a framework for
observing nodes' behavior
in IoT validation platforms

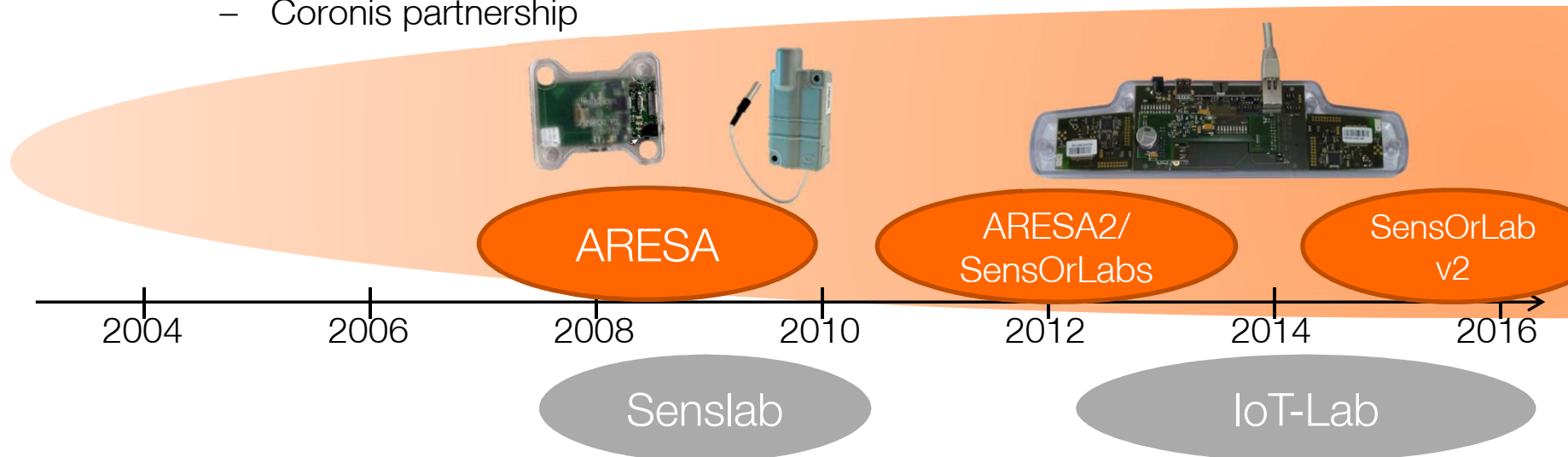Orange Labs

Quentin Lampin, Dominique Barthel
Nov 6th 2014, "IoT workshop" at INRIA, Montbonnot

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Agenda

part 1   a look back

part 2   SensOrLabs

part 3   an observability toolchain

part 4   some results

part 5   the way forward

A look back: project knitting

- Orange Labs working on WSN protocols since 2002

- ARESA1 demo (2008)

  – 86 nodes, full source code, in-band limited monitoring

- ARESA1 demo (2009)

  – 56 nodes, Coronis black-box radio, in-band limited monitoring

- Dec 2013 OLRE / ARESA2 demo

  – a 82-node fully observable platform (SensOrLabs)
  – out of band monitoring, systemic approach to observability
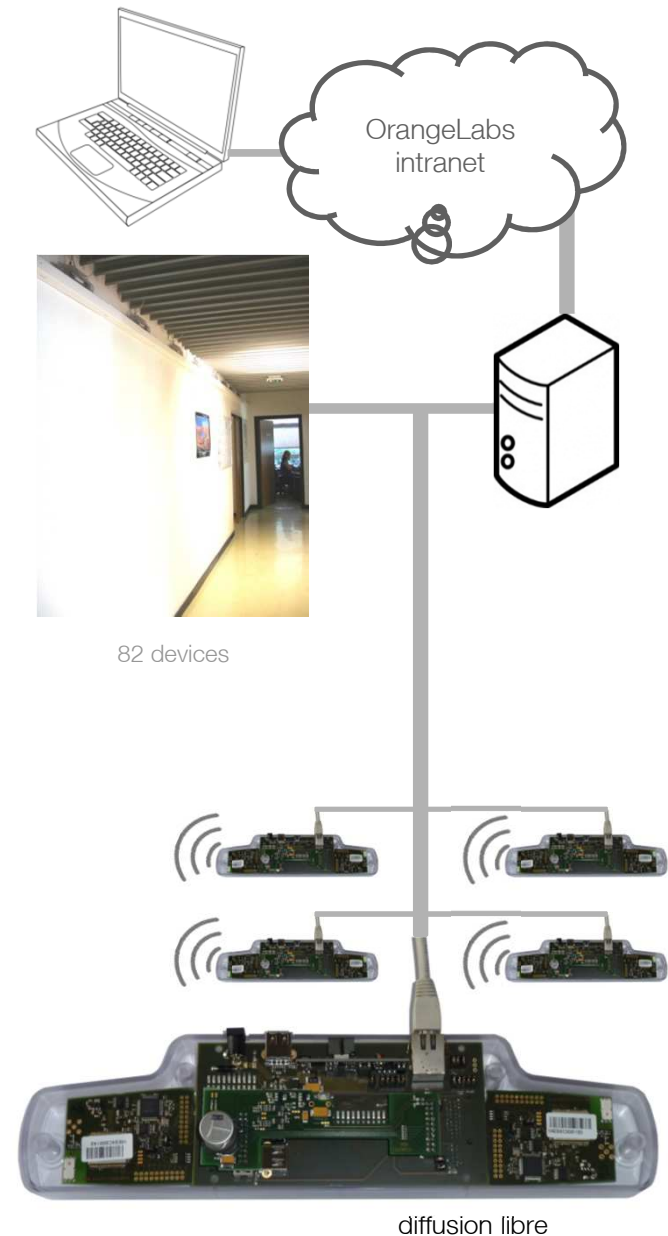 – Coronis partnership

ARESA

ARESA2/
SensOrLabs

SensOrLab
v2

2004   2006   2008   2010   2012   2014   2016

Senslab

IoT-Lab

the SensOrLabs platform

- largely Senslab-inspired, but

  – rewrote infrastructure software

  – redesigned "gateway" board assembly

  – redesigned power monitoring board

  – hosts Elster/Coronis Excelyo nodes

- 82 nodes at Orange Labs Meylan

 – plugged into any site Ethernet socket

OrangeLabs intranet

82 devices

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an observability toolchain

- a major hand-holding effort

- open node code instrumentation

- power monitoring processed similarly

- event timestamping

- PCAP encapsulation

- flow multiplexing

- Wireshark as a general event browsing and display tool

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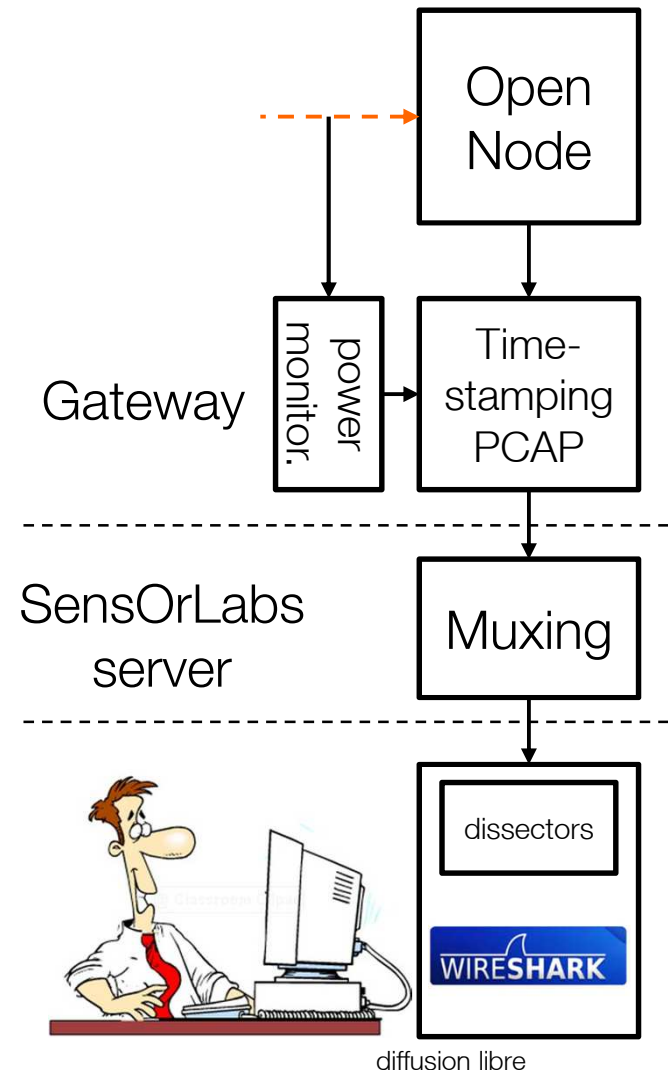
an underlying model for the network

- nodes, entities

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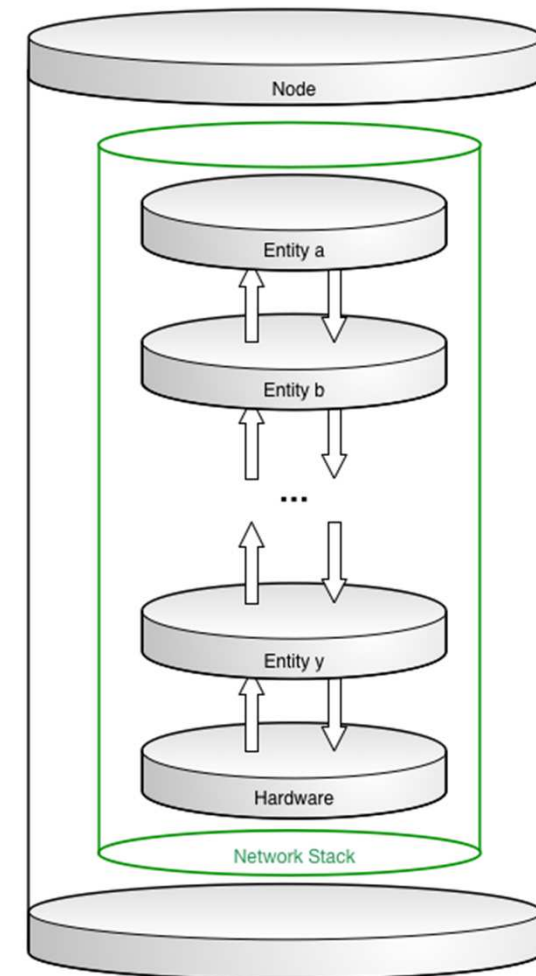
an underlying model for the network (2)

- nodes, entities

- links

- packets

- already applied to very different comm. stacks

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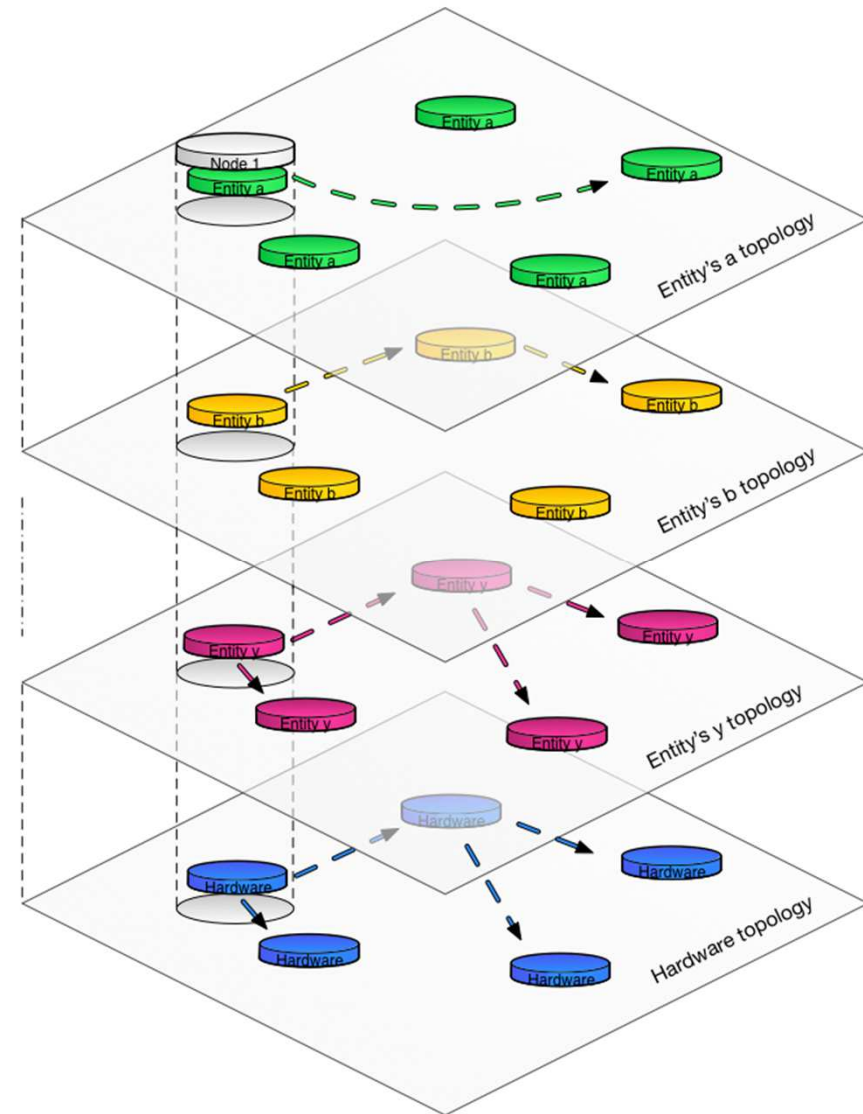
a taxonomy of observability events

Event name	Hexadecimal value (1 byte)
EVENT_NODE_ADD	0x00
EVENT_NODE_PROPERTY_ADD	0x01
EVENT_NODE_PROPERTY_UPDATE	0x02
EVENT_NODE_REMOVE	0x03
EVENT_ENTITY_ADD	0x10
EVENT_ENTITY_PROPERTY_ADD	0x11
EVENT_ENTITY_PROPERTY_UPDATE	0x12
EVENT_ENTITY_REMOVE	0x13

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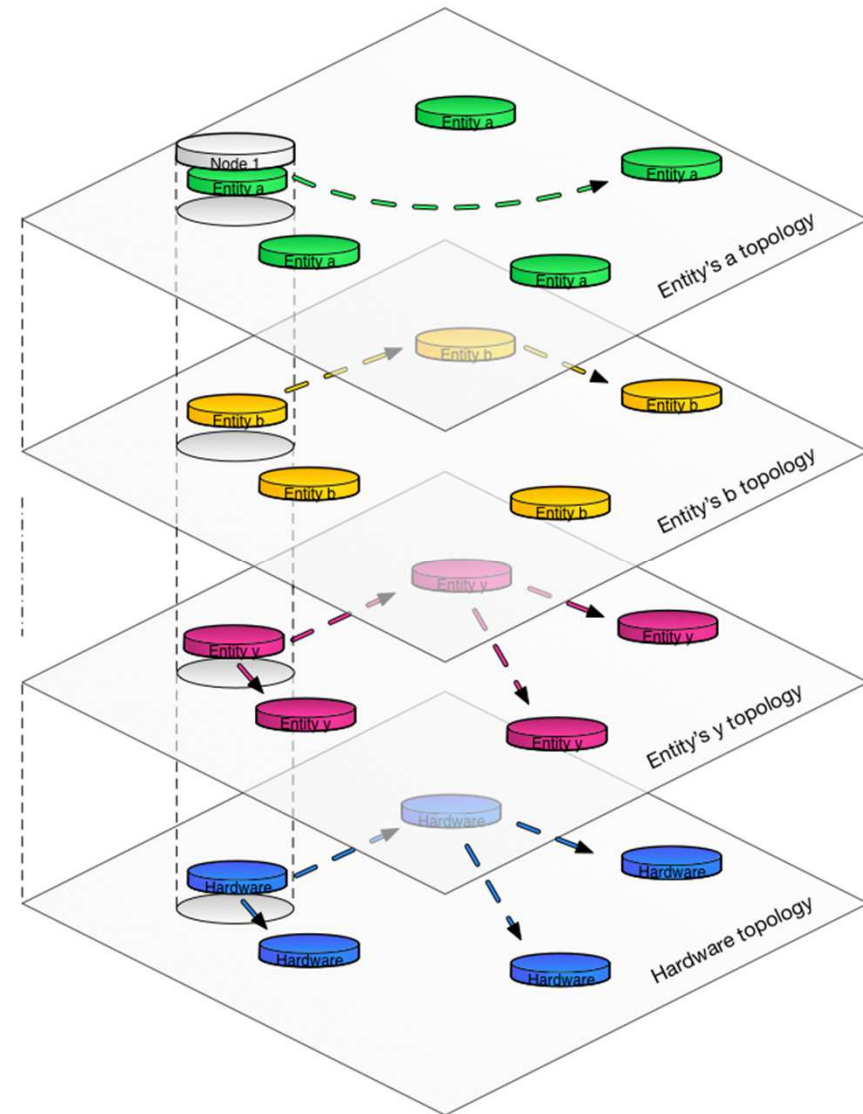
a taxonomy of observability events (2)

Event name	Hexadecimal value (1 byte)
EVENT_LINK_ADD	0x20
EVENT_LINK_PROPERTY_ADD	0x21
EVENT_LINK_PROPERTY_UPDATE	0x22
EVENT_LINK_REMOVE	0x23
EVENT_FRAME_PRODUCE	0x30
EVENT_FRAME_PROPERTY_ADD	0x31
EVENT_FRAME_PROPERTY_UPDATE	0x32
EVENT_FRAME_DATA_UPDATE	0x33
EVENT_FRAME_TX	0x34
EVENT_FRAME_RX	0x35
EVENT_FRAME_CONSUME	0x36

- Wireshark dissectors remain totally generic
  - assuming the network model

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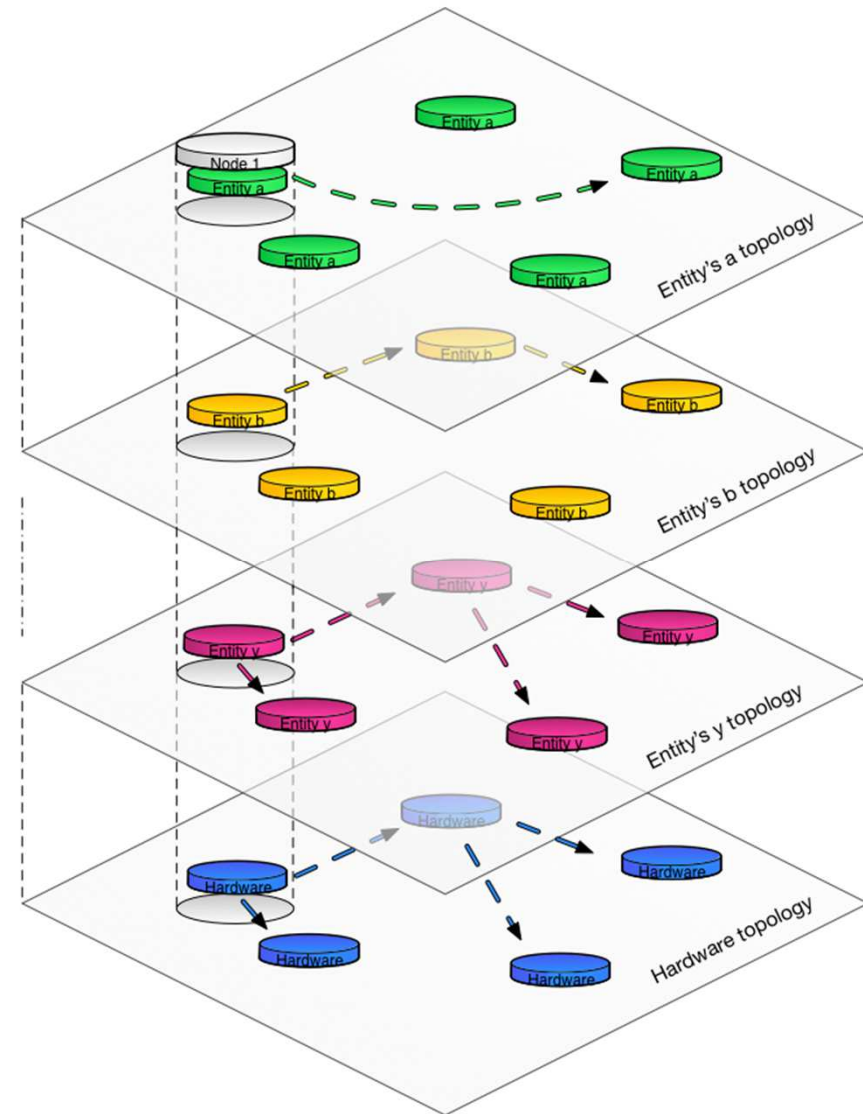
Staged timestamping and PCAP encapsulation

- log time spent in event buffer

    – in open node clock ticks

- compute serialization time

- insert (adjusted) absolute time

- restore platform-wide time monotonicity

event

Open Node
(relative time)

serial

Gateway
(absolute time)

Time-
stamping

NTP

SensOrLabs
server

Reordering
Muxing

Wireshark output

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Orange Labs Network visualizer
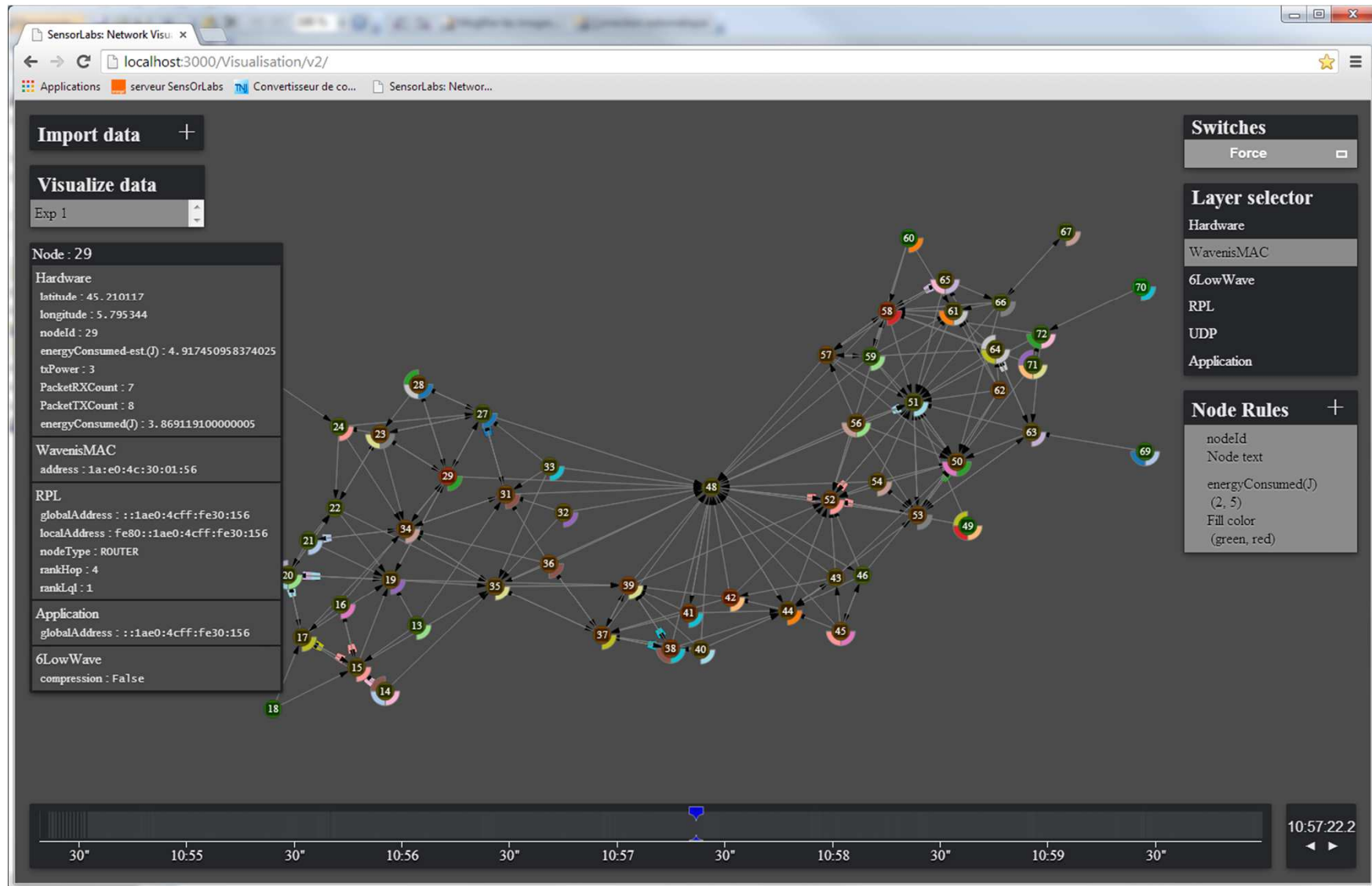
The way forward

- Make observability event specifications public

- Submit Wireshark dissectors for commit

- Provide Open Source observability libraries

  - Contiki, TinyOS, RIOT, FreeRTOS
  - might use a little help on this one

- Version 2 of SensOrLab

  - "standard" open node interface
  - more generic gateways (e.g. Raspberry PIs)
  - GPS synchronization, enhanced timestamping/reordering

thank you

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