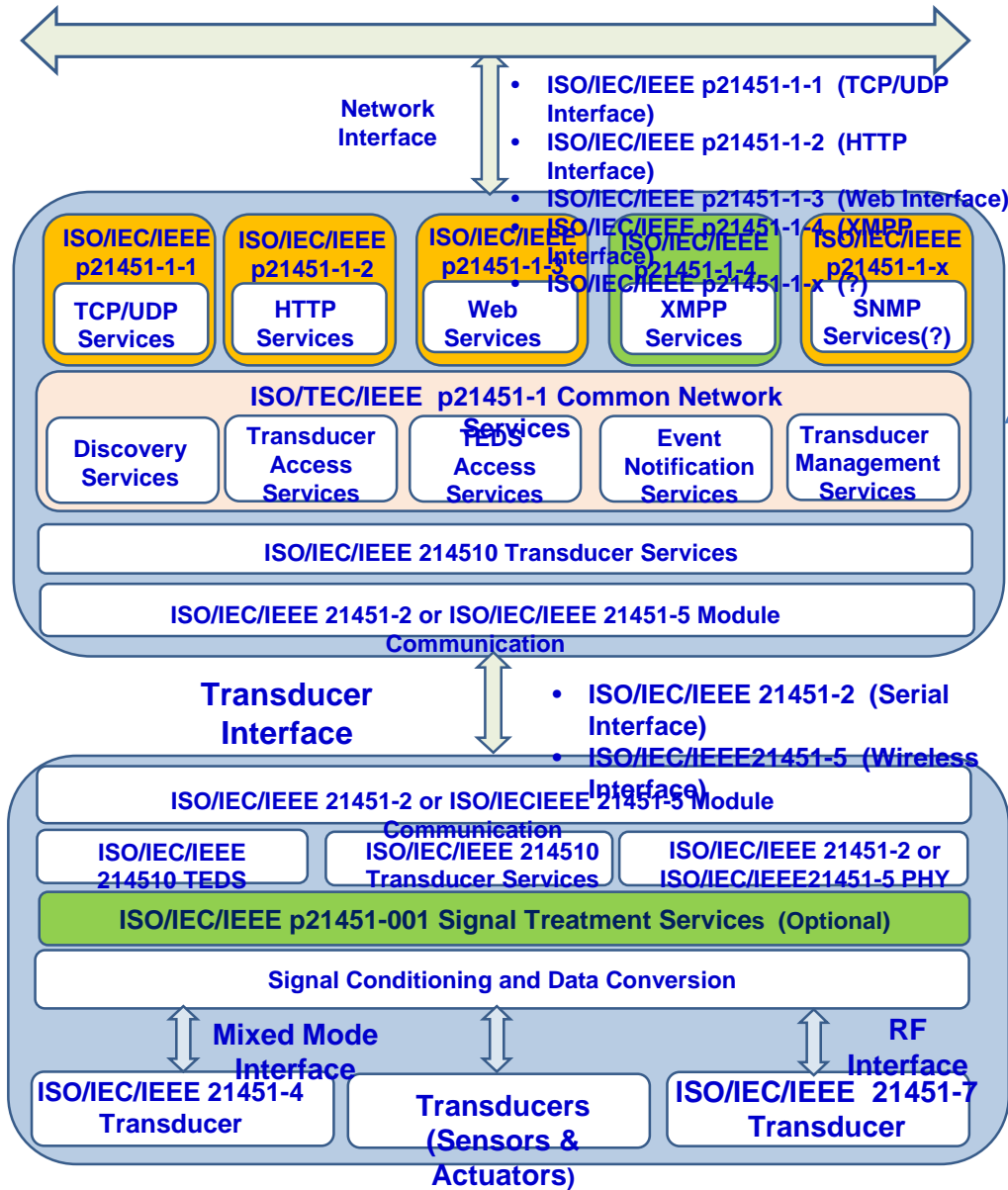


XMPP Federated Cloud Service Brokers



XMPP Standard: ISO/IEC/IEEE P21451-1-4

User Network



P21451 Family of Standards

Network Node – Network Capable Application Processor (NCAP)

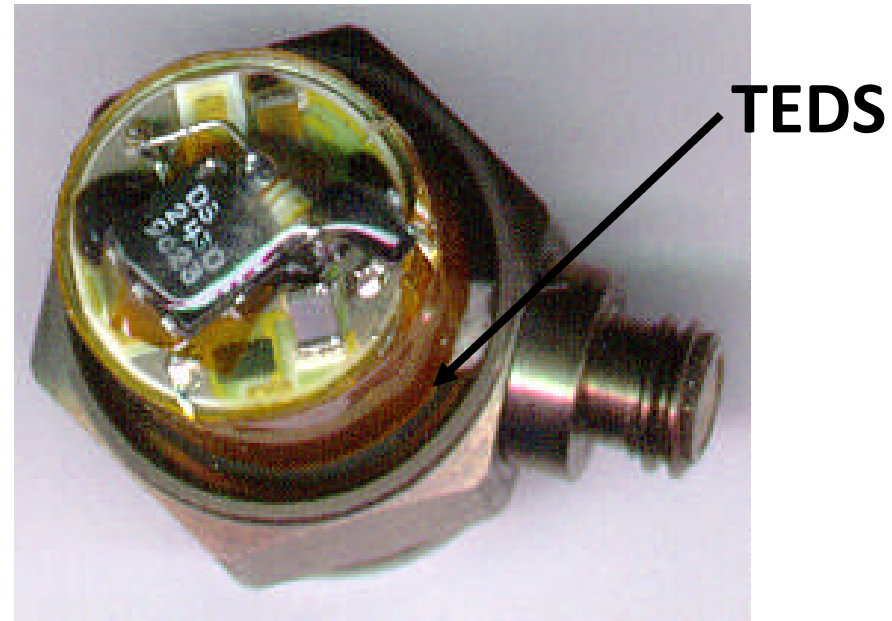
Sensor Node - Transducer Interface Module (TIM)

Project to be proposed In the future

Standard being developed

Transducer Electronic Data Sheets (TEDS)

- **TEDS**, a memory device attached to a smart transducer node, store Metadata, transducer identification, measurement range, calibration, correction data, user and manufacture-related information, which can be used for transducer self-identification and description.
- Different TEDS are defined:
 - Meta TEDS
 - Transducer Channel TEDS
 - Physical TEDS
 - Calibration TEDS
 - Frequency Response TEDS
 - Geo-location TEDS
 - and more....



Health Electronic Data Sheets

- HEDS will provide condition monitoring and remote diagnostics for transducers
- Provide condition codes reflecting phases of condition of a device over time
- New capability particularly useful for high reliability environments requiring reliable highly accurate measurements such as the rocket industry

TEDS HASH Code

- FIPS 202 SHA-3 HASH Codes are required for TEDS to validate that the content has not been changed.
- The HASH codes can be used during provisioning of a device

IPDX.NET UNIVERSE

Federated Cloud Sensor Network

- **ISO/IEC/IEEE P21451-1-4** provides session initiation and protocol transport for sensors, actuators, and devices. The standard addresses issues of security, scalability, and interoperability. This standard can provide significant cost savings and reduce complexity, leveraging current instrumentation and devices used in industry today.

<http://www.ipdx.net>



Sensei/IoT* 



Sensei/loT*  XMPP

<http://www.sensei-iot.org>

Thank You!