INFN Cloud
Prossime Attività e Visione Futura

Workshop sul Calcolo nell'INFN
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What's in this presentation

1. A high-level background
2. INFN Cloud within the new INFN Computing Structure
3. One slide on how INFN Cloud "works"
4. Moving forward: some technical and strategic directions

Important: this is not intended as a "Technical Communication".

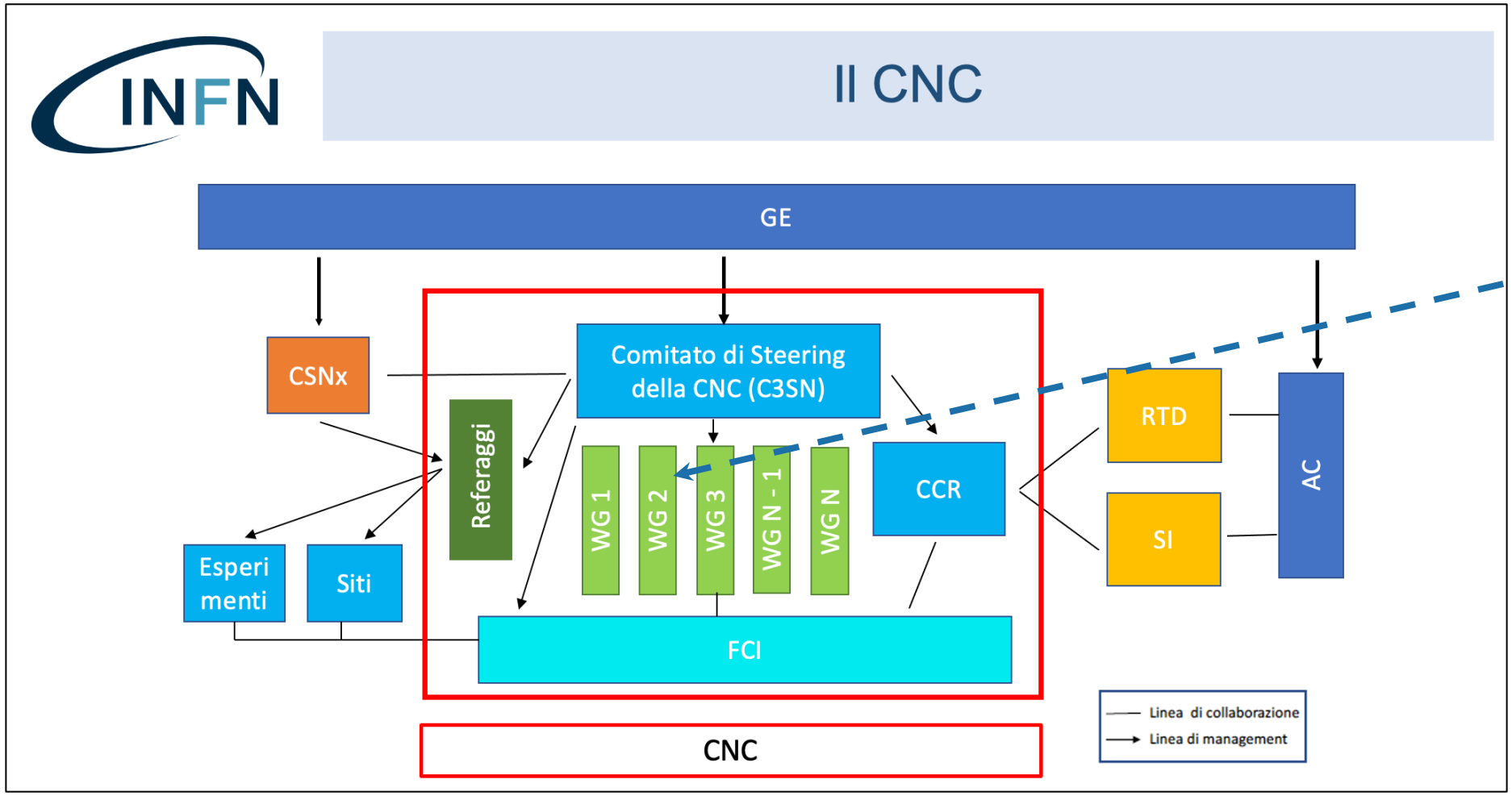
It is more a **stimulus for discussion**, here or later.

Some of the main drivers for the next 10 (?) years of scientific computing for INFN

- Infrastructure
  - **Renew infrastructures** to be ready for the High Luminosity-LHC (HL-LHC) era, up to ~2035 or more
  - **Use more compact computing** (from today's ~20 kW/rack to 80 or more)
  - **Lower the PUE** (power usage effectiveness), be greener
  - **Extend and expand networking** for a future-proof infrastructure
- Hardware, Software, Services
  - **Foster and simplify the utilization of more viable technologies** (€/task or J/task), like GPUs, FPGA, down to Quantum when available
  - **Be more efficient, elastic and resilient**
    - Pervasive use of **geographically distributed storage** ("the Datalake")
    - Abstract from physical machines, and form a **national pool of resources and high-level services** ("the Cloud")
    - **Extend elastically to external providers** such as HPC@CINECA or other cloud providers ("dynamic federations")

The evolution of Infrastructure and of Higher-level Services must proceed together

The New INFN Computing Structure

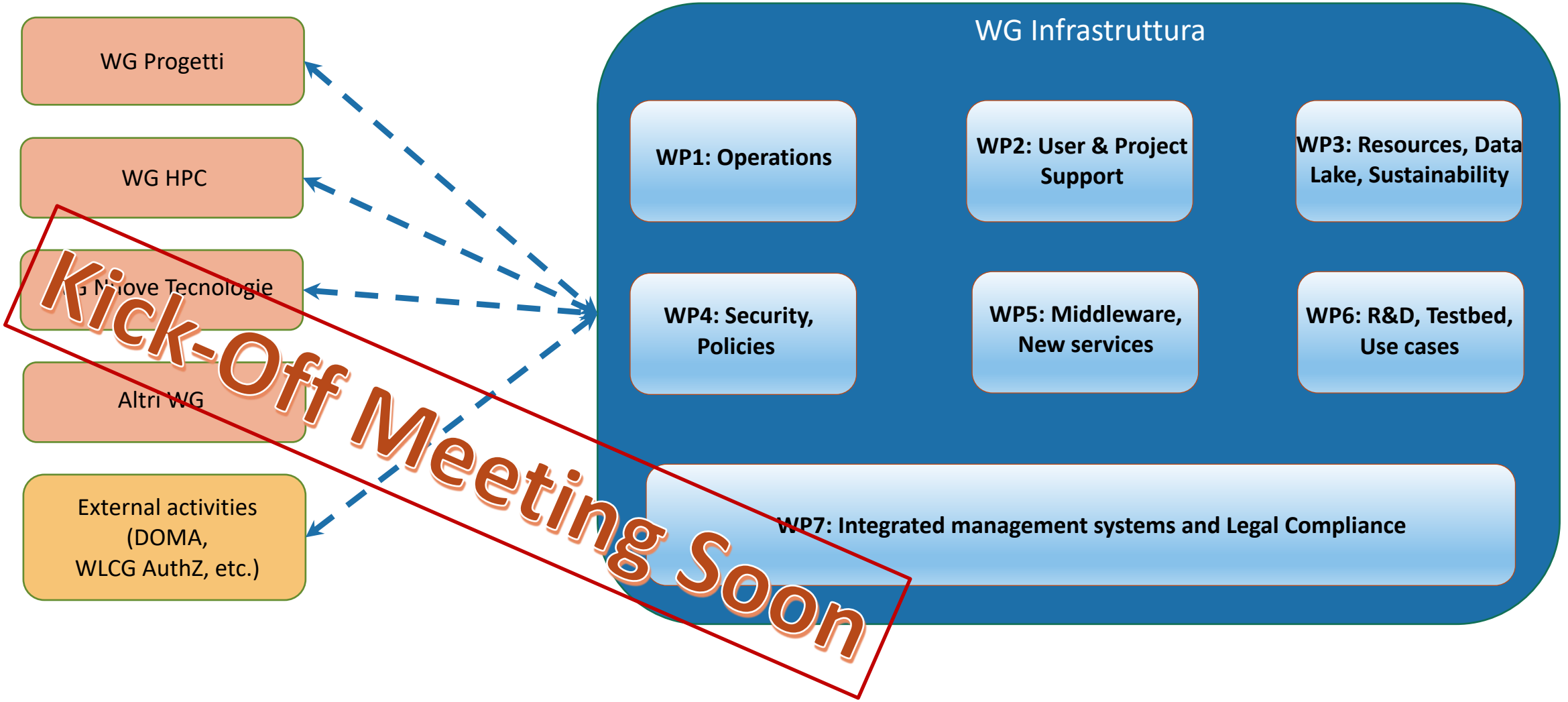


One of these WGs is the **WG Infrastruttura,** extending and evolving the current **INFN Cloud** project.

The «Infrastructure WG» Mandate

- The Infrastructure WG will deal with **several core activities related to computing @ INFN**:
  - Development, implementation & management of the INFN Datalake architecture.
  - Development of ISO-Certified solutions. These are having a very strong push, thanks also to PNRR funds and to various collaborations.
  - Support to users and to the management and operation of INFN Tier-x sites.
  - Development of new services.
- A fundamental key point of the WG is the **integration** between the traditional, WLCG-like Tier-x infrastructure and the "Cloud Native" model (currently represented by INFN Cloud).
  - **Integration of what?** → Of resources, methods, people, solutions.

The Infrastructure WG Structure



Our Assets – which we must protect

- Know-how: 20+ years of successful collaborations and developments in Grid & Cloud computing formed an exceptional corpus of people and knowledge.
- Resources: we own, operate and evolve the largest distributed research infrastructure in Italy, and one of the largest in Europe.
- Ideas: our environment attracts and stimulates ideas in multiple fields.
- Reputation: internationally, INFN is recognized as a trusted leader in big data, distributed computing and related fields.
- Flexibility: we adapt to the challenges and find practical, working solutions.

Pain points

- **Sustainability**: we need to define a future-proof path for
  - **Support** → PEOPLE
  - **Infrastructure** → HARDWARE
  - **Services & Evolution** → INTEGRATION

The PNRR funds offer here unique opportunities (see Claudio's presentation).

- **Barriers**: even with the PNRR funds, we will still need to
  - **Work out an evolution path for the current Tier-X centers** → PROCESS, TECHNOLOGY
  - **Find and hire new people** → DISSEMINATION, COORDINATED RECRUITMENT
  - **Work out a fully distributed model** → INTEGRATION (again)

How INFN Cloud really “works”

- There is one key principle which **all** INFN Cloud developments from INDIGO-DataCloud on have consistently followed:

  Simplify, Scale, Extend, Reuse through **Service Composition.**

- This is true for **all** the services and concepts you see in today’s INFN Cloud Service Portfolio; for example:
  - Vendor neutrality, Orchestration, AAI/IAM, Marketplace, Dashboard, Monitoring, Service Evolution, Hybrid Cloud, Multi-Disciplinary Solutions.

We do this via an evolving technological vision of the **Infrastructure as Code (IaC)** concept.

Where do we go now?

- From an organizational point of view, we are in the process of finalizing the structure of the Infrastructure WG, in the context of the new CNC.

  There will be an “All-Hands Meeting” of the WG, probably after summer, open to all interested INFN people.

- The following slides provide **my own views** on where we may want to look at for technical and strategic evolutions related to distributed computing at INFN.

Communication

Think and communicate to stimulate **new ideas** (e.g., WhatNext Tech 2.0) and get out of present-only moods.

The Distributed Data Fabric

Integration of **heterogeneous data sources** across platforms and communities.

Beyond HEP/Physics

The **Health and Earth Observation** Data Spaces.

Organizational & Regulatory Compliance

ISO beyond the formal part.

Cloud-native Applications

IaC brought to developers, together with **AI-supported software development** (e.g., GitHub Copilot).

Distributed HPC Bubbles in the Cloud

One size (even if Exascale) **does not fit all**.

Hyper-Connectivity

The network **“disappears”.**

Multi-Cloud Operations

Get resources **wherever appropriate, transparently**.

Integration and Intelligence to/from the Edge

The **Edge and Cloud continuum**.

Digital/Biological Twins

The **Physical and Digital continuum**.

Cybersecurity Mesh

Integrate **multiple, distributed security services**.

Solution-focused Collaborations

New opportunities and **know-how**.

Recap

- We started from a description of some high-level patterns primarily focused on INFN core activities (e.g., HEP).
- We then mentioned the new INFN computing structure. In that structure, an important role is played by the Infrastructure WG.
- A key focus of the Infrastructure WG will be sustainability and integration, covering both WLCG Tier-x centers and INFN Cloud.
- We reviewed our key assets, followed by a list of some pain points, as well as some clear opportunities.
- We mentioned the major principle of the INFN Cloud architecture and solutions: consistent Service Composition.
- Finally, we presented some possible directions for technological and strategic trends.