WalT: testing sensor networks and distributed environments

E. Dublé, F. Rousseau, J. Baranguán, J. Zeni, I. Juc,

P.-H. Frohring, B. Faure

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The problem

- How to efficiently debug a **distributed system**?
- Sensor networks: even harder (constrained devices)

WSNs: existing solutions

- **Senslab - IoT-Lab**, other public platforms:
  - Pros: many nodes, readily available
  - Cons: remote access, not very flexible (e.g. you cannot replace a sensor)
- **"Hand-made"** one-time experiment:
  - Pros: on your own desk, very flexible, local setup
  - Cons: time-consuming setup, not conceivable for many nodes

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The WalT approach

- **WalT**: Wireless Testbed
- Intermediary approach:
  - **Local** in your lab or company
  - **Open source** testbed management software
  - **Open documentation** and hardware recommendations
- You buy the (cheap) infrastructure, the project provides the rest of the stack

WalT nodes and network

- Walt nodes are built on a cheap (around 35€) Single-Board-Computer called **Raspberry Pi**[1]
- Walt nodes boot an OS stored on the LAN. Depending on the use case, it may be:
  - Your choice of **Linux** distribution
  - **Android** (if you simulate a network of smartphones)
- Walt nodes are linked together using a Power-Over-Ethernet network

[1] We may evolve to another platform in the future if needed / valuable.

WalT scenarios

1. **Sensor networks**:
   connect 1 or more sensors to each RPi node
   - The RPi is used as a gateway to communicate with the sensor and control it (flash, reboot)
   - Useful to test WSN protocols

2. **Distributed systems**:
   use the RPi nodes themselves
   - Useful to test data management systems, TCP congestion avoidance optimizations, etc.

Founding

- **AGIR (UJF/INP) 2013/2014**: Hardware, trainees
- **ST**: Sensors, industrial contract (up to end 2013)

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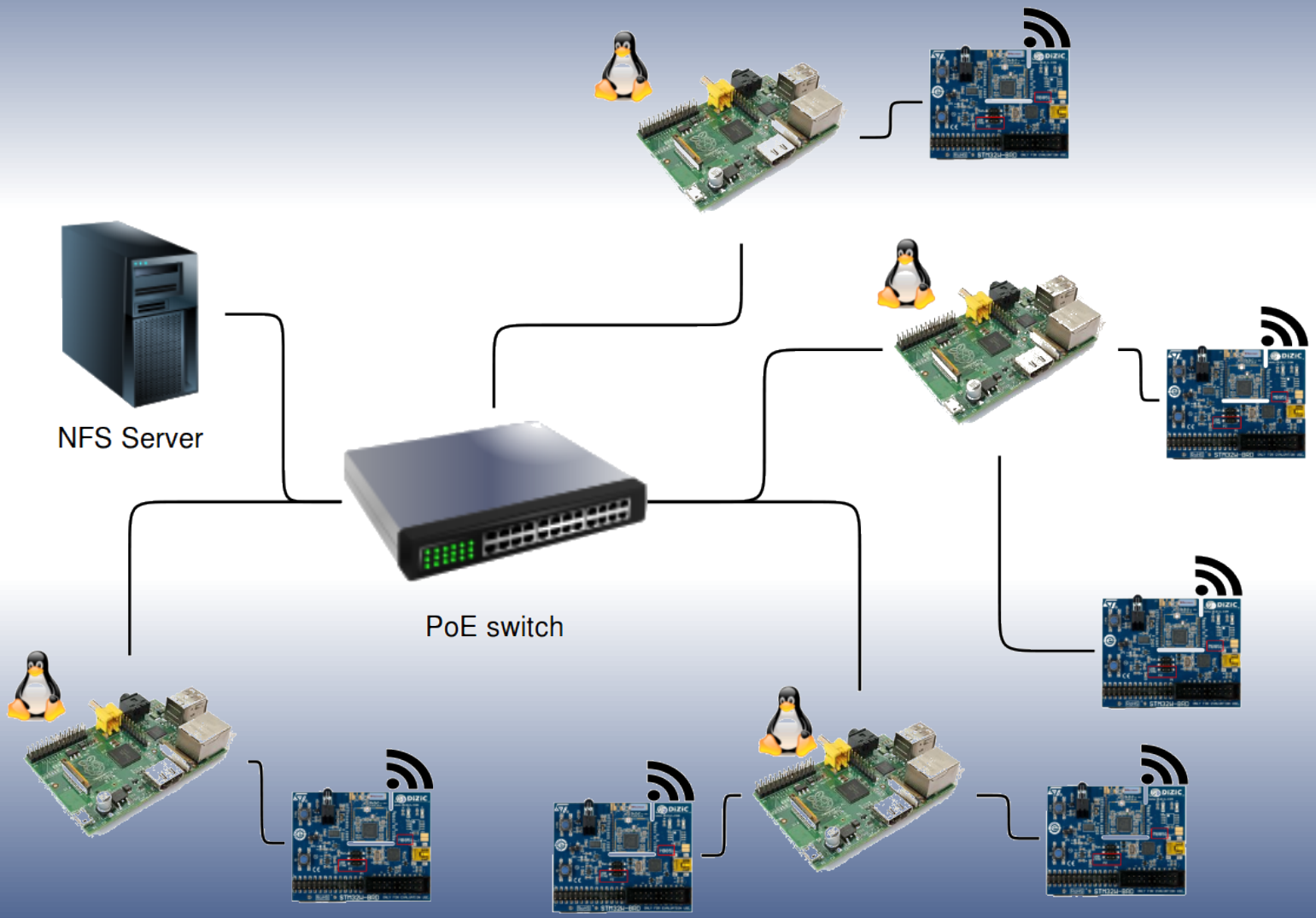
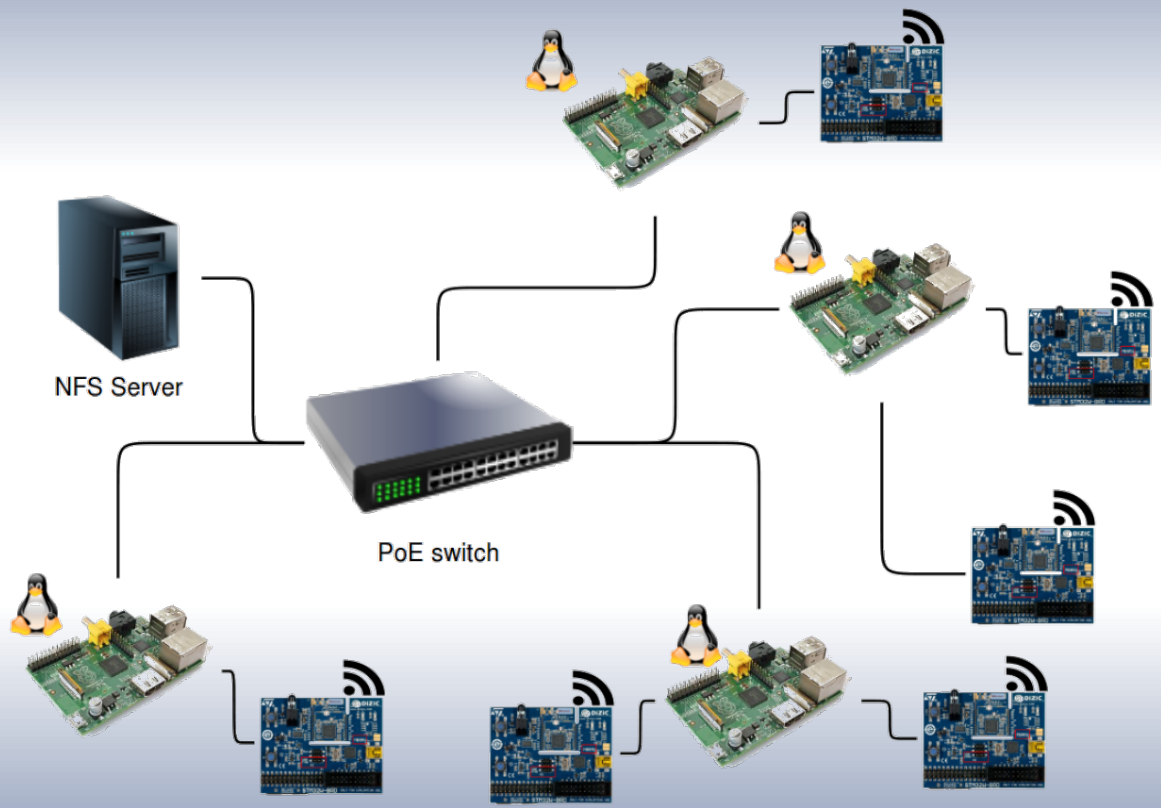
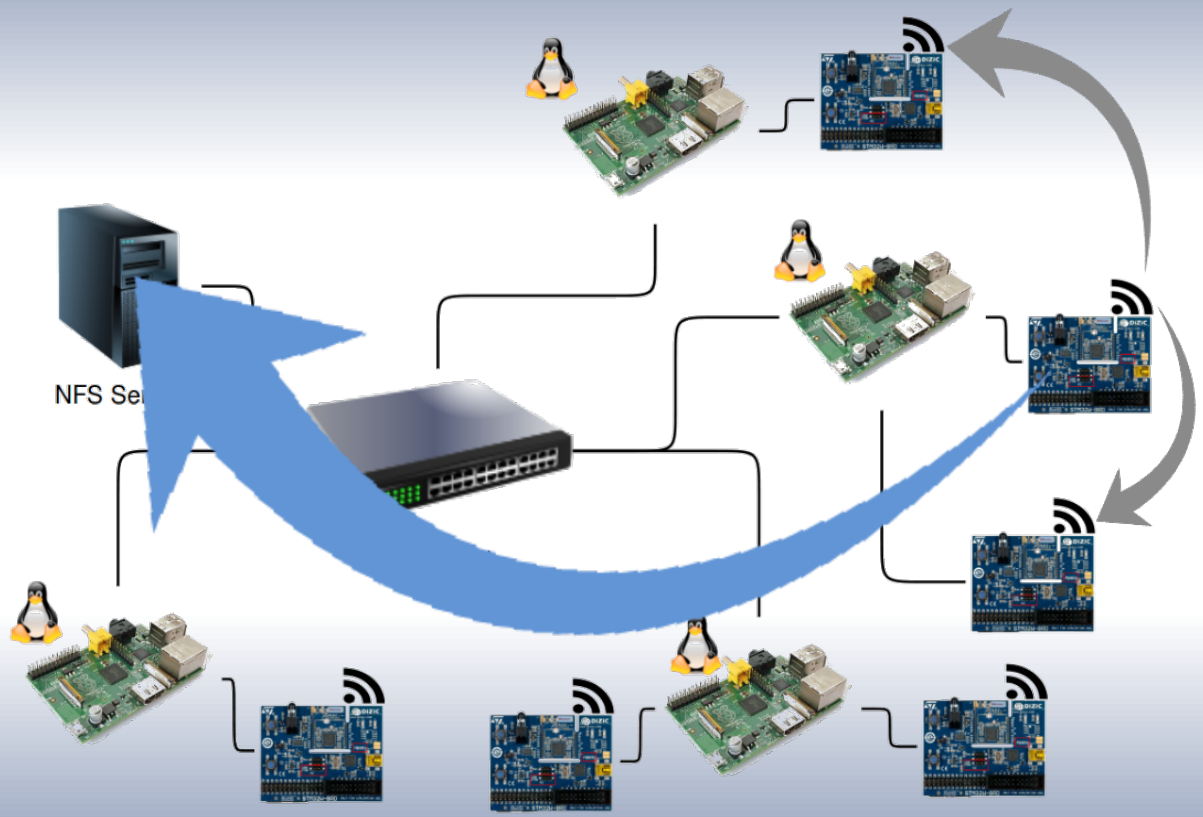
WalT architecture (scenario 1)



Collecting sensor traces...

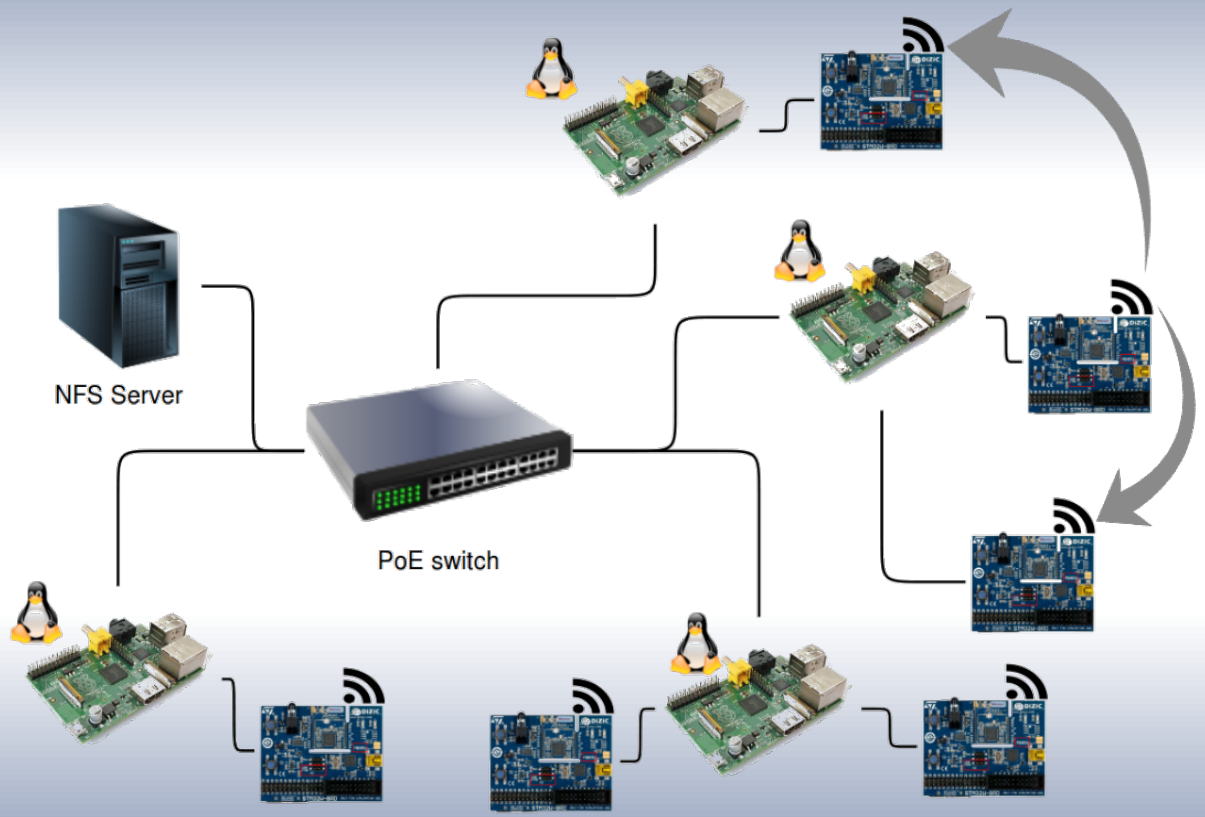


Collecting sensor traces...

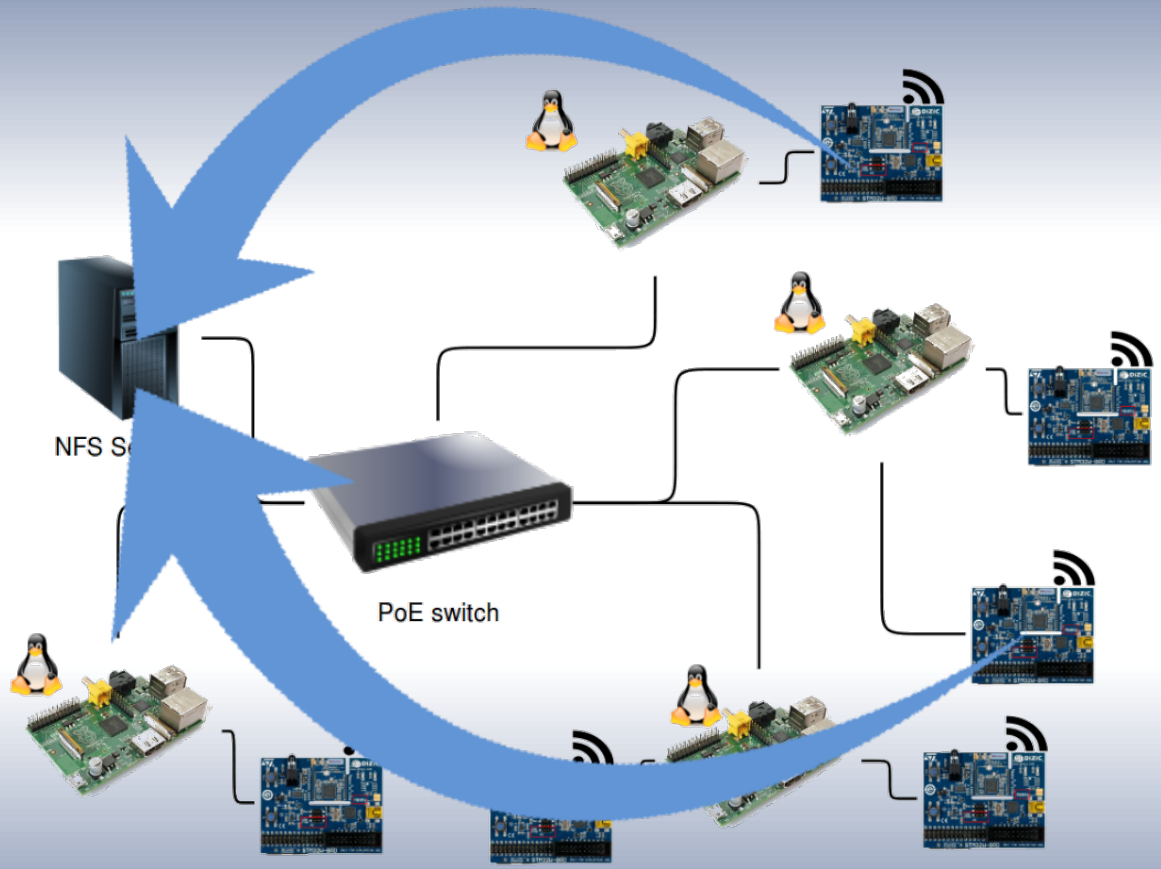


trace from sensor X : **sending** <**packet**>

Collecting sensor traces...



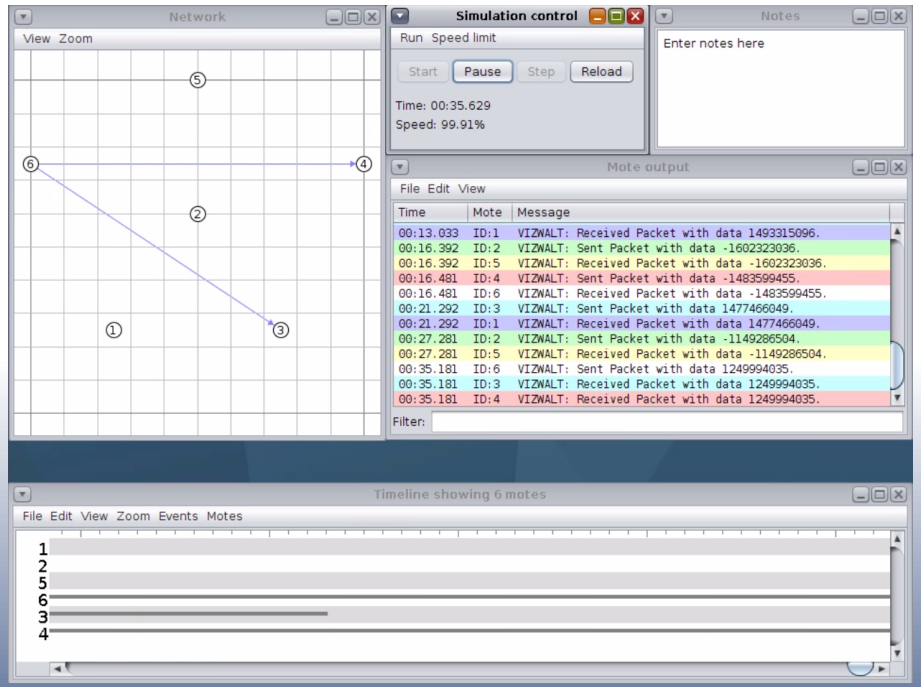
Collecting sensor traces...



trace from sensor Y : **received <packet>**
trace from sensor Z : **received <packet>**

...and then:

- The traces are analysed by the server (e.g. "which sensors received this packet?")
- The traces are then directed to the **VizWalT** GUI



WaIT GUI: VizWaIT

- A modified simulator: **cooja**
  - VizWaIT reuses cooja's interface
- But:
  - In an unmodified cooja : each node is *smart*
  - In VizWalt : each node *reflects* the behaviour of a real sensor

Technical challenges

- Sensors send traces through their **serial link**, which is slow (slower than the radio!)
  - It may disturb the behavior of the sensor.
  - Solutions being implemented:
    - Send only one small part of the packet (enough to identify it).
    - Improve the serial link driver (use **DMA**).
- **Synchronization** issues (being explored)
- **Cooja-related** issues (real-nodes versus emulated-nodes paradigm)

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Demos

1. Preliminary version of a **WalT tesbed management** tool
2. Sample **WalT session with DSME nodes**

The end...

Questions?