Kolkata Tier II @ ALICE and Status

Map of INDIA
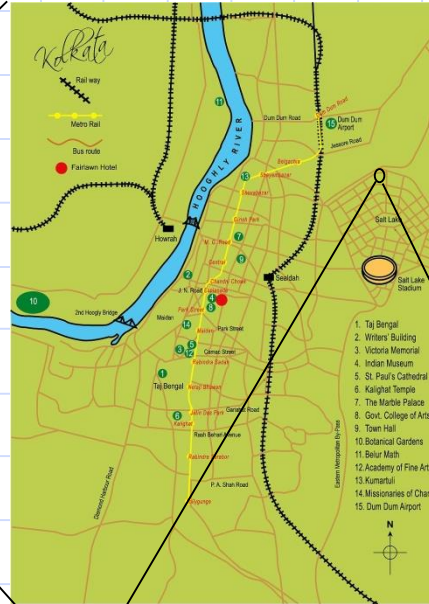
Kolkata

Site Name :-
Tier-2 Site for the WLCG
(World Wide Computing Grid)
GOCDB Name:- IN-DAE-VECC-02
VO :- ALICE
Group:- EHEPAG
Unit:- VECC
City:- KOLKATA
Country :- INDIA

1. Taj Bengal
2. Writers' Building
3. Victoria Memorial
4. Indian Museum
5. St. Paul's Cathedral
6. Kalighat Temple
7. The Marble Palace
8. Govt. College of Arts
9. Town Hall
10. Botanical Gardens
11. Belur Math
12. Academy of Fine Arts
13. Kumartuli
14. Missionaries of Charity
15. Dum Dum Airport

Kolkata,
The capital of West Bengal
Calcutta,
Located in eastern India,
known as the "City of Joy".
Mother Teresa, Rabindranath
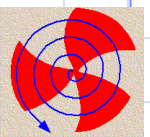Tagore, Satyajit Ray, J C Bose,
and S N Bose

VECC Main Building

VECC, Variable Energy Cyclotron Centre,
DAE, Department of Atomic Energy. Govt of India.

Team:-
Subhasis Chattopadhyay
Vikas Singhal
Prasun Singh Roy

T. K. Samanta and S. K. Pal
helped in establishing the centre
in the initial years.

Evolution of Grid Computing Facility at VECC

2002
- 2 Desktop Machine
- 512MB HD in Desktop Machine
- 128Kbps network shared link

2003
- 2 Tower Like Servers
- 40GB as DAS
- 512Kbps Network

2004
- 9 HP 1U Servers
- 400GB in HP MSA 500
- 2Mbps Dedicated Link

2009
- 8 Quad Core HP Blades
- 25 TB i-SCSI storage
- 100Mbps from VSNL (ERNET)

2008
- 40 Dual Core HP Blades
- 108TB HP EVA SAN storage
- 30Mbps WAN from Reliance

2006
- 17 Wipro 1U Servers Single Core
- 2TB Wipro NAS storage
- 4Mbps WAN Network from Bharti

2010 - 2012
- 32 Dual Processor Blades
- 200TB IBM DS 5100 storage
- 300 Mbps WAN from NKN
- Cold aisle cooling solution
- Efficient cooling (1.47 PUE)

2012 -2015
- GPU Computing with Tesla 2075
- 1Gbps NKN WAN under LHCONE
- 148 TB of disk based storage
- Low cost storage solution based on EOS RAIN-6 concept.

2017-2018
- Xeon-phi co-processor for computing
- 48 (2*14 Core) Dell Dense servers
- 51TF cluster in TopSuperComputers
- 10Gbps WAN network from NKN
- 6 Million ALICE Jobs completed.

Evolution of Grid Computing Facility and Cooling Solution
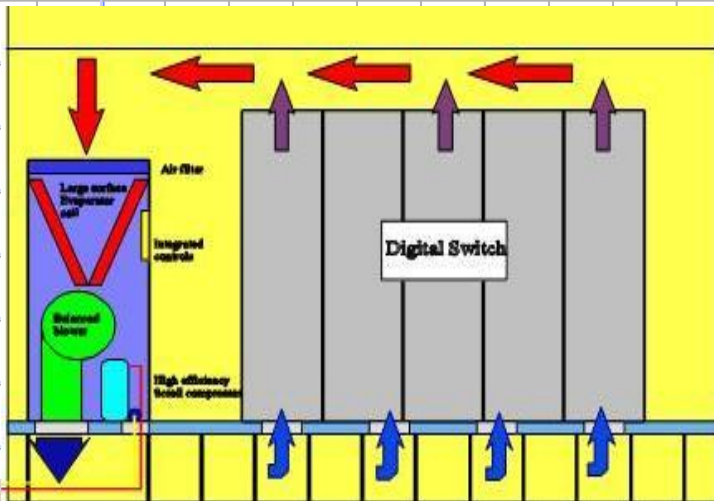
2008

2006

2010

2012

2012 - now

GRID COMPUTING FACILITY

Cooling Solution logical diagram

➢ Hot and Cool Air is separated via Cold Aisle Containment.

➢ Temperature gradient between Cold and Hot aisle is 5°C.

➢ Power usage effectiveness (PUE)
  = Total Facility Power/
     IT Equipment Power
  = 1200Units / 816Unit per Day
  = 1.47

➢ Cooling solution reduced cooling power consumption by half.

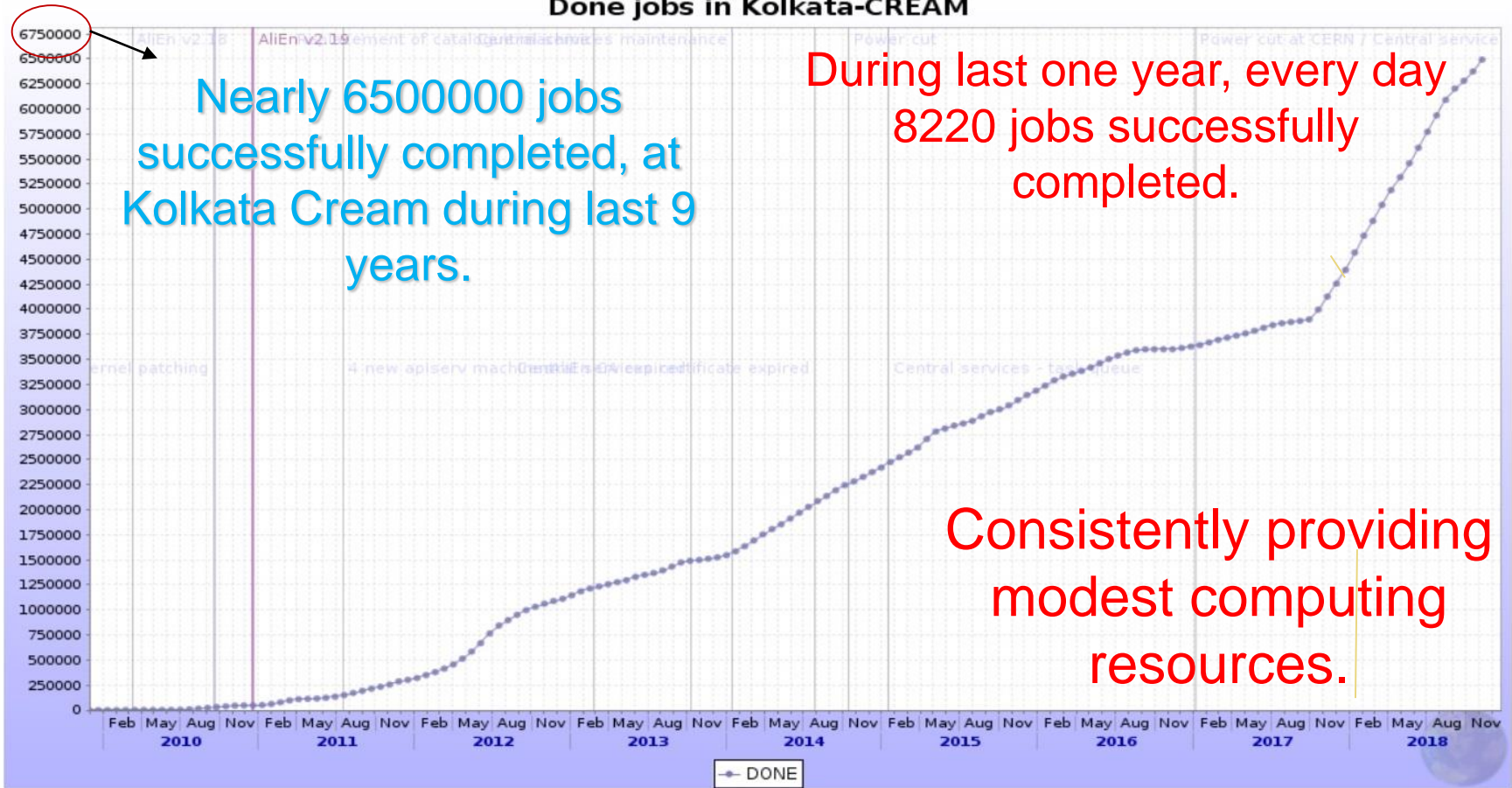➢ Management and monitoring of the server, storage is from outside Cold Aisle Containment.

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ALICE Job completed @Kolkata

Done jobs in Kolkata-CREAM

Nearly 6500000 jobs successfully completed, at Kolkata Cream during last 9 years.

During last one year, every day 8220 jobs successfully completed.
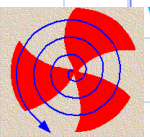
Consistently providing modest computing resources.

No AMC for Old servers. Maintaining In-house only. New resources have 5 years warranty.

Done jobs in Kolkata-CREAM

	Series	Last value	Min	Avg	Max
1	■ DONE	6492620	289	2155324	6492620
	Total	**6492620**		**2155324**	

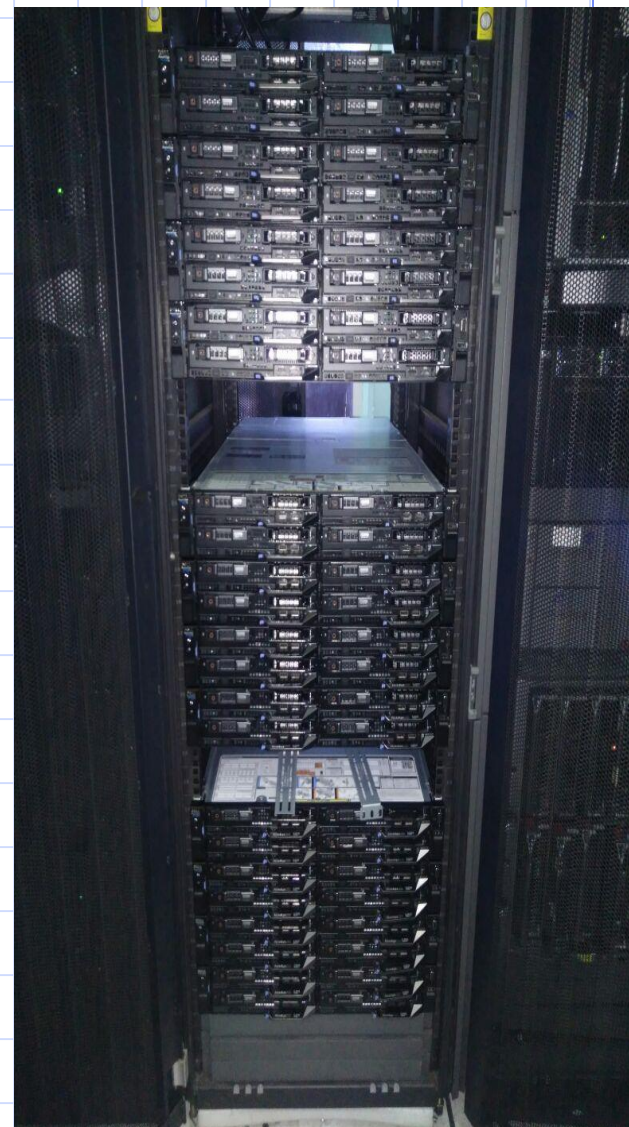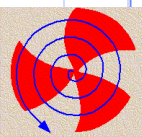**24x7 Operation, 95% availability**

Vikas Singhal, VECC, INDIA

Commissioned 2688 HT cores of Computing Resources

- 12 DELL PowerEdge FX2 Enclosures.
- Each contain 4 DELL PowerEdge FC630 servers.
- Each server configuration:-
    - 2 Nos of Intel Xeon E5-2680 v4 2.4 GHz with 14 cores
    - 8 * 16 GB RDIMM, 2400MT/s
    - 960 GB of SSD harddisk.
    - 2 * 10 Gigabit network cards.
- Total cores 48*2*14*2=2688 (HT)
- Scientific Linux CERN 6.8 installed
- 10G network connected.
- Approx cost of the equipment = $ 300,000.
- Still running with PBS and Torque,
- Will Open-PBS work? Why to change?

Kolkata Tier-2 cluster in TopSuperComputers India List

Top Super Computers in India is list of the most powerful supercomputers in India and it is maintained by C-DAC Bangalore. Earlier it was maintained by IISc Banglore since its inception in 2009.

Kolkata Tier-2 Cluster maintained its position in the list published in July 2018 also.

Listed in Top Super Computers India
http://topsc.cdacb.in/jsps/feb2018/index.html
http://topsc.cdacb.in/jsps/july2018/index.html

HPL Benchmarking performance
Theoretical Peak Performance
$$Rpeak = 2.4*28*16 \text{ Gigaflop}$$
$$= 1075.2 \text{ Gigaflop}$$
$$= 1.0752 \text{ Teraflop (Single Server)}$$
$$Rpeak \text{ for cluster} = 1.0752*48 \text{ Tflops}$$
$$= 51.6096 \text{ Tflops}$$
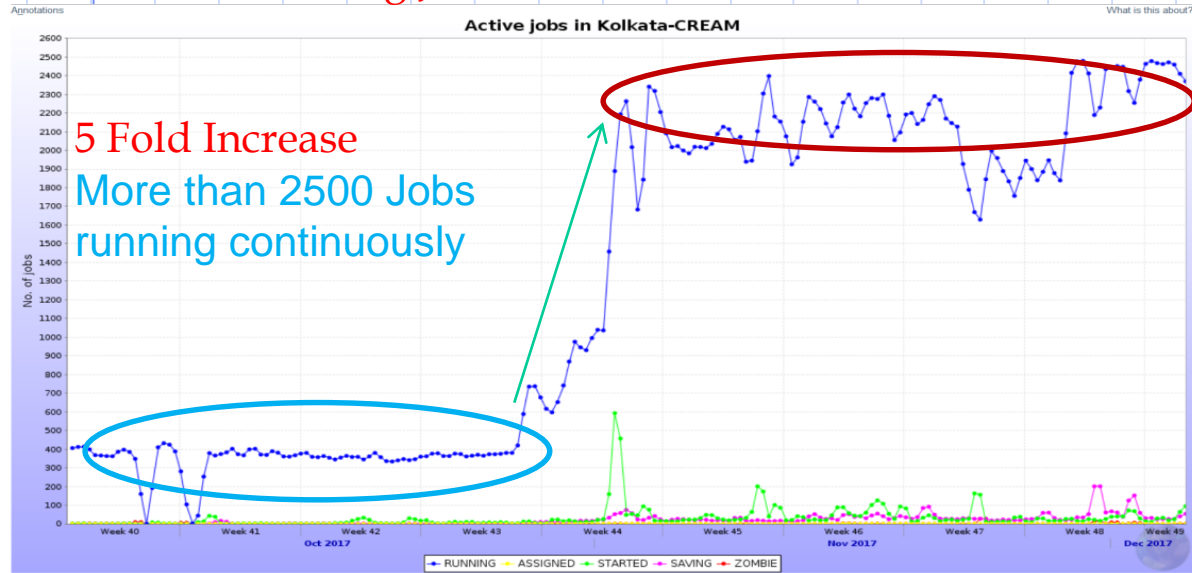**Linpack Benchmark performance**
$$Rmax = 4.30471e+04 \text{ Gflops}$$
$$= 43.0471 \text{ Tflops.}$$

Running Jobs at Monalisa Oct – Nov 17

Active jobs in Kolkata-CREAM

5 Fold Increase
More than 2500 Jobs running continuously

Kolkata Tier-2 New EOS Storage

EOS looks cost effective, expandable storage solution

Procured new 8 DELL PowerEdge R730xd 2U Server
Used 7 such server for EOS.
Each contain:-
2 * Intel Xeon 10Core Processor
8 * 16 GB = 128GB DDR4 RAM
16 * 10TB NLSAS 3.5" 7.2K RPM HDD
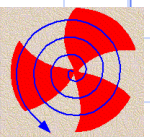2 * 480GB 2.5" SSD in RAID-1 for OS
4 * 10Gb SFP + based network card.
Price INR 55,00,000/- or USD 75,000/-

Raw Space = 160 TB in each server.
Total Raw Space = 7* 160 = 1120 TB
Usable space after RAIN-6 = 5*160 = 800TB

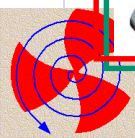# EOS Storage Solution

disk based, low latency storage solution based on RAIN-6

Storage situation at Kolkata

Configured new 1PB of Storage with EOS Citrine version, Trying to put under same name space

Existing Storage :- 174 TB Usable space
Kolkata::EOS (96TB usable but full now)
  Based on the EOS Aqua-marine version.
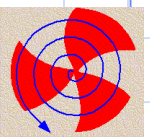 Need to migrate to EOS Citrine version.
  RAIN-6 Configuration between 3 FSTs.
  Could not migrate to Citrine Version
  Problem in connection between MQ and xrootd.
  Presently can configure in 2 different name space.

Kolkata::SE (78 TB SAN Based storage but no hardware warranty. Probably need to fetch files from other replica.)
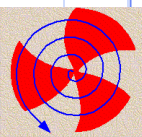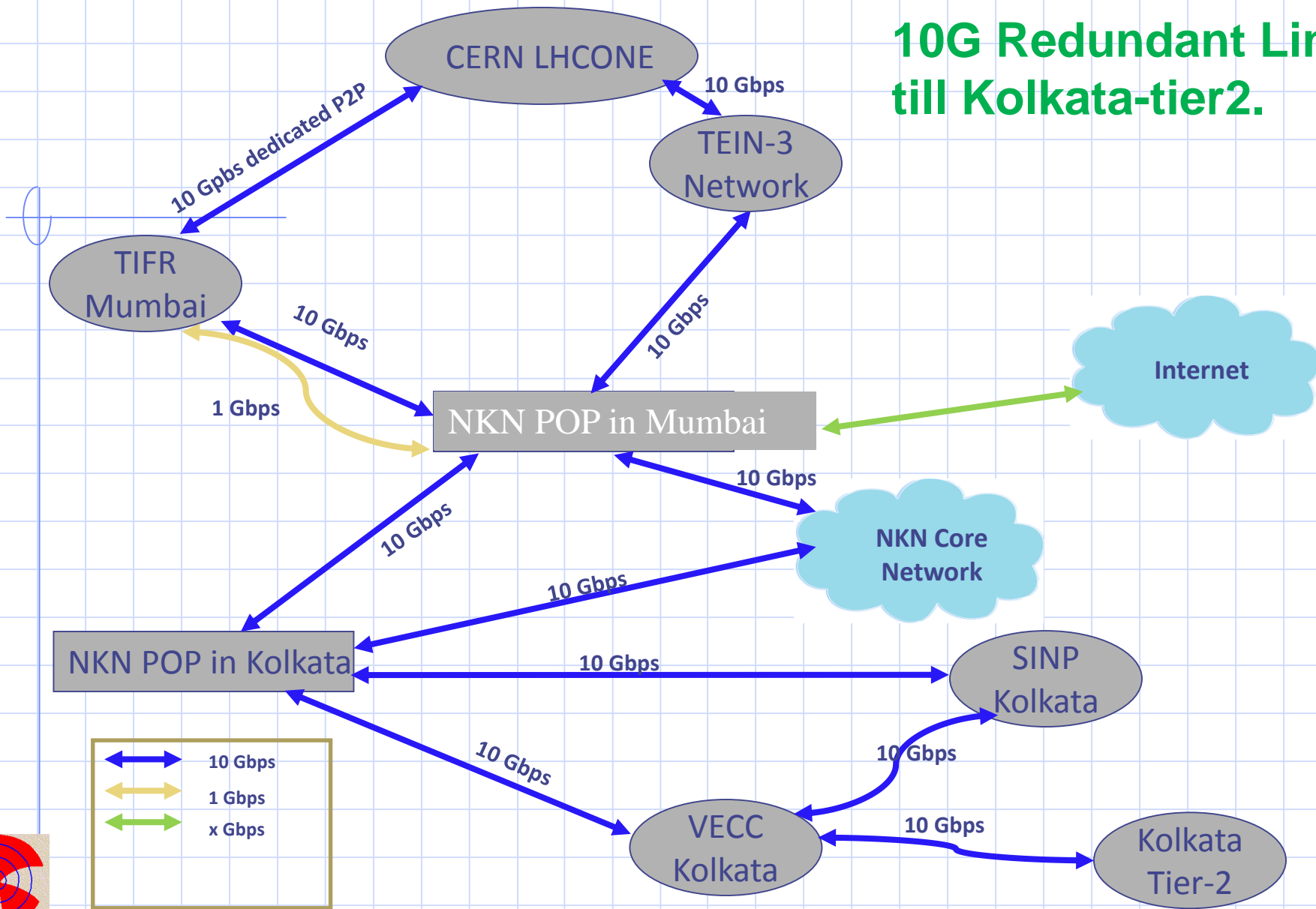
Physical Network Connectivity from CERN -- Kolkata, India

10G Redundant Link till Kolkata-tier2.
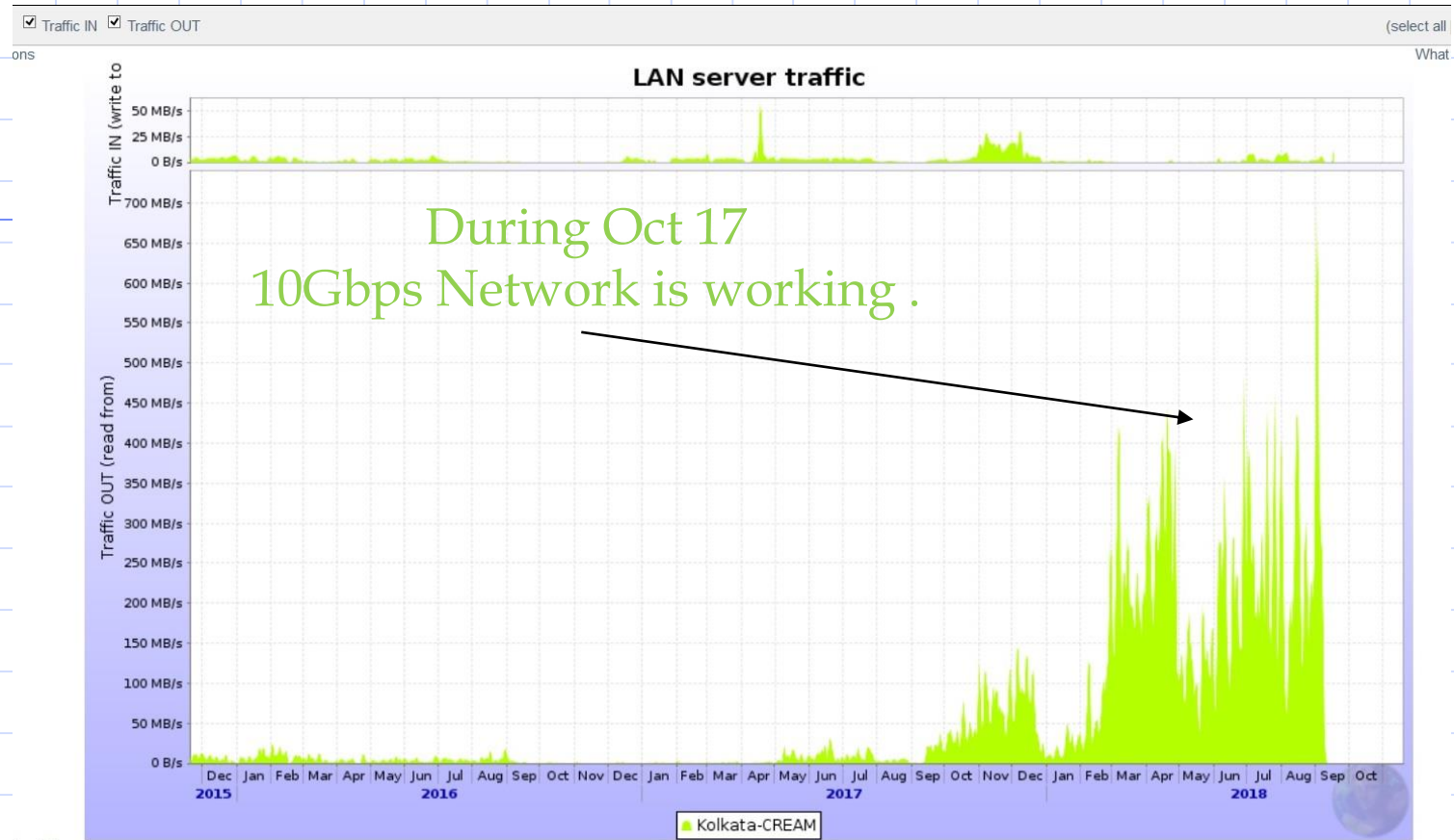
CERN LHCONE

10 Gbps

TEIN-3 Network

10 Gpbs dedicated P2P

TIFR Mumbai

10 Gbps

10 Gbps

1 Gbps

NKN POP in Mumbai

Internet

10 Gbps

10 Gbps

NKN Core Network

10 Gbps

NKN POP in Kolkata

10 Gbps

SINP Kolkata

10 Gbps

10 Gbps

10 Gbps

10 Gbps 10 Gbps

VECC Kolkata

10 Gbps

Kolkata Tier-2

Legend:
- ← → 10 Gbps
- ← → 1 Gbps
- ← → x Gbps

10G Network Utilization by Kolkata Tier-2

During Oct 17
10Gbps Network is working .

Traffic IN					
Series	**Last value**	**Min**	**Avg**	**Max**	**Total**
1. Kolkata-CREAM	11.9 MB/s	0 B/s	2.759 MB/s	655 MB/s	234.6 TB
Total	**11.9 MB/s**		**2.759 MB/s**		**234.6 TB**

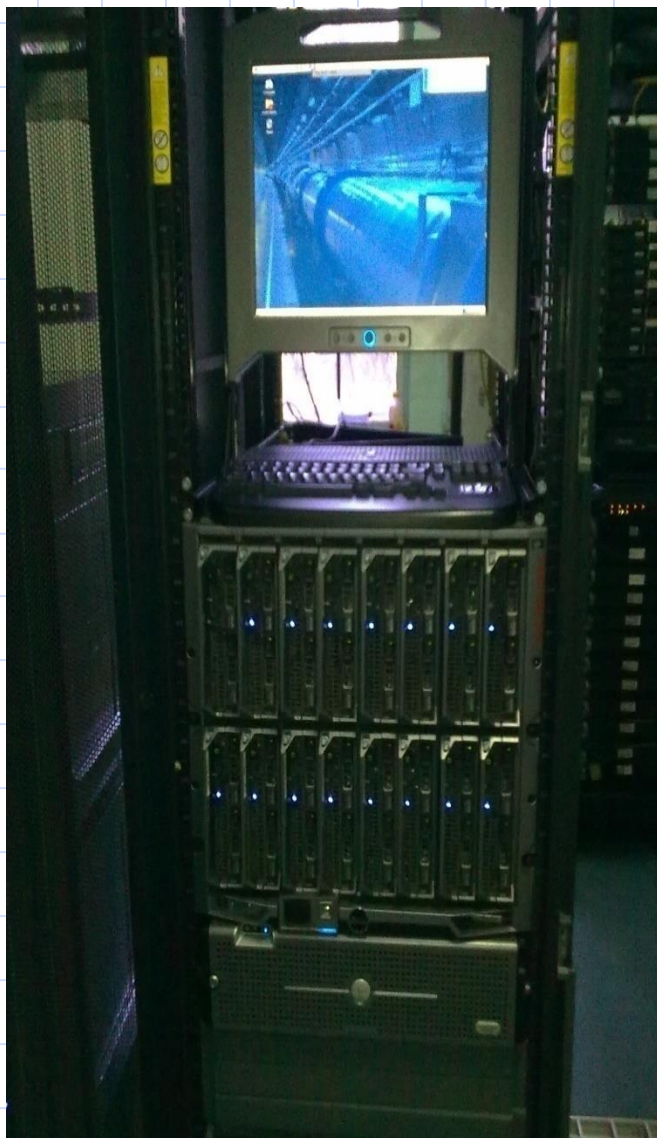| Traffic OUT					
Series	**Last value**	**Min**	**Avg**	**Max**	**Total**
1. Kolkata-CREAM	0.339 MB/s	0 B/s	56.46 MB/s	7.115 GB/s	4.69 PB
Total	**0.339 MB/s**		**56.46 MB/s**		**4.69 PB**

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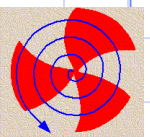
Grid-Peer Tier-3 Cluster Status

- **More Load on the CLUSTER as CBM user also utilizing the cluster**

- 8 Numbers of HP BL675G7 Blade servers each with 4 * AMD Opteron Processor 6380(16 Core)

- 3 Number of Dell M610 Blade servers each with 2 * Intel Quad Core E5530 Xeon 2.4GHz CPU 8MB cache and 16GB RAM.

- 6 out of 8 HP blade servers are dedicated for non-interactive nodes and rest is being used for CBM work.

- 3 Dell blade servers are being used as interactive node.

- Extensively used by VECC users and PMD Collaborators, completed more than 35000 jobs successfully in last 3 months.

- 75 TB storage, almost filled up.

- 75 + active users (across India.)

- 45 + active users (in VECC.)

- Tape based backup of Tier-3 storage performed twice in a month.
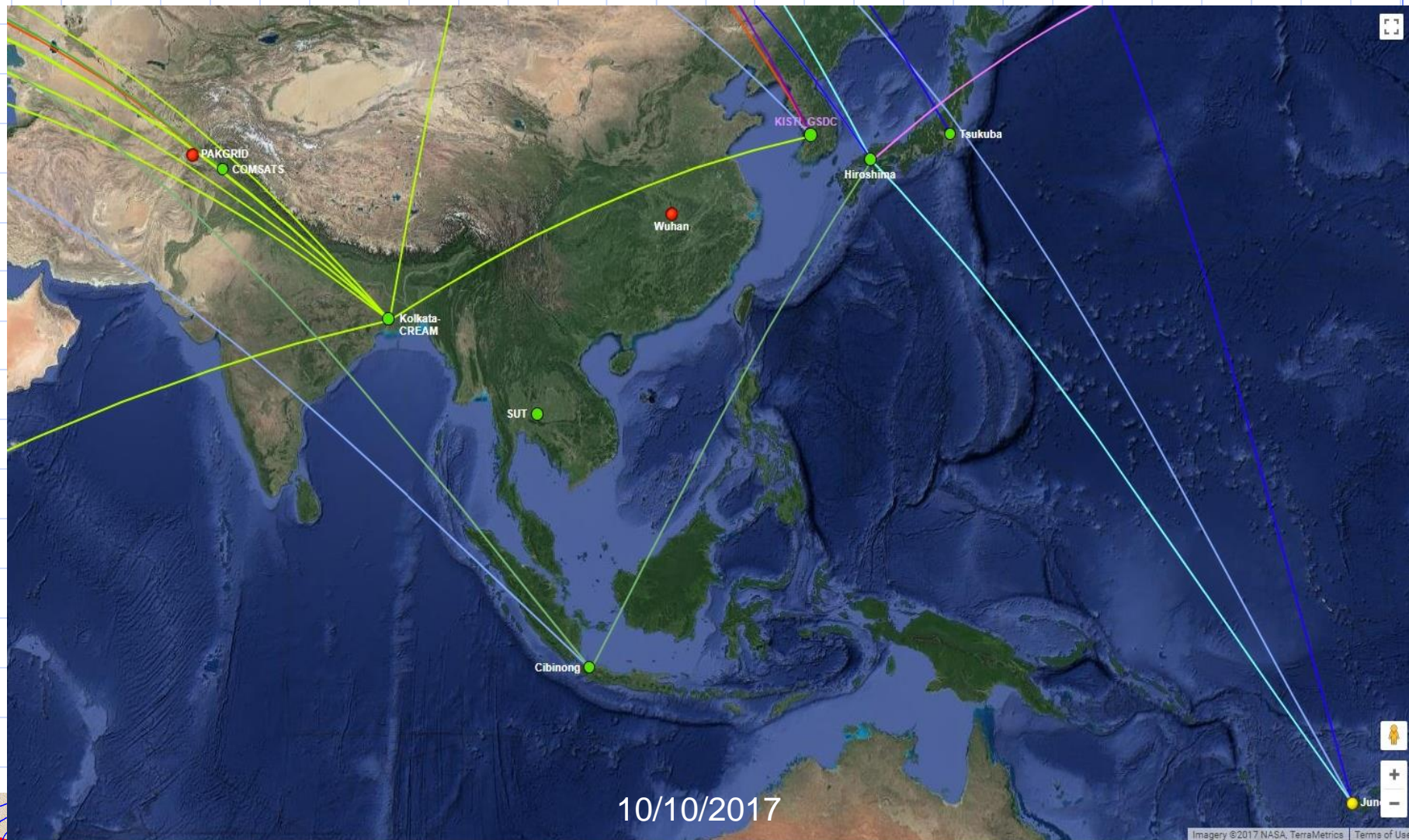
12
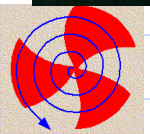
Connectivity between Asian Tiers

Not bad increasing day by day.

10/10/2017

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Future Road Map and Vision

For the huge data resources, using the low cost storage solution based on the EOS CERN.
Procuring the low cost storage boxes.

Started Procurement of 1.5 PB Of disk based storage servers
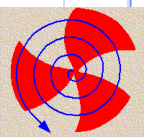– Tentative with 18 * 12TB = 216TB in each and 7 such servers.

During Jan-Feb 19 we shall start procurement of 2 PB of disk based storage server.

During Jan-Feb 19 we shall start procurement of approx 20KHEP Spec Computing.

Accelerated or Heterogeneous Computing is new evolving field. (Participating at CBM @ FAIR in this direction).

Focus on High Throughput Computing (HTC) using of Accelerates like NVIDIA GPU, AMD, APU, Intel Co-processors.

Spreading knowledge on Parallel and Heterogeneous Computing.

Thank You