सत्यमेव जयते

National Knowledge Network Overview

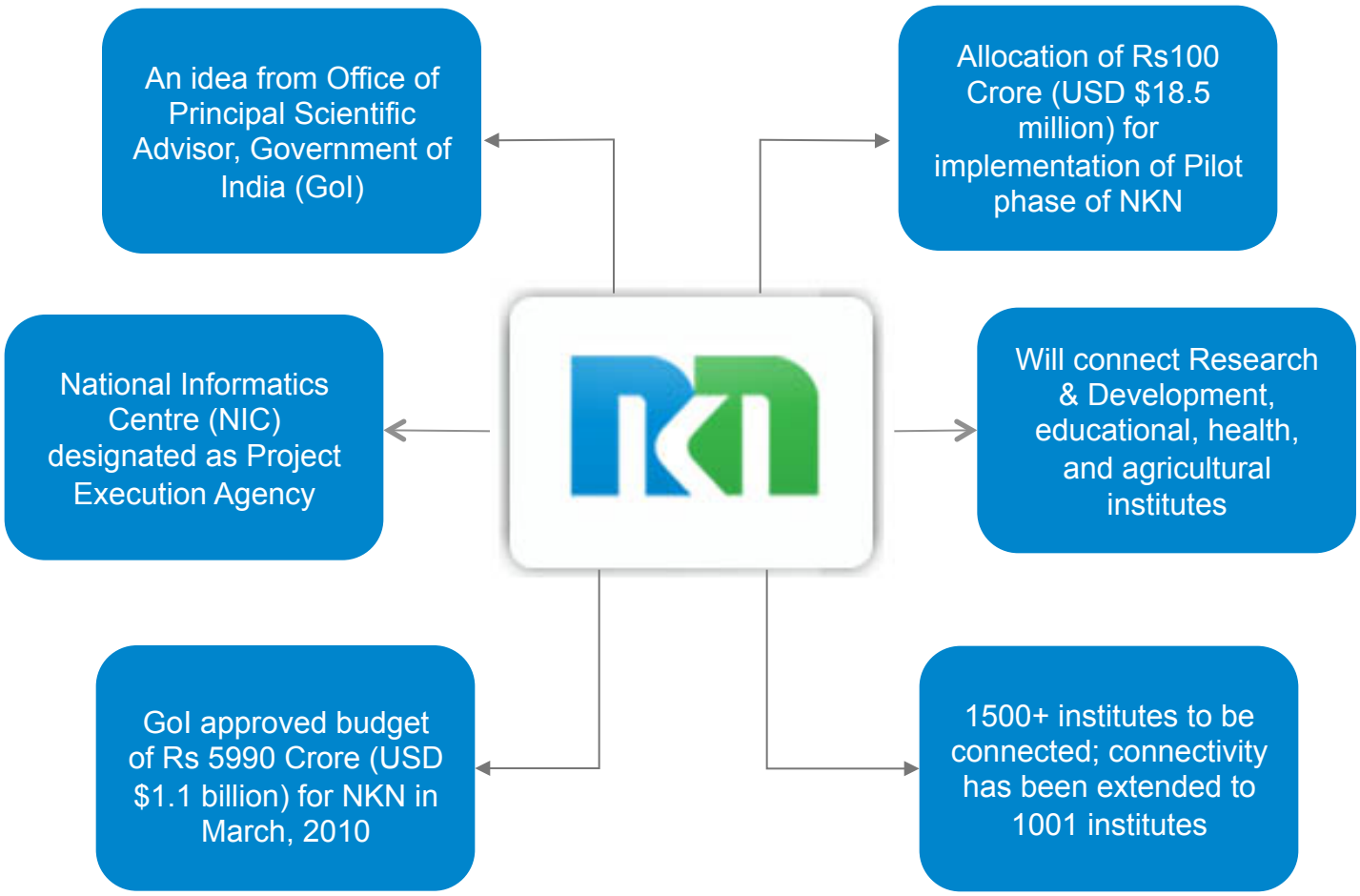
May 20, 2013

National **Knowledge** Network

Former President Smt. Pratibha Devi Patil inaugurating the NKN Project on 9th April 2009

Introduction
Key Highlights of NKN

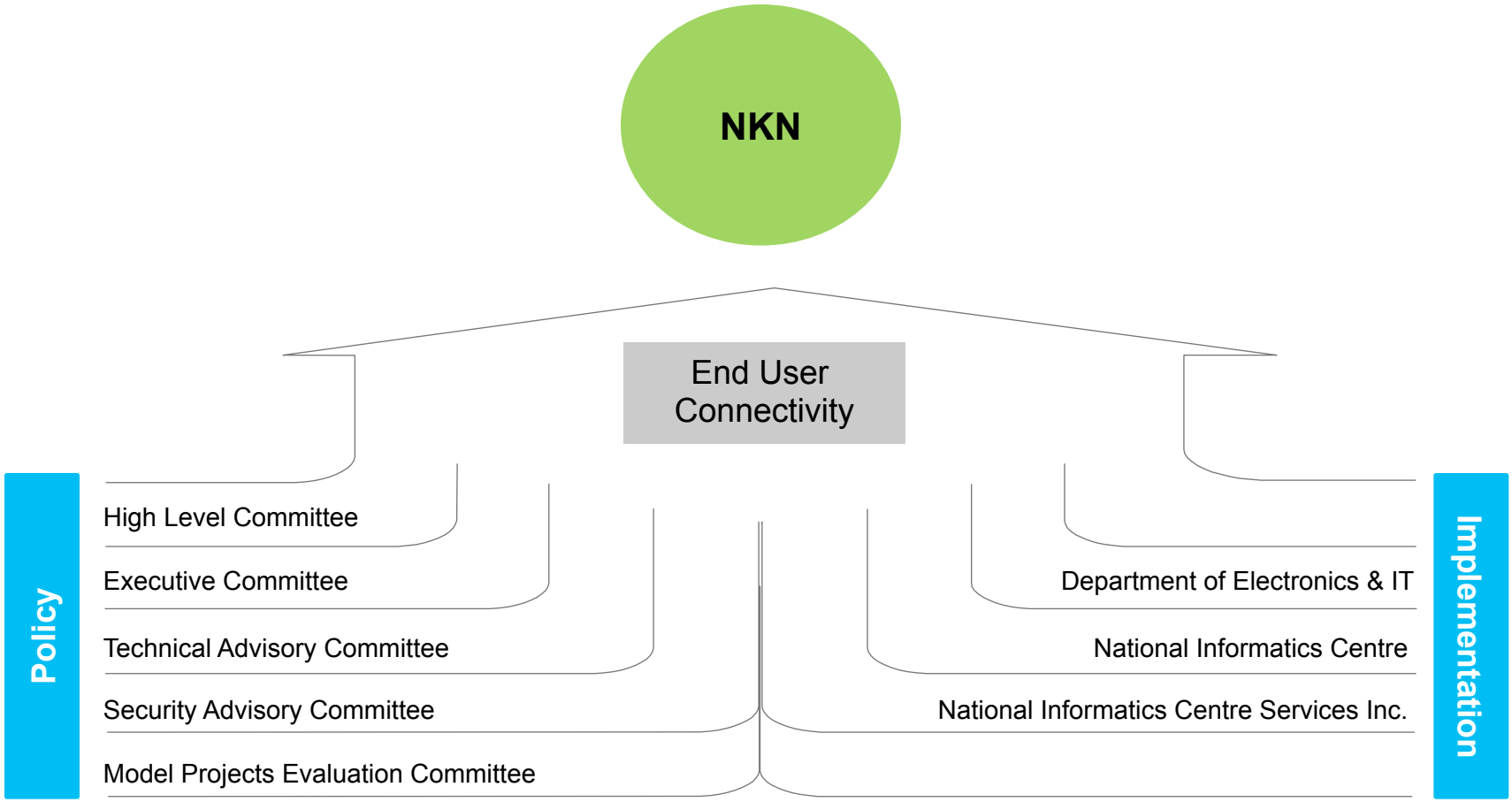
NKN is a state-of-the-art multi-gigabit pan-India network for providing a unified high speed network backbone for all knowledge related institutions in the country



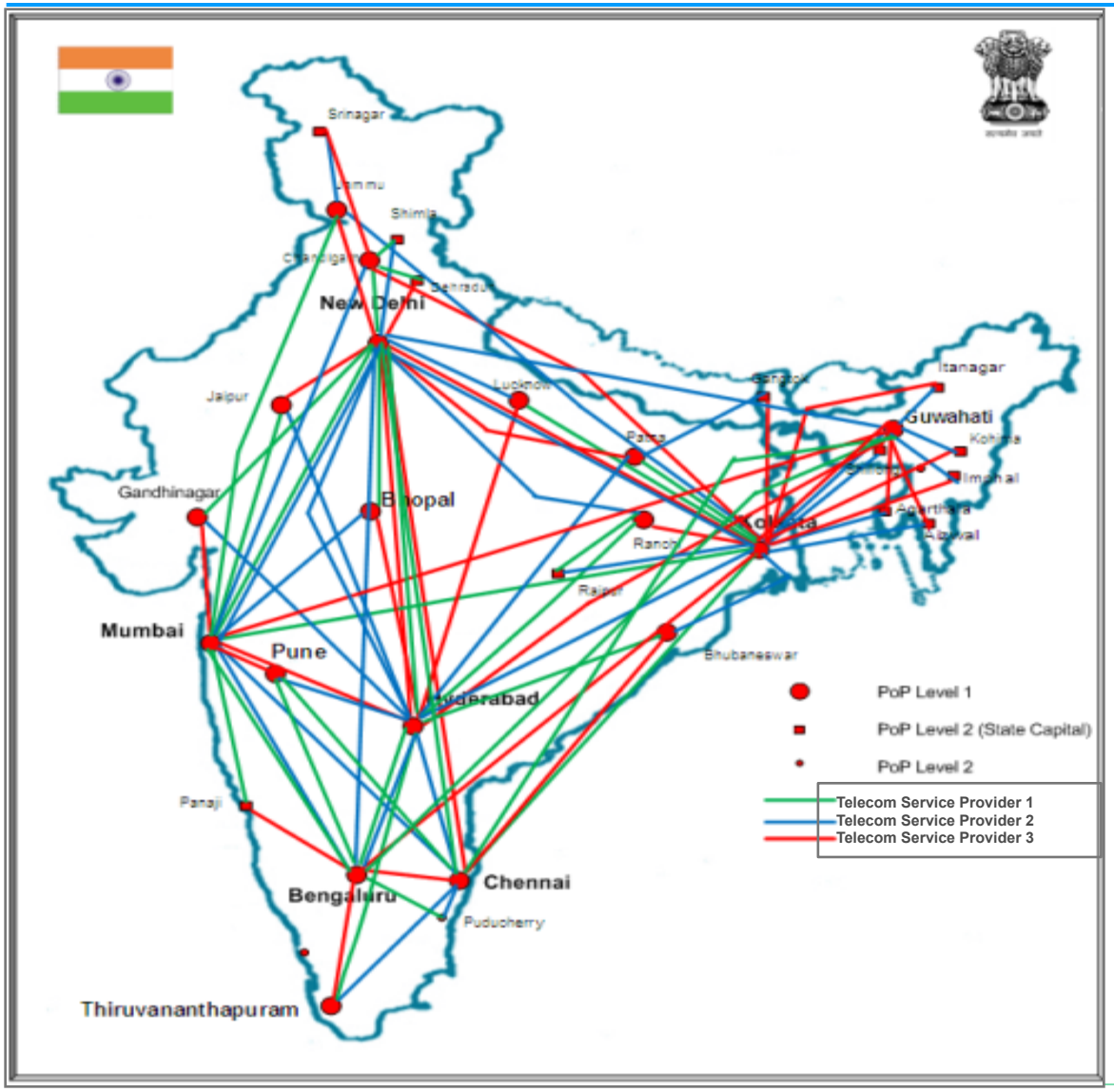
- **9th April 2009:** Hon'ble President of India, Smt. Pratibha Devisingh Patil inaugurated NKN Project. On this day the status was:
  - 16 PoPs
  - 26 Backbone Links
  - 57 Edge Links

- **5th March, 2011:** Hon'ble Minister for communications and IT, Shri Kapil Sibal and Hon'ble Minister of State for Communications and IT, Shri Sachin Pilot launched Logo and Website of NKN
  - 31 PoPs
  - 76 Backbone Links
  - 216 Edge Links

Introduction
Management Overview

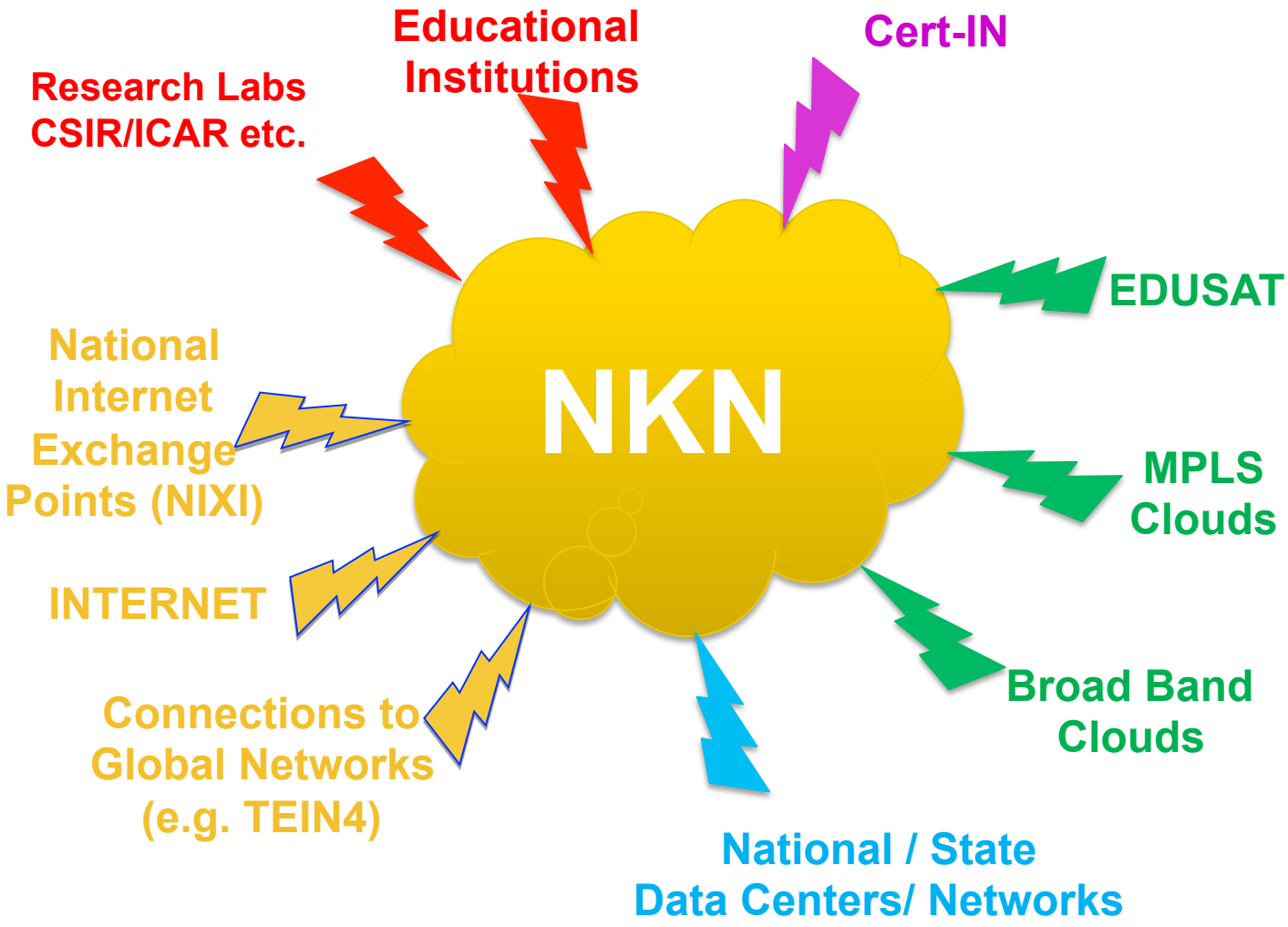


NKN: Core Connectivity

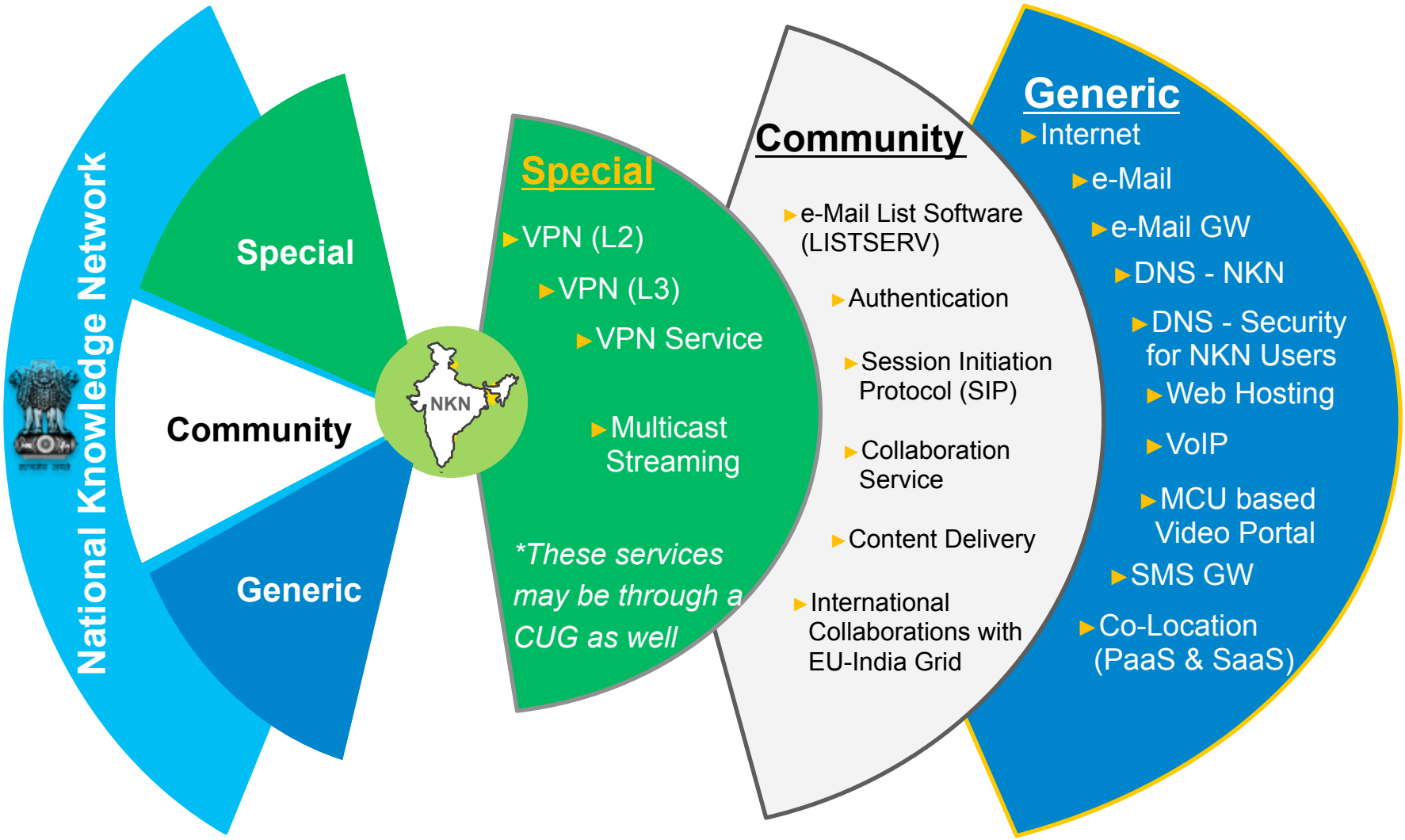


Multi- 10G Core Connecting all state capitals

NKN Connectivity

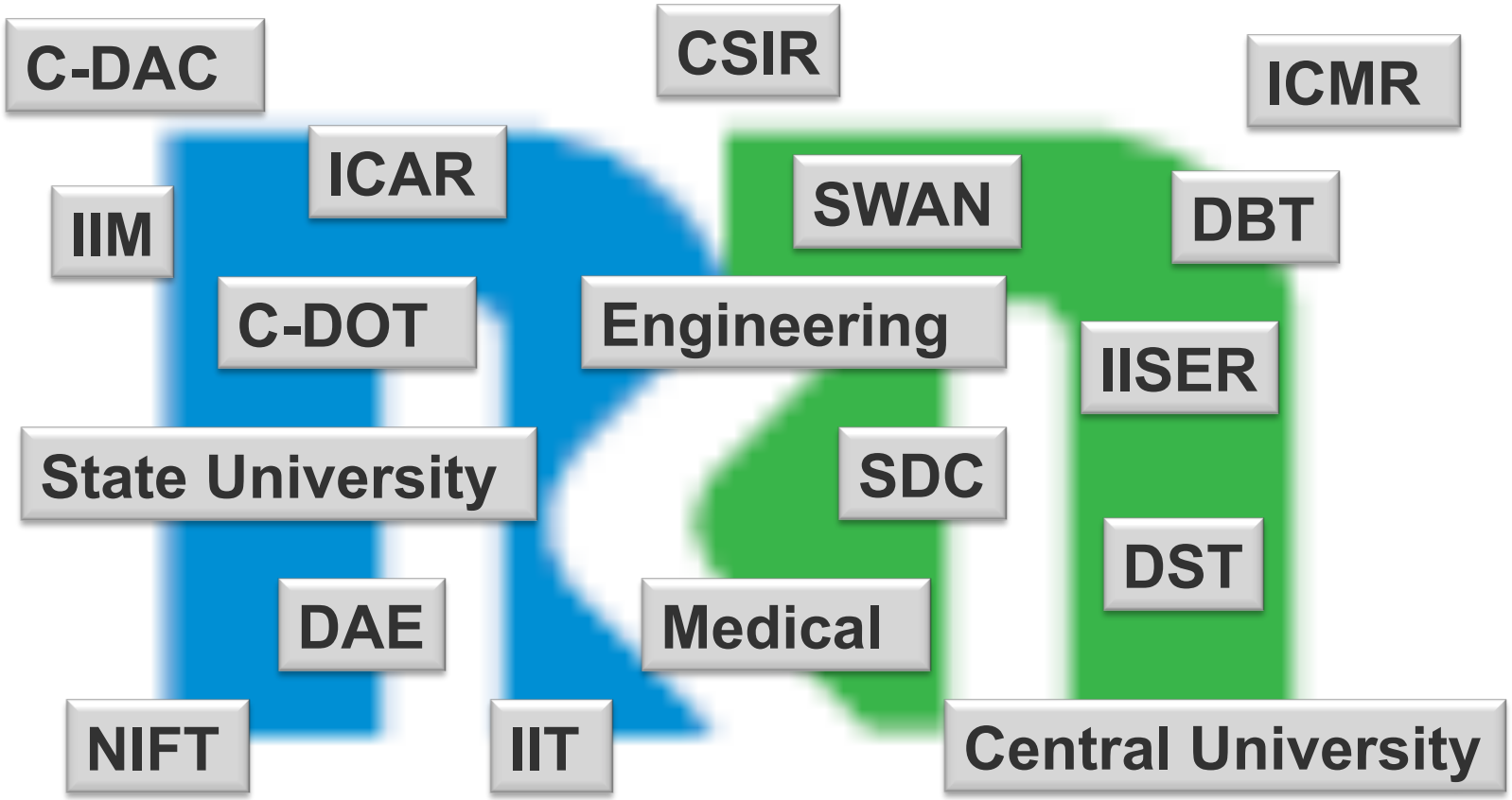


National Knowledge Network
Key Services

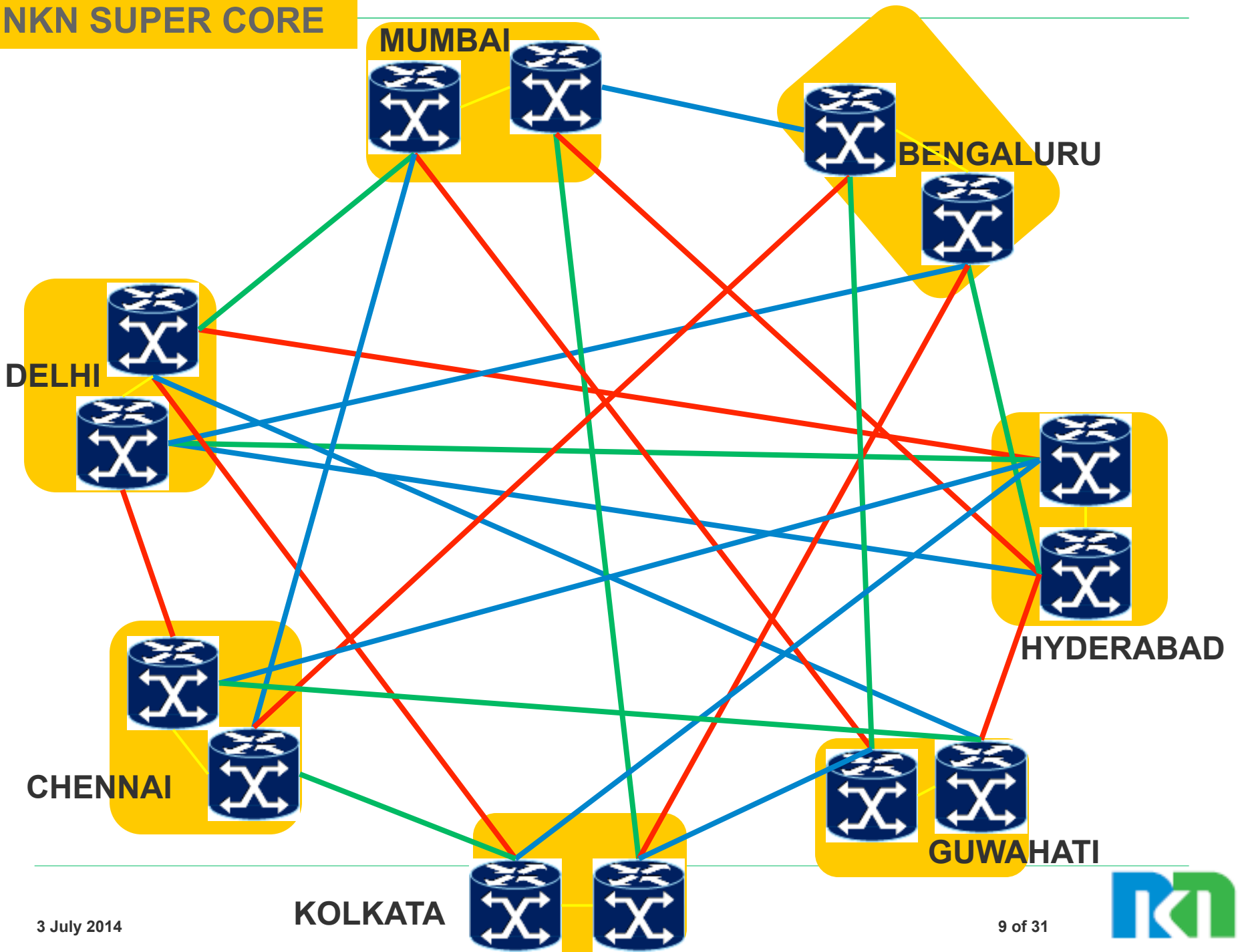


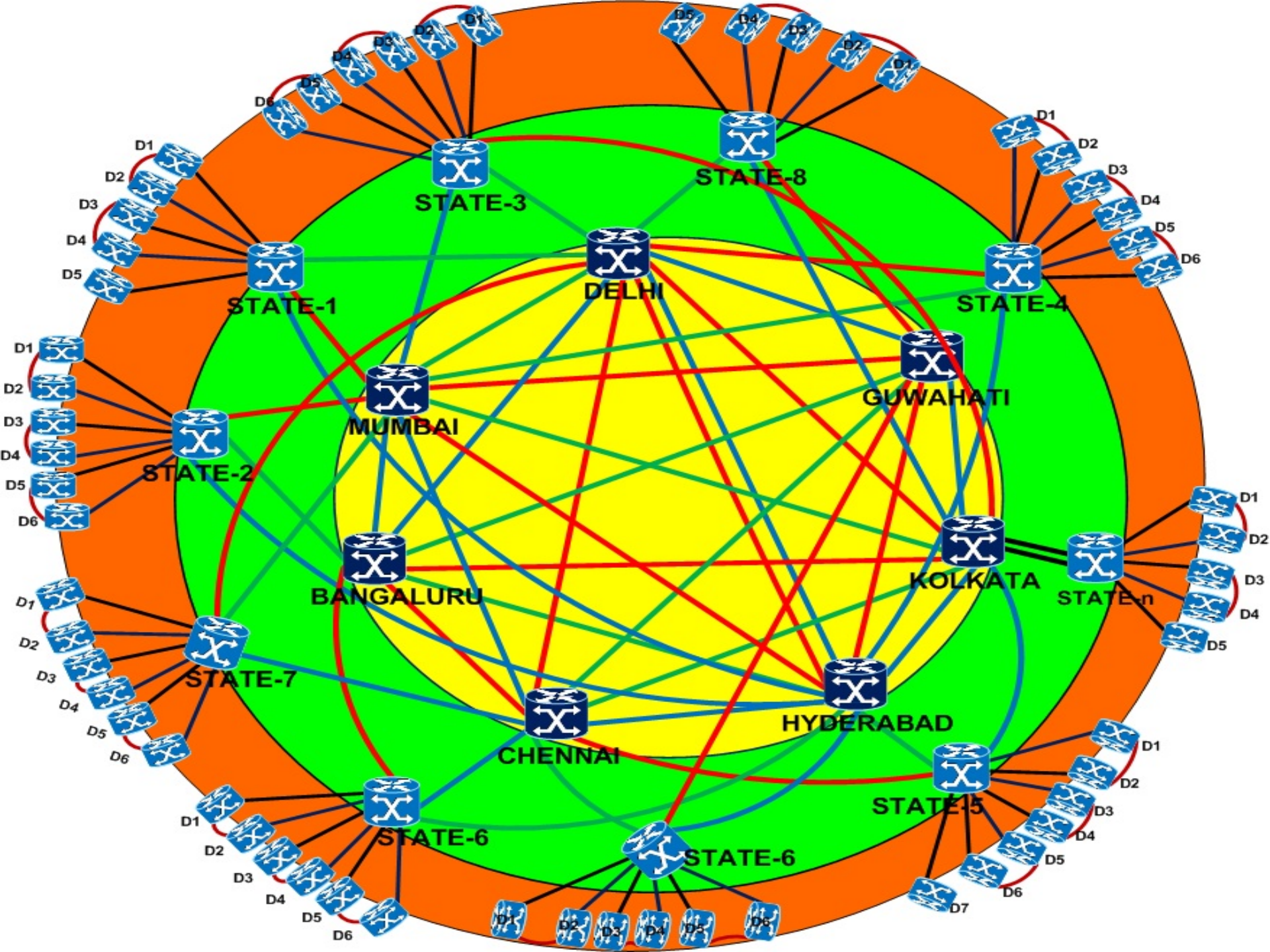
Institutes Connected Status Category wise

1015

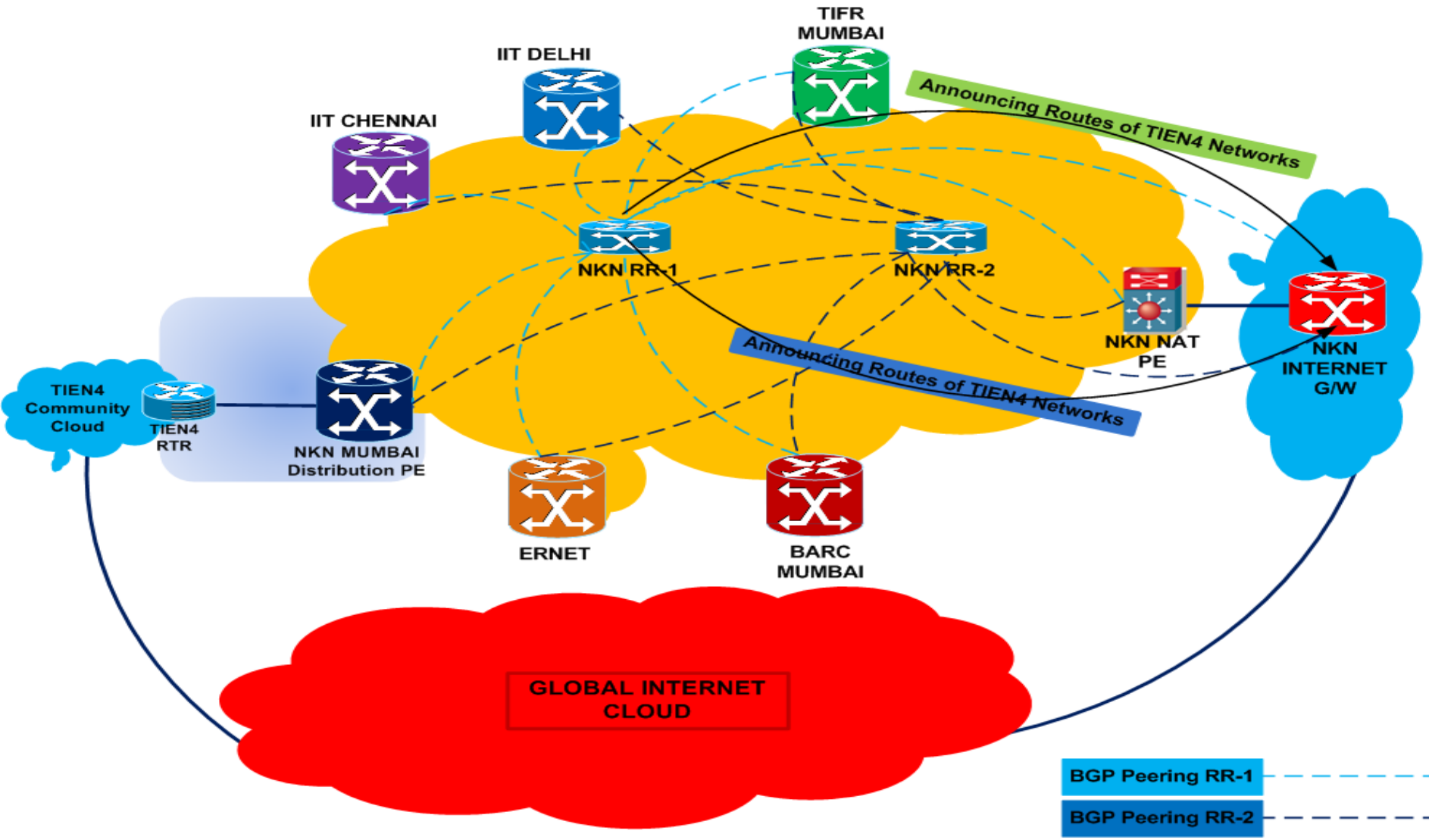


NKN SUPER CORE

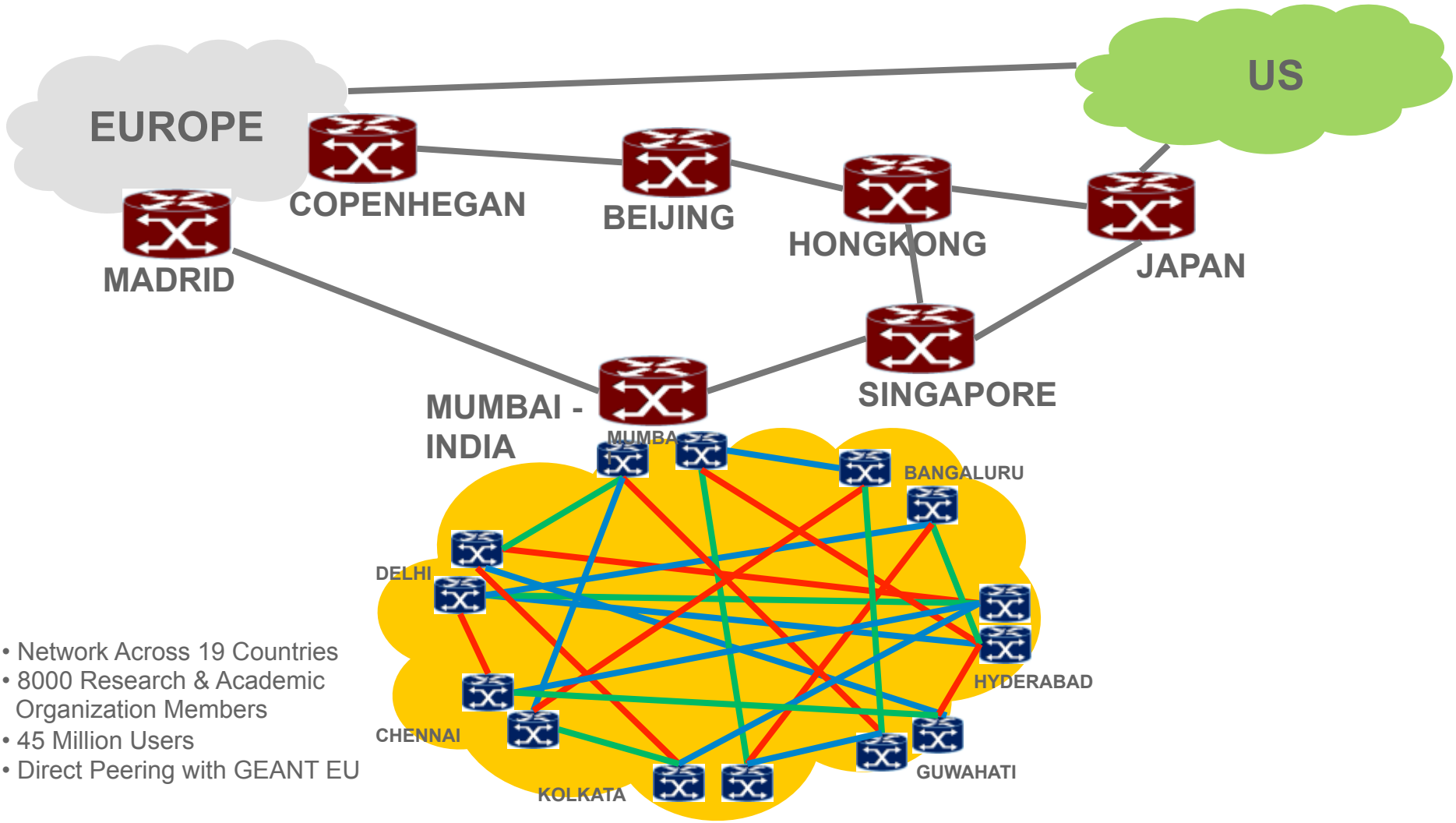



DELHI
MUMBAI
BANGALURU
CHENNAI
HYDERABAD
KOLKATA
GUWAHATI
STATE-1
STATE-2
STATE-3
STATE-4
STATE-5
STATE-6
STATE-6
STATE-7
STATE-8
STATE-n

NKN Connecting TEIN4 Network

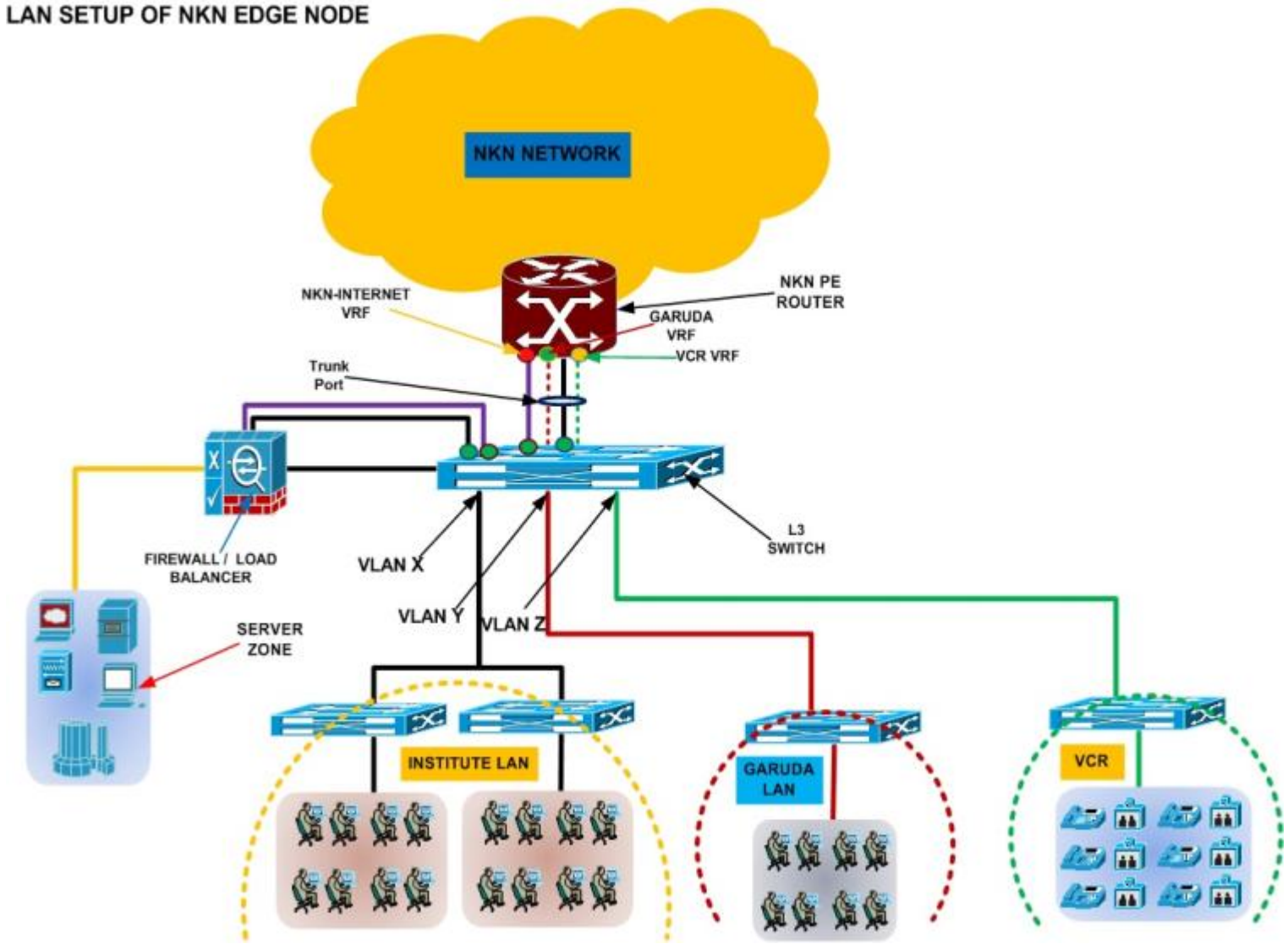


NKN Connecting TEIN4 Network



- Network Across 19 Countries
- 8000 Research & Academic Organization Members
- 45 Million Users
- Direct Peering with GEANT EU

NKN Setup at Edge location

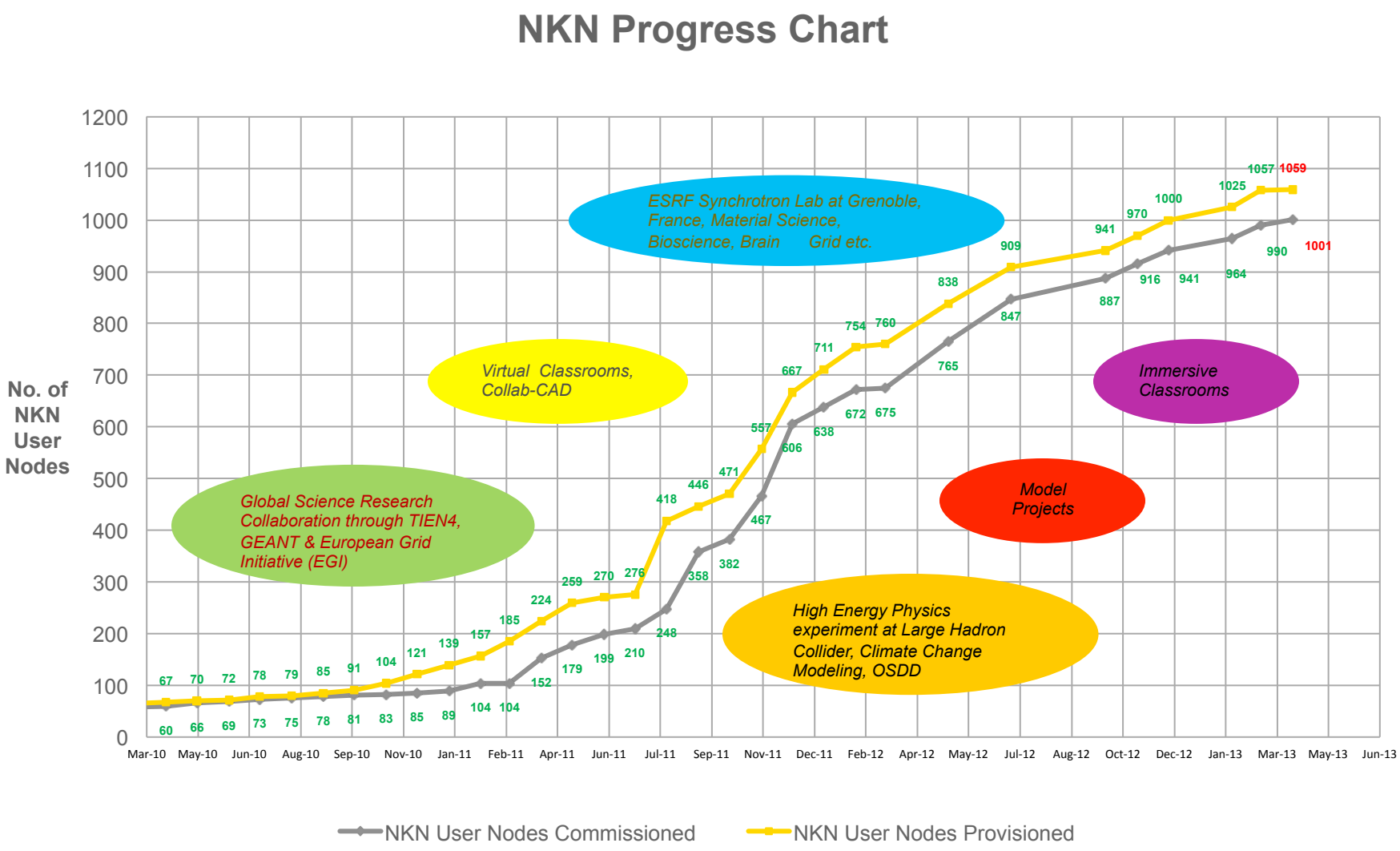


National Knowledge Network

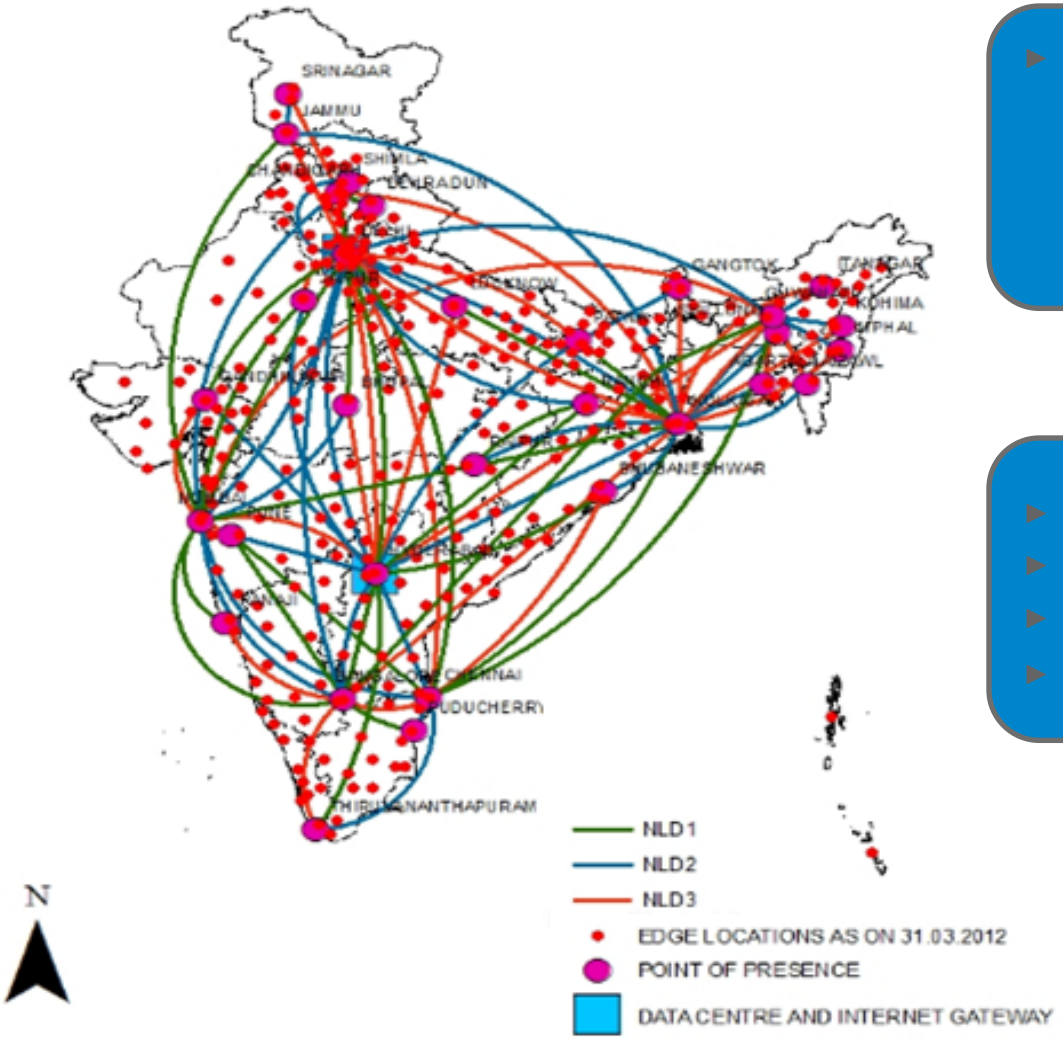
Status of NKN Connectivity *(As on May 20, 2013)*

Particulars	2013-14
Super Core PoPs	**07**
Core PoPs	**24**
Total number of institutes to be allocated under NKN	**1500**
No of NKN institutes allotted to TSPs for connectivity *(till date)*	**1350**
No of Institutes Commissioned under NKN	**1015**
Total no of core links allotted	**89**
Total no of district links allotted	**250 (Total 860 to be allocated)**

National Knowledge Network
Progress Chart



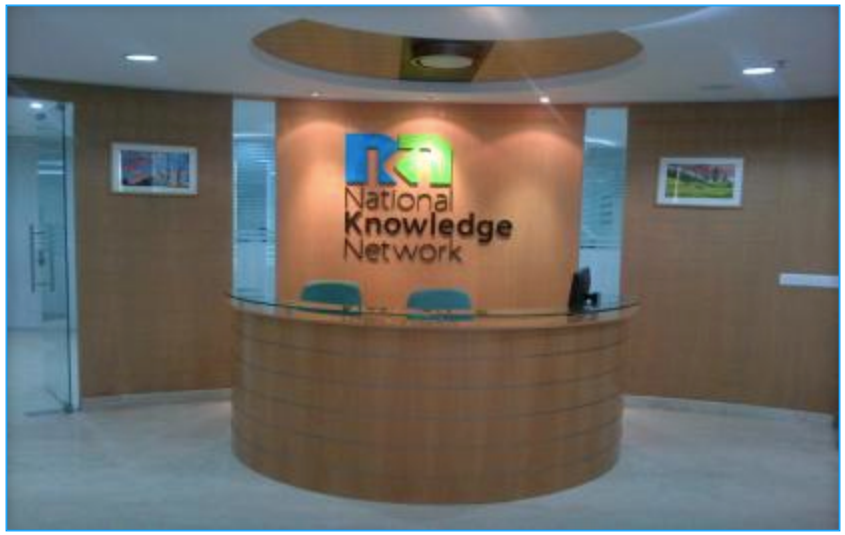
NKN: On conclusion of final phase



- At the conclusion of the final phase, NKN shall have presence in more than 640+ districts of India with connectivity to major research and education institutions

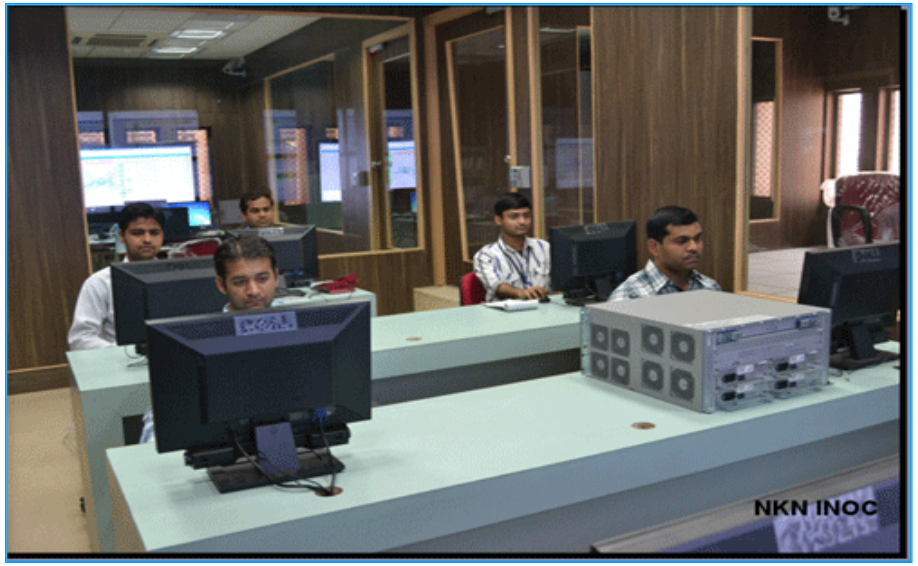
- Core Points of Presence (PoP) : 31
- Backbone Links : 89
- Edge links : 1500
- District Links : 860

National iNOC - Delhi



NKN PoP –Guwahati

NKN PoP -Bhopal



Virtual Classrooms

- Virtual classroom is a replica of the local class room teaching where in the students at remote locations will get the same feel and experience as if they are in the same classroom .
- Teachers and students have full interactivity with each other
- Teachers will be able to use all conventional teaching tools and continue to teach the way they does
- Students can ask questions and interact with the teachers as if they are in the local classroom

Virtual Classrooms

At IITs and other institutes over NKN.

Total of 66 virtual classrooms are being created over NKN

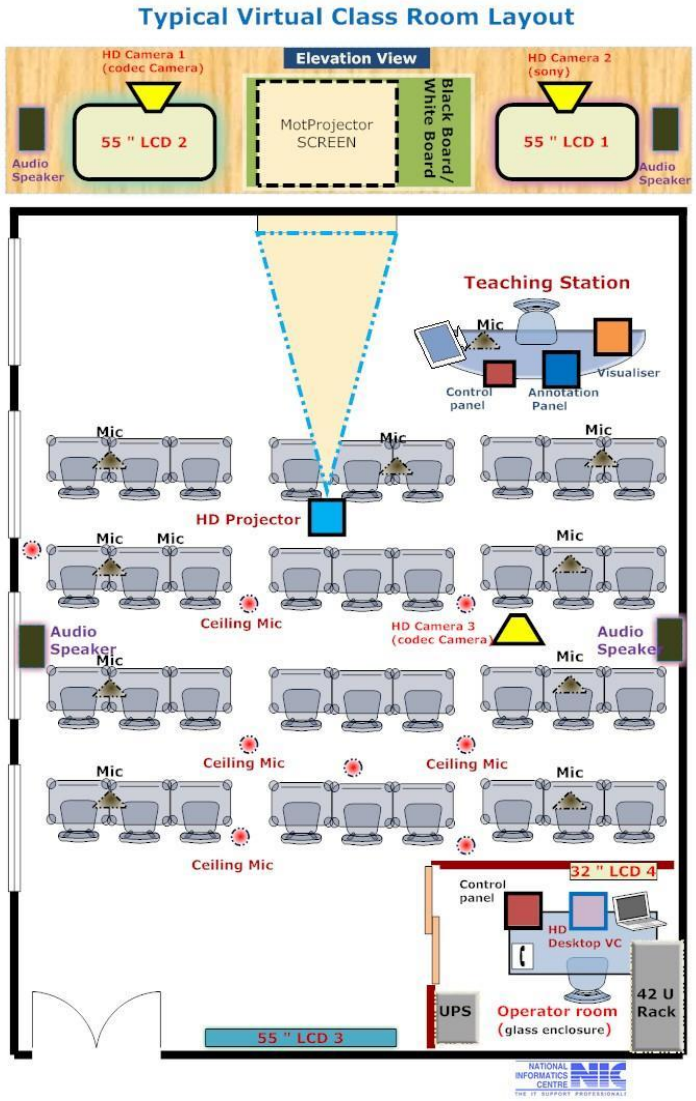
43 Virtual Classrooms have been created at IITs and NIC

23 additional virtual classrooms at NITs, IISC, IISER etc

Virtual Classrooms for IITs

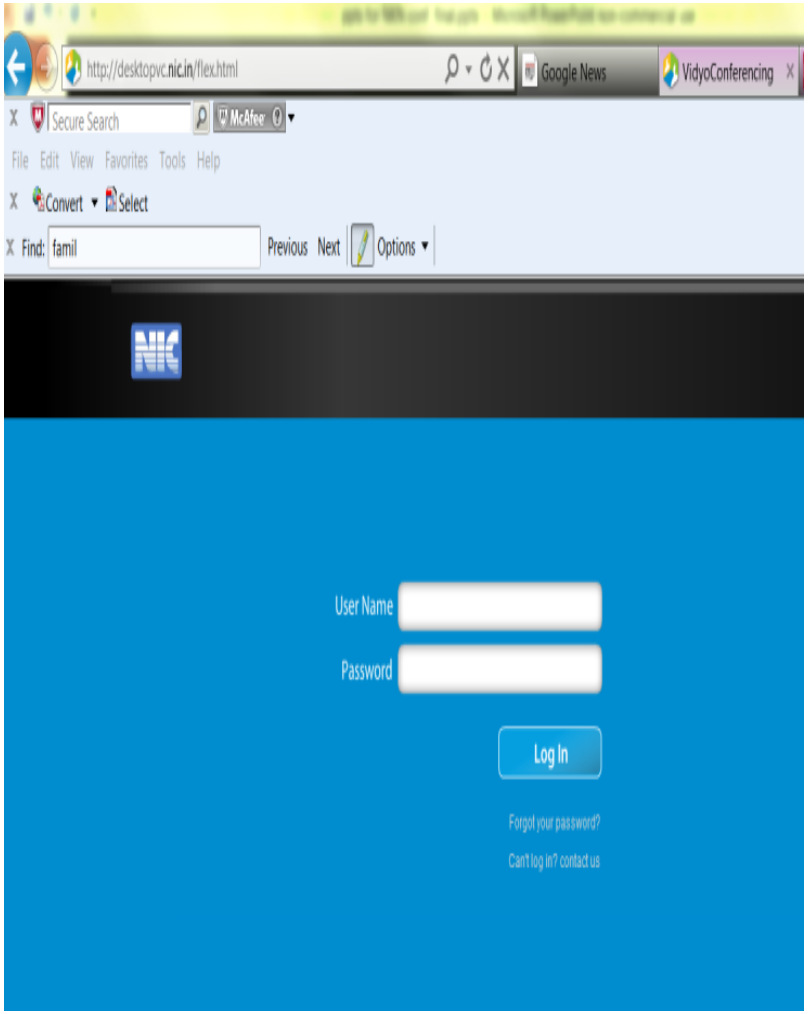
S.no	Name Of IIT	No of VCR
1	IIT-Ropar	2
2	IIT-Hyderabad	3
3	IIT-Kharaghpur	3
4	IIT-Bhubaneswar	3
5	IIT-Guwahati	1
6	IIT-Indore	1
7	IIT Gandhinagar	3
8	IIT Bombay	3
9	IIT Roorkee	3
10	IIT Madras	3
11	IIT Kanpur	3
12	IIT Rajasthan	3
13	IIT Patna	3
14	IIT Delhi	3
15.	IIT Mandi	1

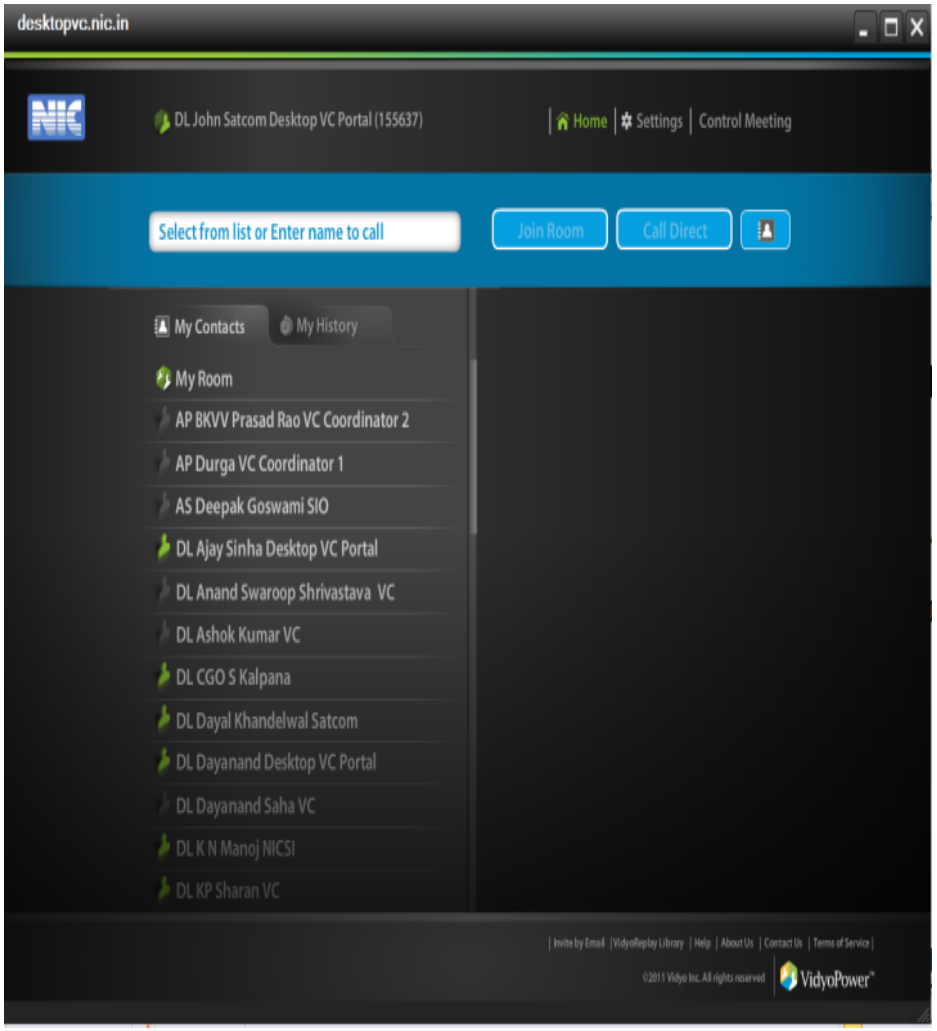
TOTAL : 38



Virtual Classrooms

WEB BASED VIDEO CONFERENCING PORTAL





Virtual Classrooms

NKN Usage

- **NKN Users**
  - NKN has connected 1015 institutes under categories such as C-DAC, IITs, IIMs, ISER, ICAR, Medical and Central/Deemed/State universities
  - Currently 563000 users (approx) are benefitting from NKN connectivity
- **International Usage**
  - Utilization for EU Grid
  - CERN Large Hadron Collider (LHC) project. India is a Tier II service provider at VECC, Kolkata
  - Astronomy database transfer (Caltech-IUCAA, Pune)
  - Virtual Laboratory (Remote Physics Experiment at ESRF, Grenoble, France on NKN)

Collaborations with other Networks (1/2)

Remote Physics Experiment at ESRF (Experimental Synchrotron Research Facility), Grenoble, France

- An experiment conducted accessing the Synchrotron at Grenoble, France from Homi Bhabha National Institute (HBNI), Mumbai, on NKN, for protein crystallography studies.
- NKN connects the HBNI to FIP (French beam line for Investigation of Protein), Grenoble, France through 2.5 Gbps Trans Eurasia Information Network (TEIN3) link to GEANT network in Europe

Connectivity to TEIN4

- The Trans-Eurasia Information Network (TEIN) uses ICT technologies to increase regional cooperation with Asian countries and to bridge digital divide of less developed regions.
- It connects universities and research institutions with high capacity Internet network to increase exchange of knowledge
- TEIN4 is the fourth generation of TEIN network. NKN is currently connected to TEIN4 a high capacity internet research network across Asia Pacific.

Collaborations with other Networks (2/2)

NKN collaboration with CERN

- NKN currently connects two Tier-2 centres namely VECC and TIFR.
- With a NKN POP in their vicinity, they are instrumental in addressing the growing demand of enhanced bandwidth from different institutions desirous of working on the LHC project

NKN Collaboration with Garuda

- GARUDA is a Nation-wide Grid spread over several cities of the country, comprising of computational nodes, mass storage, scientific instruments and collaboration of science researchers, with an aim to bring "Grid" networked computing research, to facilitate scientific, engineering solutions for socio-economic development.
- The GARUDA computing and storage resources are made available over high speed National Knowledge Network (NKN). Garuda's migration to NKN gives ample opportunity to exploit Gigabit speeds for scientific and engineering applications being run on GARUDA.

Model Projects under NKN - Virtual Medical Classroom

In the area of medical education, NKN launched a model project with AIIMS as the Principal Investigator, to understand the ICT technology flavor that will match the pedagogy natural to medical education while using the high speed and low latency offered by NKN.

Eight institutions joined AIIMS in this experiment and have come up with solutions after mutual consultations and actual field trials. They now have a template as to what combination is natural and acceptable to their community for skill transfer, knowledge transfer, and knowledge repository creation.

It is interesting that they use high-end graphics coupled with animation for "routine" skills (Blood and urine Sample, Blood Pressure monitoring, etc.) transfer and direct video for classroom interaction, and a combination to share knowledge about surgical skills that are cardiac oriented.

The USP of this project is, "Identification of appropriate match between ICT technology and Medical Application" for finding a solution to knowledge dissemination at a time when faculty are in short supply and rarest of the rare cases tend to be concentrated in certain parts of the country.

Model Projects under NKN - Network enabled online Casting Simulation System (e-Foundry)

In the area engineering education, there were several attempts in the past in creating and sharing course material, significant one being NPTEL – National Program on Technology Enhanced Learning. But the problem of continued knowledge accumulation by stakeholder community (consisting of Professors, Students, and Practitioners) using ICT remained a challenge hitherto in the absence of an infrastructure like NKN.

With IIT Bombay, a model project was initiated in Foundry Education. This is an area where the community is small, spread out, and perhaps not that tech-savvy. Besides, the experimental facilities are a challenge in Tier-2 and Tier-3 institutions.

To do it well, requires high bandwidth and low latency. At the same time, many beneficiary institutions are connected through commodity networks using Internet as they are in private sector.

USP of this project is establishment of a Web Based Portal that will use Computation (High Speed) and Interaction for Simulation (Low Latency) to impart Foundry education along with actual experiments with robotic instrumentation as well as simulation environment. In the process, knowledge generated by each stakeholder is meta-tagged and stored for anyone to view as “orchestrated” information. This approach ensures that database will naturally grow due to usage and user participation and retain diversity of source of knowledge, as the simulator in web site is capable of solving real-life problems for foundry industry.

Model Projects under NKN - Network Enabled Medical diagnosis and Education in Skeletal Imaging using X-Rays

In the area on inter-disciplinary research, three organizations were brought together to demonstrate the power of NKN in multi-institutional interaction. They are, NIC, CSIO, and AIIMS.

The basic idea is to use engineering design solutions to solve medical requirements. CollabCAD platform - software capable of three dimensional structural simulation with all the engineering nuances – was retargeted to solve a personalized dental imaging in 3-D.

While NIC took care of the ICT part, CSIO concentrated on the imaging part, and AIIMS articulated the end-user requirements. It is in a stage where multiple 2-D images are used to create s 3-D virtual reality.

USP of this project is that all three organizations are using the same image database on the same server for online and real-time manipulation of images, while discussing and annotating on the same image. Such a facility is not available even commercially, across the globe

Model Projects under NKN - Indian Integration with Global Imaging System via McGill Linkage, NBRC

In the area of Brain MRI medical imaging and integration of Indian medical science with global medical science, with NBRC as the lead organization, I-Brain was established as a research infrastructure layer over NKN.

All these institutions share their Brian MRI images online and in real-time with C-Brain of Canada and G-Brain, which is global.

While the current team will focus on using the infra for Alzheimer related studies, ICMR is planning to use it as a general purpose infra for several brain related research projects that are multi-institutional.

USP of this project is establishment of ICT infrastructure by medical community for a high end use, that too in a shareable form. While the establishment is successful, the share-ability is still under exploration.

Model Projects under NKN - Global classroom of the Amrita Vishwa Vidyapeetham

Using videoconferencing for imparting education is a well-known application. But scaling it to be an Immersive Experience is a technology challenge even for a point-to-point interaction.

With Amrita University in collaboration with IIT Bombay, SUNY, Buffalo, and MIT, Massachusetts, USA an immersive classroom that adapts itself to the mannerisms of a "teacher" is being attempted. Initially, video stitching of output from two cameras is being attempted. The idea is that, if one is addressing two sites simultaneously, it will appear as a single classroom at the "teaching" end.

The solution requires use of a supercomputer for running the algorithms that decide the "sync" between two camera eyes. This project challenges the reliability and availability aspect of NKN significantly, as the high volume and high-speed computation is in real-time and a failure will directly "hit" the classroom experience.

USP of this project is automatic aligning of "teacher behavior" and "pedagogy" with display structure at the receiving end – hitherto unaddressed issue, even by advanced countries in the world. This is expected to result in a paradigm shift in our perception of large-scale spread of quality education. This project is also likely to create "niche" technologies in several areas.

Thank You

Please visit our website www.nkn.in for further information

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