!CHAOS
A Cloud of Controls

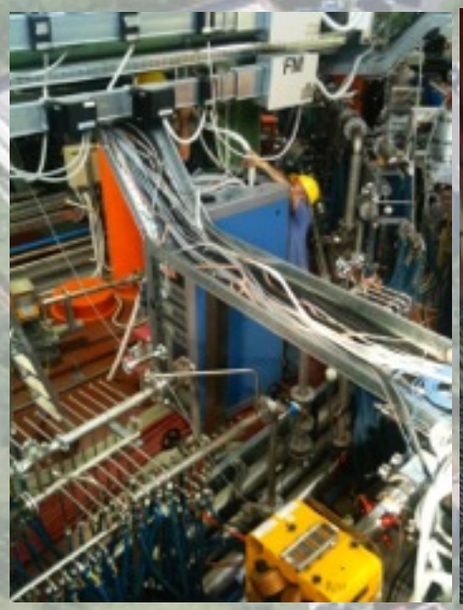
Design and implementation of a **prototype** of **Control as a Services**: an infrastructure at **national level** which offers a **cloud of services** and **procedures** distributed and shared over the LAN/WAN, to **monitor** and **control** any hardware device, system or intelligent component and which provides resources to processing services, data logging and archiving.

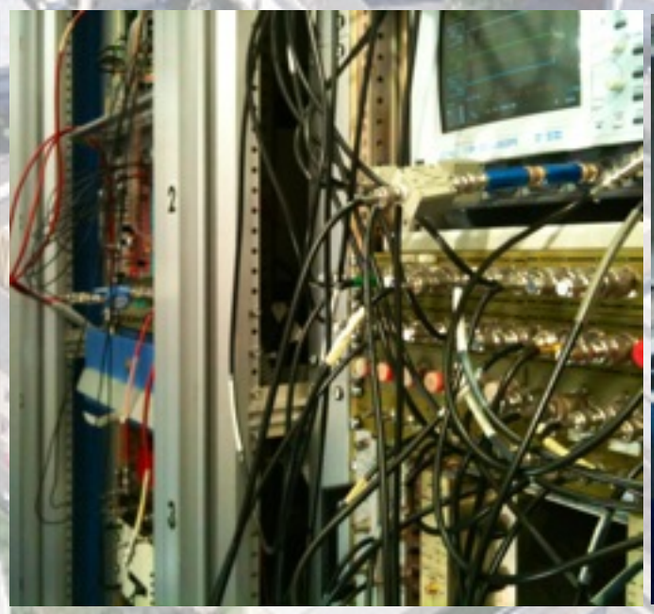
G.Mazzitelli on behalf of !CHAOS project
http://chaos.infn.it/

Workshop della Commissione Calcolo e Reti dell'INFN
Laboratori Nazionali del Sud dell'INFN
27- 30 May 2014

Why, when & where the project started

plant → sensors/actuators → front-end → control room





!CHAOS general objectives

To design a new Control System — using cutting-edge software technologies — with the following aims:

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- native integration of a DAQ system
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- compatibility with commercial standards

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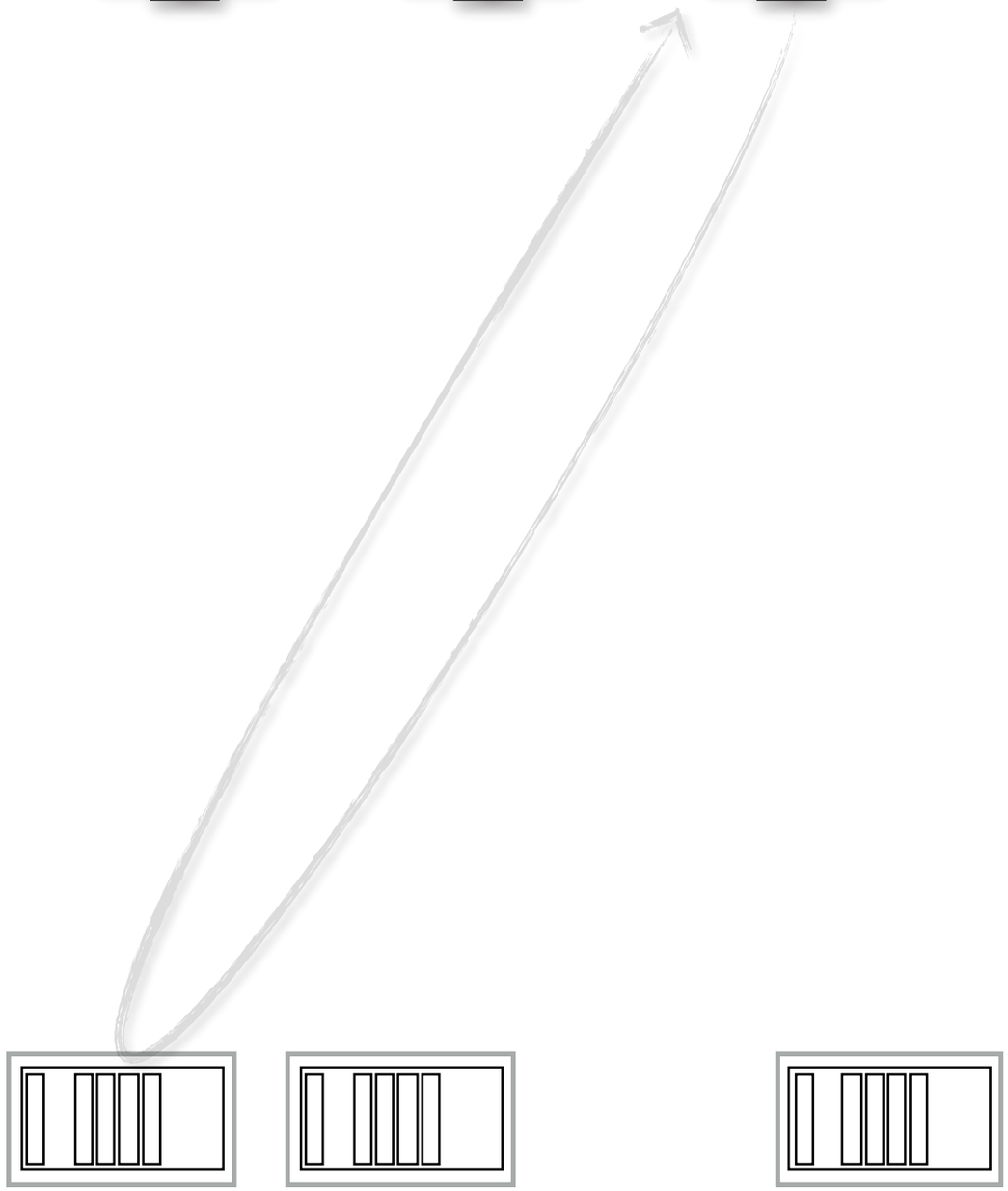
✓
- format free data and processes abstraction

✓
- devices (to be controlled) hot-integration and auto-configuration

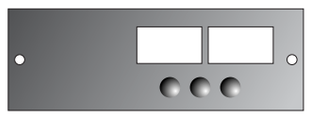
✓
- native integration of a DAQ system
- compatibility with commercial standards

!CHAOS is a *System that offers Services* rather than a mere *Control System*

control room

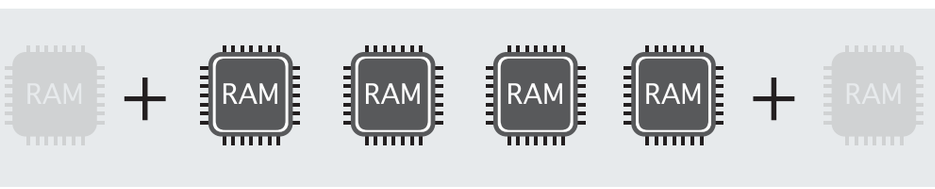


front-end controllers

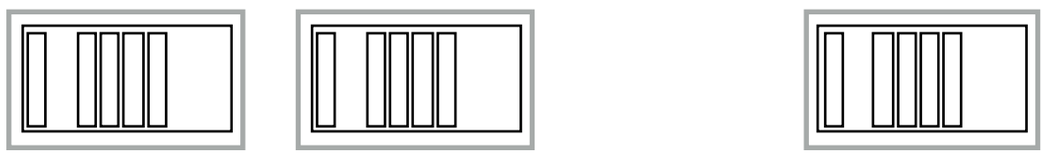


device

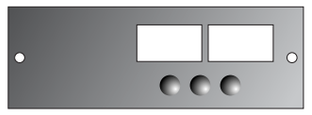
control room



object caching

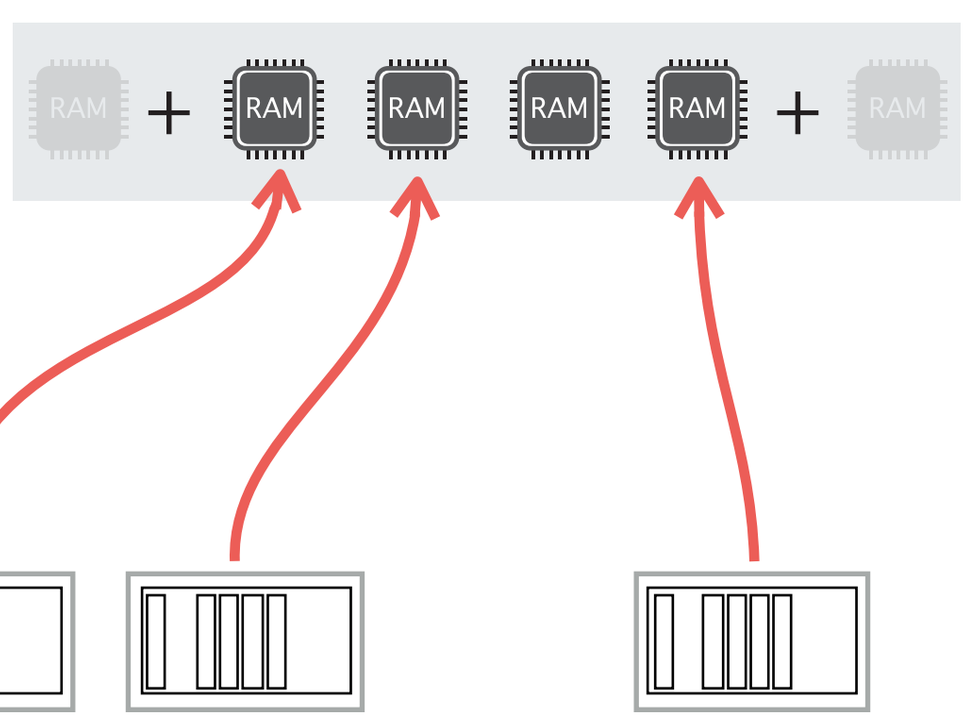


control units (CUs)



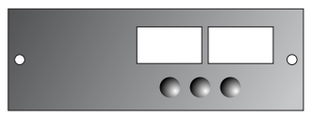
device

control room



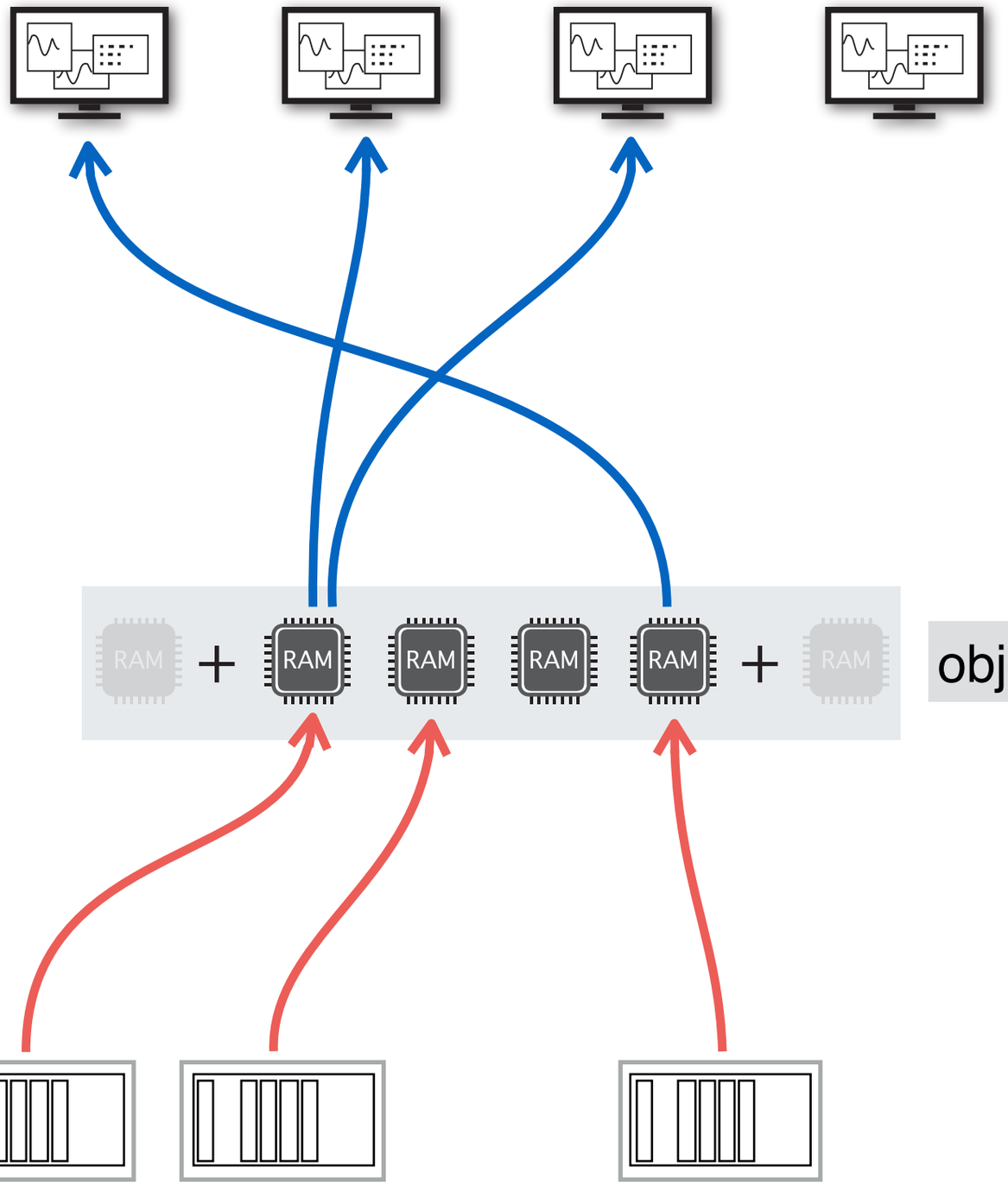
object caching

control units (CUs)



device

control room

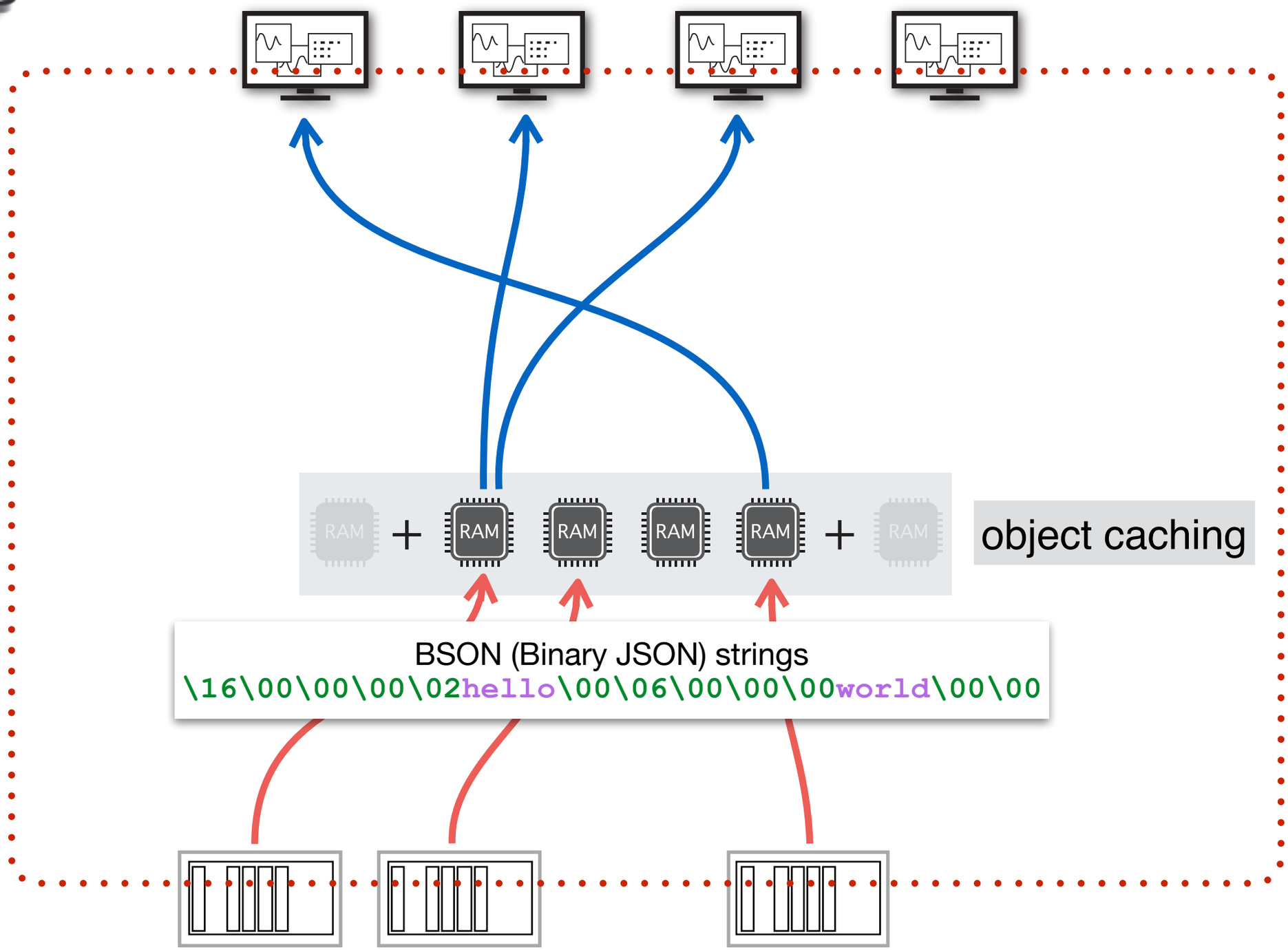


object caching

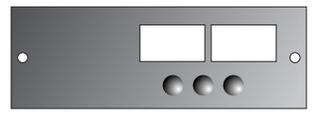
control units (CUs)

device

control room

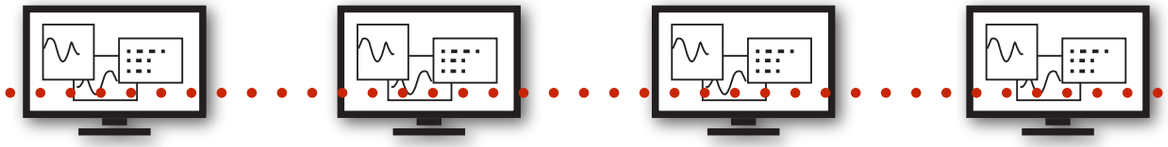


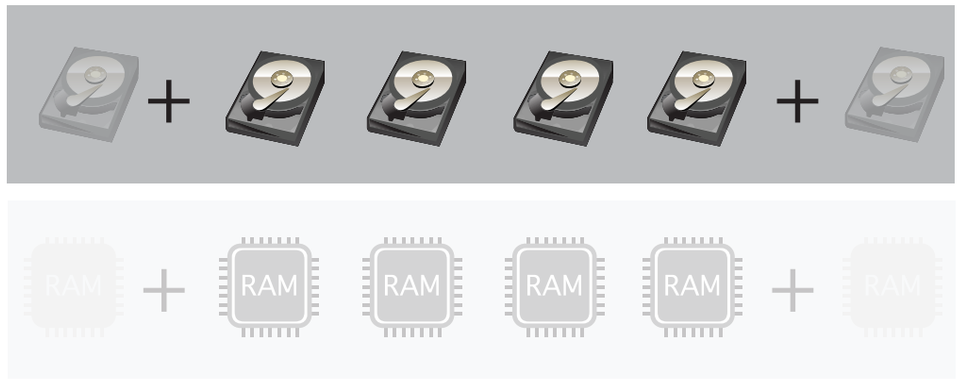
control units (CUs)



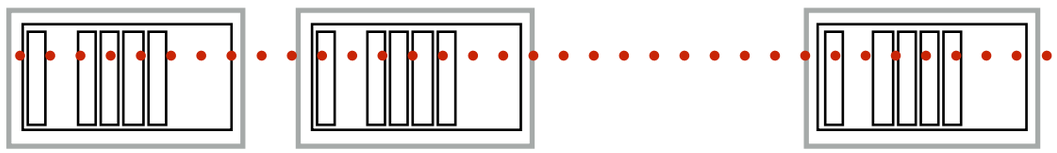
device

control room





key-value DB



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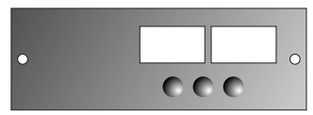
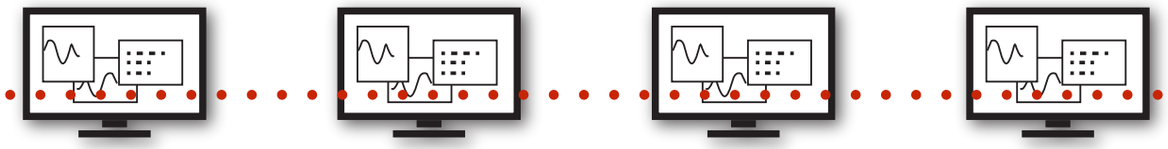
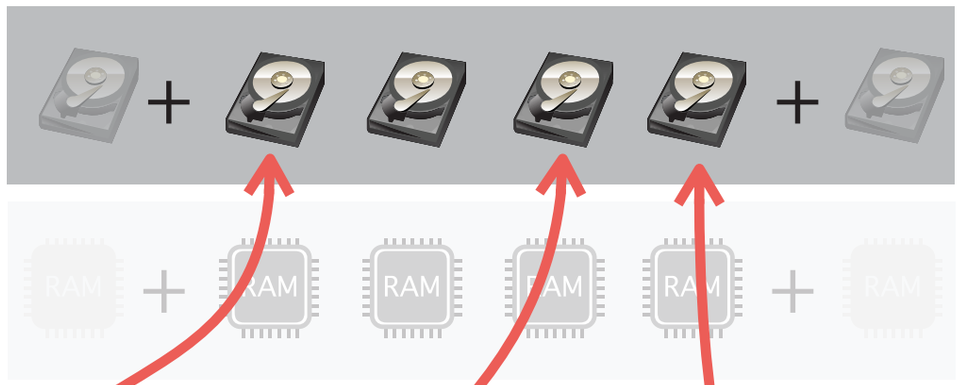


device

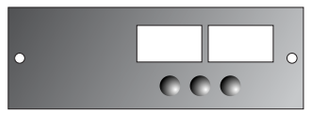
control room



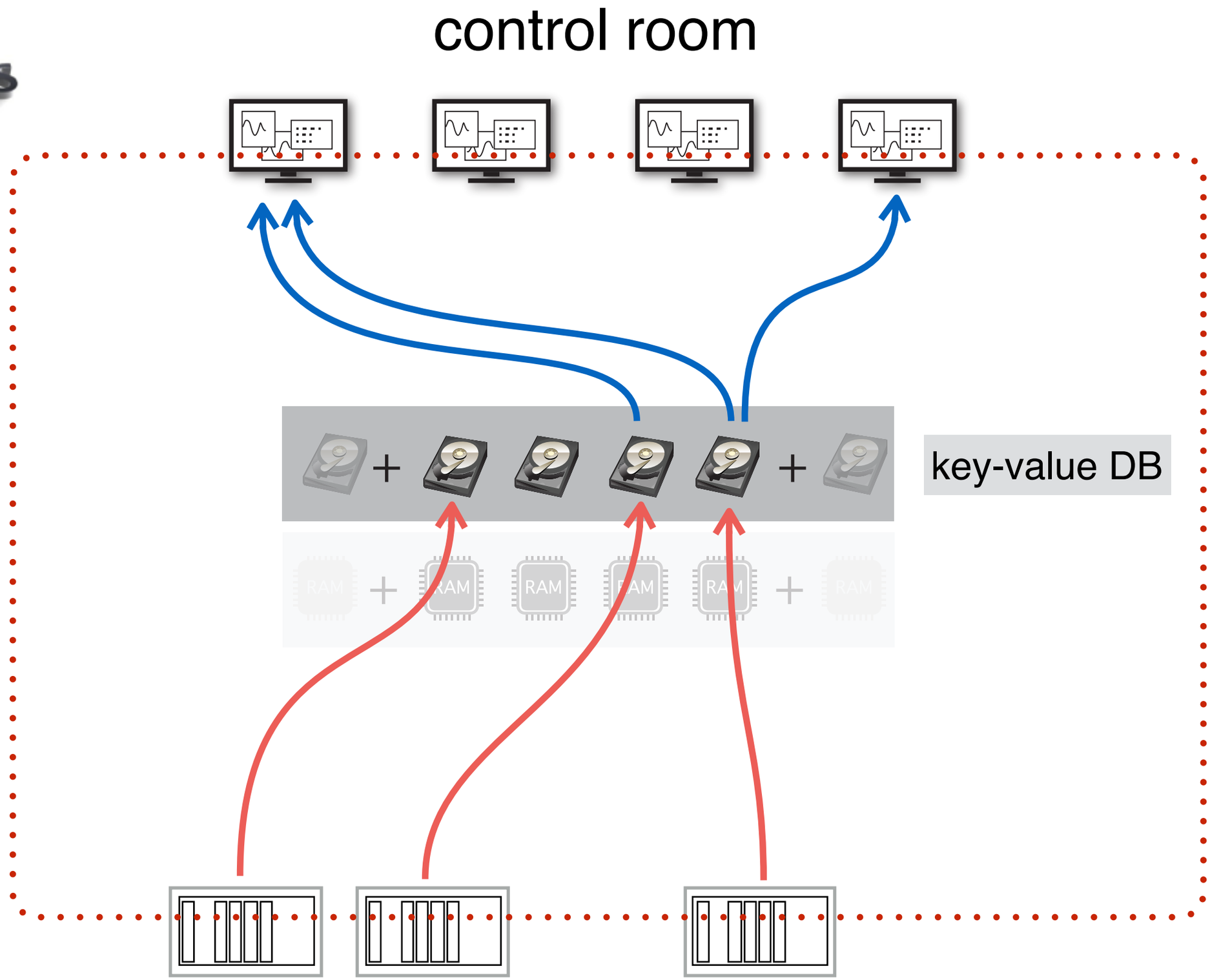


key-value DB

control units (CUs)



device


control room
key-value DB
RAM
control units (CUs)
device

control room

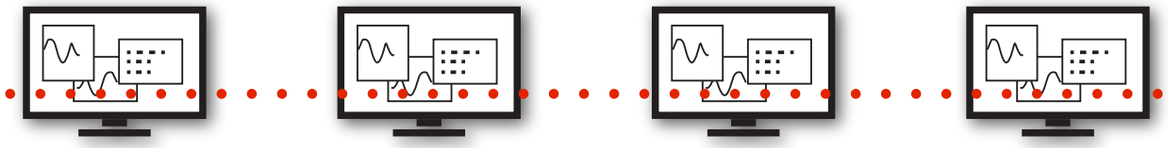
key-value DB

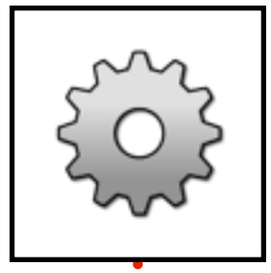
data management

control units (CUs)

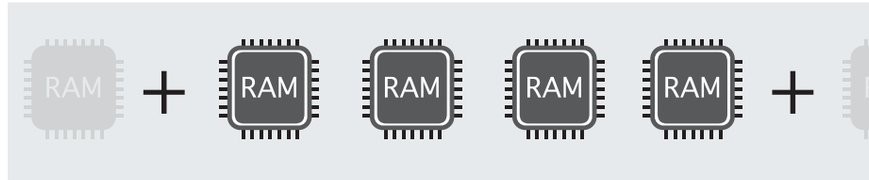
device

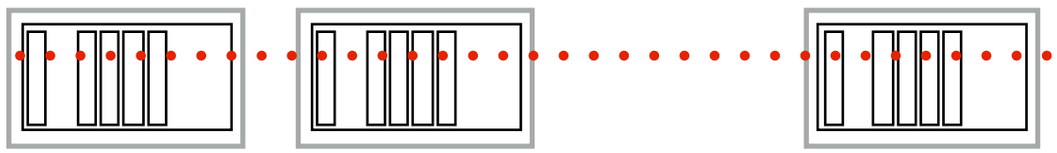
control room





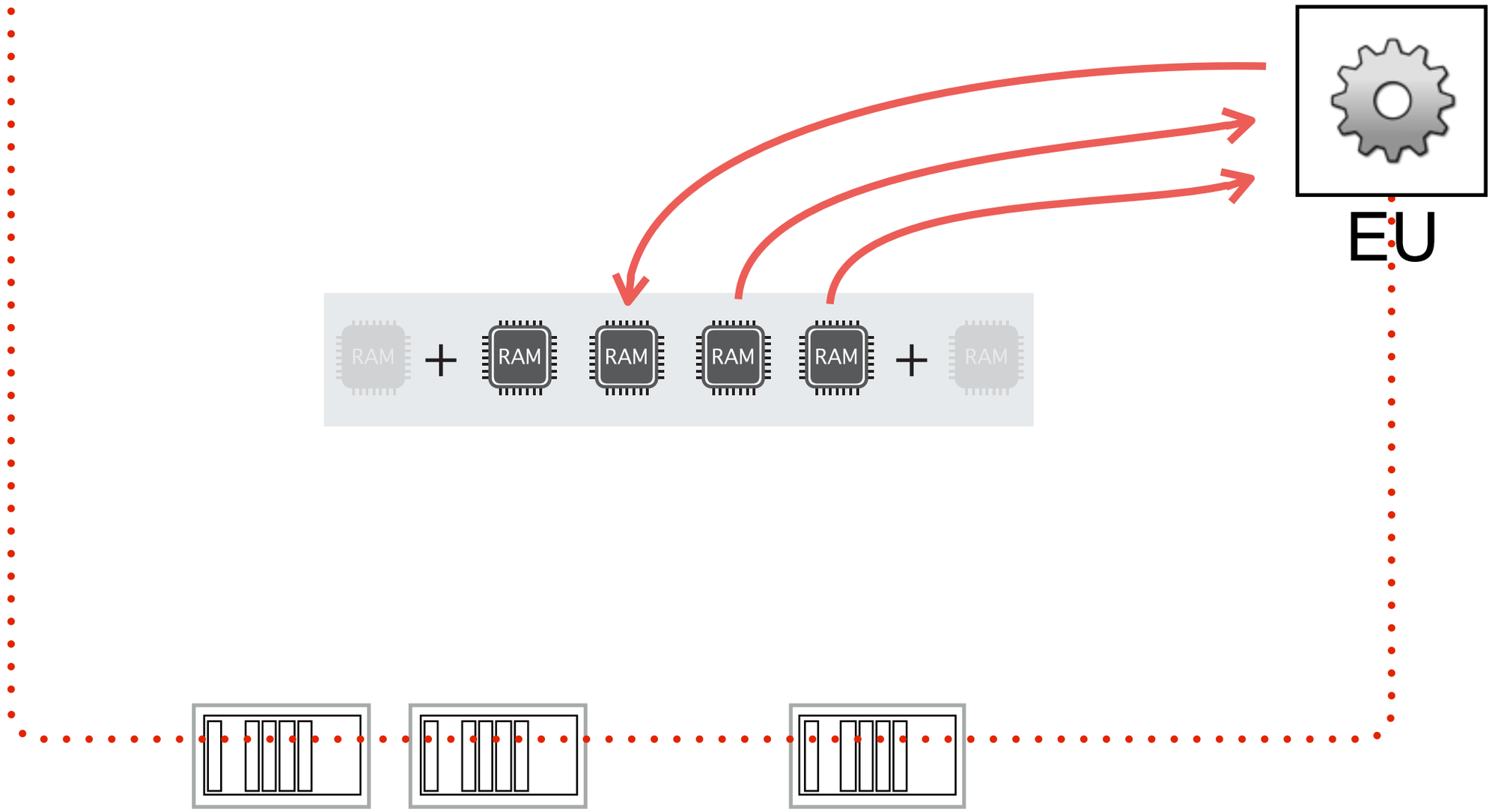
EU





control units (CUs)

control room



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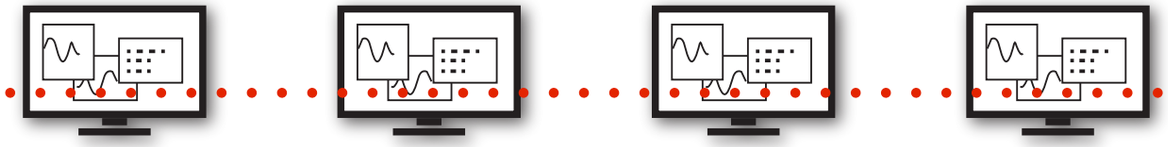
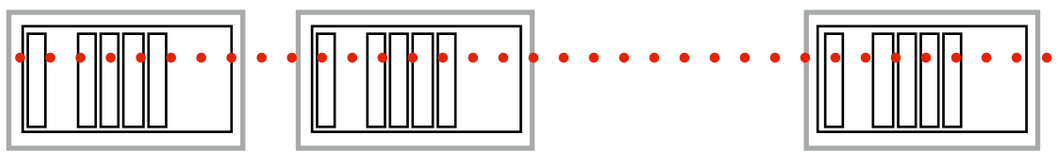
control room



Metadata server
system dynamic configuration



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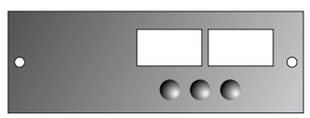
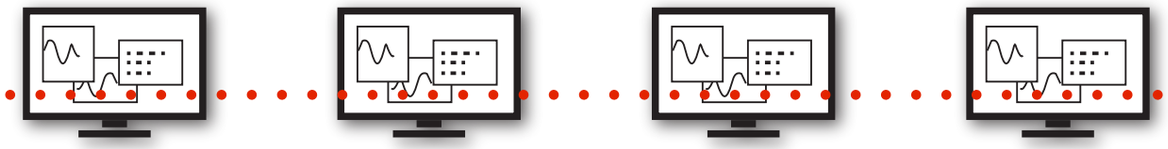


device

control room



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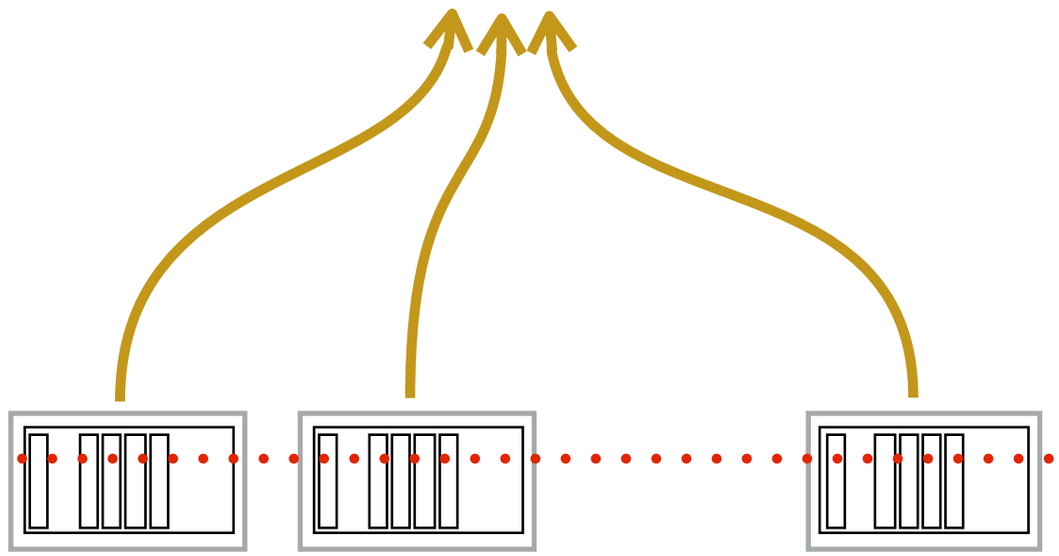
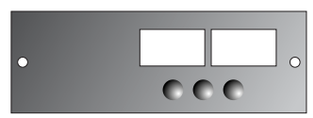
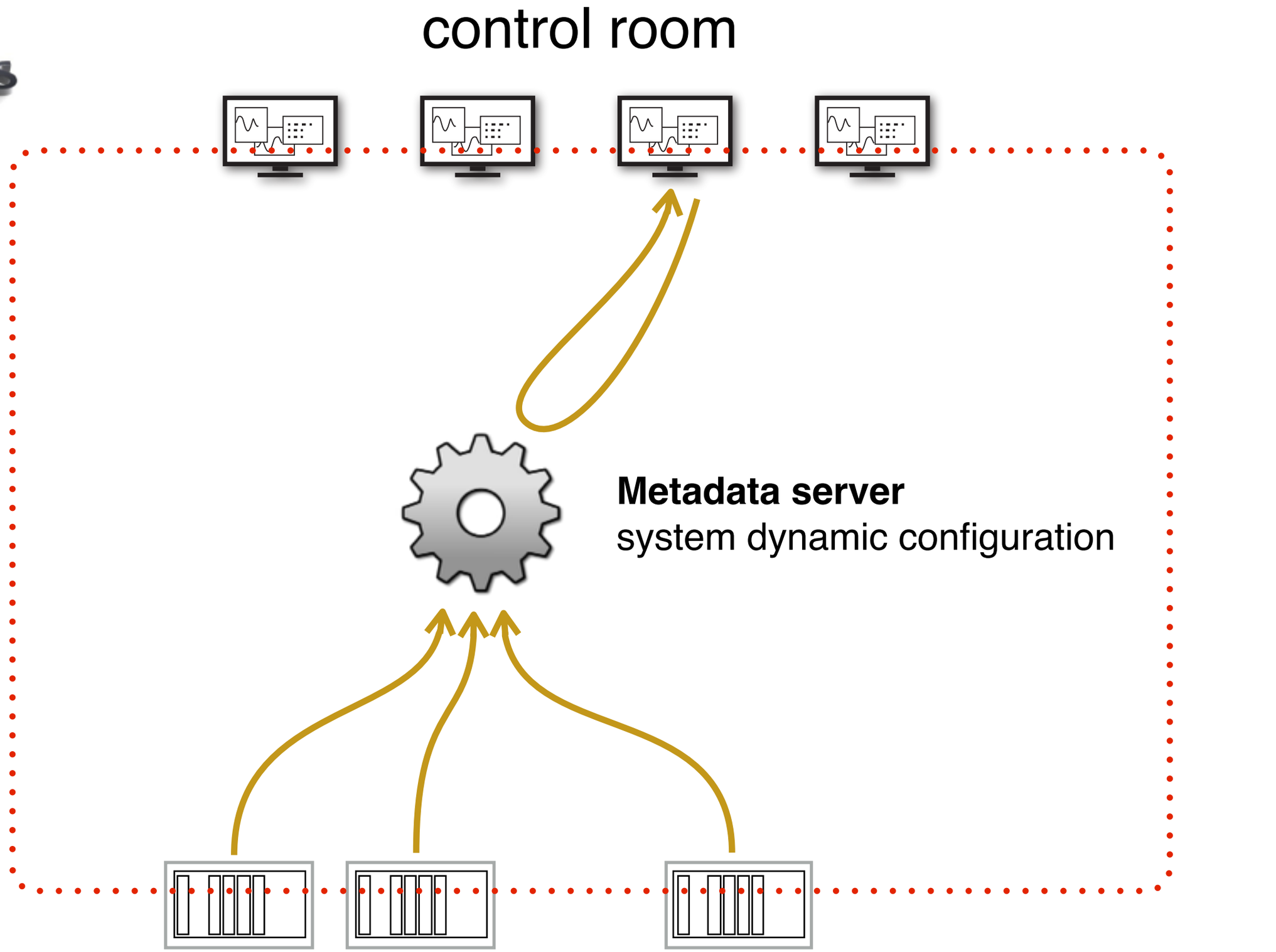
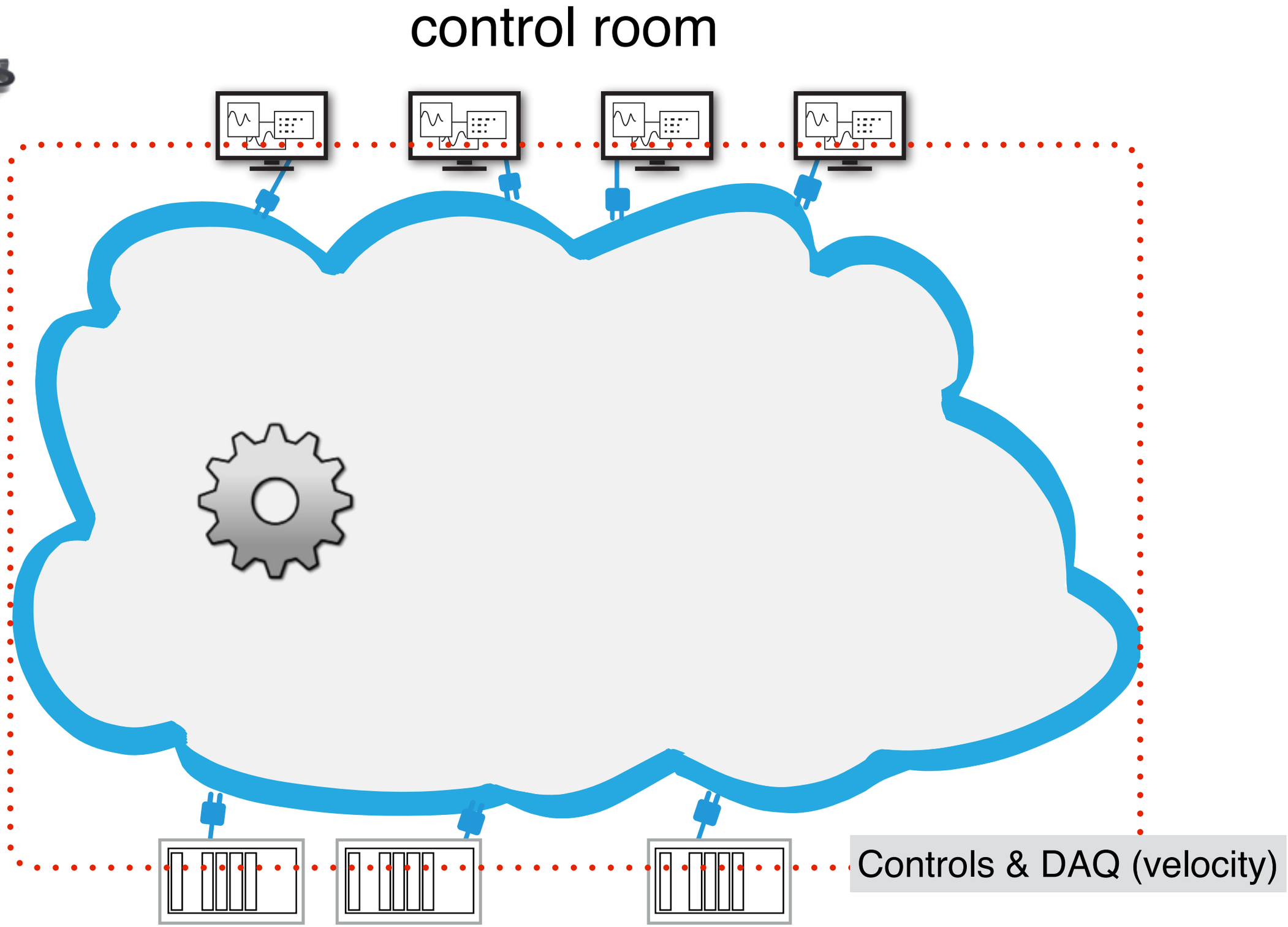


control units (CUs)



device


control room
Metadata server
system dynamic configuration
control units (CUs)
device


control room
Controls & DAQ (velocity)
control units (CUs)
device

control room

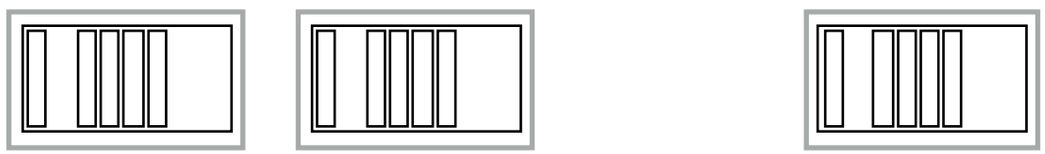
free format (variety)
process abstraction (analysis)
live data (visibility)
historical data (volume)

Controls & DAQ (velocity)

control units (CUs)

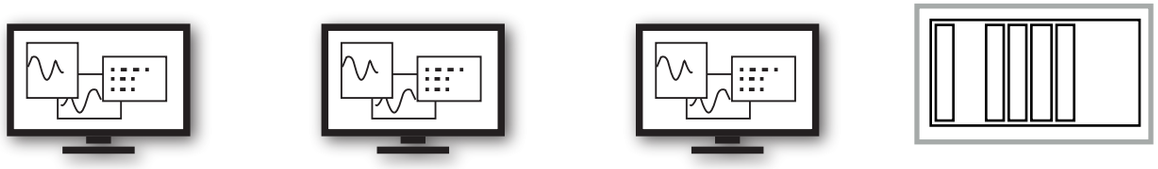
device

control room

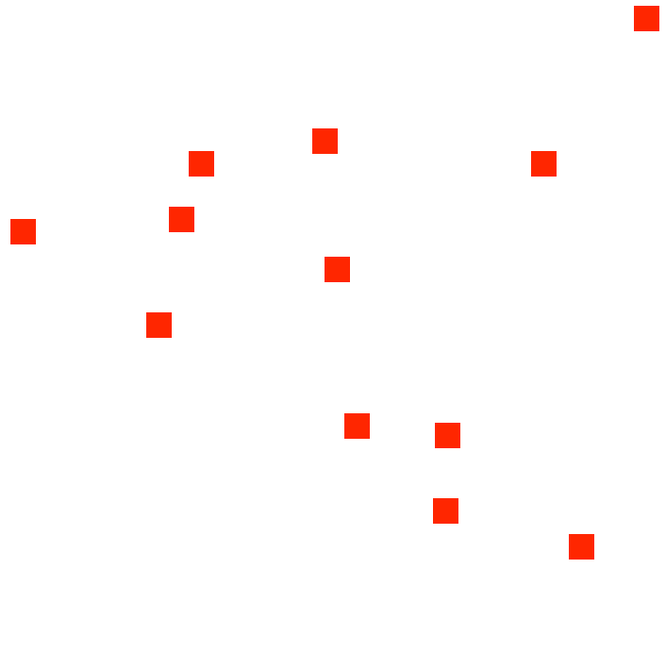


hardware layer

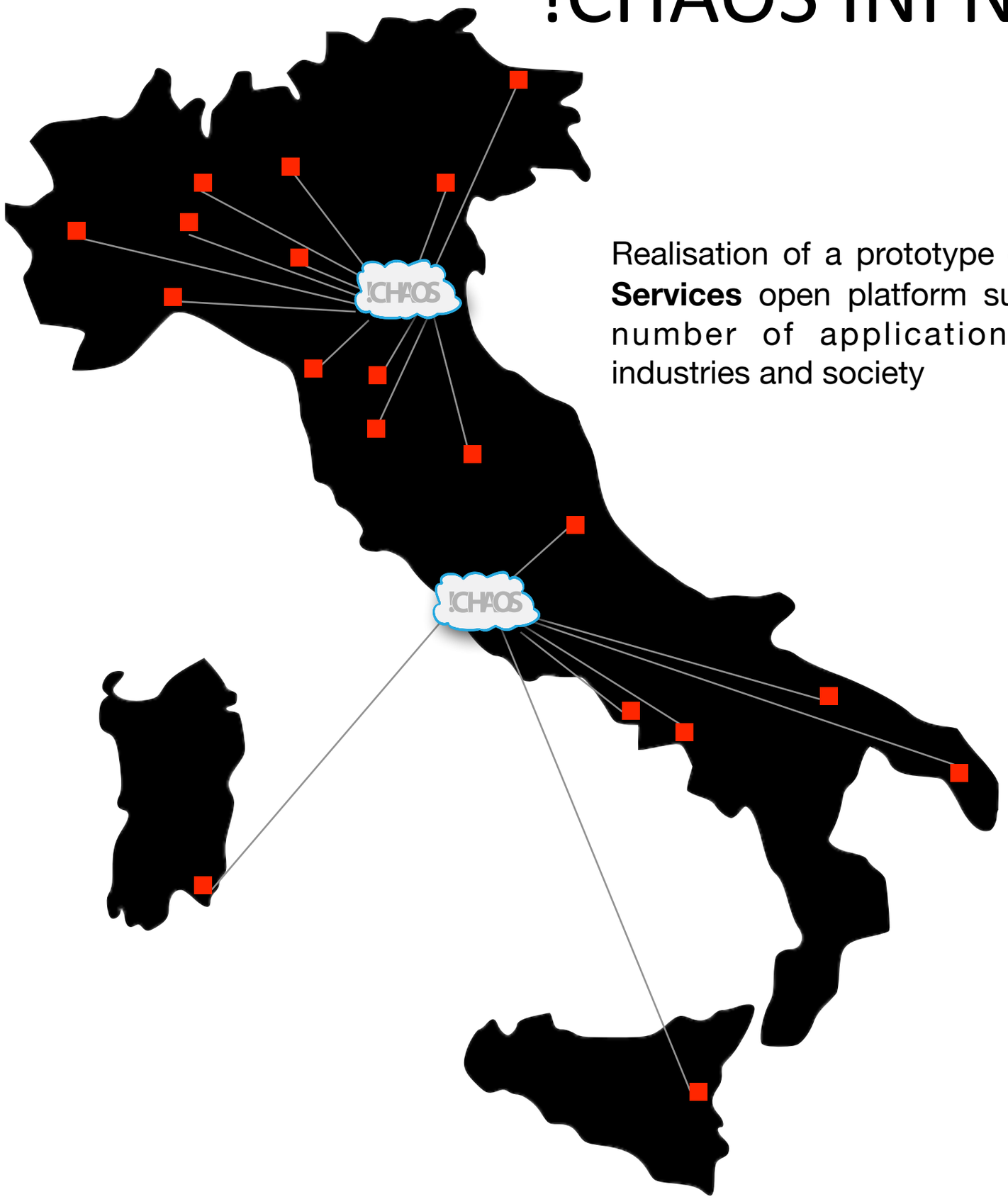
somewhere…



somewhere…



!CHAOS INFN premiale



Realisation of a prototype of **Control as a Services** open platform suited for a large number of applications in science, industries and society

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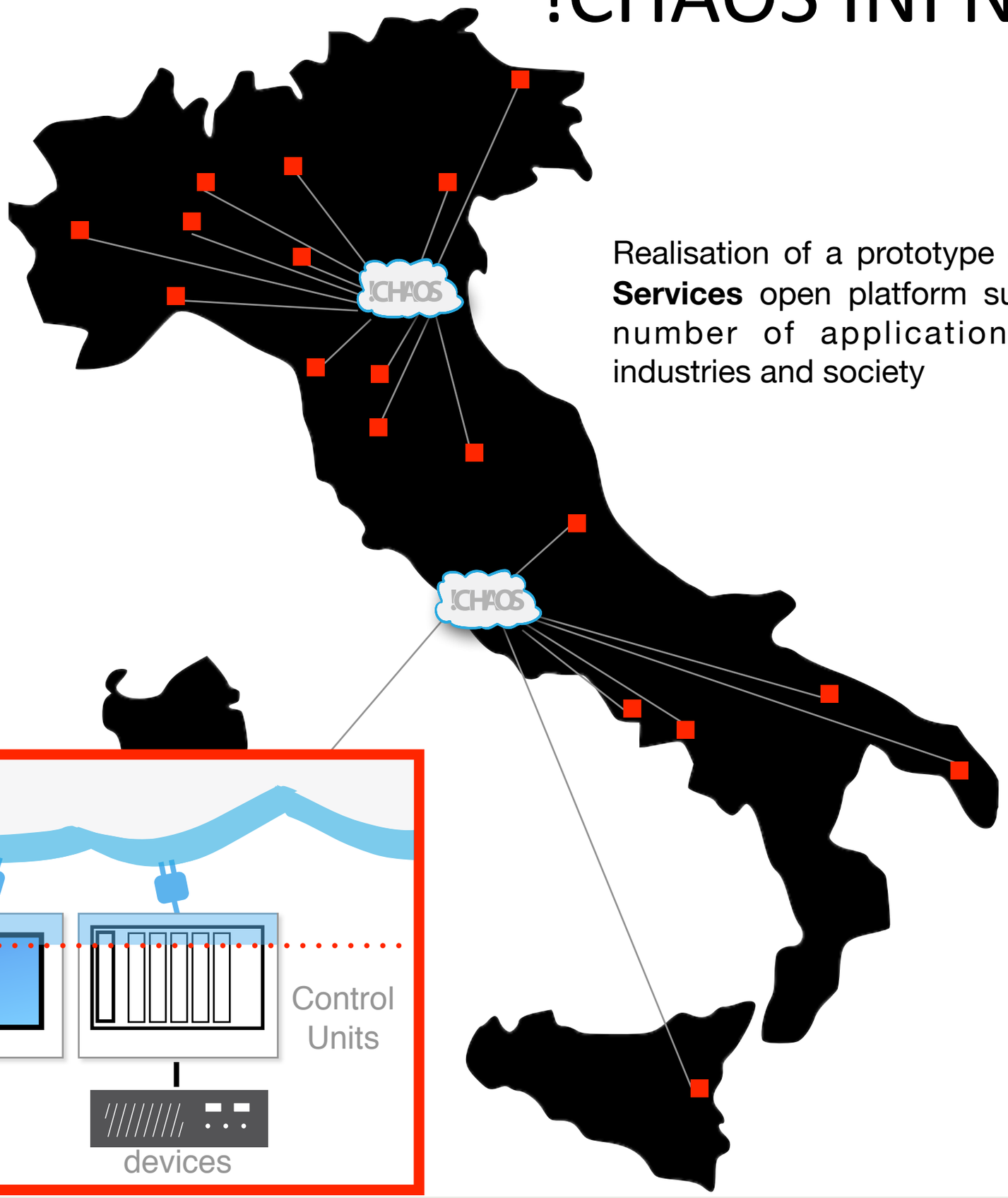

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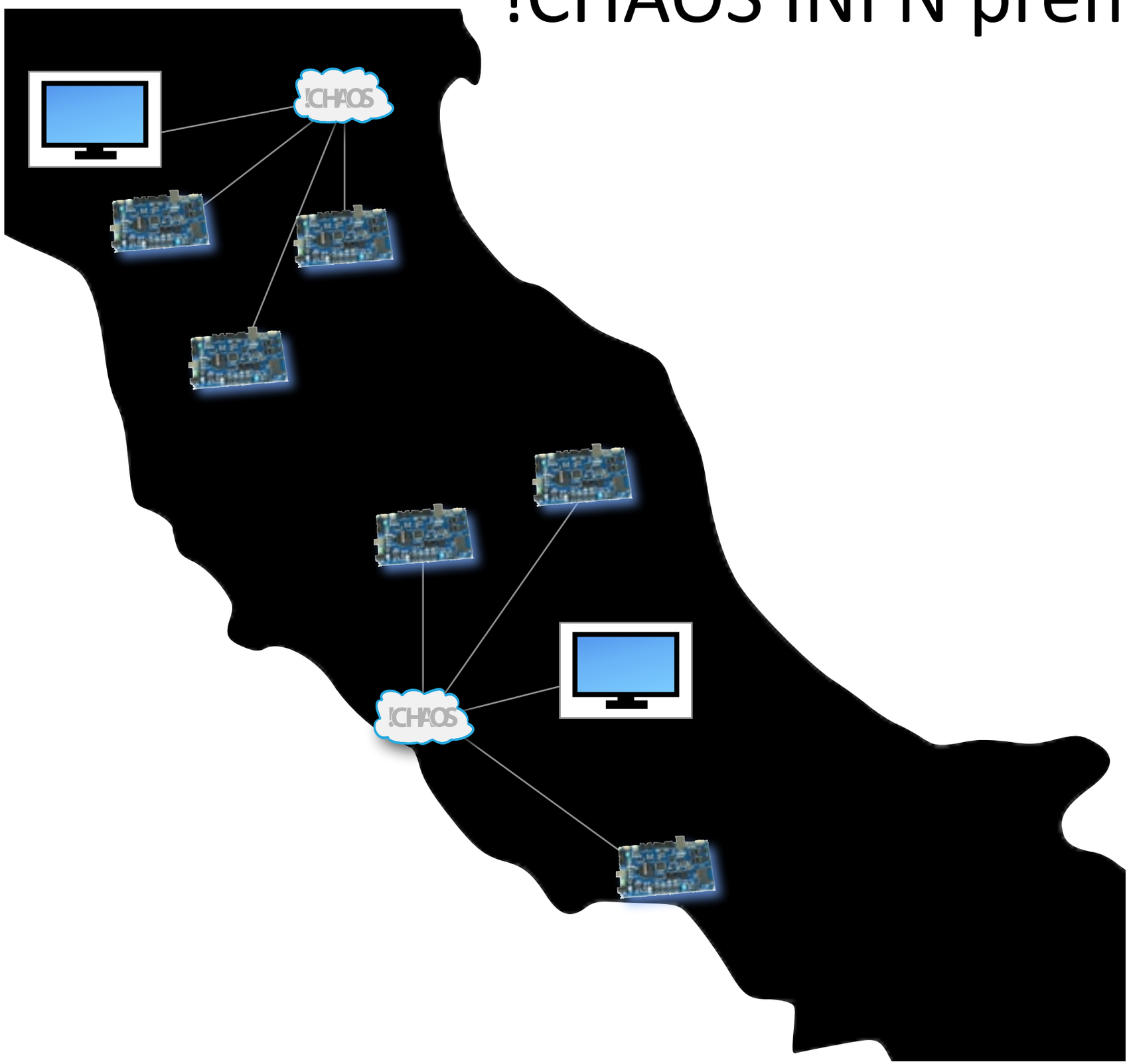

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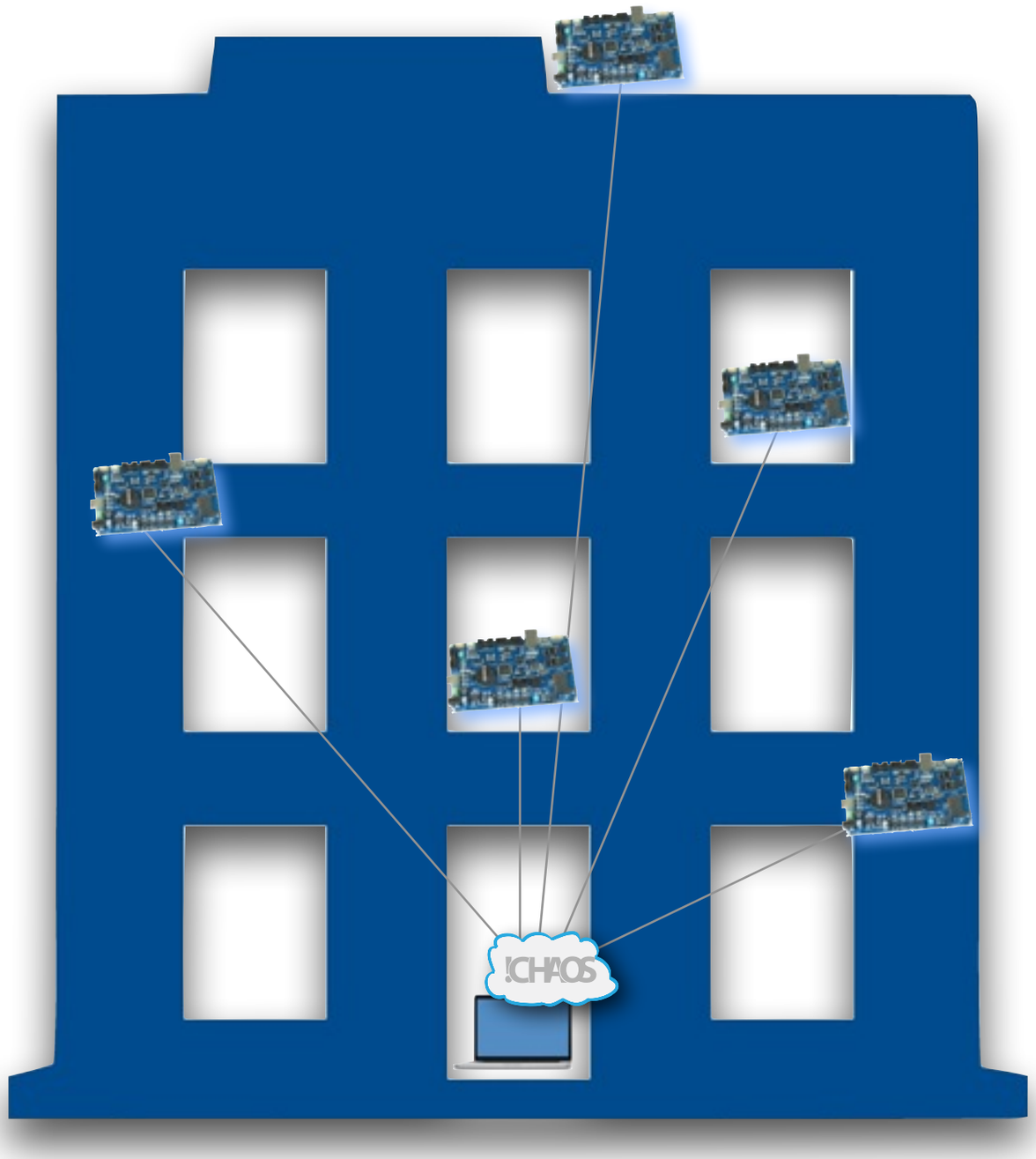

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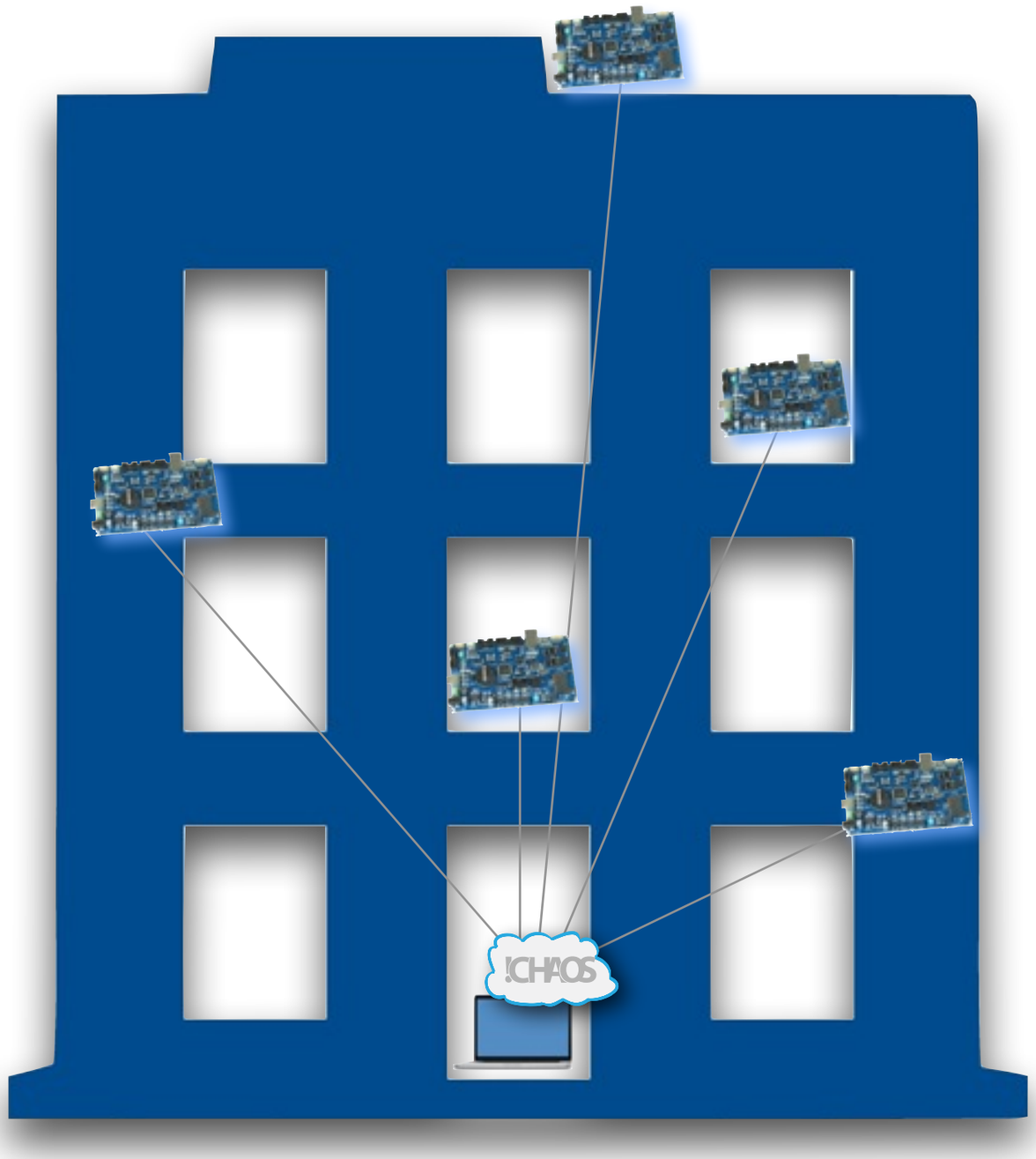
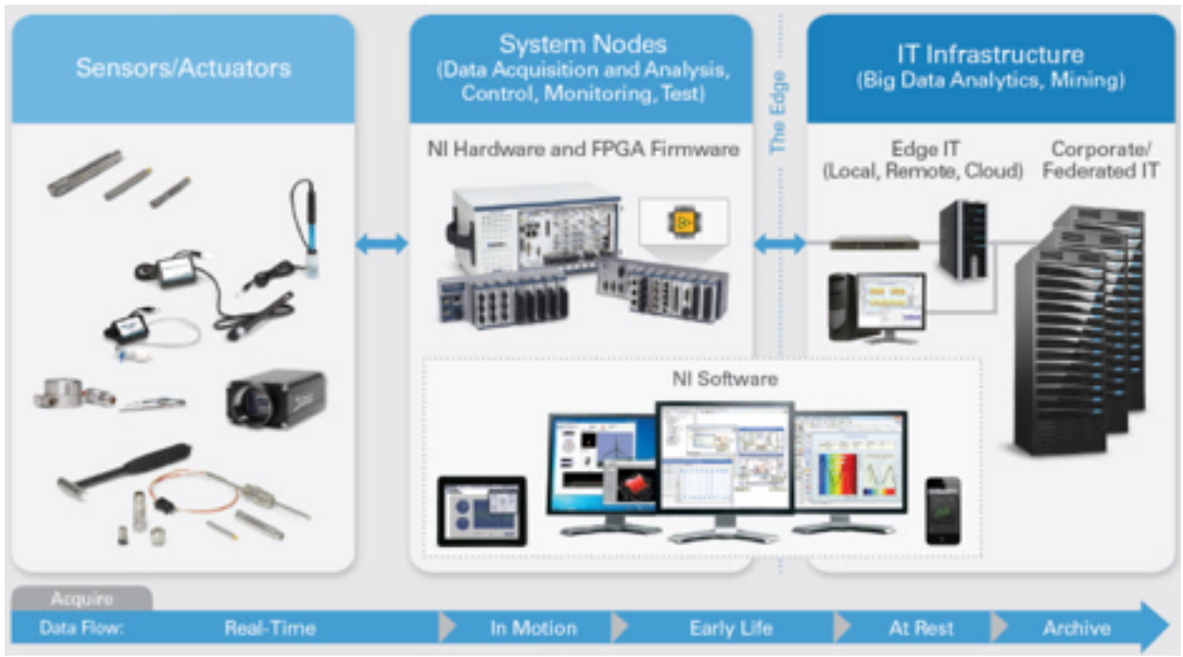


National Instruments collaboration

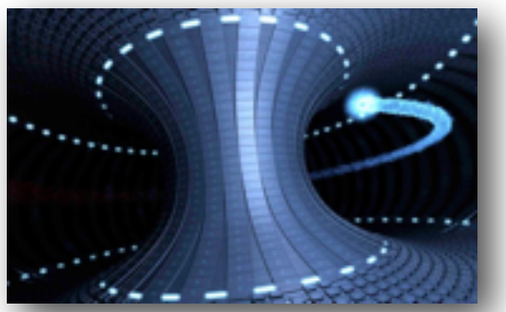


Large Deployment

Distributed Control System

What next: Big Analog Data solution for Big Physics

Visibility: access from disparate locations
Value: analyses



What next: Big Analog Data solution for Industries & society

- Create an **open source scalable platform for the control of large scale distributed sensors**, complex devices, and SoS, based on the latest information technologies, ensuring high performance throughput, scalability, reliability, up with the growing demands of technology and market.

- Increase **control's performance and time critical application**

- Ensure, through **open source** and open hardware, greater **availability on the market** of devices and drivers.

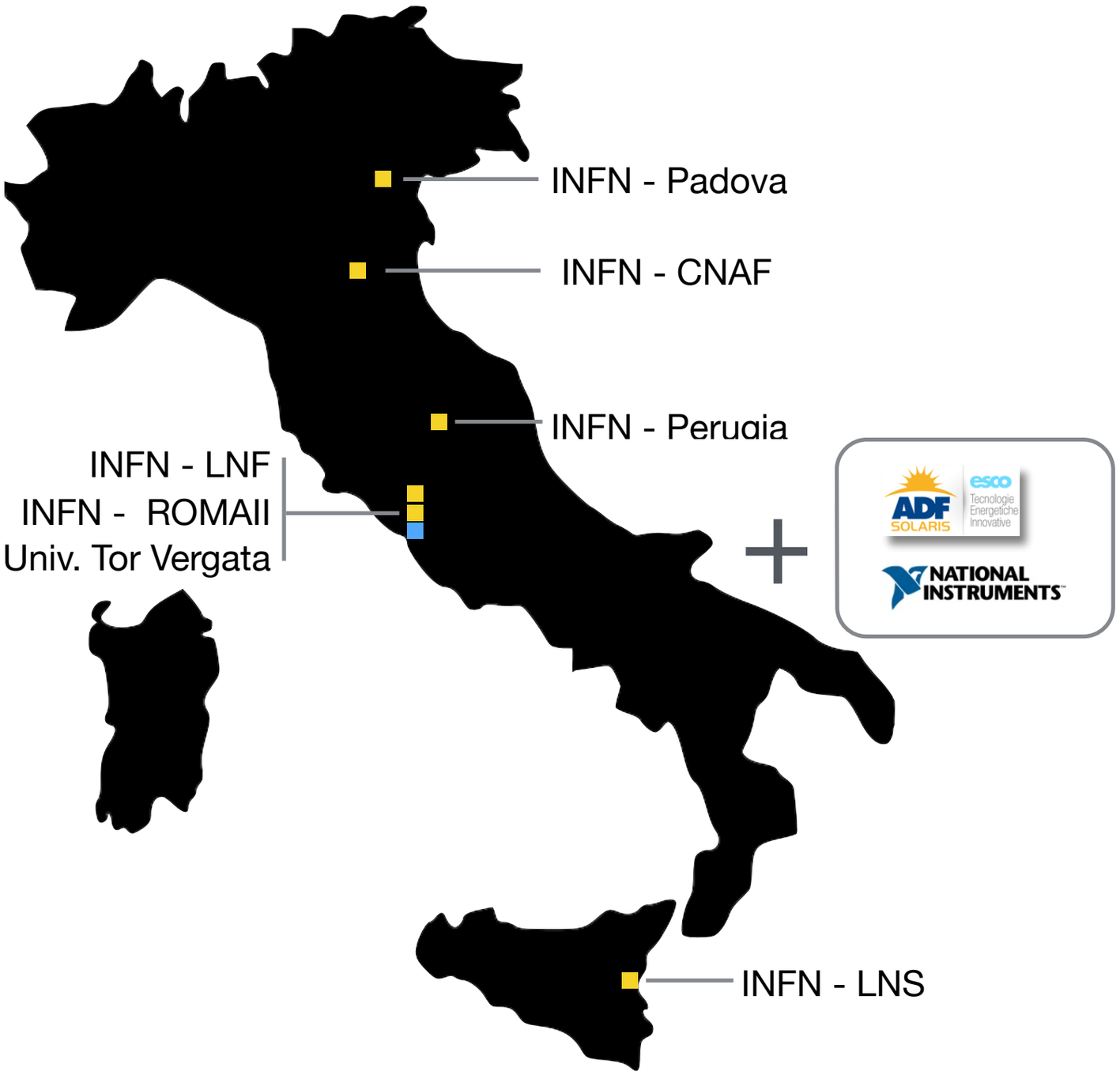
- Lower, costs, and reduce development time.

- Overcome the problems of **standardization and integration**, ensuring compatibility with all the most common standards.

- Realize a **versatile and homogenous** platform, ensuring historicization, storage, **analysis**, access and presentation of polymorphic data.

- Demonstrate the **feasibility of a national platform, open, accessible from disparate locations, scalable and reliable** to control polymorphic sensor/devices/SoS.

Who is who



WP	Workpackage title	Lead
WP1	MANAGEMENT & DISSEMINATION	INFN-LNF
WP2	ARCHITECTURE SOFTWARE DEVELOPMENT	INFN-LNF Uni. TV
WP3	FRONTEND DRIVERS & INTEGRATION	INFN-LNF ADF &NI
WP4	HARDWARE DEVELOPMENT	INFN-TV INFN-PG
WP5	IT INFRASTRUCTURE & SERVICES, ACCESS POLICY COLLABORATIVE TOOLS	INFN-CNAF INFN-LNF

Conclusion

- !CHAOS is an open-source project aimed to resolve the issue of controls, acquisition and analysis of large amount of data and analog devices going **beyond the stands of controls**;

- !CHAOS is a **research and development program**, integrating best market available solutions and Big Physics knowhow;

- !CHAOS is a **big analog data** project integrating analog data acquisition world with IT infrastructure realizing first prototype at national level of controls as a services a real cloud dedicated to analog devices;

- The opportunity to be founded as premiale INFN, open the possibility to continue the investigation of our knowhow in Controls and IT **beyond the application to accelerators** and large experiments in fields such as big data issues, industrial collaborations, social challenges solutions.

any suggestion & collaboration is well come, thanks!