Long Term Data Preservation (at INFN)

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(thanks to S. Amerio, M. Pezzi and T. Boccali)

The Data Preservation problem (1)

- **Long-term Data Preservation** refers to the series of managed **activities** necessary to **ensure** continued **access** to digital materials for **as long as necessary**
  - also after the end of the life of the experiment…
- Some scientific areas, e.g. astrophysics, are well ahead in data preservation.
  - HEP experiments now focusing on this issue
  - On going at INFN for CDF (CNAF) and Aleph (Pisa)

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The Data Preservation problem (2)

- **DPHEP:** Data Preservation in High Energy Physics
  Past experiments have already successful DP projects in place (e.g. Babar)
- All **LHC experiments** are devoting more efforts to data preservation

- Data preservation is one of the areas targeted in **Horizon2020**

A data preservation project can be divided into two main areas:

- *1 - Bit preservation : how preserve data*
- *2 - Analysis framework preservation : code preservation, virtualization*

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Bit Preservation

- (At least) two copies of data on MSS in two different places
  - Well-defined (automatic) procedure to periodically check data integrity…
  - …and (in case) copy from the other site(s).
- Periodic migration of data from a generation of tapes to the next one…
  - Needs extra funding besides the start-up

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Analysis framework preservation

- Development of the long term future analysis framework.
- Preserve data access
- Preserve reconstruction and analysis software
- Give users resources to run analysis (authentication, disk space, CPU)
- Documentation

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Aleph (1)

- Experiment took data at the CERN e+e- collider LEP from 1989 to 2000.
- Data still valuable
  - still get request by Theoretical Physicists for additional checks / studies on ALEPH Data
- Preservation done at INFN-PISA
  - 150k files, avg size 200 MB (30 TB)
  - Split between real collected events and Monte Carlo simulated events
  - Processing times (analysis) on recent machines is such that 1 week is enough to process all the sample
- Current policy: any paper can use ALEPH data if among the author there is at least one former ALEPH Member

Aleph (2)

- Computing Environment via VM approach
  - Currently using uCERN-VM (SL4)
  - Provides batch ready VMs, interactove ready VMs, development ready VMs
- Data to be served via POSIX to the executables
  - Current approach (pre Eudat) was
    - Via WebDAV (Apache, Storm, …)
    - Seen by the VM as FUSE/DavFS2 mounted POSIX Filesyste
- Currently working on EUDAT

CNAF-CDF project

- Goal: preserve a complete copy of CDF data and MC samples at CNAF and services (access, data analysis capabilities)…
- …using "standard" tools and shared resources!
- First problem: copy all (required) data from FNAL to CNAF
- Implement bit preservation
- Implement analysis framework for LTDP
- Aleph approach (i.e. EUDAT) not viable

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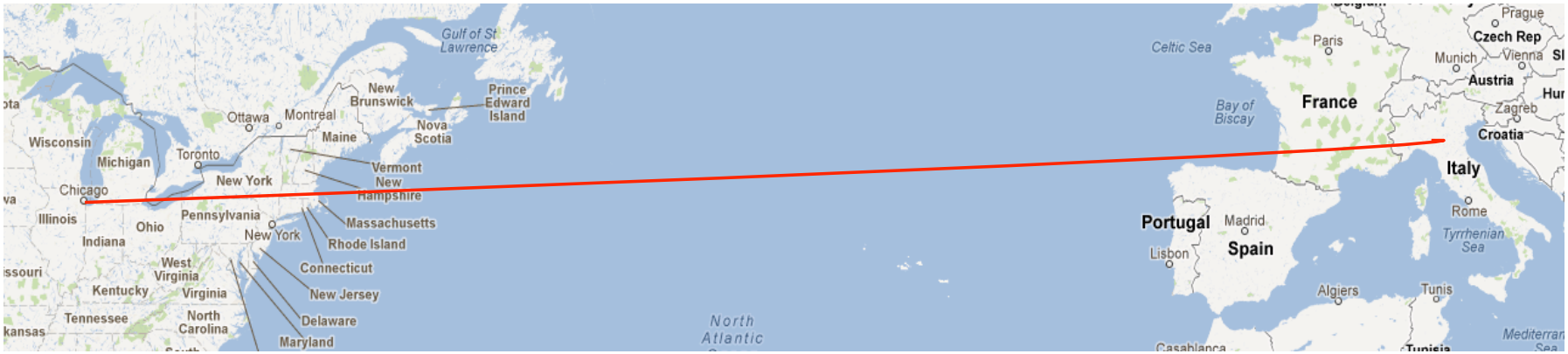
CNAF-CDF project: the copy (1)



- ~4 PB of data to be copied and preserved
  - All data and MC user level n-tuples (2.1 PB)
  - All raw data (1.9 PB)
  - Databases
- Dedicated 5 Gbps link FNAL-CNAF
  - Originally foreseen to complete the copy before Q2 2014
  - Delay in tape procurement ☹
  - Copy will be completed at the end of Q3 2014…

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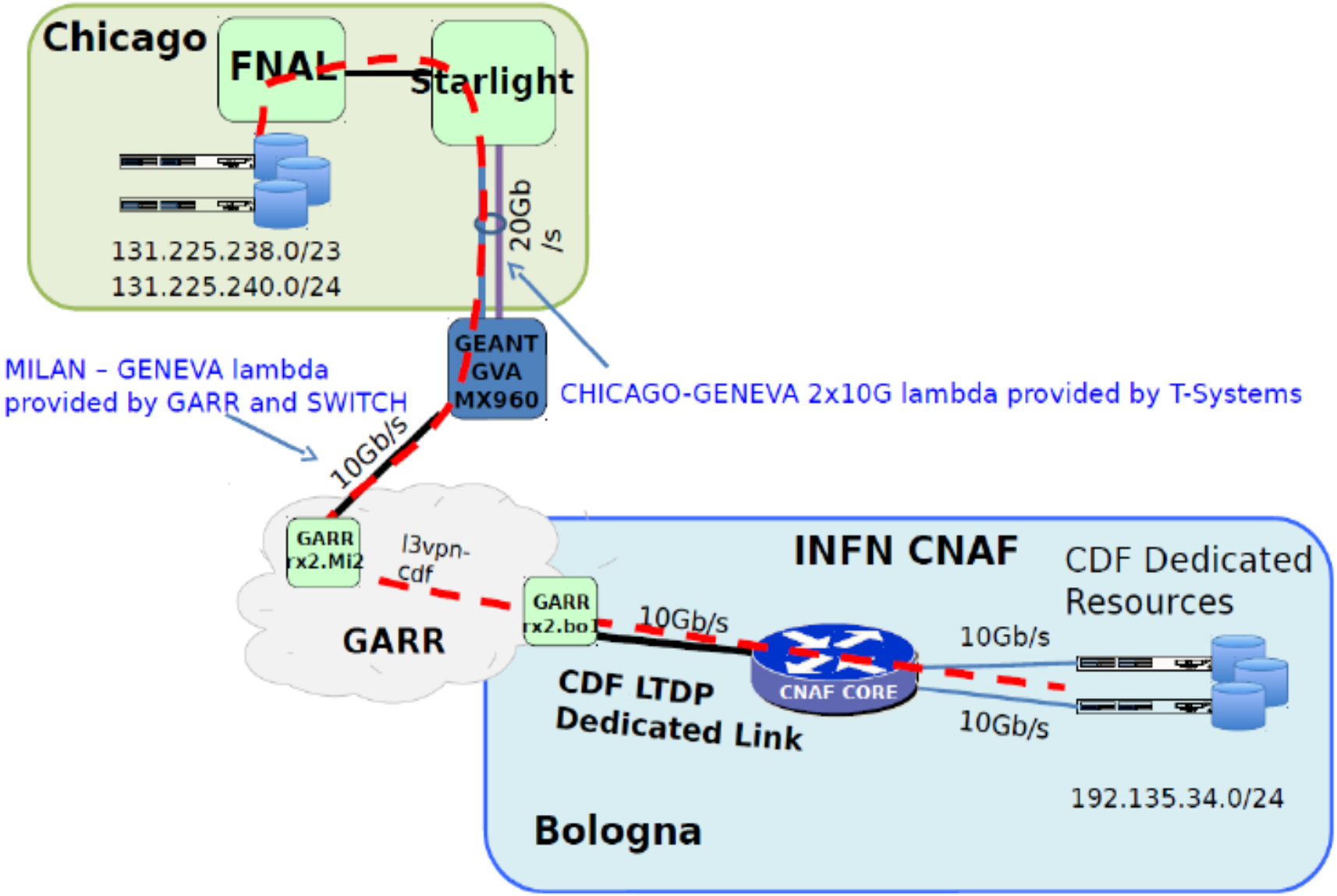
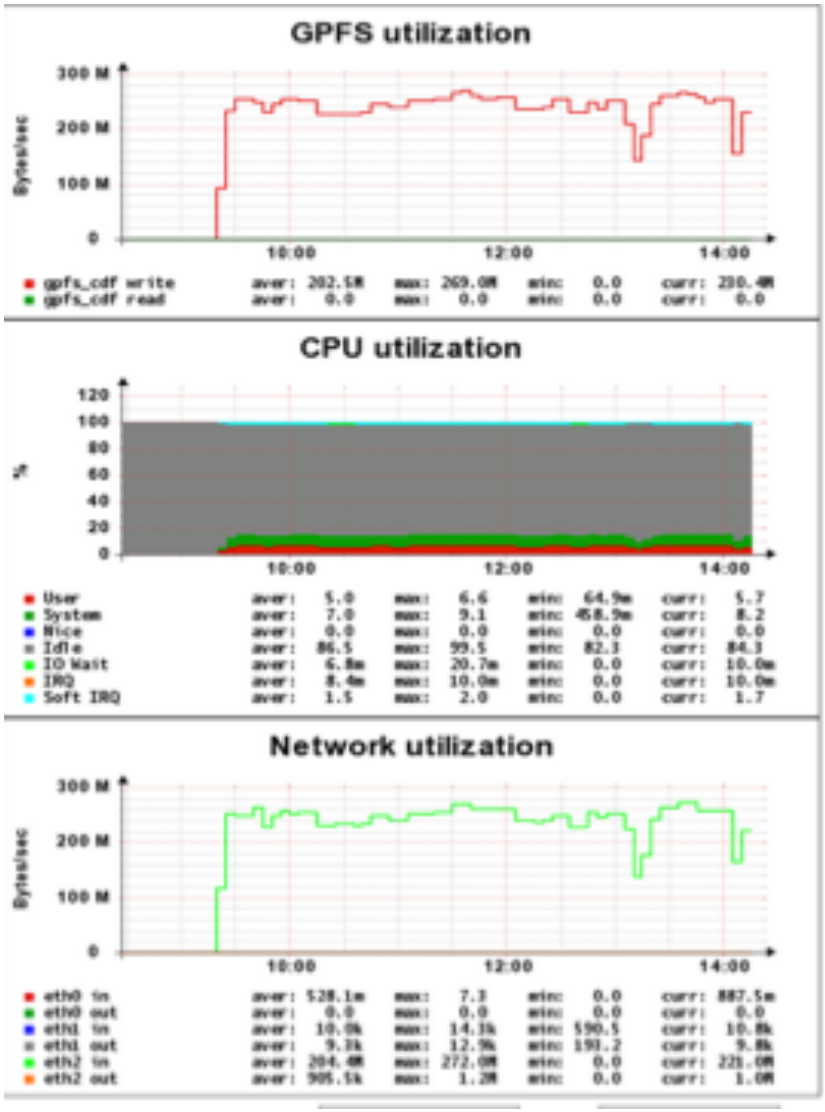
Data transfer: network layout



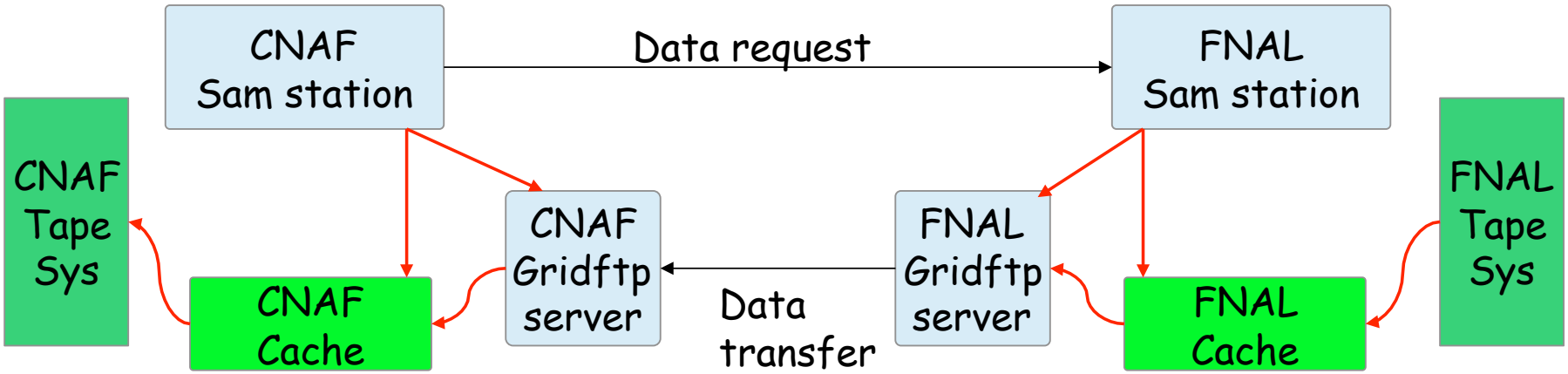
CNAF-CDF project: the copy (2)

- Some modifications needed for:
  - CDF copy system to use third party gridftp transfers
  - the SAM station to use our MSS
- Optimization of network configuration
  - Saturation of available network (5 Gb/s)
    - Limited to allow repack
  - Gridftp: 80 simultaneous processes each of which divided into 20 parallel streams
- Complete (re)use of tools and standard Tier1 infrastructure
  - Minimal FTE overhead
    - excepting the start-up!



CNAF-CDF project: the copy (3)

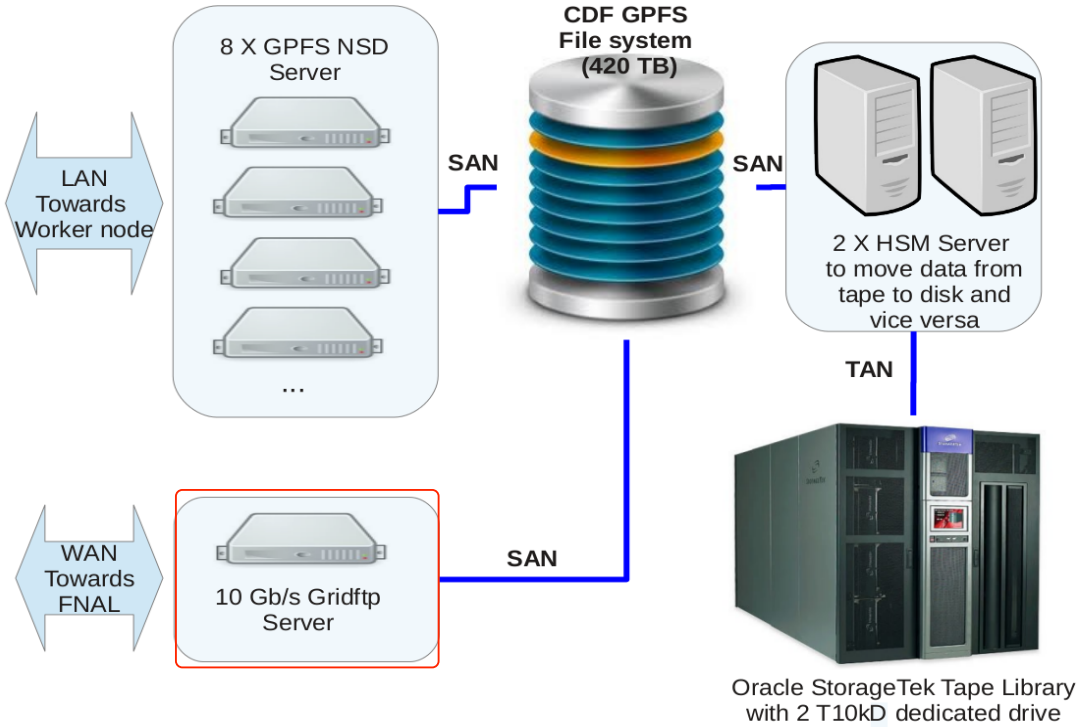
- CNAF requests data from FNAL that are staged at FNAL cache
  - The pre-staging done in parallel with the data transfer
- Data are copied via gridftp protocol (SAM performs checksum control)
- Once the data are in the CNAF cache, they are automatically migrated to tape



Data transfer archiving

1 - Data are copied from FNAL via gridftp.
2 - GEMSS moves data to tape
3 - Retrieval from tape using standard CDF commands (SAM station).

About 115 x 8,5 TB tapes (T10KD) written => ~ 1PByte



2 T10kD drive (130MB/s reading from the CDF GPFS Filesystem)

Actual DISK => TAPE (2 drives) bandwidth can reach 260MB/s

DISK => TAPE bandwidth will be improved with additional drives (2nd half 2014)

1 Single Point of Failure (single gridftp)

Cold spare machine avaliable (can be configured in a couple of hours)
Data transfer can "afford" a suspension in case of hardware failure

It's the same storage configuration that is used for other experiments

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Present status and future development

Now we have already replicated at CNAF ≈ 1 PB of CDF data on tape

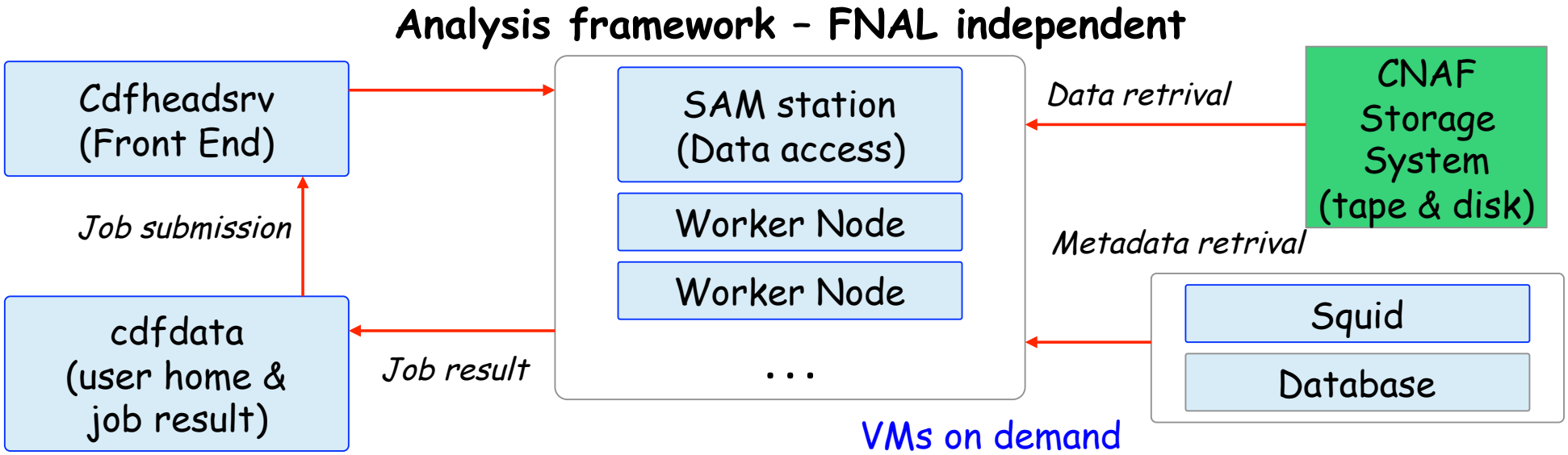
CDF data analysis in the long term future

To analyze CDF data stored at CNAF we need to implement:

- SAM station to retrieve data from tape: new version of SAM code in preparation at FNAL.
- CDF code volume, accessible via CVMFS
  Access to Batch facility
- Access to Oracle Databases (with local replicas at the INFN CNAF Tier1)
- Code preservation: CDF legacy software release (SL6) under test

In the long term future, CDF services and analysis computing resources can be instantiated on demand on pre-packaged VMs in a controlled environment.

Data analysis : future



This framework assumes limited use of CDF data in the long term future. Problems under discussion:

- Replication of Database

- Data access : QUESTION: How many years IBM will support GPFS on SL6?
  Possible solution could be NFS which provides greater compatibility with earlier version.

- Authentication : In the long future, access to the GRID resources will not be necessary.
  Possible solution could be job submission restricted to the local CNAF nodes.

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Summary

- A data preservation project can be divided into two main areas:
  - Bit preservation : how preserve data
    - For CDF data transfer still on-going data (expected to be completed by the end of 2014)
  - Analysis framework preservation : code preservation, virtualization …
    - (obvious) Strategy: ause virtualization (Openstack?)
- Some issues still open (e.g. common policy for data access, "standard" way of preserving accessibility etc..)
  - Fundamental to use "standard" tools and frameworks
  - Probably some activity in H2020
- First experiences in HEP world (BABAR, Aleph, CDF) in the framework of DPHEP are the prototype for WLCG and other experiments