

# High Energy Physics Computing Coordination in Pakistan

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# Computing at NCP

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- One of the important activities at NCP is the Experimental High Energy Physics Program.
- Involved in LHC collaborating with CMS.
- It entails:
  - High speed networks,
  - Powerful data processing facilities,
  - Data storages, and
  - Services & tools required to handle the data.

# Advanced Scientific Computing



- In August 2003, Advanced Scientific Computing (ASC) Group was established in NCP, with following aims:
  - Deploy and create high performance computing facilities.
  - Establish the hardware and software user environments in high performance computing.
  - Provide technical consultation service to all users.
  - Create an International Research Base.
  - Educate and train our young professionals.
  - Promote skilled personnel at international forums.

# Accomplishments – Grid Comp.



- CMS Production Setup
  - 08 CPUs dedicated.
- LCG at NCP
  - Certified and tested LCG Grid node.
- Certification Authority (CA)
  - Accredited Certification Authority by EU-Grid-PMA.

# Accomplishments



- Linux Cluster at NCP
  - 10 CPUs dedicated.
  - 50 in near future and 200 in two years.
  - Storage space currently 0.6 TB.
  - 5 TB in near future and 30 TB in two years.
  - Access Control.
  - Efficient job scheduling.



# CMS Production at NCP

- NCP is taking part in CMS Production since Spring 2002.
- NCP became **Regional Center for CMS Production** in Pakistan in August 2003.
- Total events produced by Pakistan **1.38M**.
- NCP's share in these produced events is **0.956M**.
- Total data generated corresponding to these events is almost **280GB**.
- Data produced by NCP is almost **170GB**.
- All **280GB** has been uploaded back to CERN.

# CMS Production Centres in PAK



- Currently there are five CMS Production Centres in Pakistan
  - NCP (Islamabad)
    - In the role of Regional & Production Centre as well
  - PAEC-I (Islamabad)
  - PAEC-II (Karachi)
  - PAEC-III (Taxila)
  - NUST (Rawalpindi)

# CMS Production Centres in PAK



- No single institute has resources to become a Tier-1 or Tier-2 Centre
- The concept of Federation of Production Centres was adopted
- PCs distributed across Pakistan contributing to CMS Production with small local farms
- Now NCP and PAEC-I are also contributing to it through LCG Grid





# CMS Production at NCP

- Resources (CPUs+Storage) dedicated to CMS by NCP and other PCs are:

<b>Production Centre</b>	<b>CPUs</b>	<b>Storage (TB)</b>
NCP	08	0.64
NUST	08	0.60
PAEC-I	14	0.32
PAEC-II	14	0.952
PAEC-III	05	0.38
<b>TOTAL</b>	<b>49</b>	<b>2.892</b>

# Events Produced (Summary)



<b>Production Centre</b>	<b>GEN. K</b>	<b>SIM. K</b>	<b>Digi w/o PU K</b>	<b>Digi with PU/Hit K</b>
NCP	715.7	204.7	10	21.8/4.5
NUST	50.1	20.1	--	--
PAEC-I	93.7	53.7	10	35/--
PAEC-II	30.1	10.1	--	--
PAEC-III	34.2	44.2	10	10/4
<b>TOTAL</b>	<b>930.30</b>	<b>332.80</b>	<b>30</b>	<b>66.8/9.5</b>

# Events Produced (Summary)



<b>Events</b>	<b>NCP</b>	<b>PAEC- I</b>	<b>PAEC- II</b>	<b>PAEC- III</b>	<b>NUST</b>
Test	338.7K	38.9K	40.2K	86.4K	70.2K
Real	618K	153.5K	--	16K	--

# Production at LCG



<b>Events</b>	<b>Assigned (Million)</b>	<b>Produced &amp; Updated (Million)</b>
CMKIN	7.0	3.3
OSCAR	5.14	Started Running

# LCG at NCP



- The effort to bring Pakistan on the LCG map as a Grid Node was started in October 2003.
- A Grid Technology Workshop was organized by NCP from October 20-22, 2003.
- The first ever testbed was deployed during the workshop for tutorial.
- LCG1 tag **1.1.1.2** was used for deployment.
- This testbed consisted of **09** machines.
  - CE(2), SE, RB, WN(3), UI, GIIS.

# LCG at NCP



- 30 machines were used during the tutorial for enabling users to communicate with the deployed testbed.
- The effort continued and NCP deployed a new LCG version which is LCG2 tag 2.0.0 in June 2004.
- In September 2004 we moved to LCG2 tag 2.2.0.
- In January 2005 we installed LCG tag 2.3.0 and finally in March we updated it to 2.3.1.
- Now NCP is a Tested & Certified Grid Node in Pakistan.

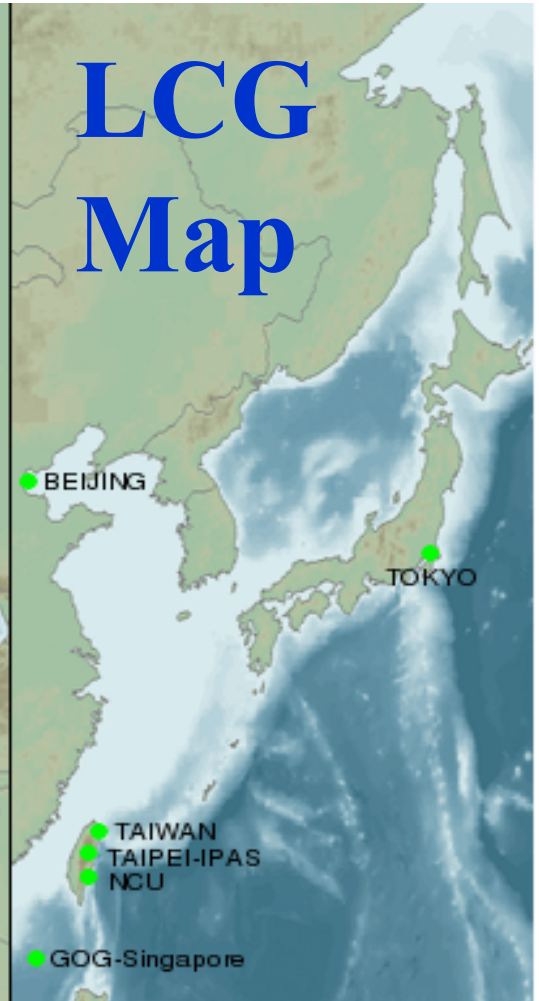
# LCG at NCP



- Tested & Certified by the Grid Deployment Team (dteam) at CERN and added to the Grid Operations Centre (GOC) website.
- A certified LCG Grid node, first in South Asia and fifth in Asia.

Status for Resource Broker CERN\_lxn1188: Mon Mar 28 04:45:01 BST 2005

# LCG Map



- No information
- Scheduled Maintenance
- Timeout
- Globus OK
- RB OK



# LCG at NCP



- Services currently deployed by NCP for LCG2\_3\_0 are:
  - UI, SE, CE, and WN.
- Following services are being used from CERN machines:
  - RB, BDII, and Proxy Server.
- Reason for using CERN machines is low bandwidth.
- Services like RB and BDII require high bandwidth.

# PK-GRID-CA



- For becoming fully operational, a Grid Node is also required to be a Certification Authority (CA).
- Which issues digital certificates to users/hosts to use grid resources under secure environment.
- The effort in this regard started in October 2003.
- NCP produced the first Certificate Policy and Certification Practice Statement (CP-CPS) document in December 2003.
- Reviewed by several members of European Grid Policy Management Authority (EU-Grid-PMA).

# PK-GRID-CA



- Three revisions were made which resulted from comments and suggestions by PMA members.
- The CA was presented in September in the 2<sup>nd</sup> meeting of the EU-Grid-PMA held in Brussels.
- NCP was formally approved by the **EU-Grid-PMA** as a Certification Authority.
- **PK-Grid-CA** had started operations since then.
- **First Certification Authority in Pakistan.**
- For more information: [www.ncp.edu.pk/pk-grid-ca](http://www.ncp.edu.pk/pk-grid-ca)

# Bottlenecks

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- More coordination is needed
- High speed network
- Non-availability of skilled manpower



# Future Plan

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- Wide Area Network
- Further expansion in computing resources
  - Computational
  - Storage
  - Bandwidth
- Grid Software Development group
- Improvement in Performance & Reliability in Grid
- Self Healing System
- Use of Grid for other disciplines

# HEC, Pakistan

## Research Support Programmes



- HEC: Higher Education Commission funding programs:
  - International Collaborative Research Initiation Grant Program (ICRIG)
  - Research Grant Program (\$35K to 100K)
  - University – Industry Technology Support Program (\$130K) 80/20 Rule
  - Pakistan – US Science and Technology Cooperative Program
  - Training Program for Technical / Scientific Staff and Researchers
  - Grants for Organizing Seminars, Conferences, Workshops
  - Travel Grant to University Teachers
  - Foreign Faculty Hiring Program (3months to 5 years)

[www.hec.gov.pk](http://www.hec.gov.pk)