The ATLAS Computing activities and developments of the Italian Cloud

Overview of the 2011/2012 data taking period
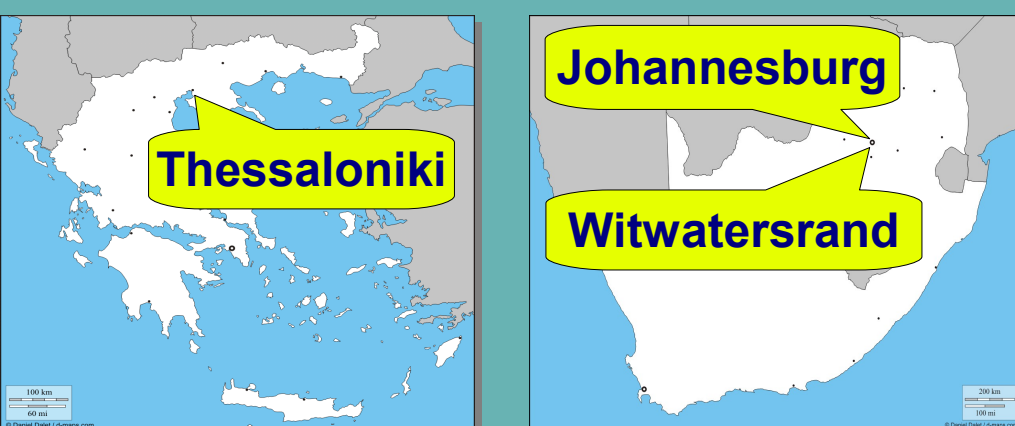
The Italian Cloud

The Italian Grid Computing Cloud consists of several computing centers located at the Italian Universities and National Institute of Nuclear Physics (INFN) departments.
Recently, the Universities of Witwatersrand and Johannesburg (ZA) and Thessaloniki (GR) joined to the Italian Cloud

In average,10% of the ATLAS Computing activities (Data Processing, Physics Analysis, Simulation and Software Development) are performed in the Italian Cloud

INFN-CNAF Tier-1

The Italian Tier-1 is located at the INFN-CNAF in Bologna and serves the computing activities of the four LHC experiments and other communities supported by the INFN

INFN Tier-1 ATLAS 2012 resources

Computing			Storage		
Job slots	HePSpec	Batch system	Capacity	SRM type	Bandwith
3000	35000	LSF	2.7 PB disk + 3.6 PB tape	StoRM+GPFS+ TSM	10 GB

ATLAS activities at INFN Tier-1
• Long term access and storage on tape of a fraction of RAW data
• Reprocessing and reconstruction of the stored RAW data
• Storage on disk of a fraction of derived data sample (ESD, AOD, TAG)
• Archival of the simulated data produced in the cloud
• Production of simulated data samples
• Group and User analysis

INFN Tier-1 data transfer input rate

Peak 800 MB/s (daily average)
Average 84 MB/s

HepSpec Usage at INFN Tier-1

- ALICE 18,4%
- ATLAS 32,6%
- CMS 17,7%
- LHCB 15,9%
- Other 16,3%

INFN Tier-1 ATLAS Storage Usage

- Experiment data 86,0%
- Group analysis 11,5%
- Scratch area 2,4%
- Simulation buffer 0,1%

INFN Tier-1 processing activities

- MC Production 71,5%
- User Analysis 15,4%
- Group Production 7,4%
- Data Processing 3,1%
- Group Analysis 1,9%
- Testing 0,5%
- Validation 0,2%

Tier-2s

ATLAS activities at Tier-2s
• Storage of analysis suitable data (AOD, NTUP, D3PD, user)
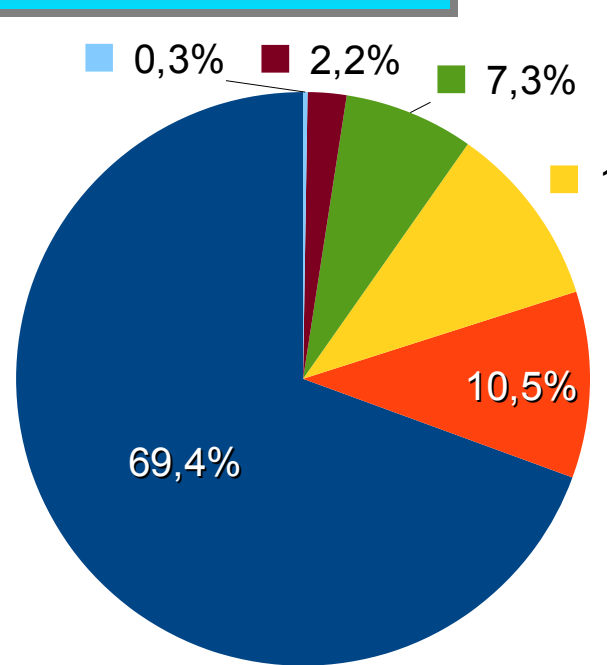• MC simulation
• User and group analysis
• Storage and analysis of local sub-detector data (calibration, alignment)
• Test and development

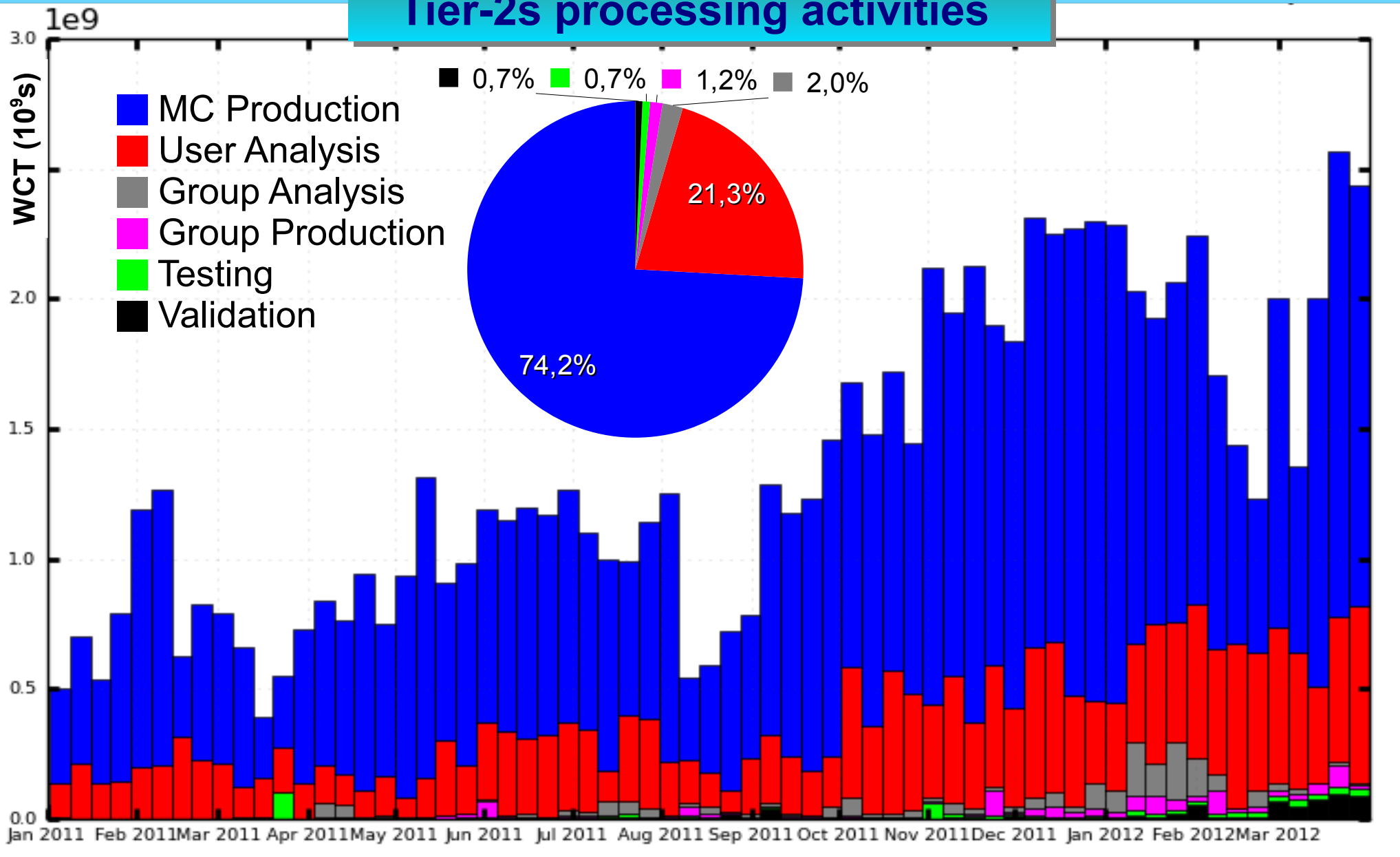| IT Tier2-s 2012 total ATLAS resources	Computing			Storage		
	Cores	HePSpec	Batch system	Capacity (TB)	SRM type	Bandwith (Gbps)
Frascati	870	8300	PBS	420	DPM	10
Milano (T2D)	1050	10900	PBS/Condor	1100	StoRM	10
Napoli (T2D)	1200	12400	PBS	1100	DPM	10
Roma1 (T2D)	1300	13100	LSF	1040	DPM	10

T2D sites are topologically connected to all ATLAS Tier-1s and T2Ds, in order to optimize data distribution and analysis

Tier-2s Storage Usage

- Experiment data 69,4%
- User analysis 10,5%
- Group analysis 10,3%
- Calibration 7,3%
- Scratch area 2,2%
- Simulation buffer 0,3%

Tier-2s processing activities

- MC Production 74,2%
- User Analysis 21,3%
- Group Analysis 2,0%
- Group Production 1,2%
- Testing 0,7%
- Validation 0,7%

Italian Cloud overall activities

Italian Cloud data transfer input rate

Peak 800 MB/s (daily average)
Average 185 MB/s
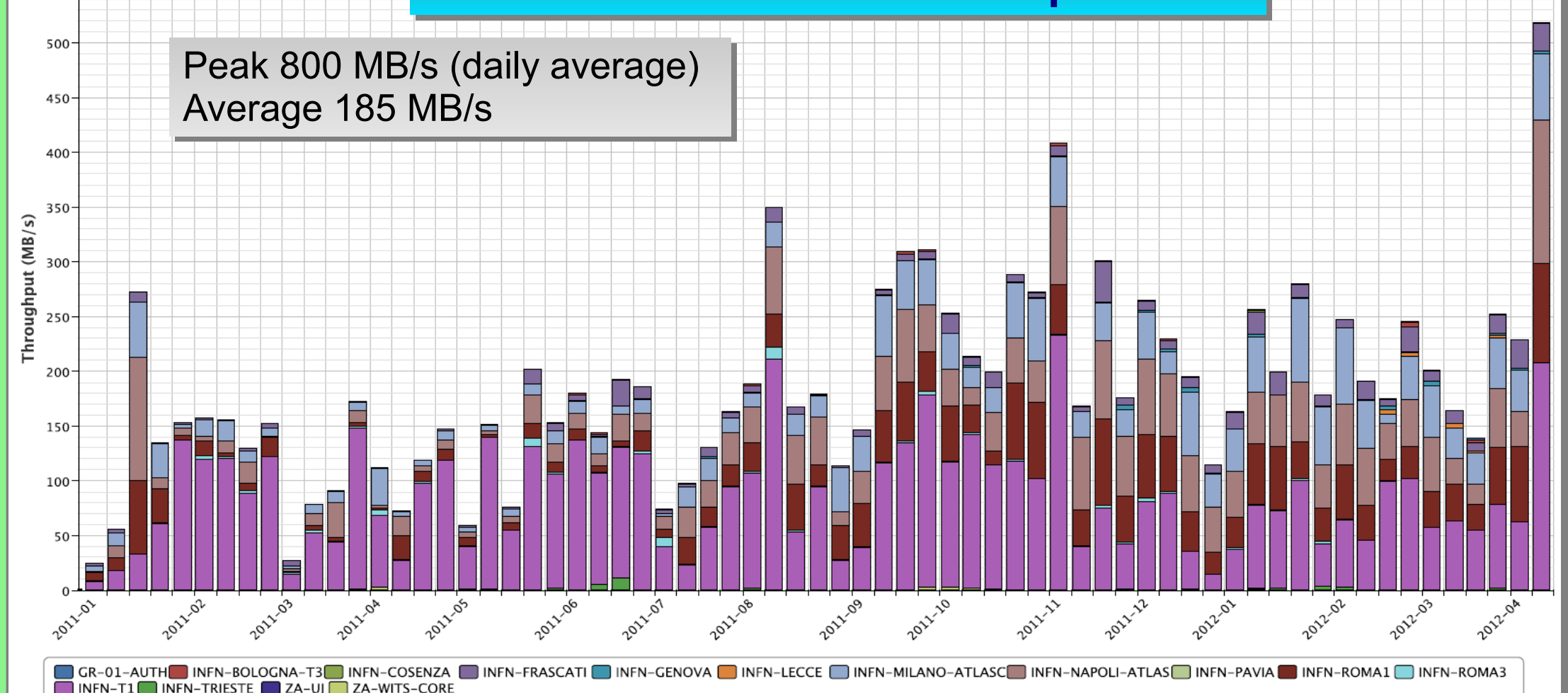
CPU consumption in 2011/2012

MC production
- INFN-T1 46,1%
- NAPOLI 16,2%
- ROMA1 16,1%
- MILANO 10,9%
- FRASCATI 5,5%
- ROMA3 2,8%
- BOLOGNA 1,1%
- GENOVA 0,7%
- LECCE
- PAVIA
- WITS

Group Analysis
- 47,6%
- 24,1%
- 14,5%
- 10,3%
- 2,1%
- 1,0%

User Analysis
- 39,5%
- 27,5%
- 11,5%
- 11,4%
- 5,3%
- 2,6%
- 1,6%

CPU usage by activities

- MC Production 73,1%
- User Analysis 18,3%
- Group Production 4,1%
- Group Analysis 1,8%
- Data Processing 1,4%
- Testing 0,6%
- Validation 0,6%

CPU usage by sites

- INFN-T1 47,1%
- NAPOLI 17,7%
- ROMA1 14,5%
- MILANO 10,5%
- FRASCATI 5,2%
- ROMA3 2,1%
- BOLOGNA 1,3%
- GENOVA 0,9%
- LECCE
- WITS
- COSENZA
- PAVIA
- JOHANN.

Tier-1 47,1% | Tier-2s 47,9% | Tier-3s 5,0%
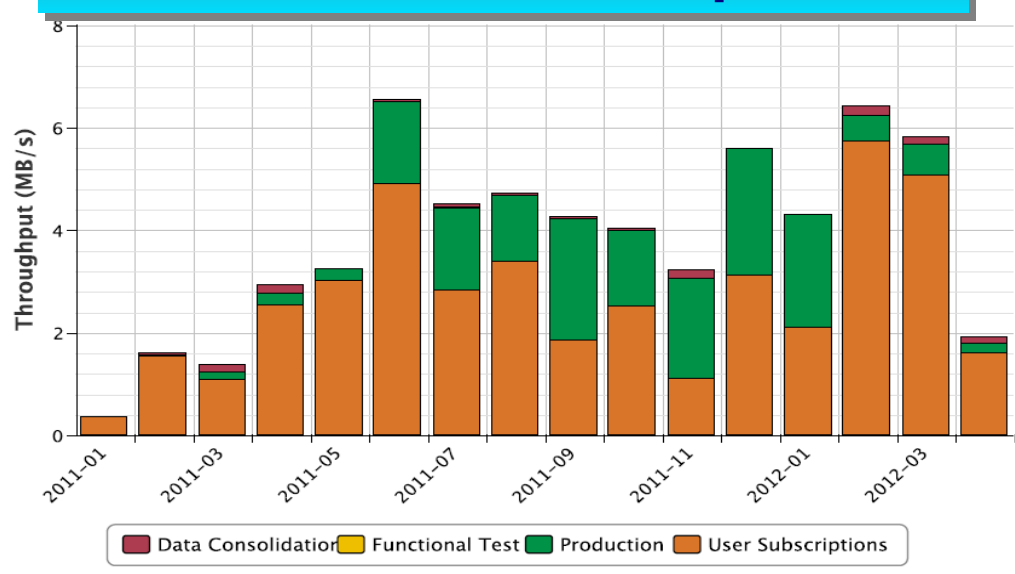
Tier-3s

An ATLAS Tier-3 is a local institutes Grid-enabled computing center (no pledged resources).
• Tier-3 sites mainly used for User Analysis and testing; also enabled for central MC production
• 11 Tier-3s in the Italian Cloud (8 in Italy, 2 in South Africa and 1 in Greece)
• Total of 730 job slots and 200 TB space on disk (starting from Summer 2011)

Tier-3 data transfer input rate

Networking

INFN-T1 2012 connectivity

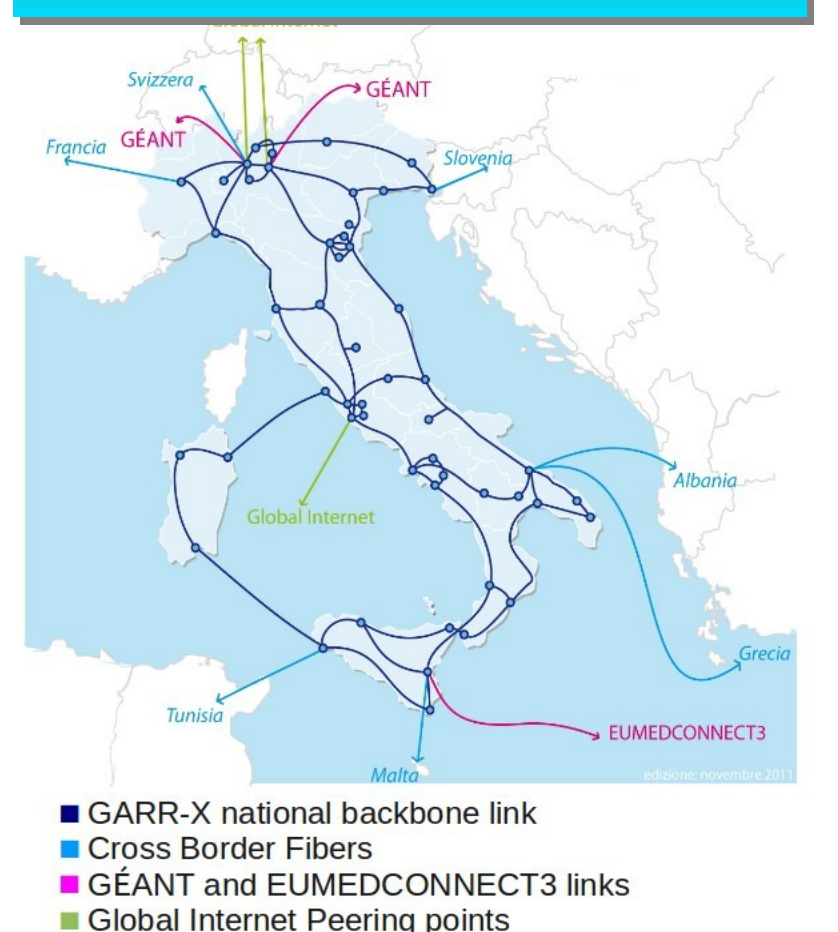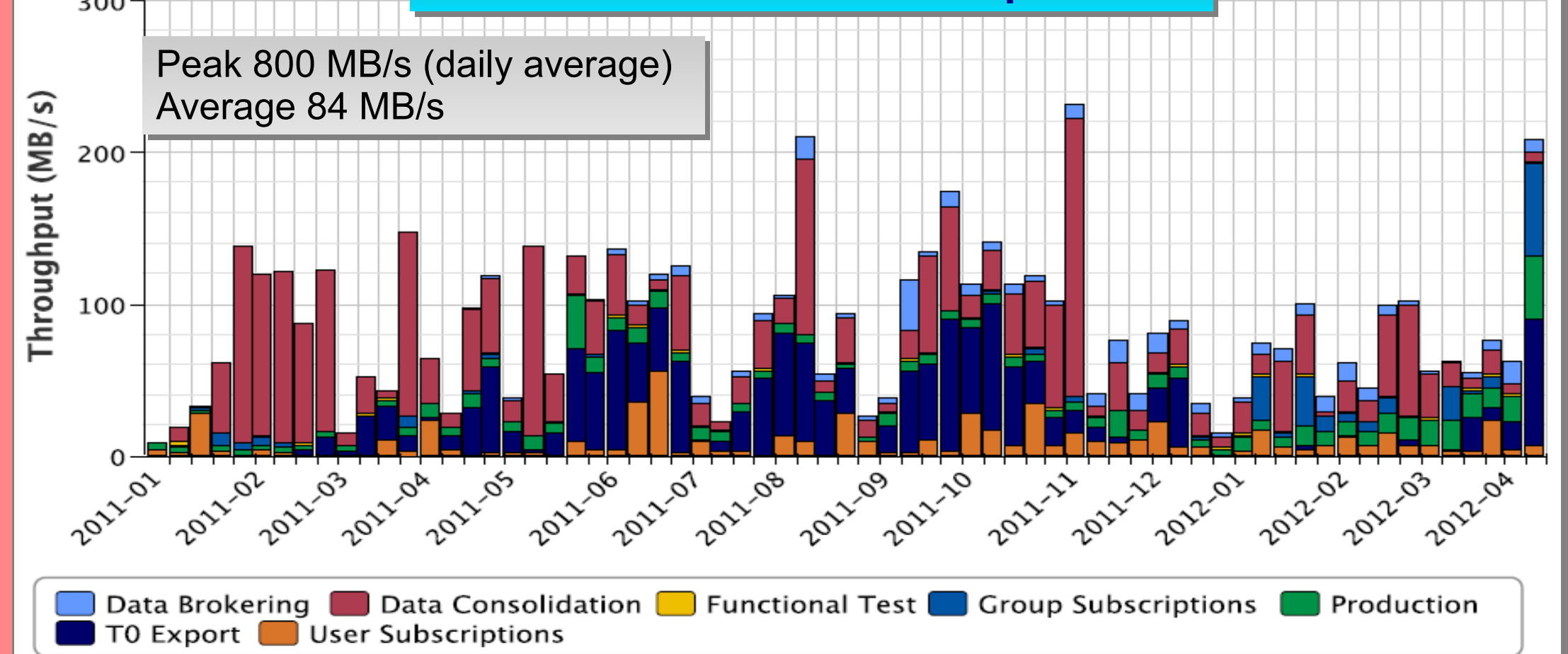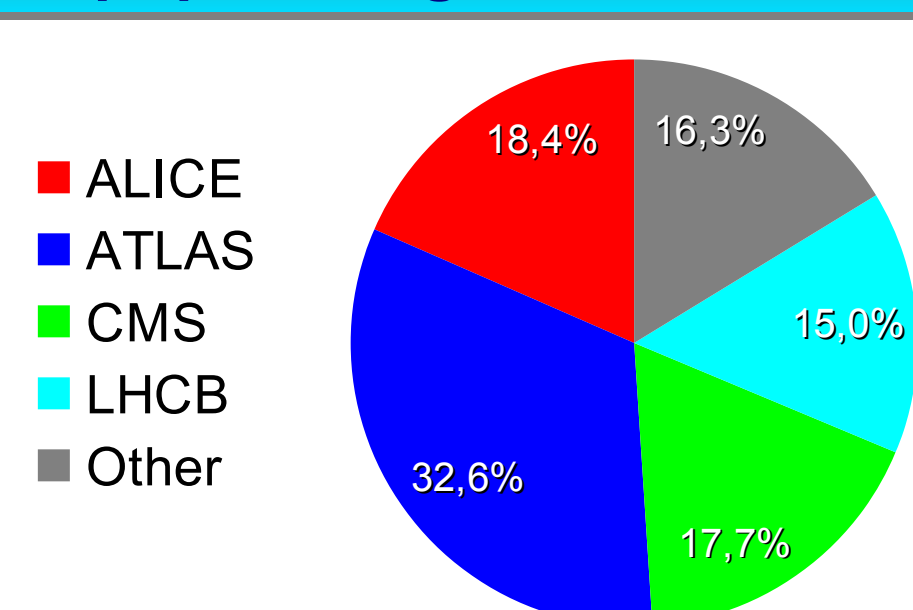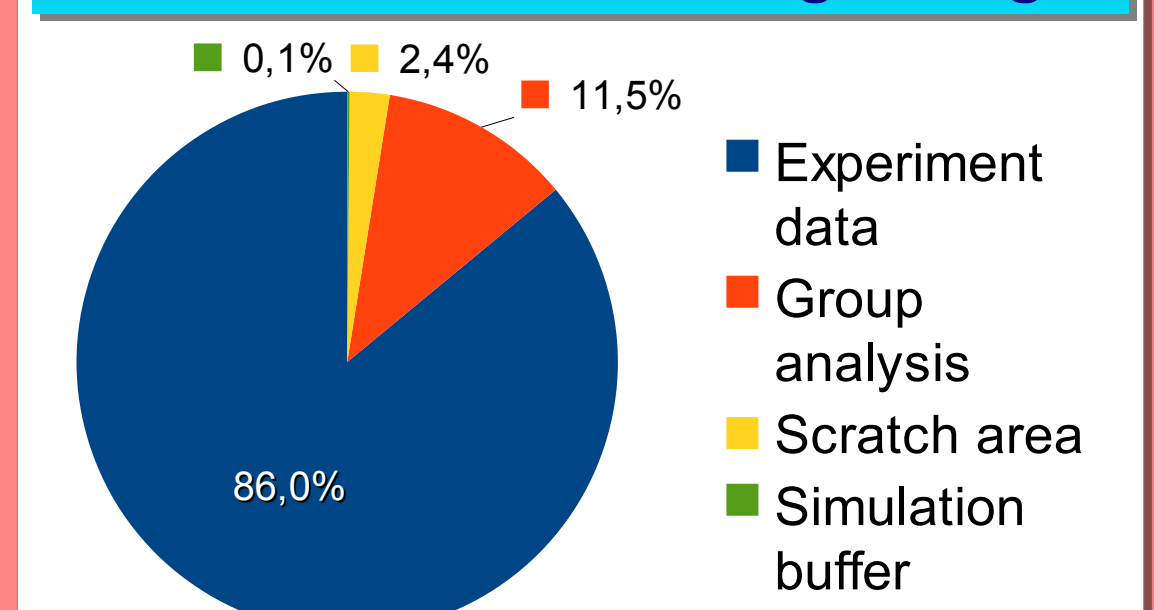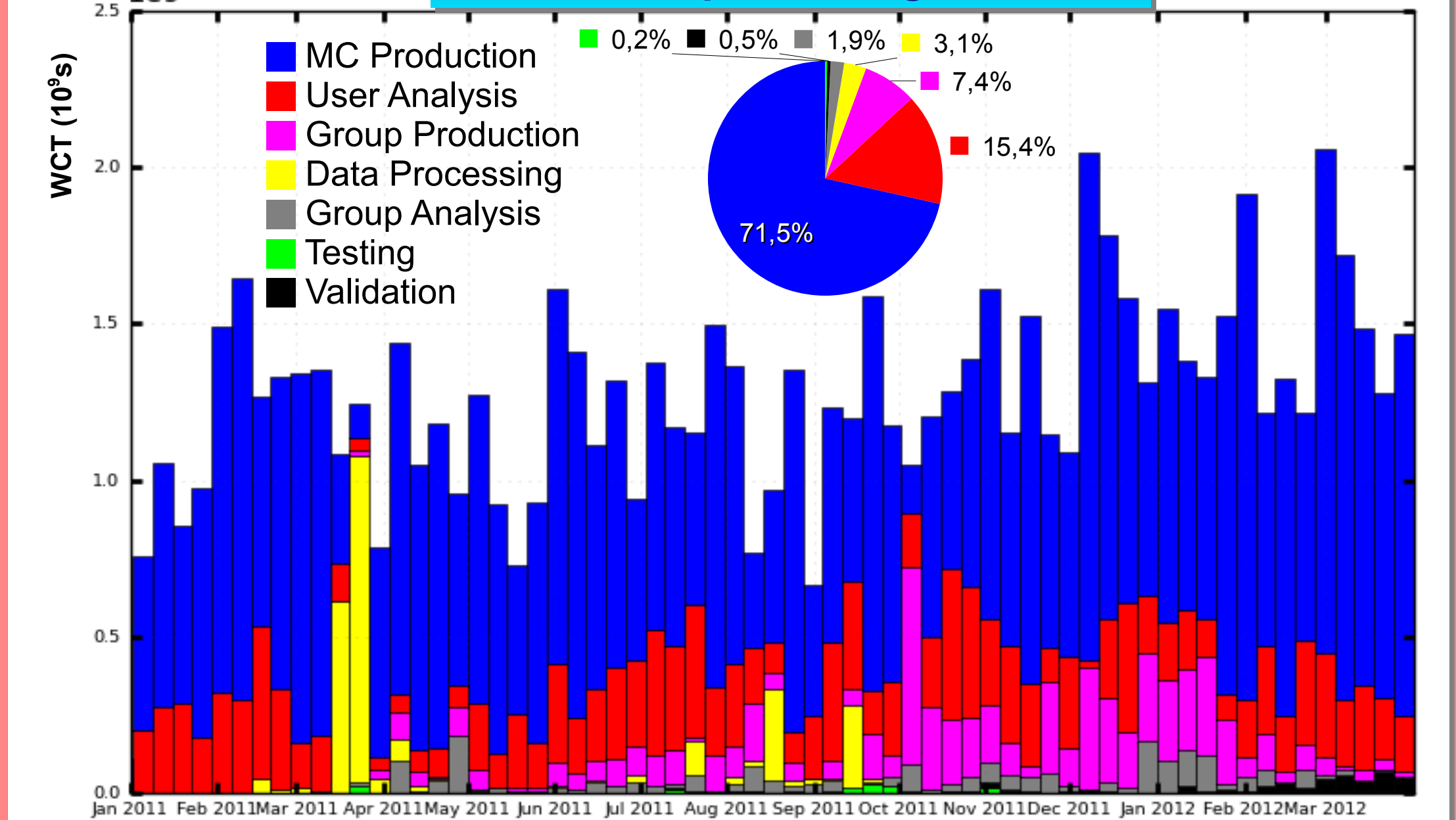| Network	Bandwidth	Traffic	
LHCOPN	10Gb/s	Tier-0/Tier-1, Tier-1/Tier-1	Now 20Gbps shared logically
LHCONE	10Gb/s	Tier-1/Tier-2 /Tier-3	
General IP	30 Gb/s	Tier-1/*	

Tier-2	Q2 - 2012	Q4 - 2012 (GARR-X)
Frascati	1Gb/s	10 Gb/s
Milano	2 Gb/s	10 Gb/s
Napoli	2 Gb/s (LHCONE)	10 Gb/s
Roma1	2Gb/s	10 Gb/s

LHCONE (LHC Open Network Environment)

• provide a private network for Tier1/2/3 traffic
• designed to guarantee high performance and reliability in the data transfers
• no additional resources required to those already provided by the various national research networks, in particular new backbones.

After a preliminary phase of study and experimentation, the ATLAS experiment has identified 14 pilot sites to start deployment and test of this new generation network, and the ATLAS Tier2 of Naples is among them.

GARR-X backbone fiber

- GARR-X national backbone link
- Cross Border Fibers
- GÉANT and EUMEDCONNECT3 links
- Global Internet Peering points

L Rinaldi[1], A Annovi[2], M Antonelli[2], D Barberis[3], S Barberis[4], A Brunengo[3], S Campana[5], V Capone[6], G Carlino[6], L Carminati[4], C Ciocca[1], M Corosu[3], A De Salvo[7], A Di Girolamo[5], A Doria[6], R Esposito[6], M K Jha[1], L Luminari[7], A Martini[2], L Merola[6], L Perini[4], F Prelz[4], D Rebatto[4], G Russo[6], L Vaccarossa[4] and E Vilucchi[2], for the ATLAS Collab.

[1] INFN CNAF and INFN Bologna, [2] INFN Laboratori Nazionali di Frascati, [3] INFN Genova and Università di Genova, [4] INFN Milano and Università di Milano, [5] CERN, [6] INFN Napoli and Università di Napoli, [7] INFN Roma-1 and Università La Sapienza

ATLAS EXPERIMENT