

Long Life Web-of-Things with Efficient XML Interchange (EXI)

Yusuke DOI, Corporate R&D Center,
TOSHIBA Corporation

Internet of things: \$8.9 trillion market in 2020, 212 billion connected things

Summary: *IDC tries to put a number on the Internet of things and while you may quibble over the forecast, the numbers are huge assuming multiple hurdles can be overcome.*



By [Larry Dignan](#) for [Between the Lines](#) | October 3, 2013 -- 12:59 GMT (05:59 PDT)

 [Follow @ldignan](#)

The Internet of things and the technology ecosystem surrounding it are expected to be a \$8.9 trillion market in 2020, according to IDC.

In a nutshell, the Internet of things is the product of sensors, technology and networking all coming together to allow buildings, infrastructure and other resources to swap information. Today, the Internet of things and machine-to-

More on M2M

→ [M2M and the Internet of Things: A guide](#)

ZDNet(2013/10/3)

<http://www.zdnet.com/internet-of-things-8-9-trillion-market-in-2020-212-billion-connected-things-7000021516/>

E-Waste

Internet of things: \$8.9 trillion market in 2020, 212 billion connected things

Summary: IDC tries to put a number on the Internet of things and while you may quibble over the forecast, the numbers are huge assuming multiple hurdles can be overcome.



By Larry Dignan for [Between the Lines](#) | October 3, 2013 -- 12:59 GMT (05:59 PDT)

[Follow @ldignan](#)

The Internet of things and the technology ecosystem surrounding it are expected to be a \$8.9 trillion market in 2020, according to IDC.

In a nutshell, the Internet of things is the product of sensors, technology and networking all coming together to allow buildings, infrastructure and other resources to swap information. Today, the Internet of things and machine-to-

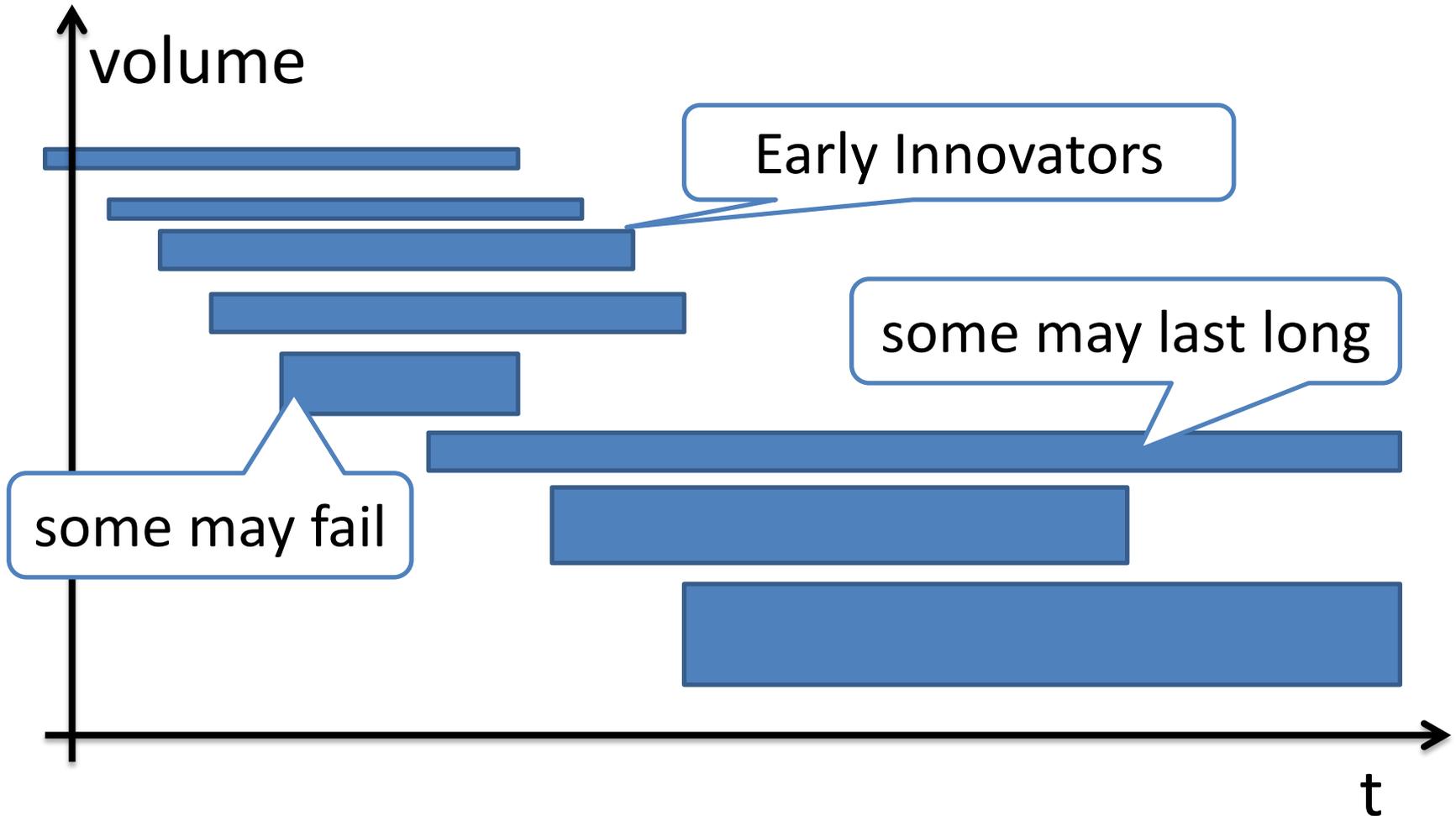
More on M2M

→ [M2M and the Internet of Things: A guide](#)

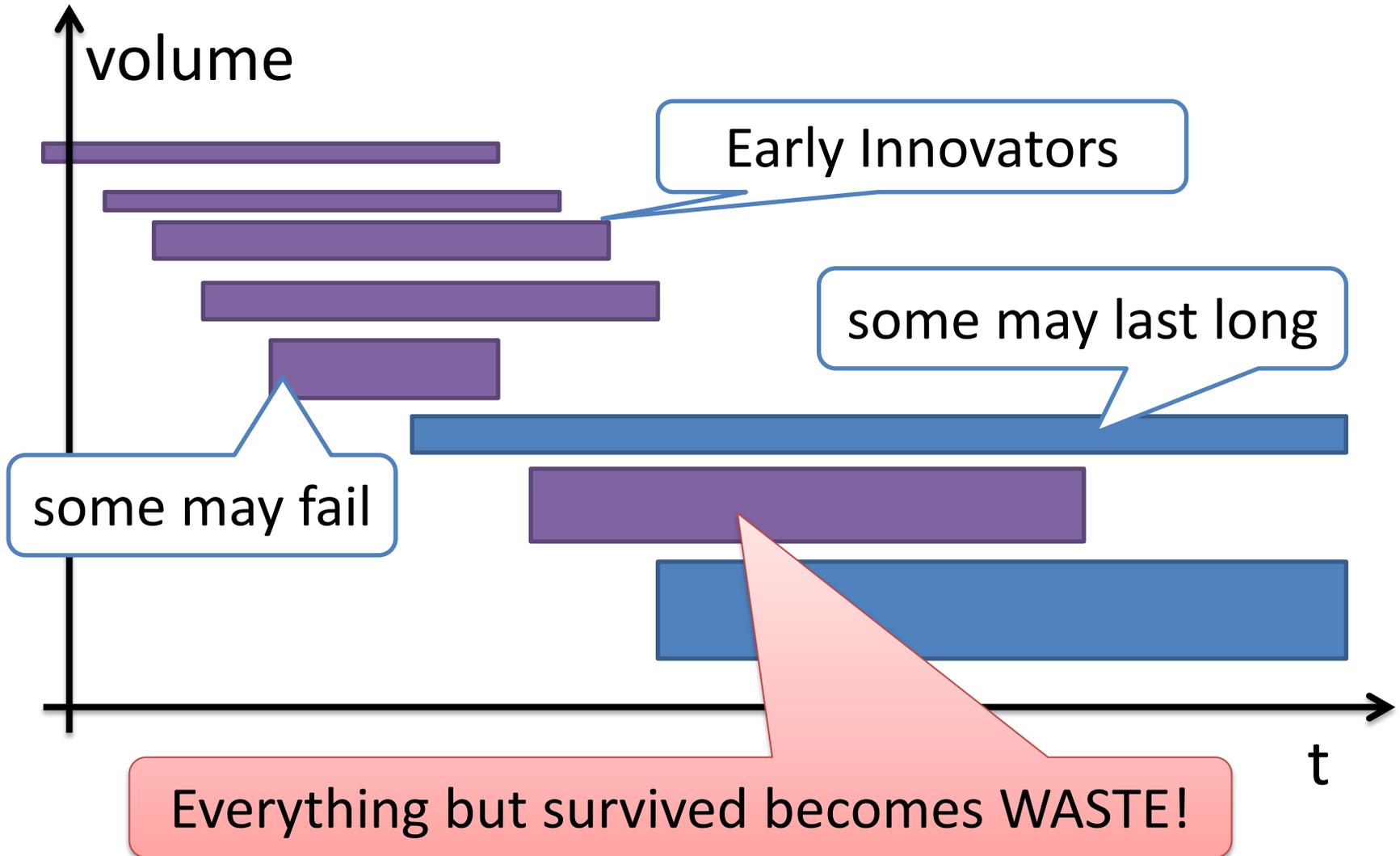
ZDNet(2013/10/3)

<http://www.zdnet.com/internet-of-things-8-9-trillion-market-in-2020-212-billion-connected-things-7000021516/>

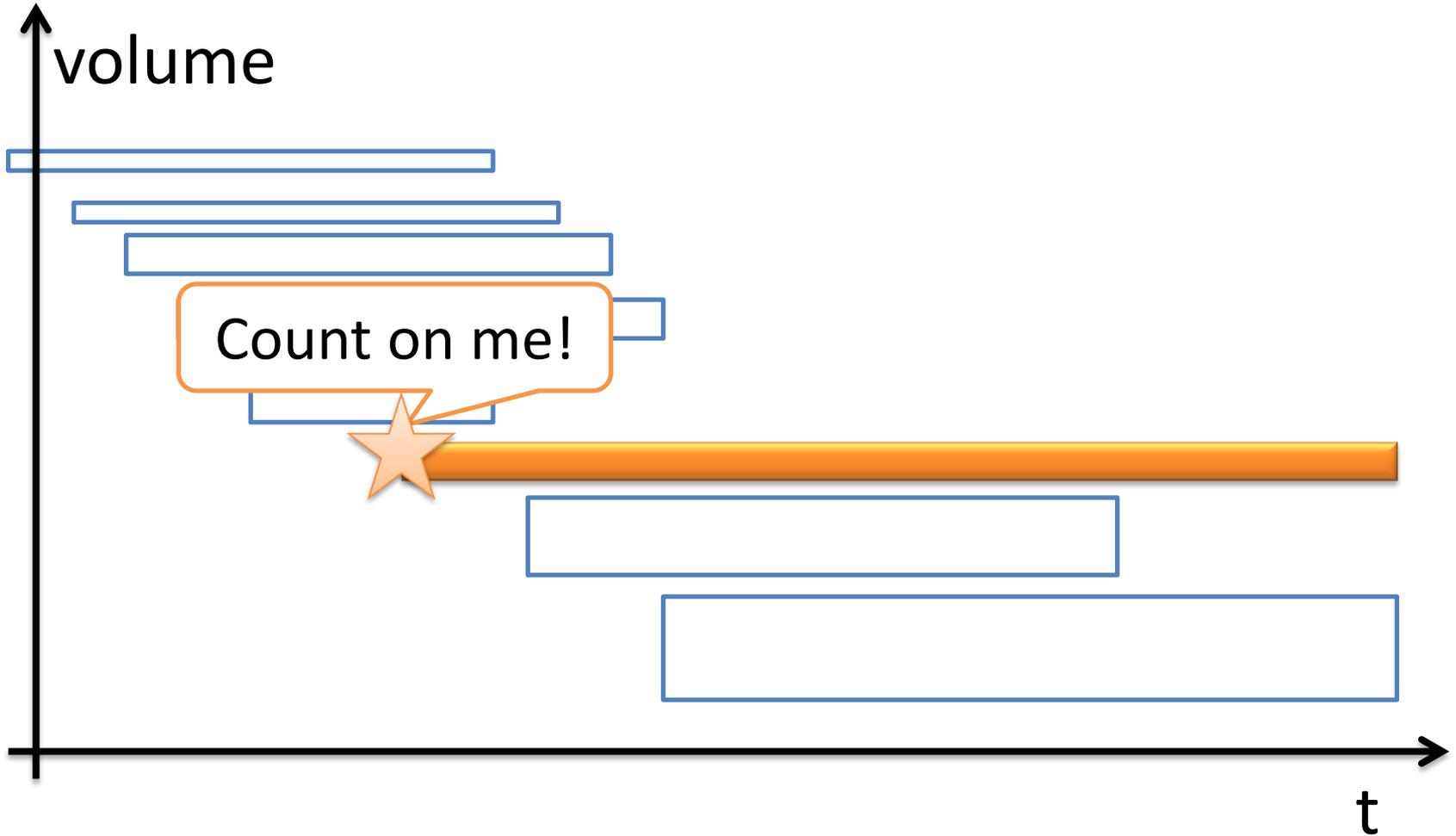
WoT Generation and Waste



WoT Generation and Waste



Standardized WoT → Long Life WoT



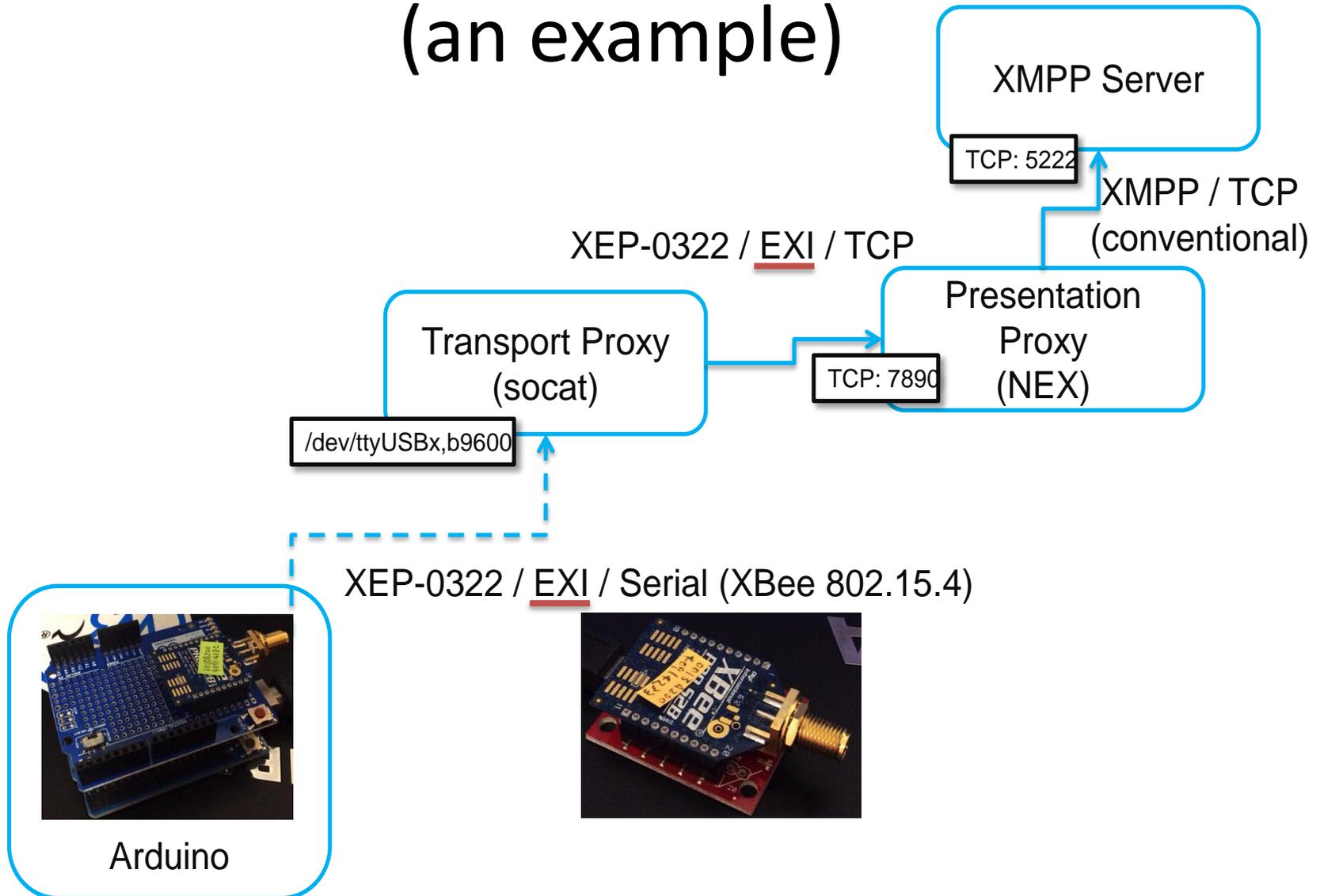
Successful? WoT Standards

- IEC 61968
- IEEE P2030.5
(a.k.a. ZigBee SEP2)
- BACnet/WS
- OpenADR / OASIS-EI



Defined in
XML/UML-ish
Data Models
(XML Schema)

XML on the Things (an example)



XML is Ready for 'Things'

- EXI: Efficient XML Interchange
 - Binary XML
- Fully Supports XML Schema (uses schema as a grammar for efficient encoding)



Efficient XML Interchange (EXI)
1.0 (Second Edition)

W3C Recommendation 11 February 2014

This version:
<http://www.w3.org/TR/2014/REC-exi-20140211/>

Latest version:
<http://www.w3.org/TR/exi/>

Previous version:
<http://www.w3.org/TR/2011/REC-exi-20110310/>

Recent Activities of EXI WG

- EXI Profile for Efficient Use of Memory
 - EXI1.0 does not have proper memory cap i.e. Malicious or incautious EXI data stream may use up decoder's memory
 - The profile adds the memory cap
- Grammar Exchange Format
 - Grammar Exchange Format can be used as grammar
 - Now under discussion (format is not yet defined)



Efficient XML Interchange (EXI) Profile for limiting usage of dynamic memory

W3C Proposed Recommendation 06 May 2014

This version:
<http://www.w3.org/TR/2014/PR-exi-profile-20140506>

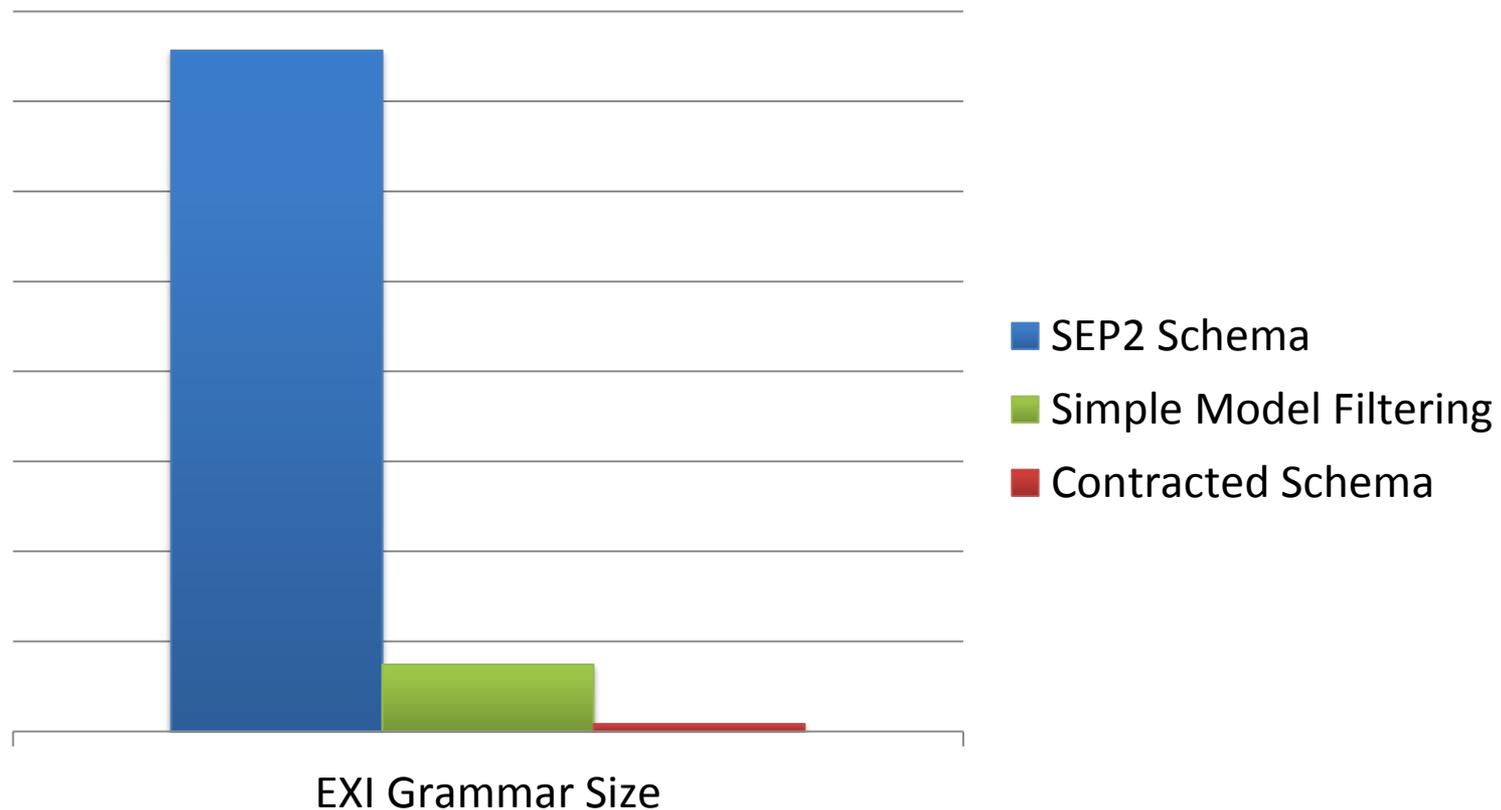
Latest version:
<http://www.w3.org/TR/exi-profile/>

Previous version:
<http://www.w3.org/TR/2013/CR-exi-profile-20130416>

Editors:
Youenn Fablet, Canon Research Centre France
Daniel Peintner, Siemens AG

Example of Trick for XML-of-Things (non-standard)

- Schema contraction for a device-specific XML



Conclusion and Open Question for the Workshop

- Web-of-Things need some standards
 - Otherwise we would make too much wastes
 - Not “a standard of Web-of-Everything”
- Good standard has well-defined data model
 - UML/XML is known as a good tool to make a common understanding between many stakeholders
- We have EXI: XML is ready to be used among ‘Things’
- However, EXI is just a tool. How, when, and where to make a standard of WoT is an open question
 - Detailed spec. should be discussed in IEC, IEEE, OASIS, HL7, etc... (domain experts)
 - I expect meta-standards (standards for application standards) of WoT be discussed in W3C

ZigBee, ZDNet, W3C, and some other words are trademark or registered trademark of corresponding entity.