



Istituto Nazionale di Fisica Nucleare

**April 10 2024**  
**INFN CNAF TIER1 Update**

**State of the new Datacenter**  
**CNAF-CERN DCI Preproduction**

**S.Zani**

# New Datacenter state of art

New Datacenter at Technopole

- 2,4km walking distance
- 7 km far fiber path

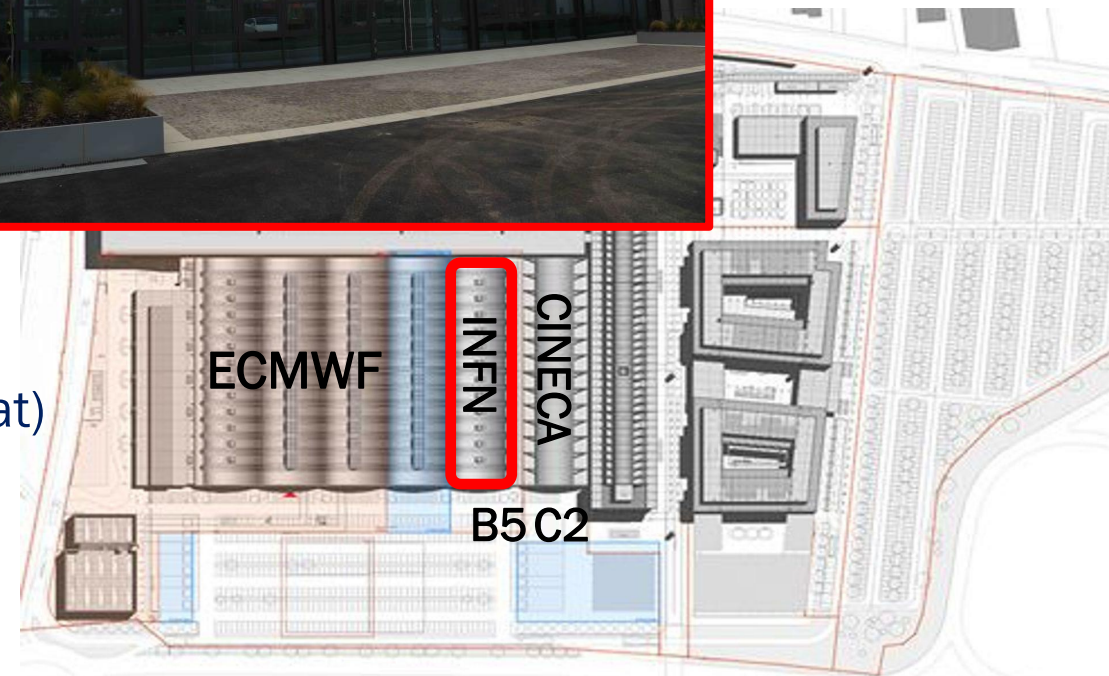


NEW DATACENTER  
(Via Stalingrado)

B5 Building OK



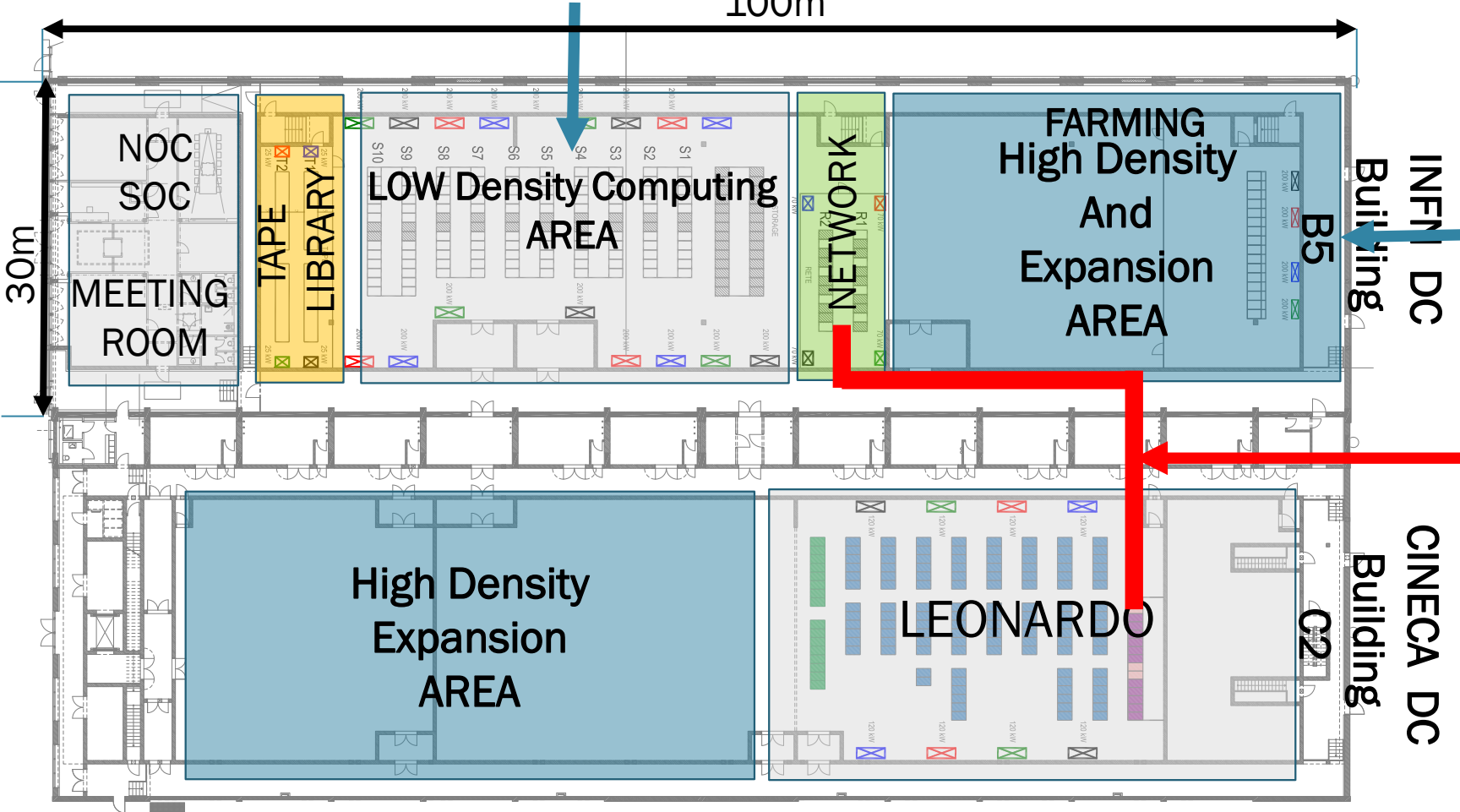
CURRENT  
DATACENTER  
(Viale Berti Pichat)





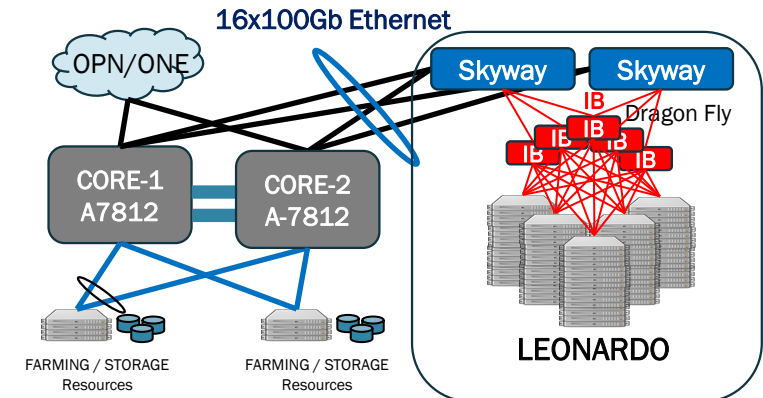
# Areas of the new Datacenter

Cold water (26 °C inlet) only for Air cooling  
(Cold isle) system (Up to 16 kW/Rack)  
100m



“Temperate” water (36 °C inlet) for  
DLC and cold water for Air Cooling  
Up to 80kw/Rack

CNAF-Leonardo  
Direct cabling connection <100m

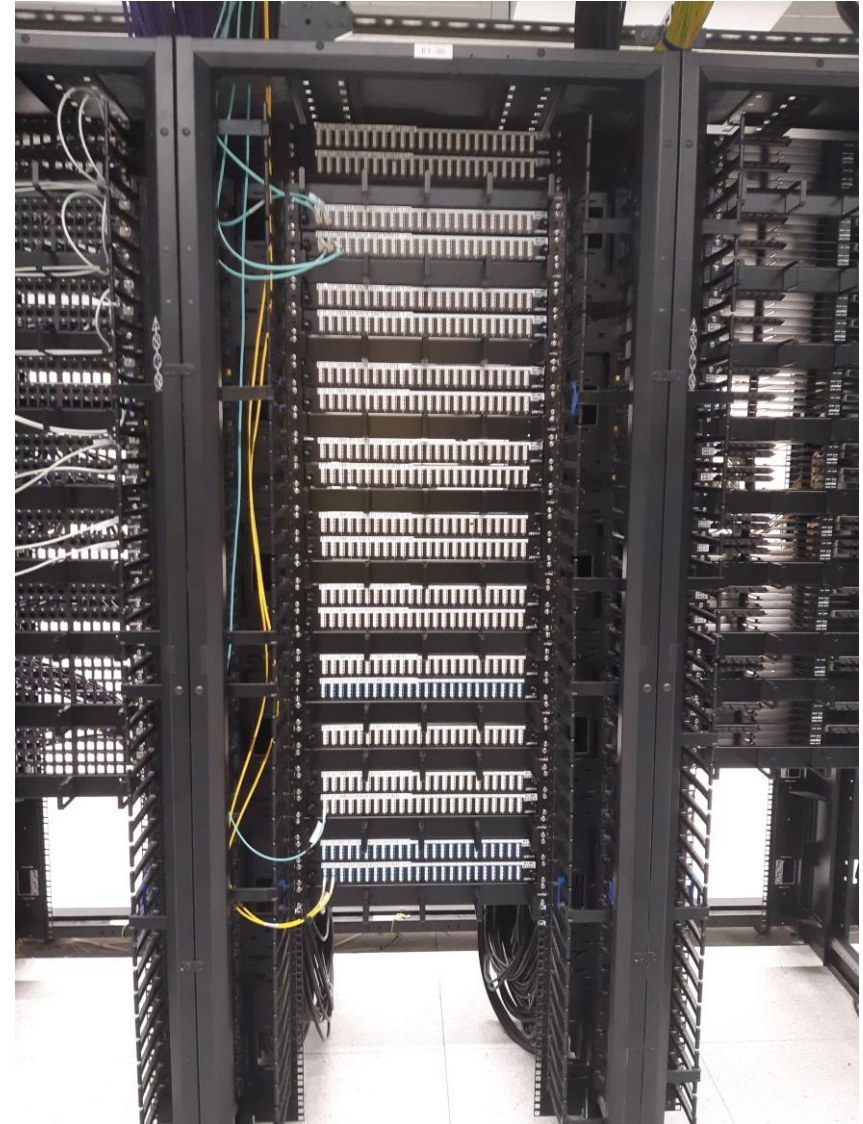


# Cabling

The Cabling system is concentrated from every row in the Network Room (Close to center of the building)

- LC-LC MM (OM5) → 1-100Gb Ethernet
- LC-LC SM → 1-400Gb → Longer distance and 400G-FR4 Ethernet
- MPO-12 MM (OM5) → 40G-SR4, 100G-SR4, 400G-SR4.2 Ethernet
- MPO-12 SM → 400G Ethernet (400G-DR4)
- RJ45 → 1-10Gbps

## Cabling complete!





# Low density Area

150 racks in place  
Under Floor Cooling System operational

First Computing and storage resources

First 5 CPU Racks transferred in the new data center In low density area → In production

First 64 PB of new storage resources are installed in the new data hall → configuration in progress





# Network Area

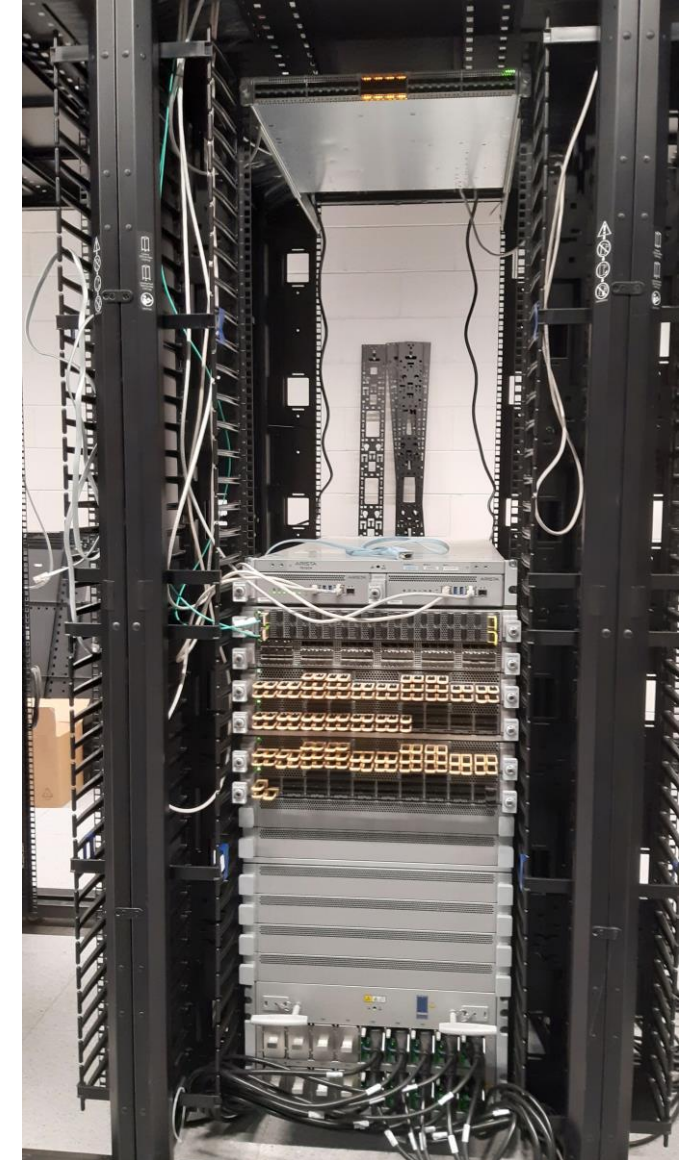
- Cabling system from Network Area to every row in place
- 2x Modular Core Switch/Router (ARISTA 7812) – TIER1 Scientific DC
- 2x "Switch/Router" (ARISTA 7280) – General Internet Access
- 15x Management Switch
- 2 Racks for GARR POP

Everything in place (Configuration of the devices in progress)

## NETWORK ROOM



## ONE OF THEN TWO CORE AND ROUTER RACKS



ARISTA 7280

ARISTA 7812

# High Density and expansion area

- Network Cabling racks are in place
- The High density farming area can host 3 rows of 16 Racks full of DLC systems (Up to 80 kw/Rack) or very dense air cooled systems (Up to 30kw/Rack)
- An Expansion area of about 800 sqm is available for future use

## FREE EXPANSION AREA



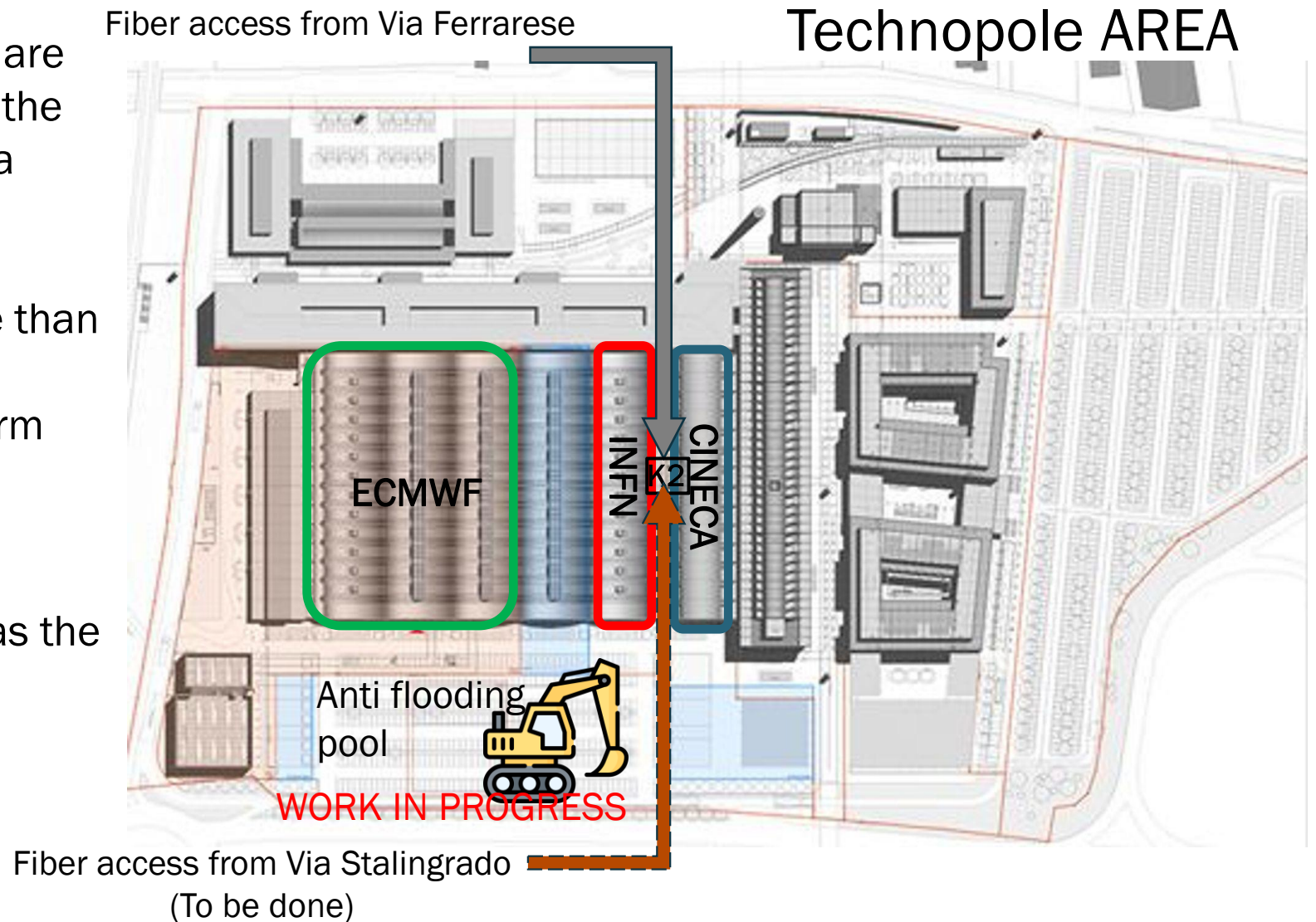


# Physical connectivity of the building

Differentiated optical fiber accesses are foreseen for network operators from the two sides of the Technopole Area (Via Stalingrado e Via Ferrarese)

At the time of this presentation more than 140 single mode fibers have been installed by **Lepida e TIM** entering from via Ferrarese.

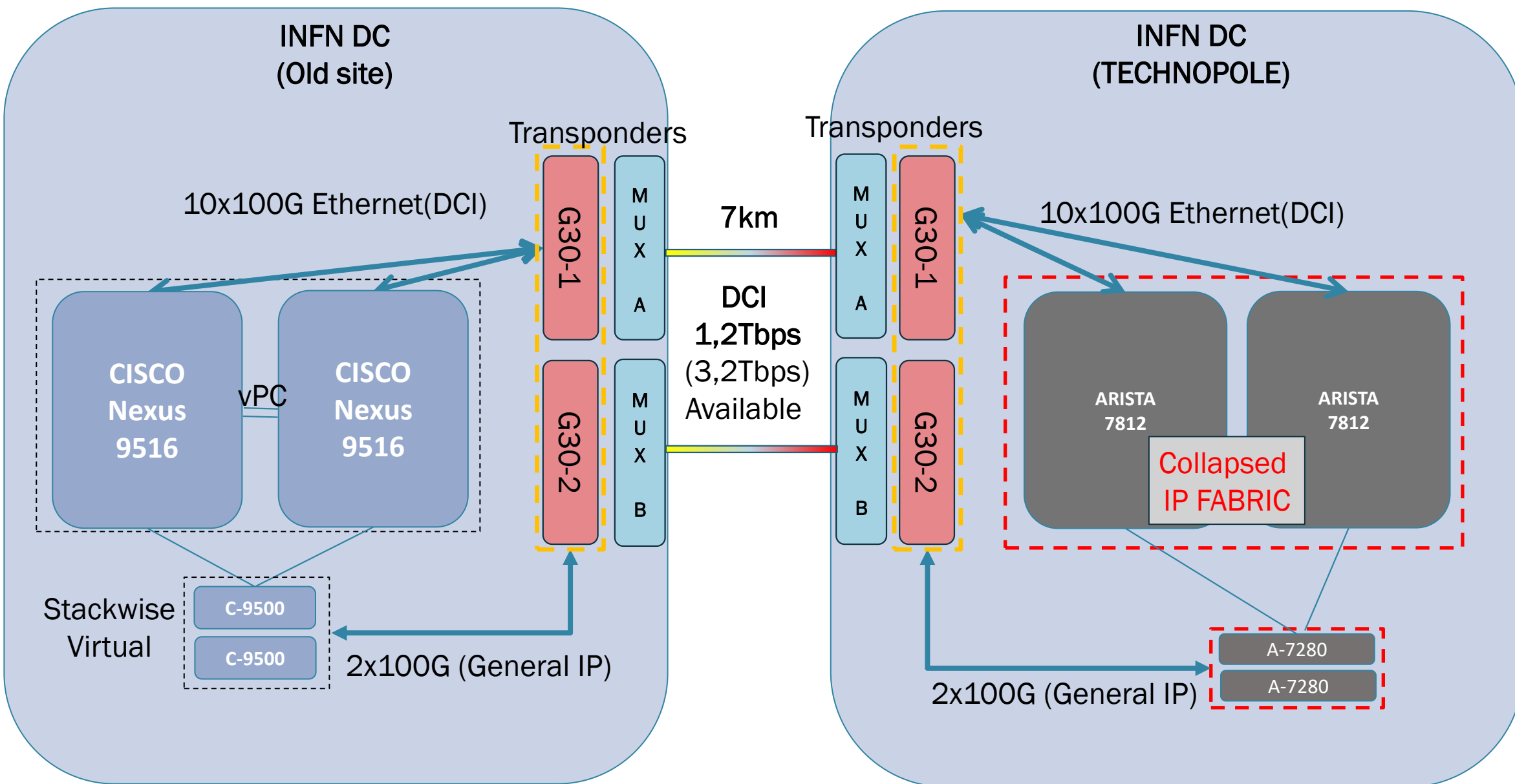
Fibers in the other way (From Via Stalingrado) will be installed as far as the underground big anti flooding water expansion pool will be finished



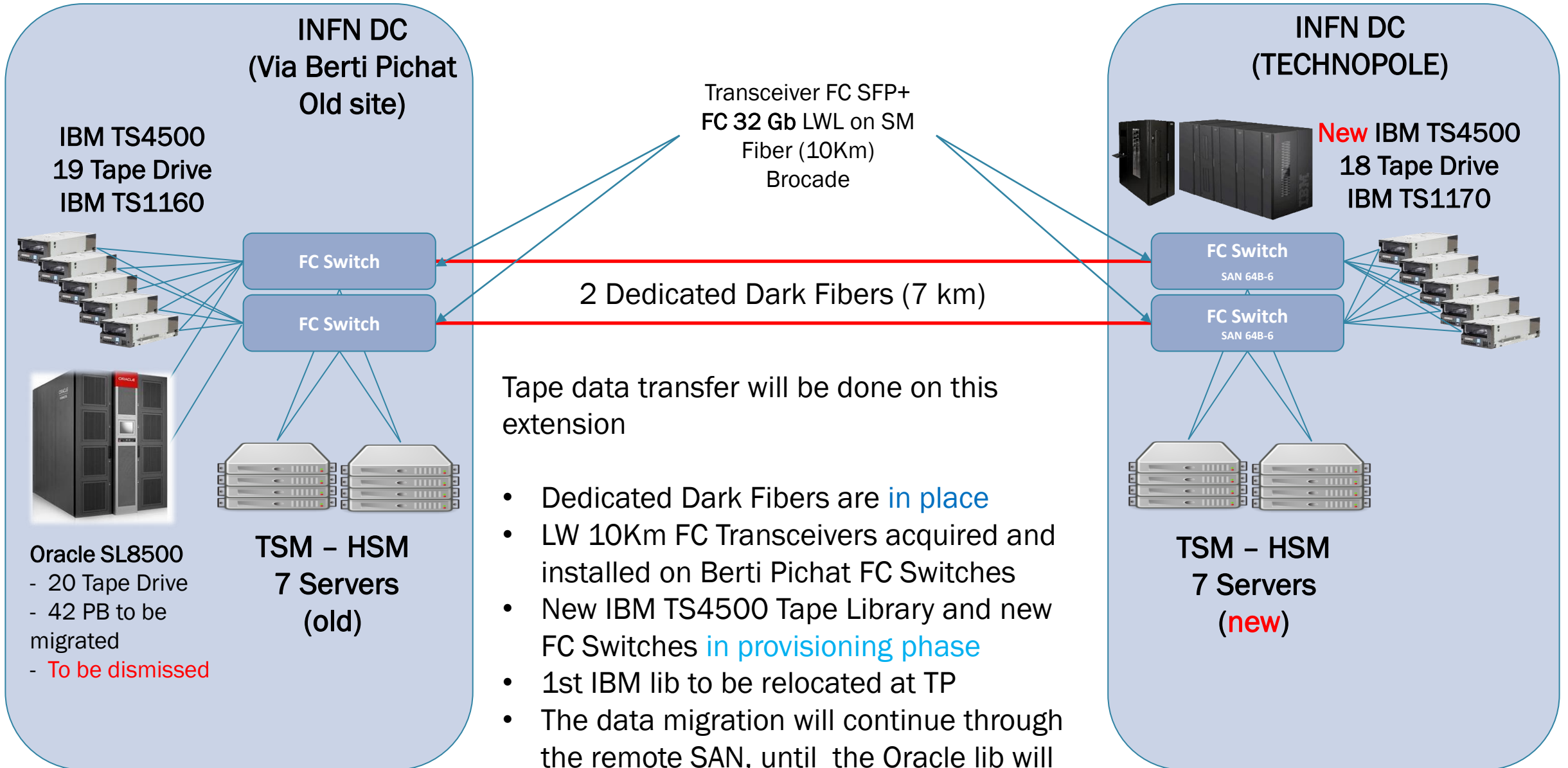


# Datacenter Extension

## Between Current CNAF site and New Technopole site



# Tape Area Network Extension

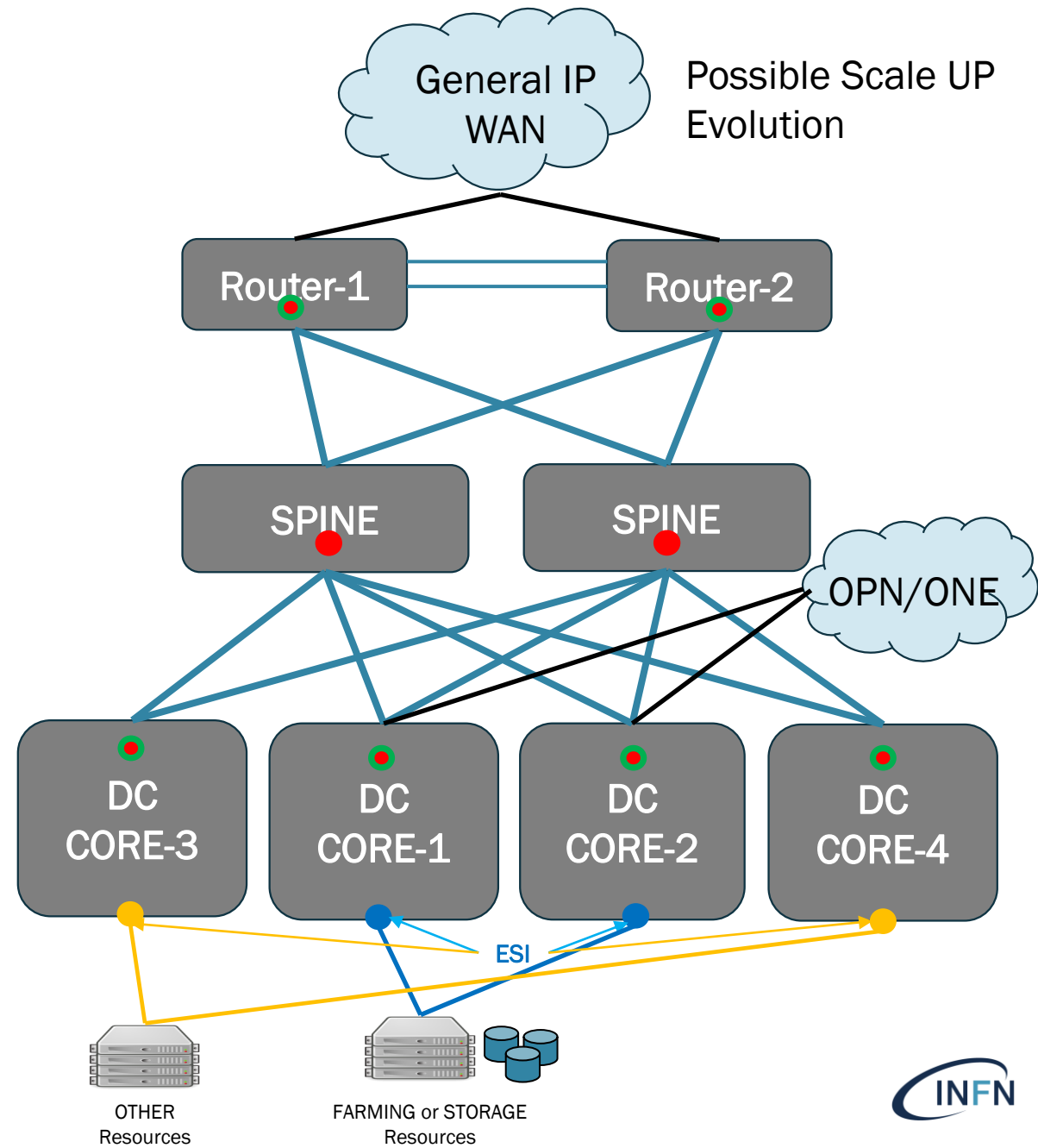
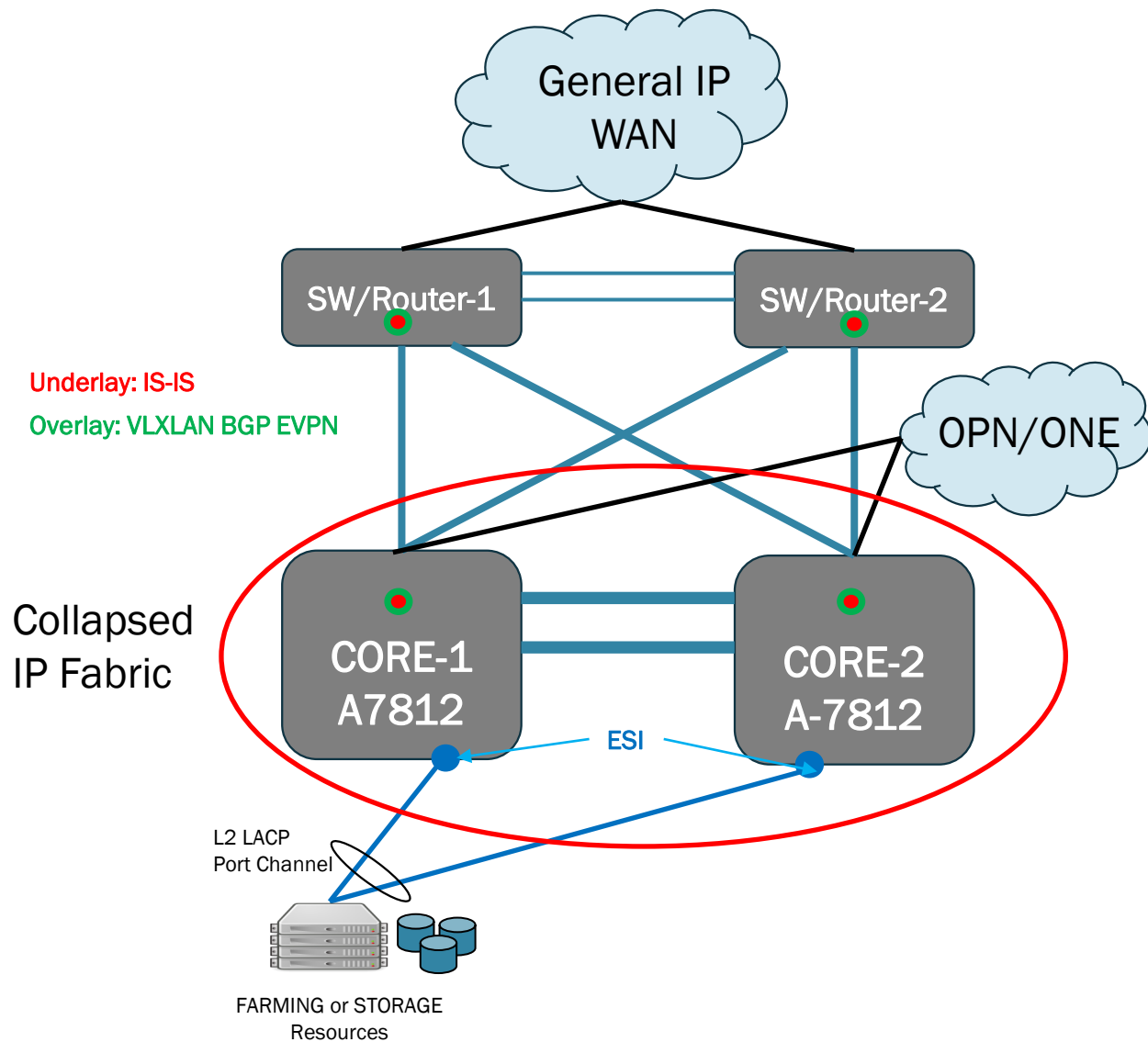


Tape data transfer will be done on this extension

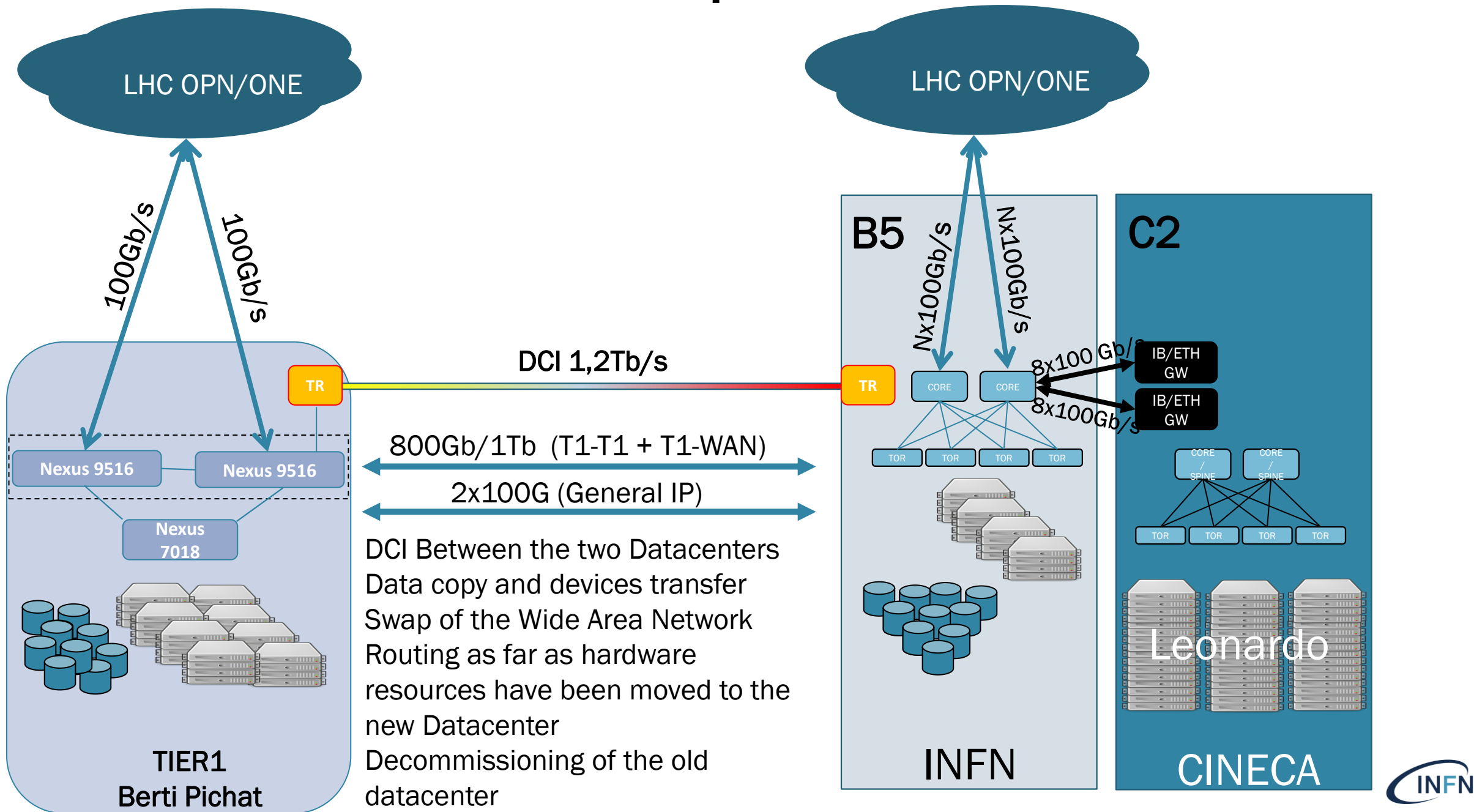
- Dedicated Dark Fibers are **in place**
- LW 10Km FC Transceivers acquired and installed on Berti Pichat FC Switches
- New IBM TS4500 Tape Library and new FC Switches **in provisioning phase**
- 1st IBM lib to be relocated at TP
- The data migration will continue through the remote SAN, until the Oracle lib will be emptied



# Conceptual CORE network Configuration



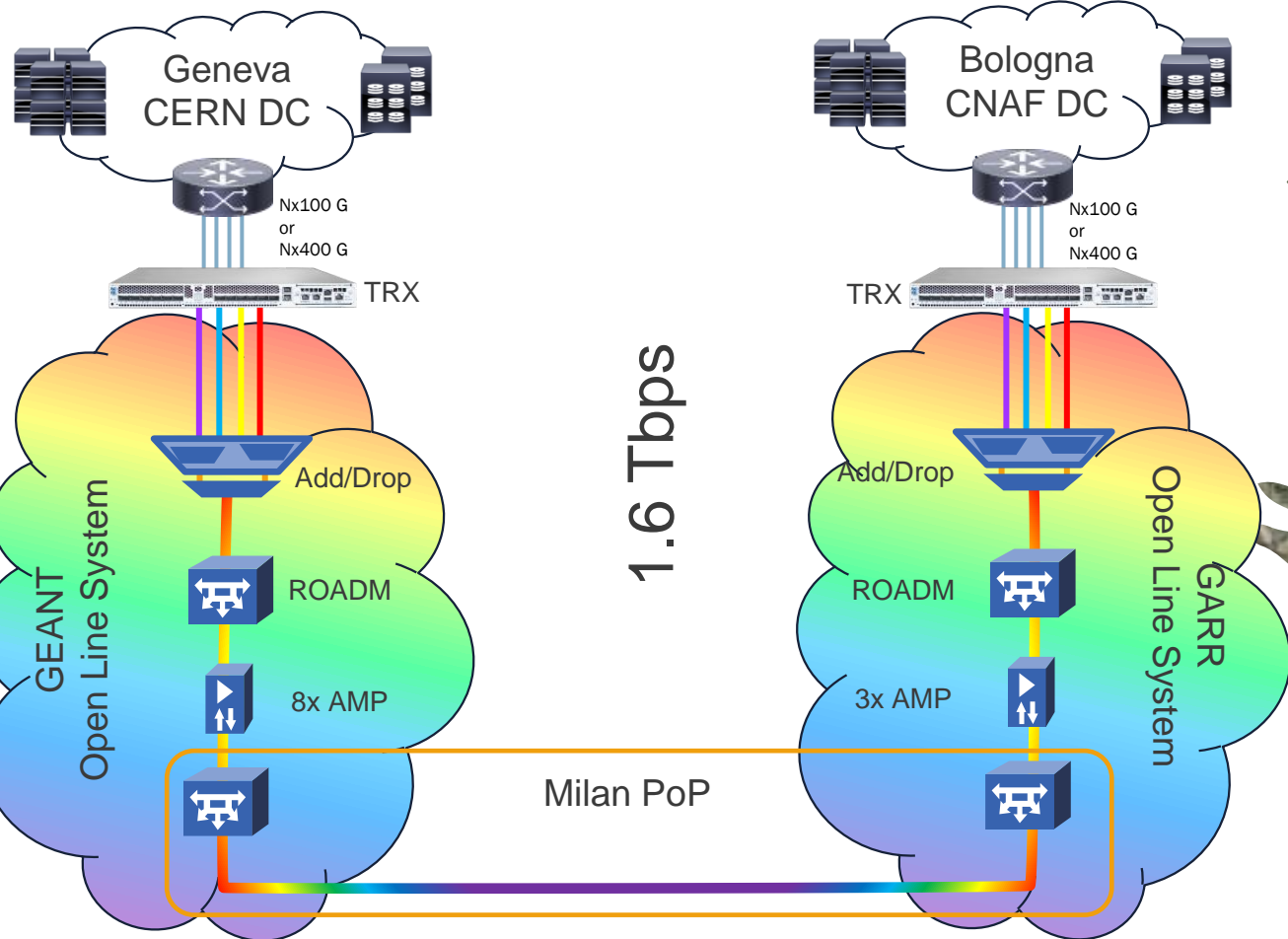
# DC Transfer phases





# CERN – CNAF DCI

As presented last year we have a pilot link based on multidomain Spectrum sharing Connection.  
We managed to activate a **4x100Gbps** to be used as LHCOPN link for INFN-T1 during the **Data Challenge 2024**



# CERN-CNAF DCI (Pre production)

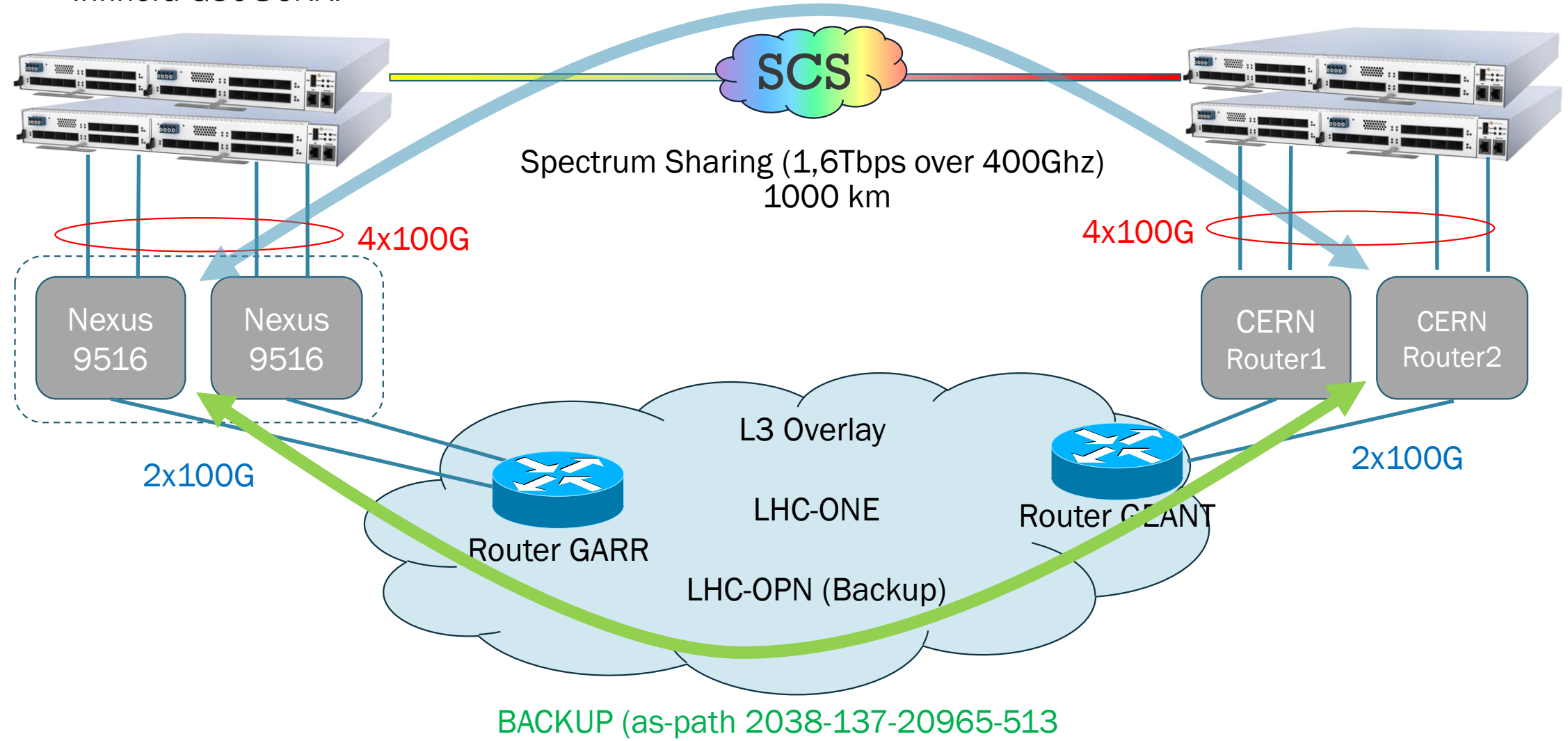
## Primary and backup path CERN-CNAF

### CNAF

2 Transponders  
Infinera G30@CNAF

### CERN

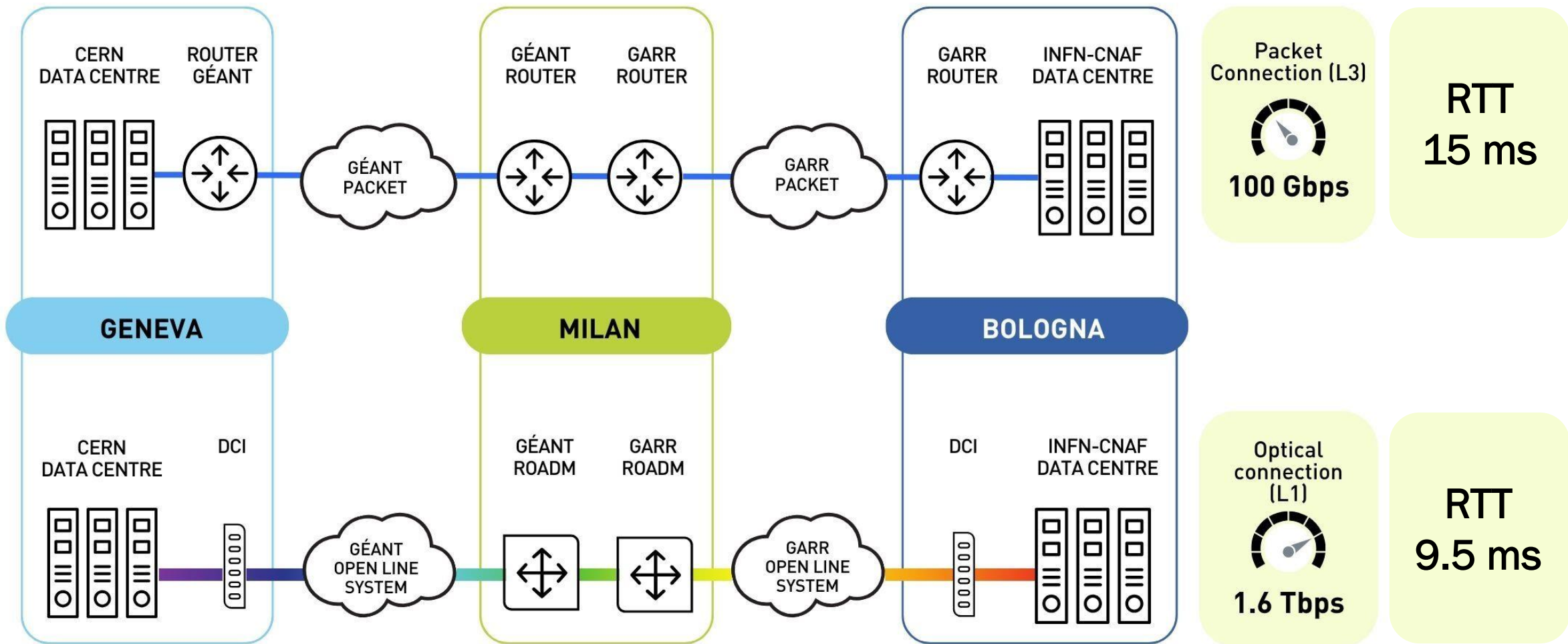
2 Transponders  
Infinera G30@CERN





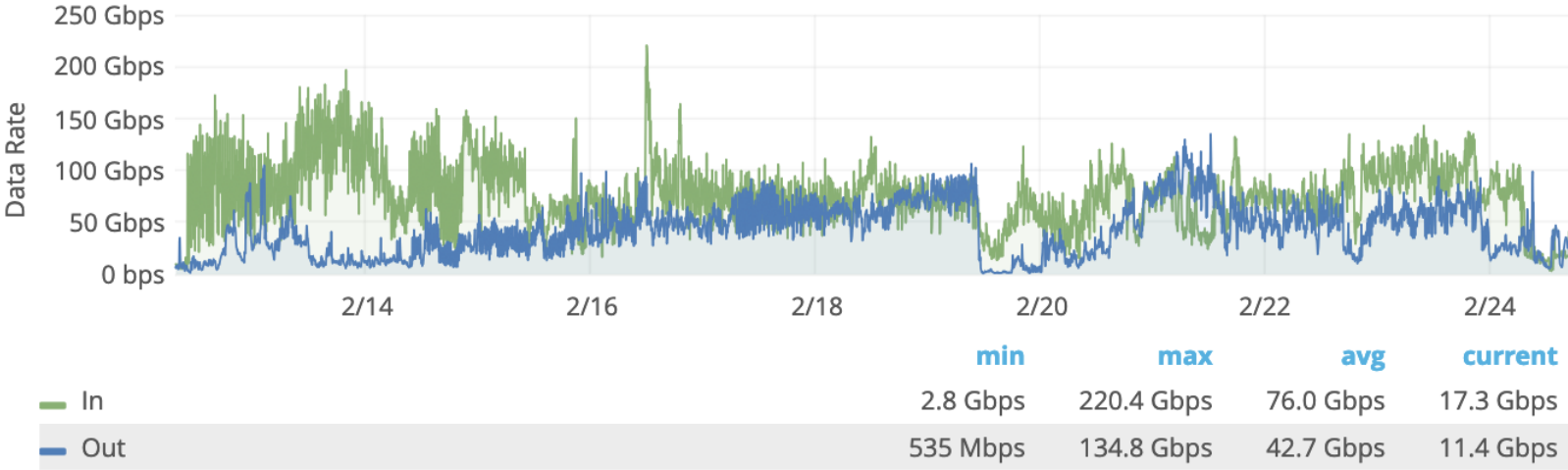
# CERN-CNAF DCI

## CERN-CNAF DCI



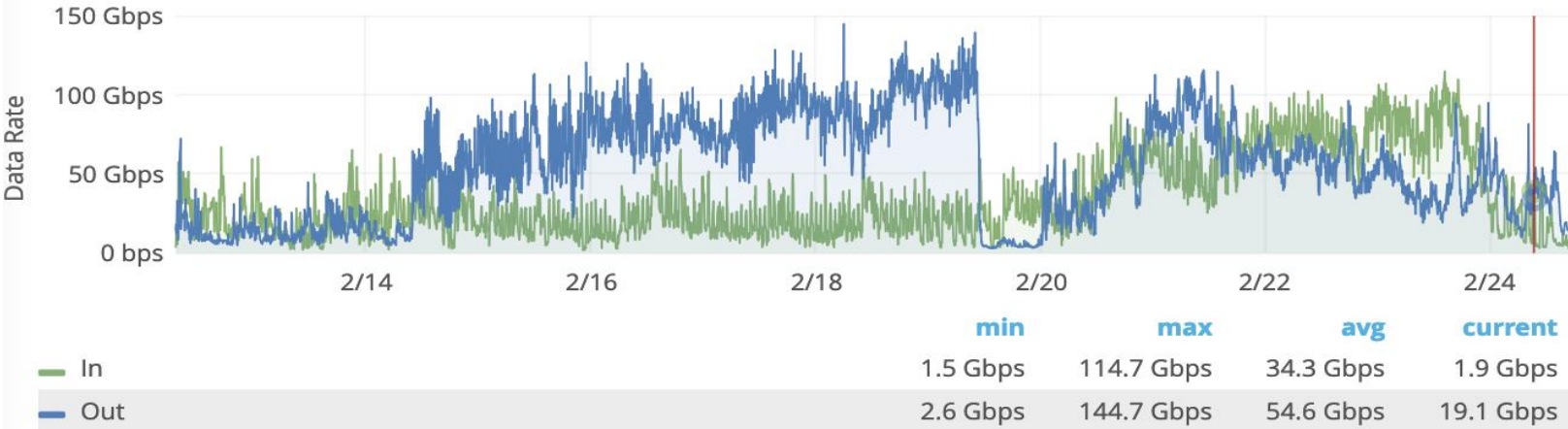
# Data Challenge 2024 (Using DCI link)

CERN-OPN



On 400Gbps CNAF-CERN DCI Reached **220 Gbps** (5 minute average)

LHC-ONE



On LHCONE (T1-T2 + T1-T1 per FZK e IN2P3) Reached **145 Gbps**

Quite good rates reached (>200Gbps) and network don't represent a limit for the data movement (Never saturated)



# Telemetry (On transponders)

Data observed via Telemetry on transponder devices (peaks close to 300Gbps)

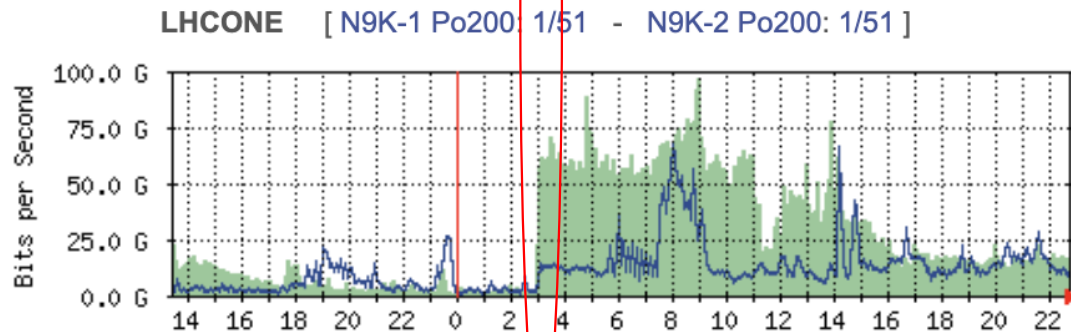
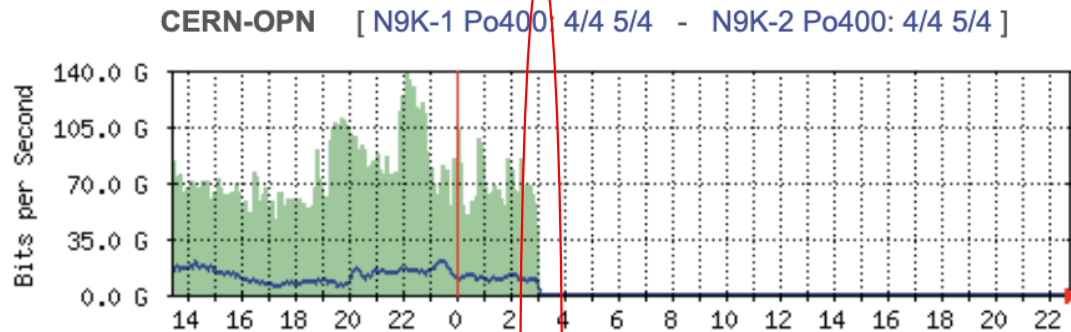


285 Gbps

Telemetry gives us instant data (not average) and it is better to observe peaks.

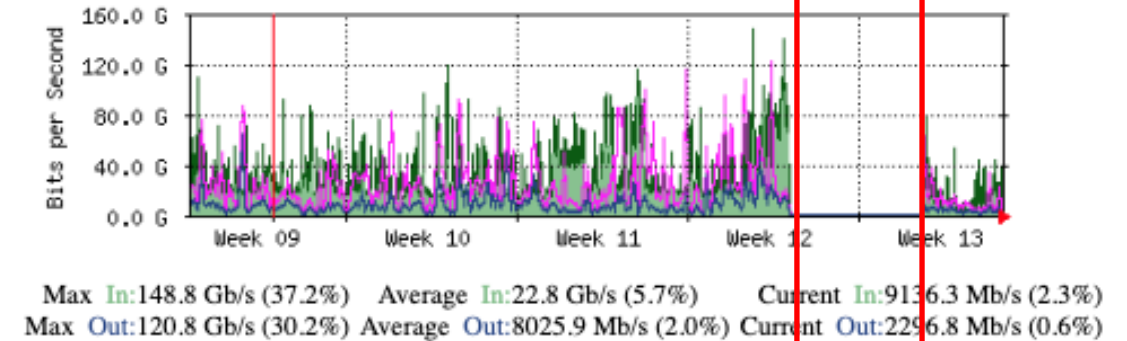
# Fiber CUT on DCI (22/3/2024 – 27/3/2024)

CUT 22/3/2024

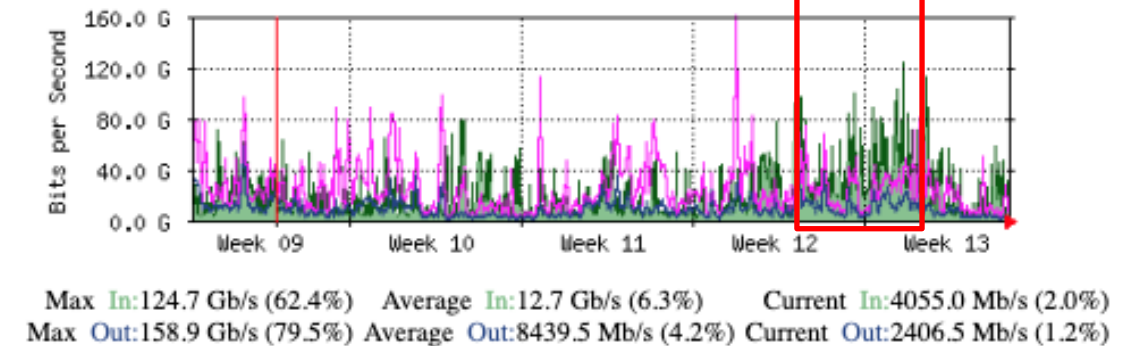


During "CUT time" traffic Flowed on LHC-ONE "Routed" Path

OPN CERN – CNAF DCI  
`Monthly' Graph (2 Hour Average)



OPN-ONE CERN – CNAF (backup)  
`Monthly' Graph (2 Hour Average)





# CERN-CNAF DCI (Next steps)



DCI on spectrum sharing is ready for production

Pilot activities will continue

- 400Gbps and multiple 400Gbps Ethernet connections
- Extension of the pilot to the new datacenter @Tecnopolo
- Try to find a second optical path for redundancy
- Improve automation on optical network programmability

## Acknowledgments:

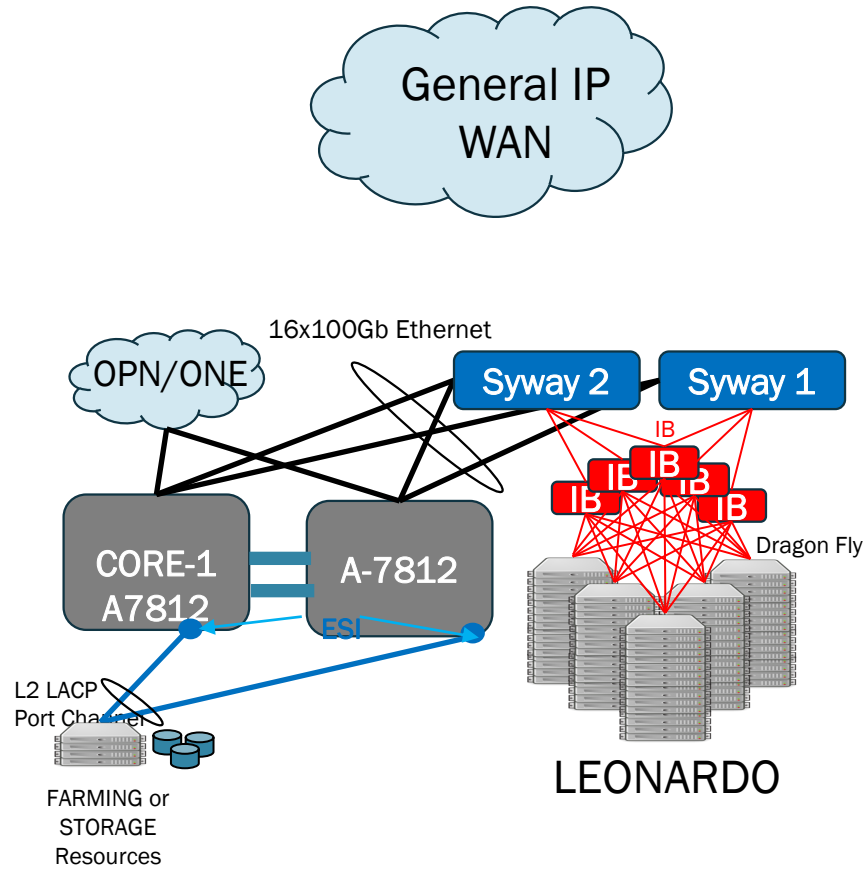
- GARR Optical : Colantonio, Vuagnin
- GARR Packet : Inzerilli, Marletta, Valiante
- GARR DC & DevOps : Cesaroni, Chiarelli, Marzulli
- CNAF Team: Zani, De Girolamo
- CERN Team: Martelli
- GEANT Team: SCS Team, Roberts
- GARR Management/Amm/CTS

**That's it**

# Backup Slides

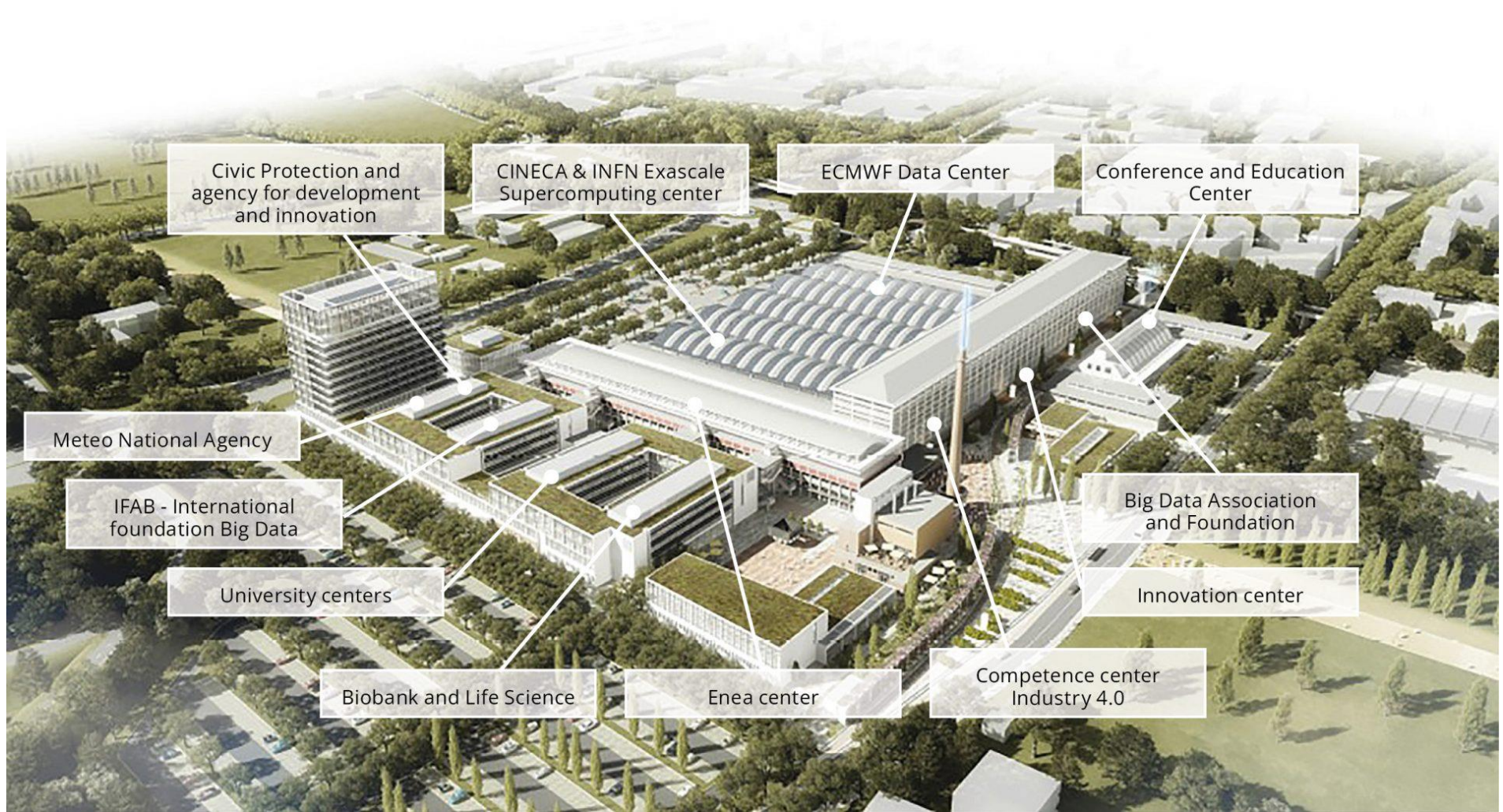


# Connection to Leonardo



# Outline

- New Datacenter state at Tecnopolo
  - Schema, Photos, Numbers
- Datacenters Interconnection between the two DCs
  - Two ways fiber access to the building
  - 1Tbps DCI provided by GARR
  - Tape Area Network Extension
  - Complete plot of the extensions (CINECA, Berti Pichat, Technopole)
- Plan for the transfer
  - Challenges
- New network infrastructure
  - Cabling system and technologies used
  - Devices HW description
  - Description of the collapsed IP Fabric for the CORES
  - Leonardo Interconnection
    - PoC done last year
    - New infrastructure
  - Focus on CERN-CNAF DCI
    - State of art
      - Next steps of the experimentation
    - Data Challenge analysis from network point of view
- Different kind of workflows and different confidentiality of data (GDPR compliancy and WLCG)
- Conclusions



Civic Protection and agency for development and innovation

CINECA & INFN Exascale Supercomputing center

ECMWF Data Center

Conference and Education Center

Meteo National Agency

IFAB - International foundation Big Data

University centers

Big Data Association and Foundation

Innovation center

Biobank and Life Science

Enea center

Competence center Industry 4.0