Head in a Cloud: an Approach for Arduino YUN Virtualization

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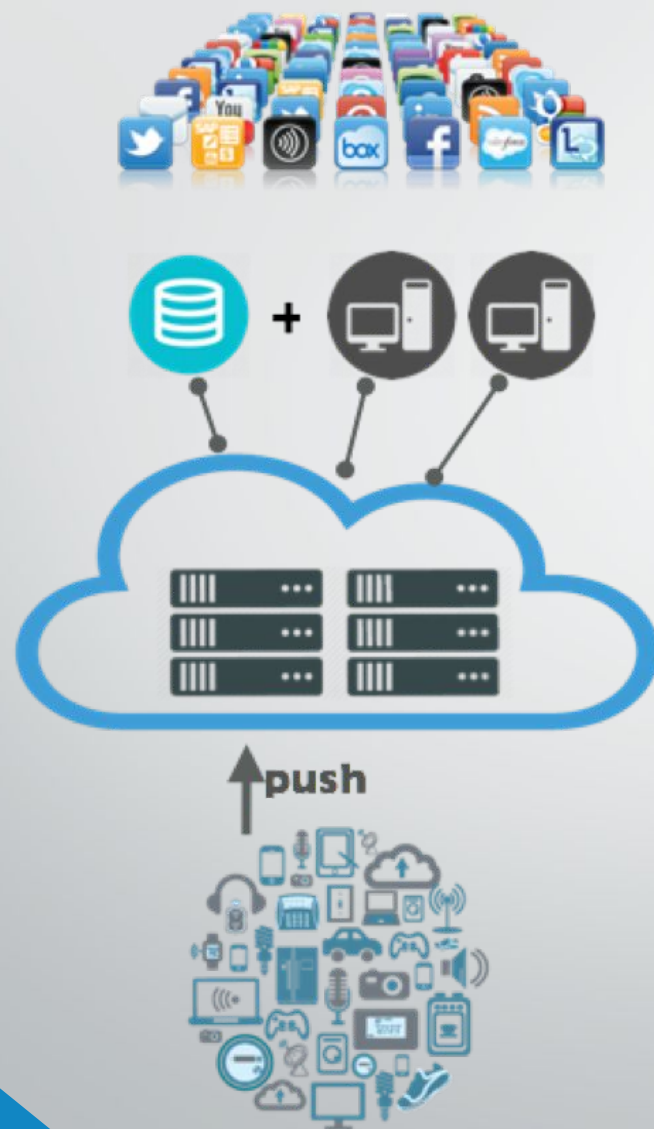Kazan Federal University
Arduino

Outline

- Intro
  - device-centric paradigm
- Technology enablers
  - Arduino
  - OpenStack
- Virtualization approach
  - design
- Proof-of-Concept
- Experiment
  - results
- Future work

Cloud and IoT integration: data-oriented

- IoT devices **send** data to the Cloud

- apps built on top of **standard** cloud facilities (VMs, storage, network)

- apps make use of stored (**non-real time**) IoT data

- indirect, IoT **device-initiated** only, retrieval of actuation commands

Cloud and IoT integration: application-specific

ad-hoc
interaction

push
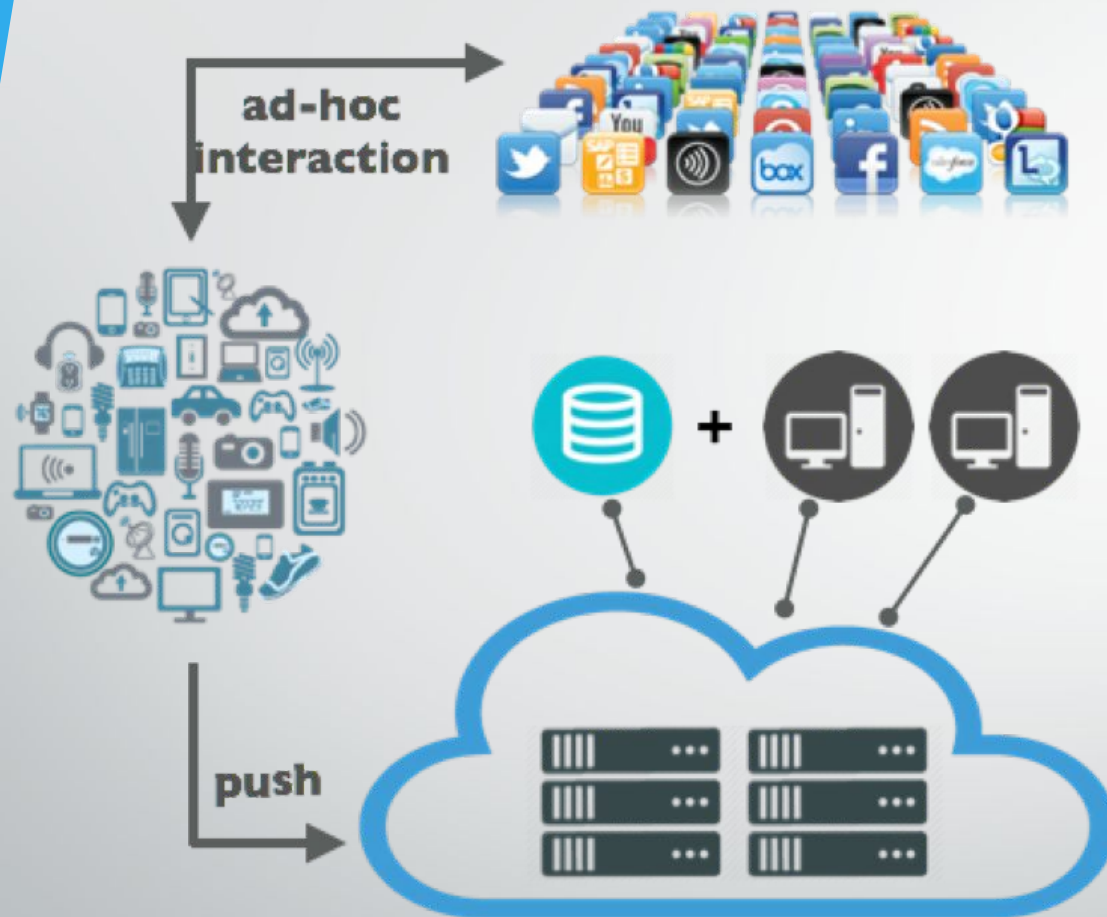
- apps use **ad-hoc mechanisms** to interact with IoT devices

- **no explicit interactions** between Cloud components and IoT infrastructure

- **static** infrastructure deployment

Cloud and IoT integration: full thing "cloudification"

- IoT infrastructure as a **natural extension** of a datacenter
- well-defined Cloud **API** as a resource management interface
- **separation of concerns** between infrastructure and application (when needed)
- from Cloud to Fog/**Edge** computing
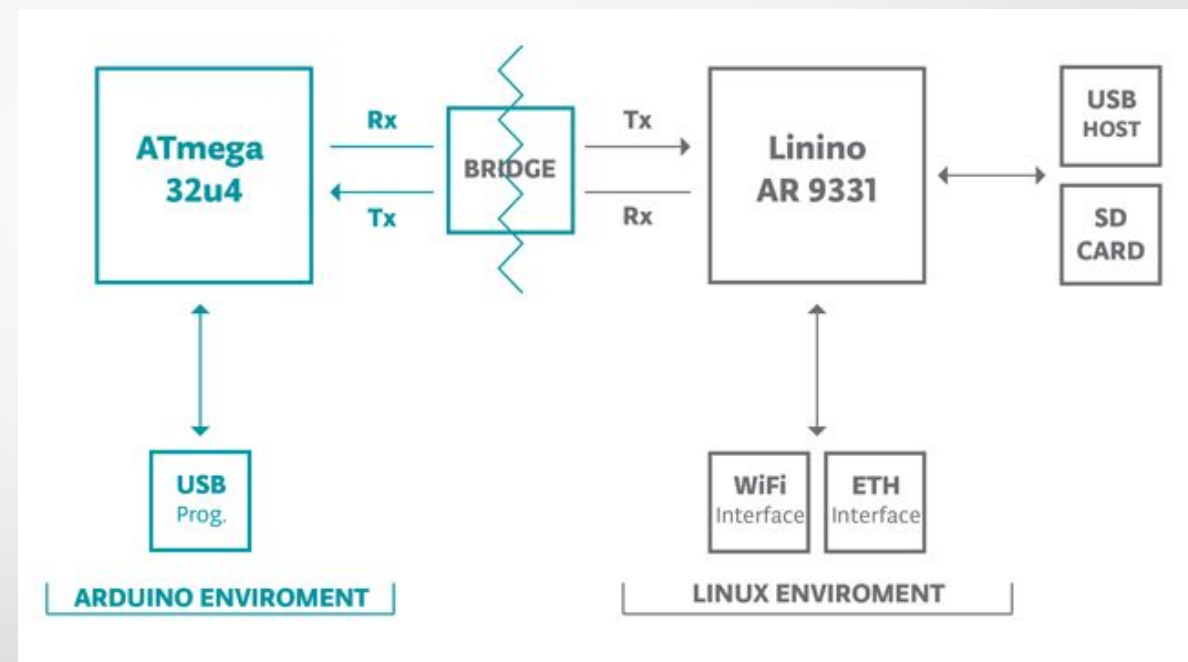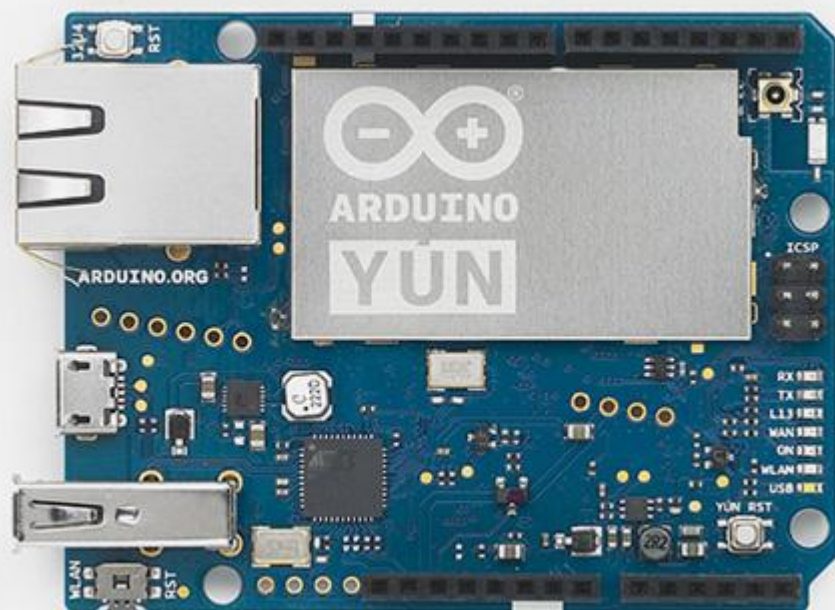- device computation **offloading**

Device-centric paradigm: I/Ocloud
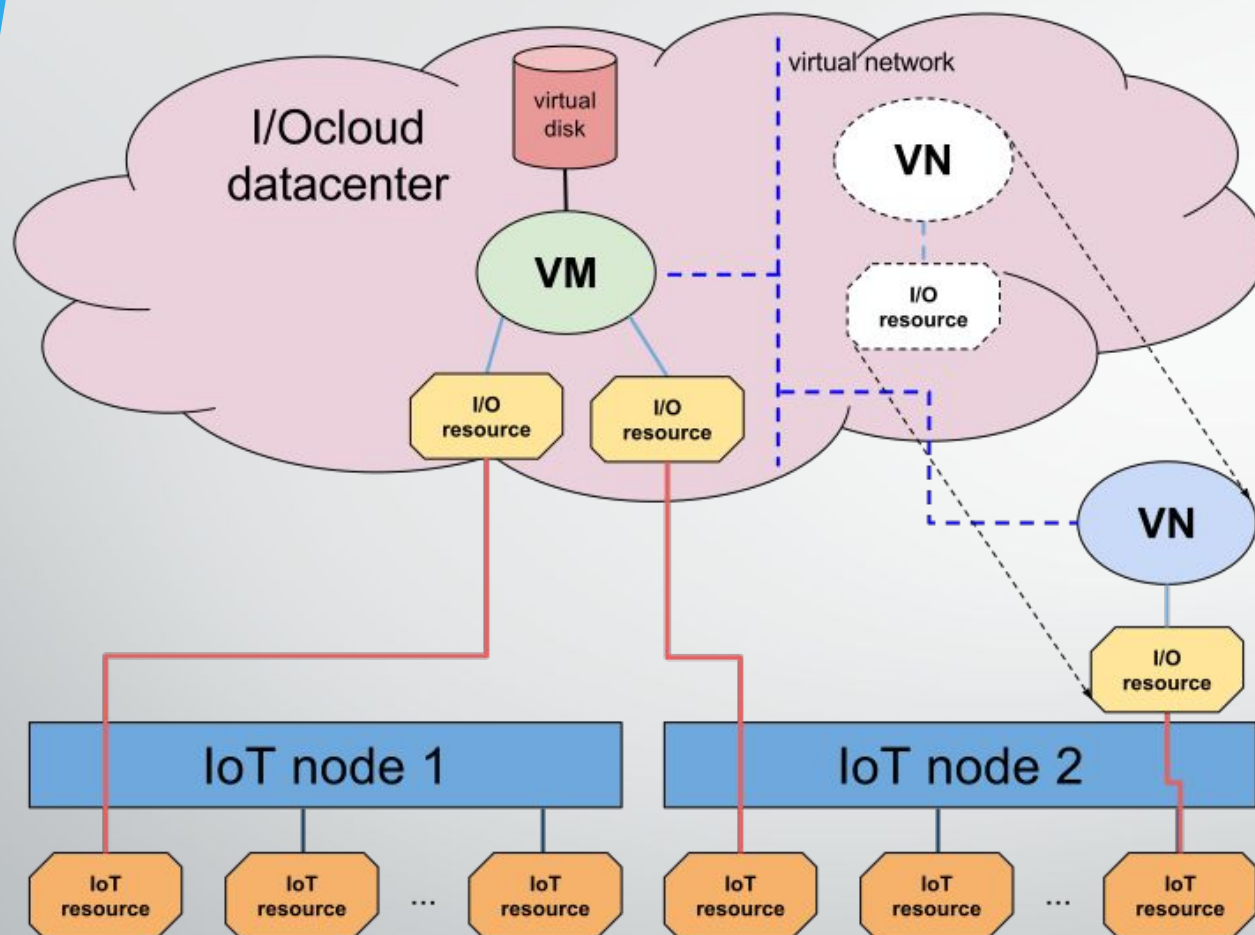
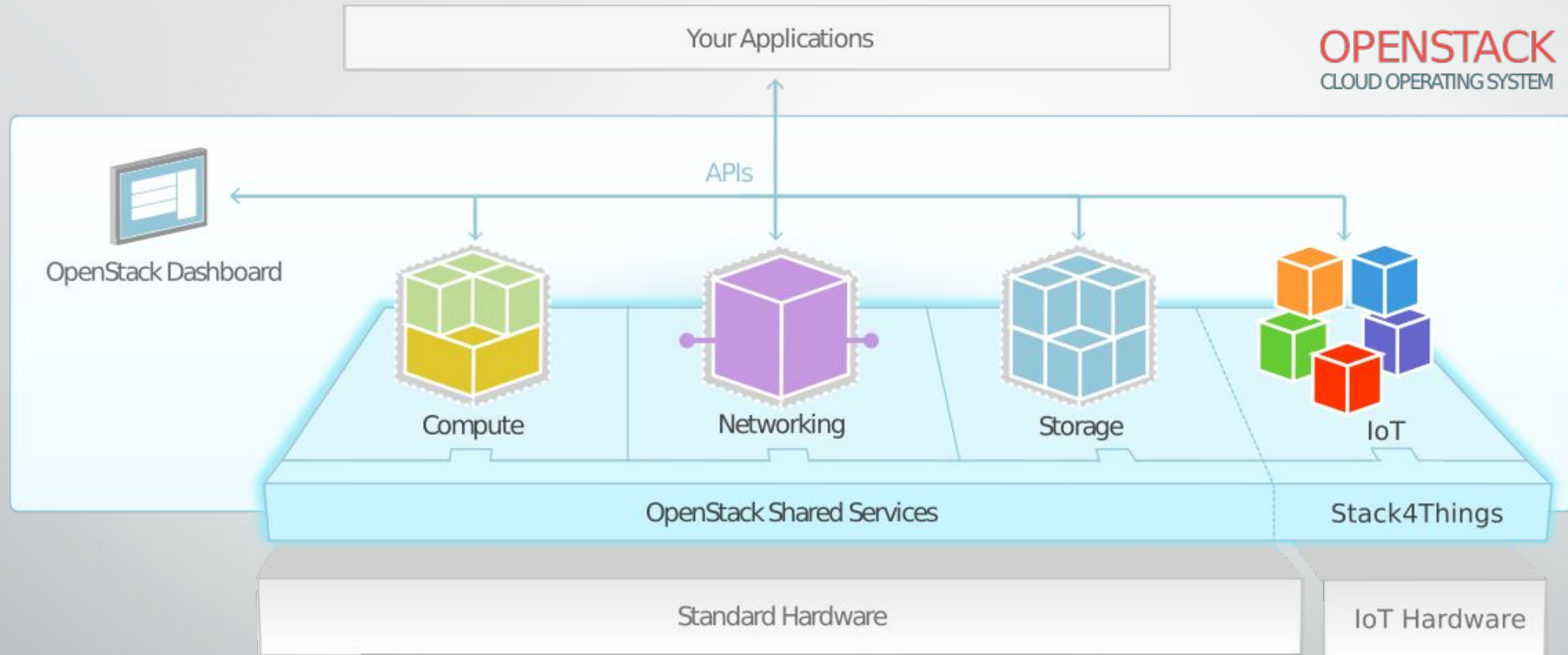Approaches
(to **I/O extensions** for the Cloud):

- Bare-metal (**VM**s with **I/O**)
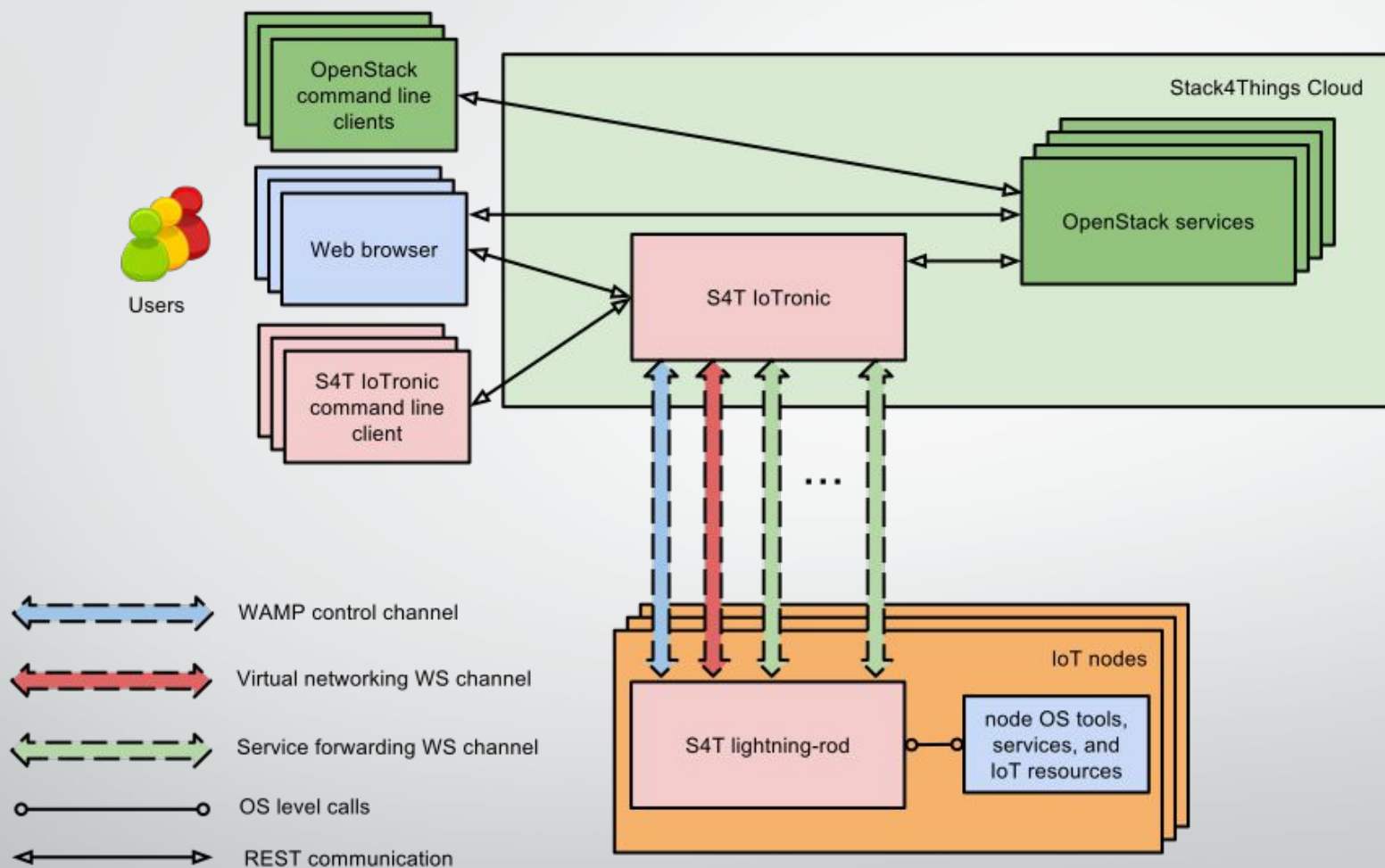- Virtualization (**VN**s)

Arduino YUN

OpenStack extensions for IoT: Stack4Things

Stack4Things architecture

Virtualization: architecture
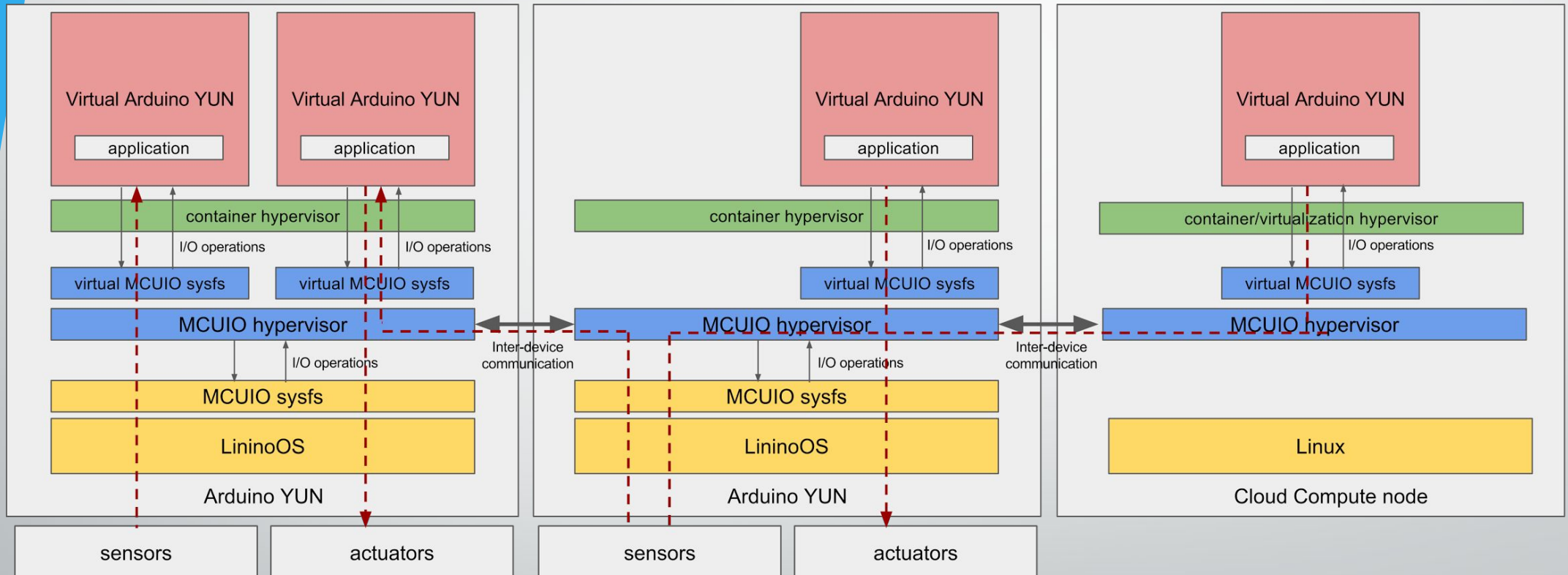
PoC experiment: scenario
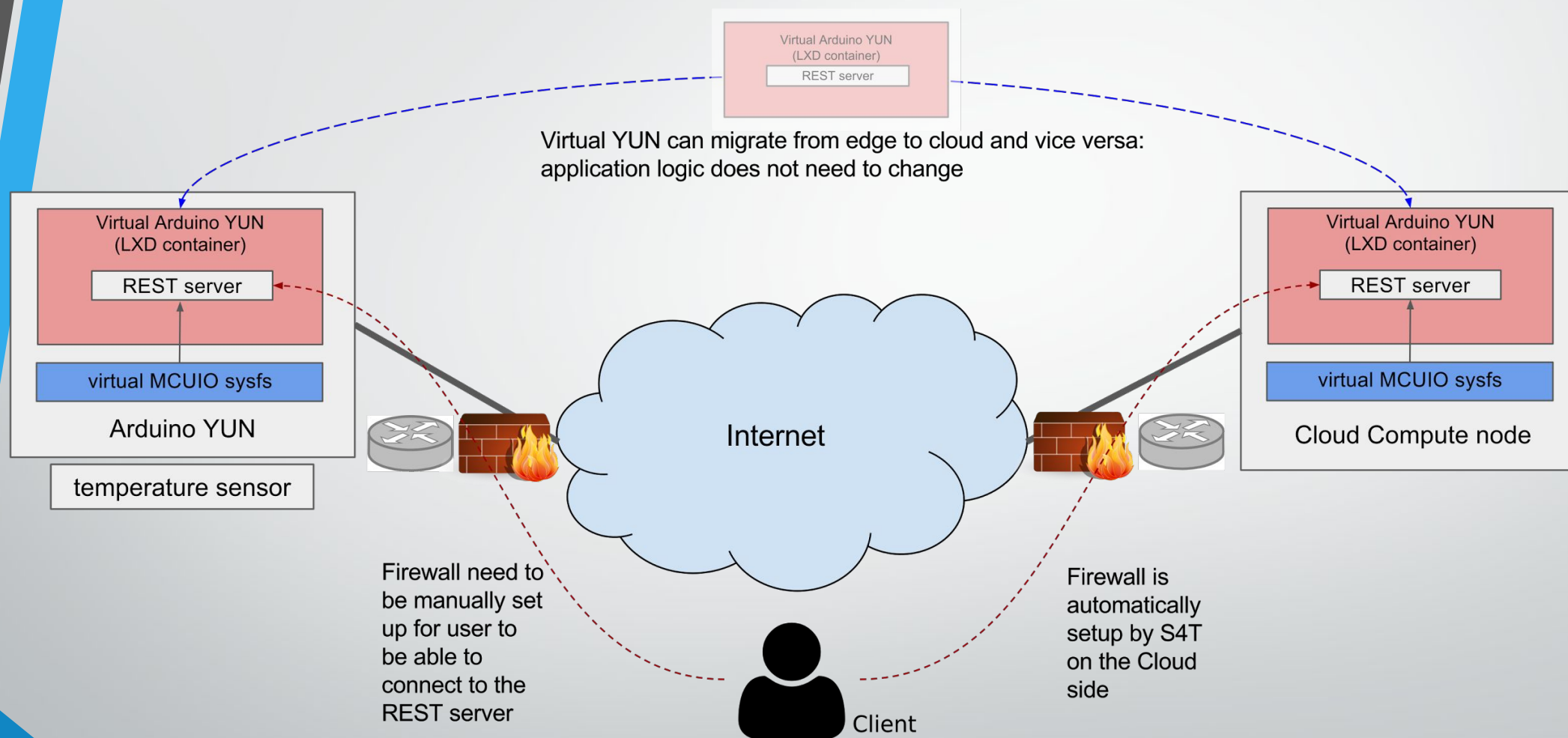
Experimental results
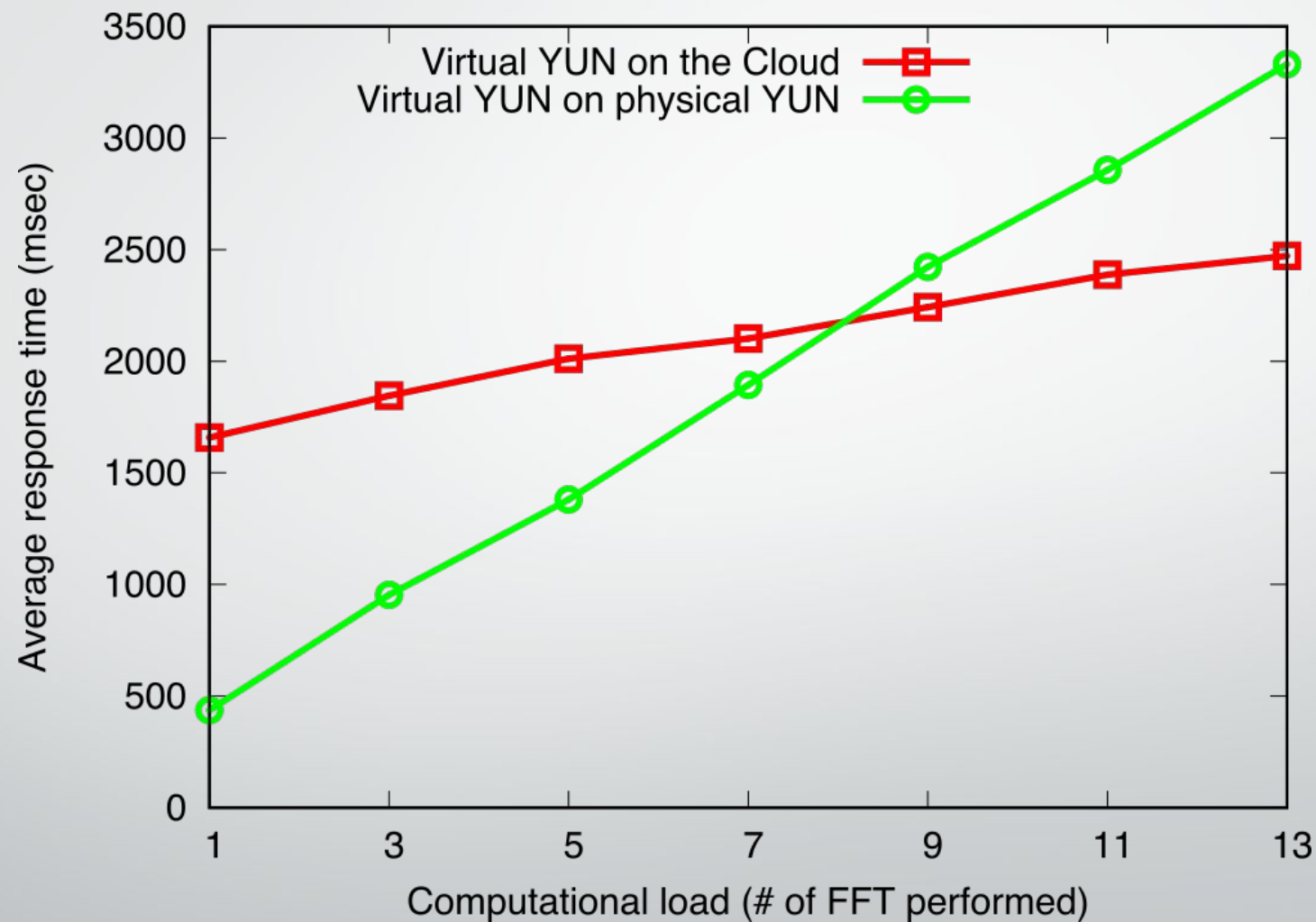
Future work

- manage pin naming/**mapping**, access control and **concurrency**

- forward hardware **interrupts** (*poll*-like POSIX semantics)

- **migrate** virtual IoT devices across **ISA**s

Q&A

Thanks!

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