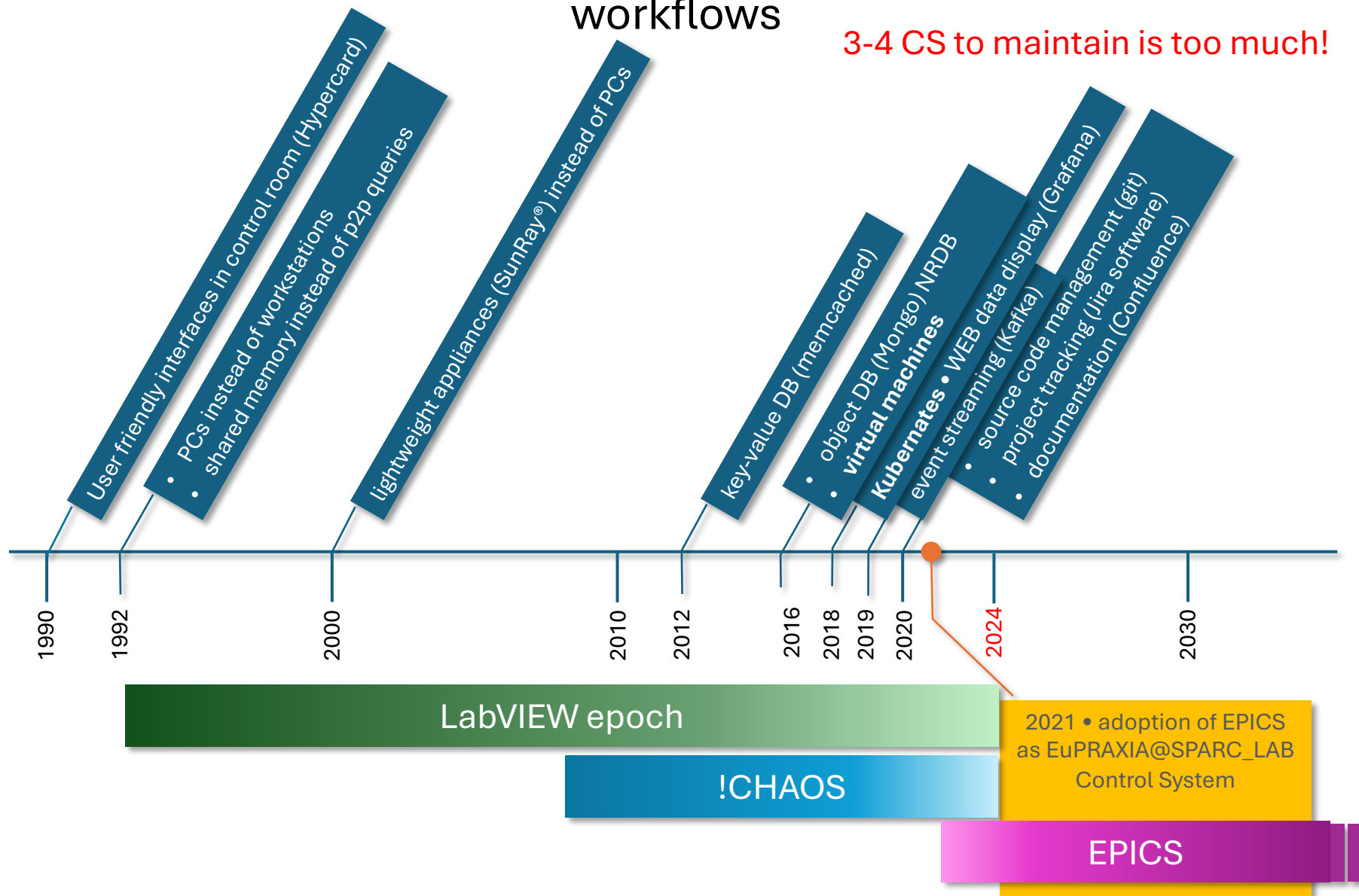# *Control Systems Service*
EPICS transition action plan

Andrea Michelotti
26/6/2024

The LNF Control Group
long history of developing innovative control systems and workflows

3-4 CS to maintain is too much!

- User friendly interfaces in control room (Hypercard)
- PCs instead of workstations
- shared memory instead of p2p queries

lightweight appliances (SunRay®) instead of PCs

- key-value DB (memcached)
- object DB (Mongo) NRDB
- **virtual machines**
- **Kubernates**
- event streaming (Kafka)
- WEB data display (Grafana)
- source code management (git)
- project tracking (Jira software)
- documentation (Confluence)

1990 1992 2000 2010 2012 2016 2018 2019 2020 2024 2030

LabVIEW epoch

!CHAOS

2021 • adoption of EPICS as EuPRAXIA@SPARC_LAB Control System

EPICS

LNF Control Group strategy
"3-4 CS to maintain is too much"

Work to be done

timeline →

- SPARC [DANTE2]
- SSRIP (AKA ELI 2) [EPICS]
- FLAME [!CHAOS]
- EuAPS
- BTF [DANTE • !CHAOS]
- DAFNE? [DANTE • !CHAOS • EPICS]
- EuPRAXIA@SPARC_LAB

Control group: 2 technicians and 3 technologists
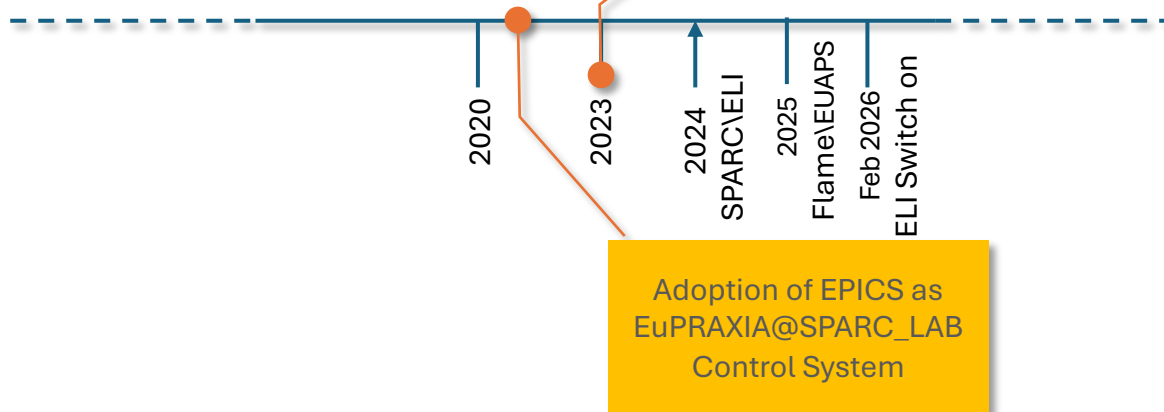
The only possible way (given the contingent situation)

Extension of EPICS to all LNF facilities ("one CS, one workflow", share with other INFN labs "Rete Epics")

SOFT WAY (for **existing** facilities)
- keeping in use some existing LabVIEW application
- shadowing/replacing some existing LabVIEW applications
- developing in EPICS any new needed application

STRONG WAY (for **new** facilities)
- developing everything in EPICS and adopting EPICS native/friendly/widespread methods and tools.

Timeline:
- 2020
- 2023
- 2024 SPARC\ELI
- 2025 Flame\EUAPS
- Feb 2026 ELI Switch on

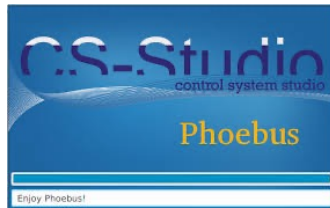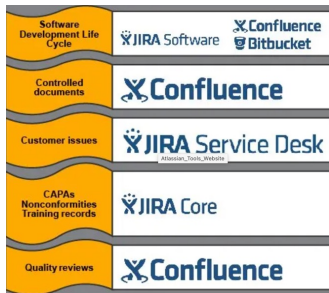Adoption of EPICS as EuPRAXIA@SPARC_LAB Control System

LNF Control Group strategy
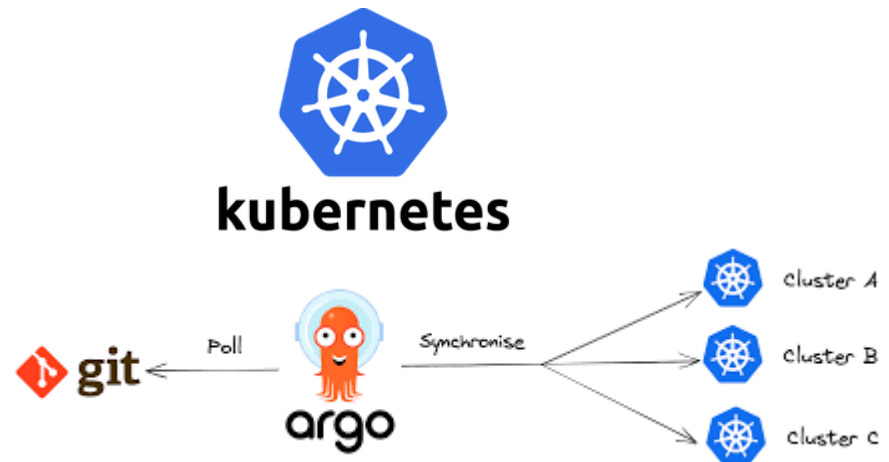## "One CS one common workflow"

Development Infrastructure

- GITLAB code management CI/CD
- JIRA task and issue tracking
- CONFLUENCE documentation
- PHOEBUS for OPI development
- Python/Bluesky for scientists (investigating)

Deployment Infrastructure

- Local/Centralized servers managed by IT
- Servers organized in K8s clusters managed by IT
- IOC deployed as much as possible containers
- Services/IOC deployed in k8s
- Use as much as possible YAML templating (DSL IBEK) to generalize, share and facilitate deployment
- ArgoCD deployment manager (key difference respect DLS epics-container workflow)
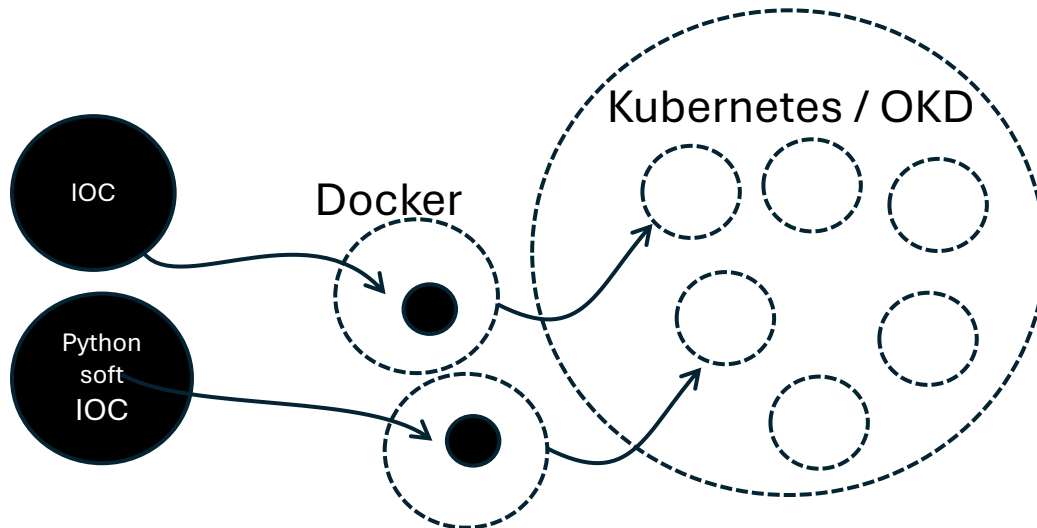
LNF Control Group strategy
"One CS one common workflow"

Containers/Dockers

- ➢ Containers are decoupled from the host OS and each other: isolation
- ➢ Isolation predictability, stability, security...
- ➢ Run anywhere: develop, test, share, demo on a laptop or home machine

Orchestrator/K8s

- ➢ Auto start IOCs when servers come up
- ➢ Restart crashed IOCs
- ➢ Manually Start and Stop IOCs
- ➢ Allocate the server which runs an IOC
- ➢ Move IOCs if a server fails
- ➢ Throttle IOCs that exceed CPU limit
- ➢ Restart IOCs that exceed Memory limit
- ➢ Deploy versioned IOCs to the beamline
- ➢ Track historical IOC versions
- ➢ Rollback to a previous IOC version
- ➢ Monitor IOCs status and versions
- ➢ View the current log
- ➢ Connect to an IOC and interact with its shell

LNF Control Group strategy
Full picture
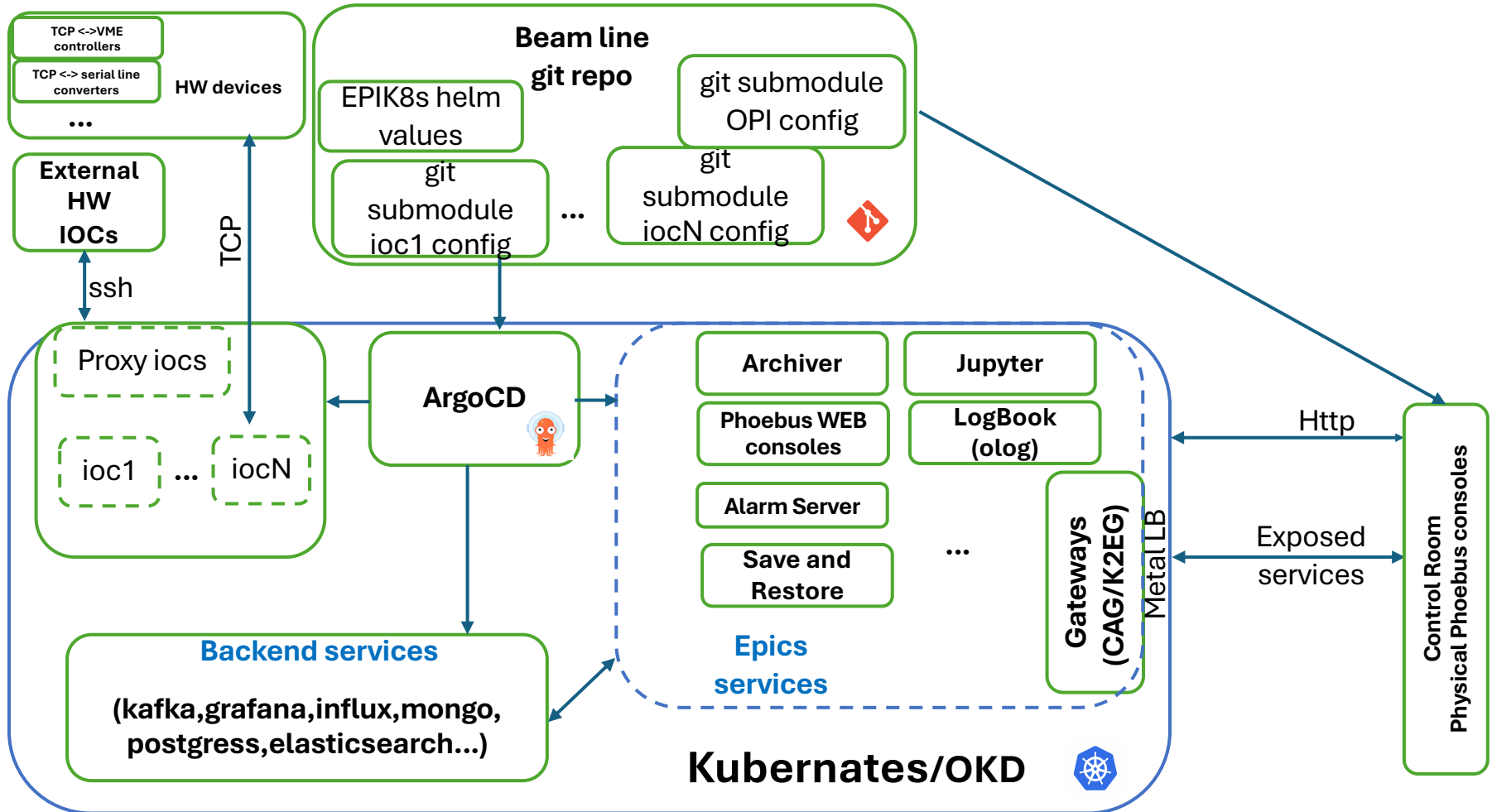
LNF Control Group strategy
Status

Prototyping and installation

- BTF (motors, magnets, cameras)
- Dafne (BPMs, orbit, temperature sensor)

Installation on going

- SPARC (motors, magnets, cameras, timing, BPMs, sensors..)
- ELI

2024 Sparc\ELI

2025 Flame\EUAPS

Whatever we do is made reusable and available for future installations and for all the "*INFN Rete Epics*" community

Collaborations

- DLS – EPICS container, ibek
- LNL, MI(STAR) – "*INFN Rete Epics*" sharing repositories, experiences and workflows
- SLAC – Kafka on Epics, daq..
- Community – for bugs and enhancements coming from DLS/LNF epics-containers

EPIK8S

LNF Control Group strategy
Conclusion

- Good News: "The CS road to EUPRAXIA is mapped out"
  - EPIK8s workflow dramatically simplify development and deployment of IOCs and Services
  - Adoption of a clear/unique and simple workflow across facilities helps:
    - train and create a community;
    - reuse things;
    - improve reproducibility, test, stability, consistency

Critical points

1. Long Backlog of activities but the Control Group consists of **2 technicians and 3 technologists.**
   ⇒ At least <u>3 SW experienced technologists</u> must join the group;

2. IT "*Centro di Calcolo*" should be involved and committed in implementing professional and uniform IT solutions for all our present and future facilities.