eScience in India

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सी डैक CDAC | प्रगत संगणन विकास केंद्र
CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

National Monsoon Mission

- Government of India has announced Monsoon mission program - $44 million – 2012 - 2017

- India launches high performance computer system – Pratyush & Mihir from Ministry of Earth Sciences (MoES), Govt of India.
- Pratyush will be India's largest in terms of Peak capacity and performance and will propel the country's ranking to the top 30 in list of HPC facilities across the world.
- India will now also be ranked 4th, after Japan, UK and US for dedicated HPC resources for weather/climate community.

National Monsoon Mission

- Participating Institutions
  - Indian Institute of Tropical Meteorology (IITM), Pune
  - Indian National Centre for Ocean Information Services (INCOIS), Hyderabad
  - National Centre for Medium Range Weather Forecasting (NCMRWF), Noida
  - India Meteorological Department, New Delhi

National Monsoon Mission

- The Ministry has acquired the HPC facility of 6.8 Peta Flops (PF), along with 18 petabytes of storage and has been installed at two of its constituent units: 4.0 Peta Flops HPC facility at Indian Institute of Tropical Meteorology (IITM), Pune and 2.8 Peta Flops facility at National Centre for Medium Range Weather Forecasting (NCMRWF), Noida.
- The HPC facility 'Pratyush' at IITM was dedicated to the nation on January 8, 2018.

Mihir HPC cluster - NCMRWF, Noida

Description
1. Cray XC-40 class system 2. 2322 CPU-only Nodes (Intel Xeon Broadwell E5-2695 v4 CPU) with 83592 cores 3. Total storage of 7.839 PB using Lustre Parallel file system 4. Cray Aries interconnect

Pratyush HPC cluster - IITM, Pune

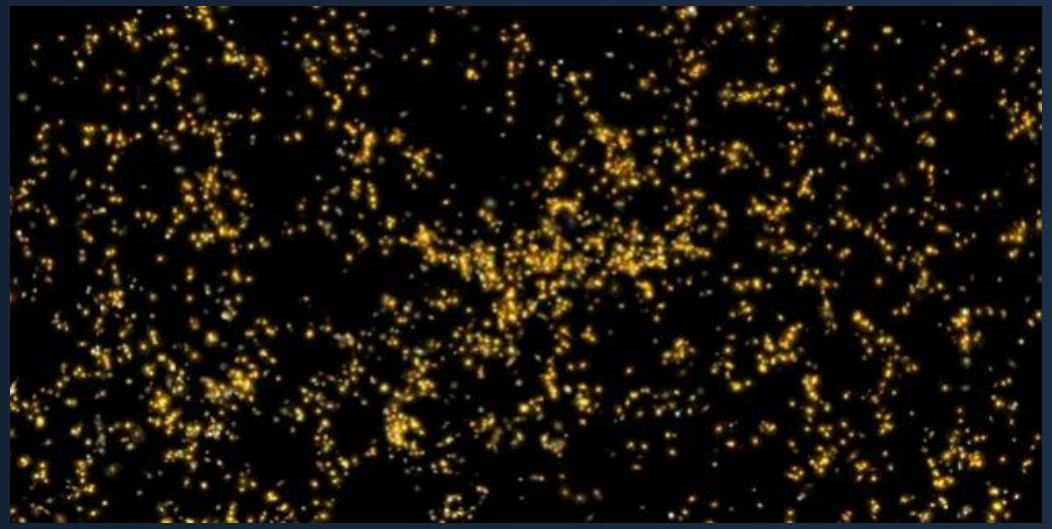
Description
1. Cray XC-40 class system 2. 3315 CPU-only Nodes (Intel Xeon Broadwell E5-2695 v4 CPU) with 119232 cores 3. Total storage of 10.686 PB using Lustre Parallel file system 4. Cray Aries interconnect

National Monsoon Mission

- Pratyush & Mihir is expected to improve weather forecasts at the block level, predict extreme weather events, and offer high resolution seasonal and extended range forecasts of active/break spells of the monsoon.
- The facility will also make possible very high resolution coupled models for prediction of cyclones with more accuracy and lead time.
- Further, the services that will improve with the new facility are ocean state forecasts including marine water quality forecasts at very high resolution, tsunami forecasts with greater lead time, air quality forecasts for various cities and climate projections at very high resolution.

Astronomy

- The year 2017 was big for Indian astronomers for 2 things:
  - The Nobel prize for the discovery of Gravitational Waves that had some contribution from our scientists (Dr. Dhurandhar built the mathematical tool that was very important to find the tiny vibrations from the passing gravitational waves)
  - The discovery of a super cluster of galaxies, named Saraswati, after the Indian goddess of music, art and knowledge, which is 4 billion light years away.

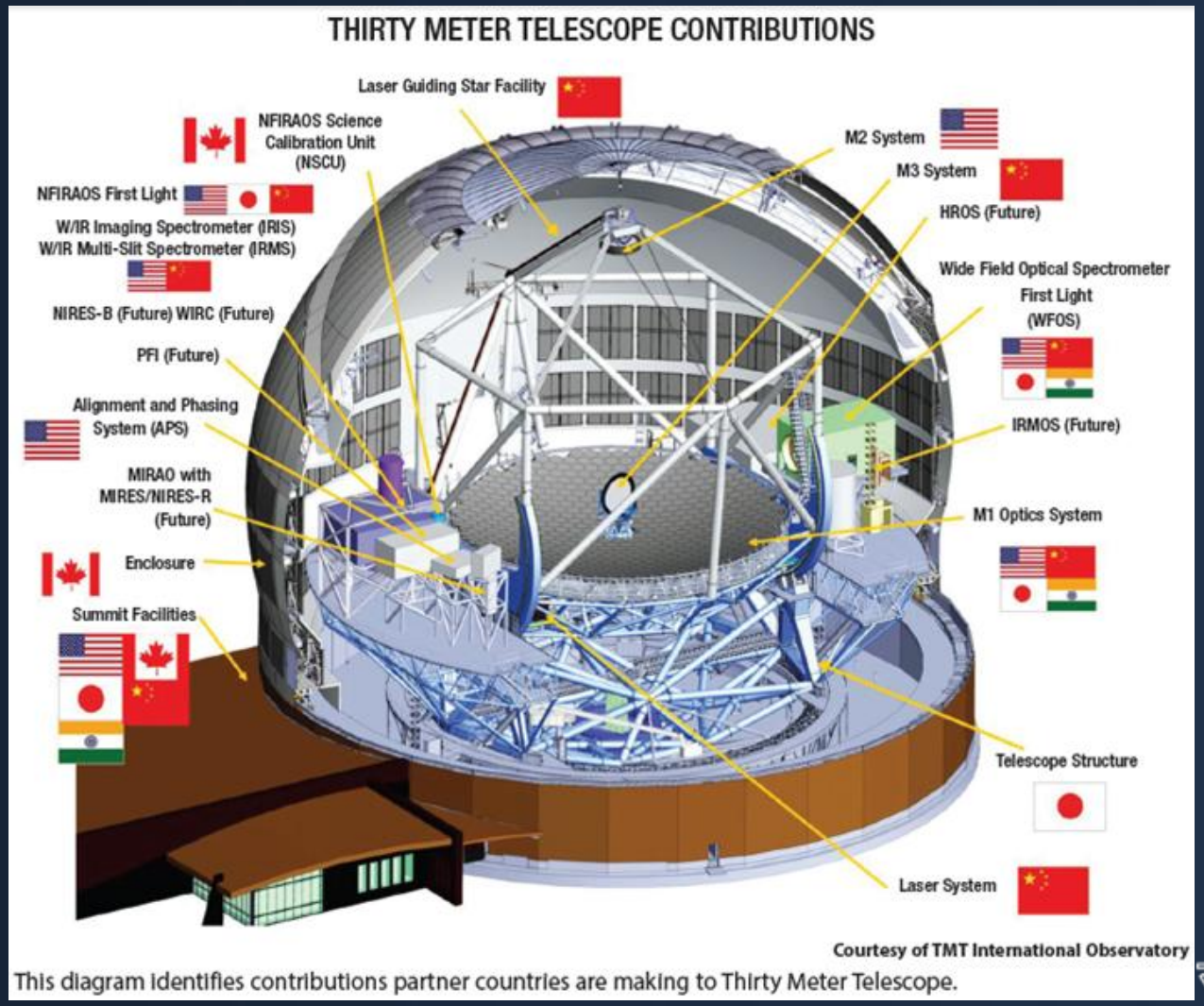


ISRO – propelling India's success in space science

- Our scientists set a world record with the launch of the largest number (104) of satellites in a single flight (PSLV – C37), and a rocket launch (GSLV Mark III) with the heaviest payload.
- ISRO has now established its ability to launch satellites on a commercial scale, providing a reliable, low cost option to its customers.
- ISRO launched a whopping 130 customer satellites in 2017 alone!
- Satellites ranging from 3136 kg to a meagre 4g!

- The Thirty Meter Telescope (TMT) is a unique project to build one of the most advanced and powerful ground-based telescopes in the world.
- Department of Science and Technology and Atomic Energy is funding $180 million for 2014-2023
- Indian Participants are: IIAP, ARIES, IUCAA.
- The project is a result of an international partnership between India, Canada, China, Japan and institutes from the USA.

Contributions to TMT



This diagram identifies contributions partner countries are making to Thirty Meter Telescope.

India at CERN

- Indian scientists have been involved in:
  - LHC
  - ALICE
  - CMS
  - COMPASS
  - ISOLDE
  - nTOF

India at CERN

- WLCG Participation - TIFR & VECC hosts - Grid Tier2 centre for CMS experiment
- 2 of the 50 T2 centers world-wide
- Active since 2008
- Average availability and reliability: ~ 90%

Pledged Resources (2016) from TIFR

Site Name	VO	Pledge Type	Resources pledged	% of required resource in CMS
T2_IN_TIFR	CMS	CPU (HEPSPEC06)	12,288	2%
		Disk (TB)	1980	5%

Pledge Resources for (2017) from TIFR

Site Name	VO	Pledge Type	Resources Pledged	% of required resource in CMS
T2_IN_TIFR	CMS	CPU HEPSPEC06	25,000	2%
		Disk (TB)	3,600	6%

India at CERN

- Collaborating Indian Institutes connected via NKN-TIFR-CERN
  - **Fully operational 10G connection with LHCONE(CERN) + 10G Shared via NKN**
- List of collaborating Institutes (~100 active users)

- **TIFR, Mumbai** WLCG Site
- **VECC, Kolkata** WLCG Site
- BARC, Mumbai
- Delhi University, New Delhi
- SINP, Kolkata
- Punjab University, Chandigarh
- IIT Mumbai, Mumbai
- IIT, Chennai)
- RRCAT, Indore
- IIT, Bhubaneswar
- NISER, Bhubneshwar
- IOP, Bhubneshwar
- Vishva-Bharti University
- IISER, Pune
- Rajasthan university
- IPR, Ahmedabad → for ITER project

India at CERN

Tier2 Resources @ VECC

Tier2 Resources @ TIFR

National Supercomputing Mission (NSM)

- A visionary program to take India to the league of world class computing power nations - 700 million USD
- Connect national academic and R&D institutions with a grid of over 70 high-performance computing facilities
- Launched in 2016, it’s a 7 year mission project.
- These supercomputers would be networked on the National Supercomputing Grid over National Knowledge Network (NKN).

NSM – Phase 1

- Implementing Agencies:
  - CDAC
  - IISc
- IIT, Kharagpur – 1.3 PF HPC System
- IISER, Pune – 650TF HPC System with DCLC
- IIT, BHU, Varanasi – 650TF HPC System

India Super Computers – Jan 2018

Rank	Organization	System	Cores	Rmax (Tflops)	Rpeak (Tflops)
1	Indian Institute of Tropical Meteorology (IITM), Pune	Cray XC-40, Intel Xeon Broadwell E5-2695 v4, w/Aries Interconnect	119232	3763.9	4006.19
2	National Centre for Medium Range Weather Forecasting (NCMRWF), Noida	Cray XC-40, Intel Xeon Broadwell E5-2695 v4, w/Aries Interconnect	83592	2570.4	2808.7
3	Indian Institute of Science (SERC)	Cray XC-40, Intel Xeon E5-2680 v3, w/Aries interconnect	31,104	901.5 (CPU-only)	1244.00 (CPU-Only)
4	Indian Institute of Tropical Meteorology	iDataPlex DX360M4, Xeon E5-2670 8C 2.600GHz, Infiniband FDR IBM	38,016	719.2	790.7
5	Tata Institute of fundamental Research (TIFR), Hyderabad	Cray XC-30 cluster (Intel Xeon E5-2680 v2 and 2688-core NVIDIA Kepler K20x GPU nodes) w/Aries Interconnect	11,424	558.7	730.00

Source: topsc.cdacb.in

Centre for Development of Advanced Computing (CDAC)

- Established in 1988
- Spread over 11 cities
- 2700+ employees
- R & D Organization under Ministry of Electronics & Information Technology (MeitY)
- Vision
  - To emerge as the premier R&D Institution for the design, development and deployment of World Class electronic and IT Solutions for economic and human development.

CDAC – R&D Areas

- High Performance computing (NSM)
- Grid Computing (GARUDA) & Cloud Computing
- Multilingual computing and heritage computing
- Professional electronics including VLSI & embedded systems
- Software technologies, including FOSS
- Cyber security & Cyber forensics
- Health Informatics
- Education & Training

CDAC's National HPC Facilities

Yuva II @ CDAC, Pune
First Supercomputer in India to cross 500 TF mark - 524 TF
Ranked 69th in the Top500 list released in June' 2013

PARAM Padma @ CDAC, Bangalore
First supercomputer in Top500.org

CDAC's National HPC Facilities

The Bioinformatics Resources & Applications Facility (BRAF) at C-DAC, is an effort providing high-end supercomputing facility to the researchers working in the areas of Bioinformatics.

PARAM BioBlaze @ CDAC, Pune - 10TF

PARAM BioChrome @ CDAC, Pune – 5TF

CDAC's National HPC Facilities

- PARAM Shavak – Supercomputing in a Box.
- 2-5 TF compute power equipped with C-DAC's indigenous technologies and solutions for HPC Applications
- Easy to deploy solution with no requirement for datacentre infrastructure
- Affordable solution for Academic, scientific and research institutions that are on the verge of adopting HPC Culture
- ONAMA & CHReME (CDAC HPC Resource Management Engine) software tools included
- Powered with advanced accelerator based technology.


PARAM Shavak

MEGHRAJ – Harnessing Cloud Computing for India

- 'GI Cloud' – Government of India's cloud computing environment that will be used by government departments and agencies at the centre and states.
- Cloud computing environment at a National Level – To accelerate delivery of e-Services provided by the government and to Optimise ICT spending of the government.
- A common repository of cloud – based infrastructure resources and applications available on a sharable basis.

- https://cloud.gov.in/index.php

MEGHRAJ – Harnessing Cloud Computing for India

- Services offered as part of National Cloud
  - IaaS
  - PaaS
  - SaaS
  - STaaS
  - Hosting Environments
- Services support to the Application as part of the Cloud Hosting:
  - Server Vulnerability Assessment
  - Server backup
  - Server Anti-Virus
  - Network/Application Firewall

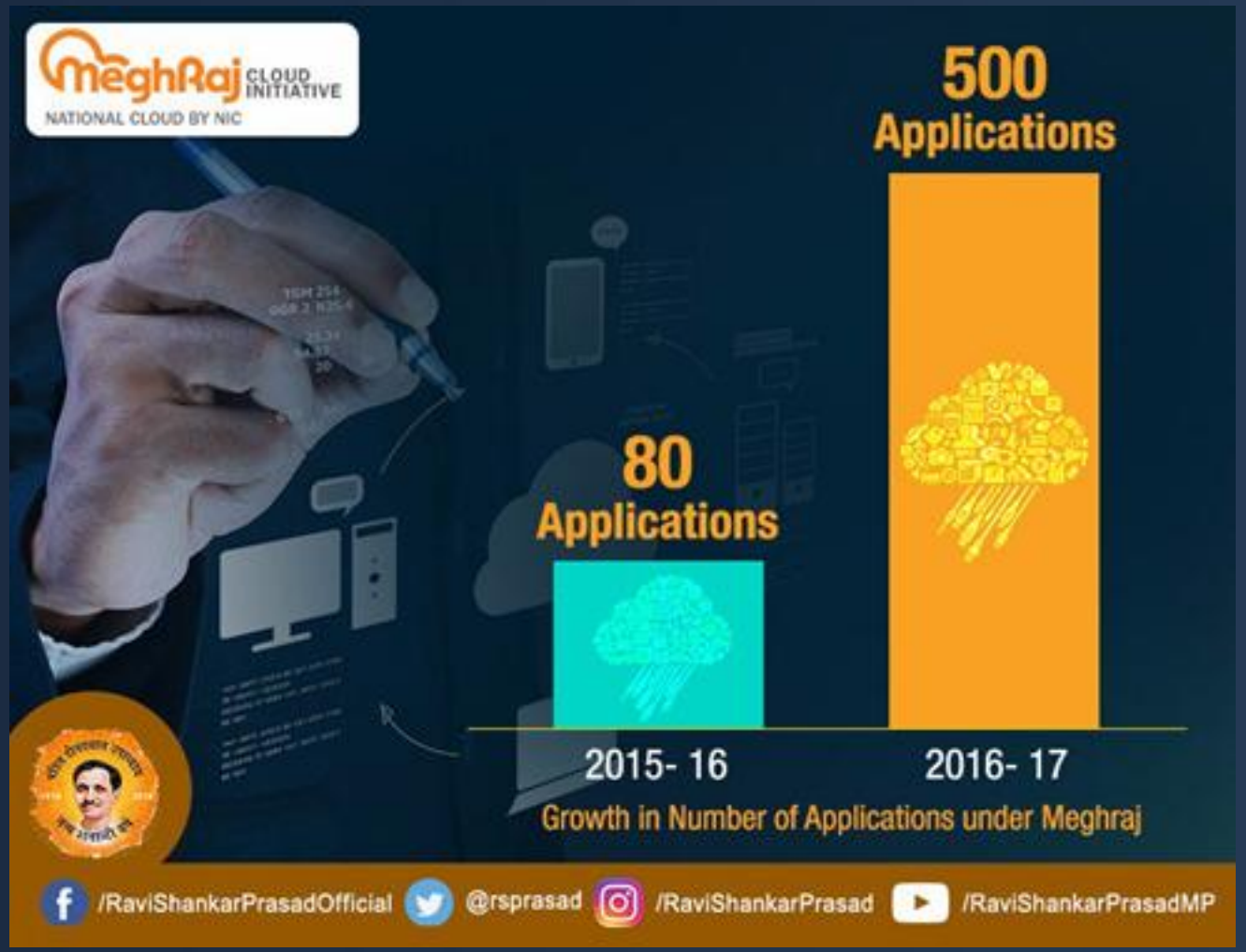
MEGHRAJ – Harnessing Cloud Computing for India

- e-Gov Applications on Cloud
  - Digilocker
  - Land Records
  - GeM,
  - E-Office
  - E-Hospital
  - Jeevan Pramaan
  - MyGov
  - Etc.,

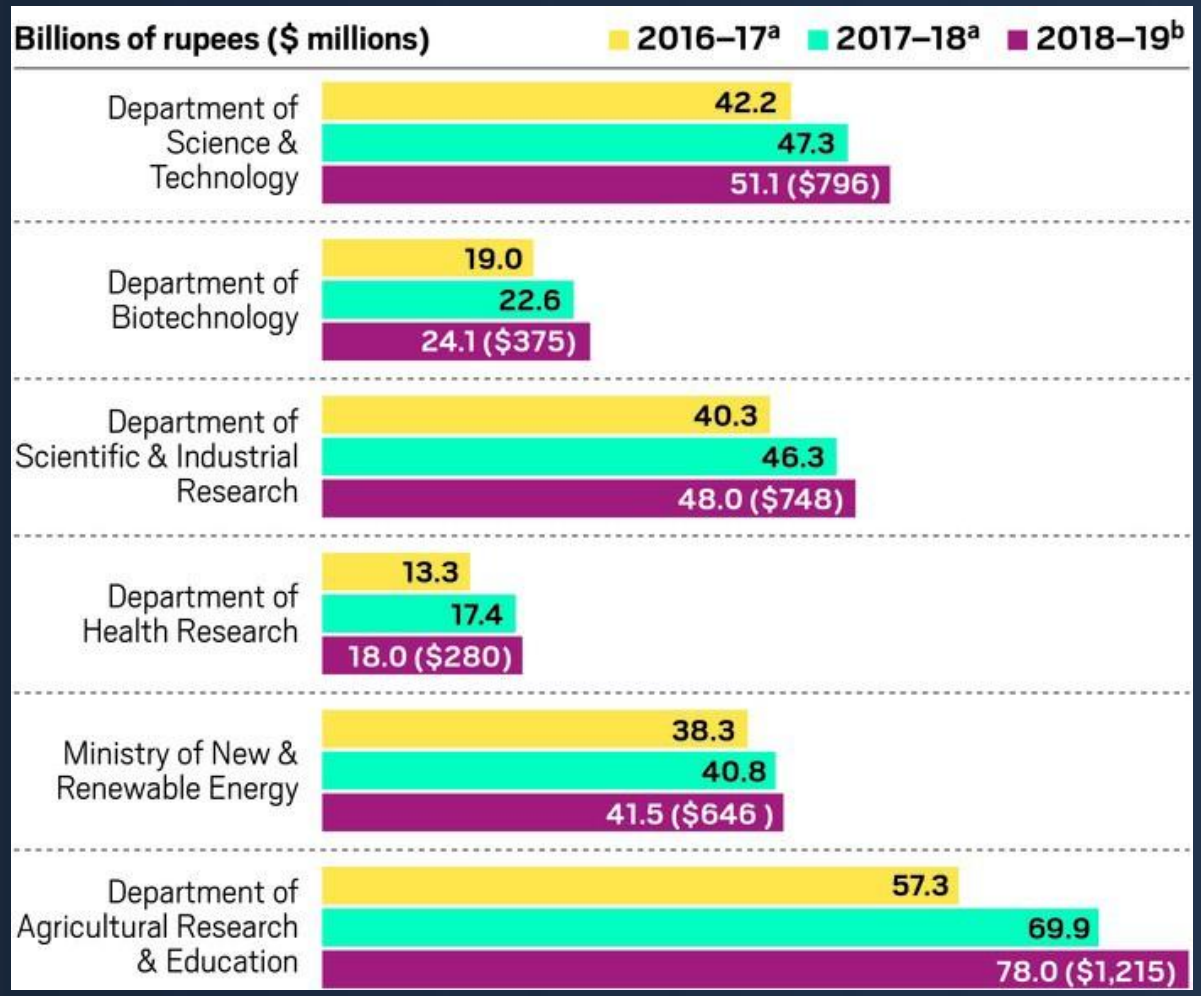
MeghRaj - Statistics

- 620 Applications
- 8100 Virtual Servers

- Distributed datacentres across the country.



India’s science and technology funding



Conclusion

- Harnessing science and technology for a better future of people is the new spirit in India
- India is at the 2nd position among countries with the highest increase in their contribution to high-quality scientific research.
- C-DAC is playing an active role in the country's S&T charter
- Way forward – Building infrastructures for next generation e-Science in India.

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Je vous remercie

gracias Danke grazie 谢谢

Thank you

ありがとうございました

Digital India

- The Digital India is a flagship program of the Government of India with a Vision to transform India into a digitally empowered society and knowledge economy.
- It aims at ensuring the government services are made available to citizens electronically by reducing paperwork.
- It also includes connecting rural areas with high-speed internet networks.
- The Electronics & IT department is the implementing Agency.
- From 2014 to 2018.

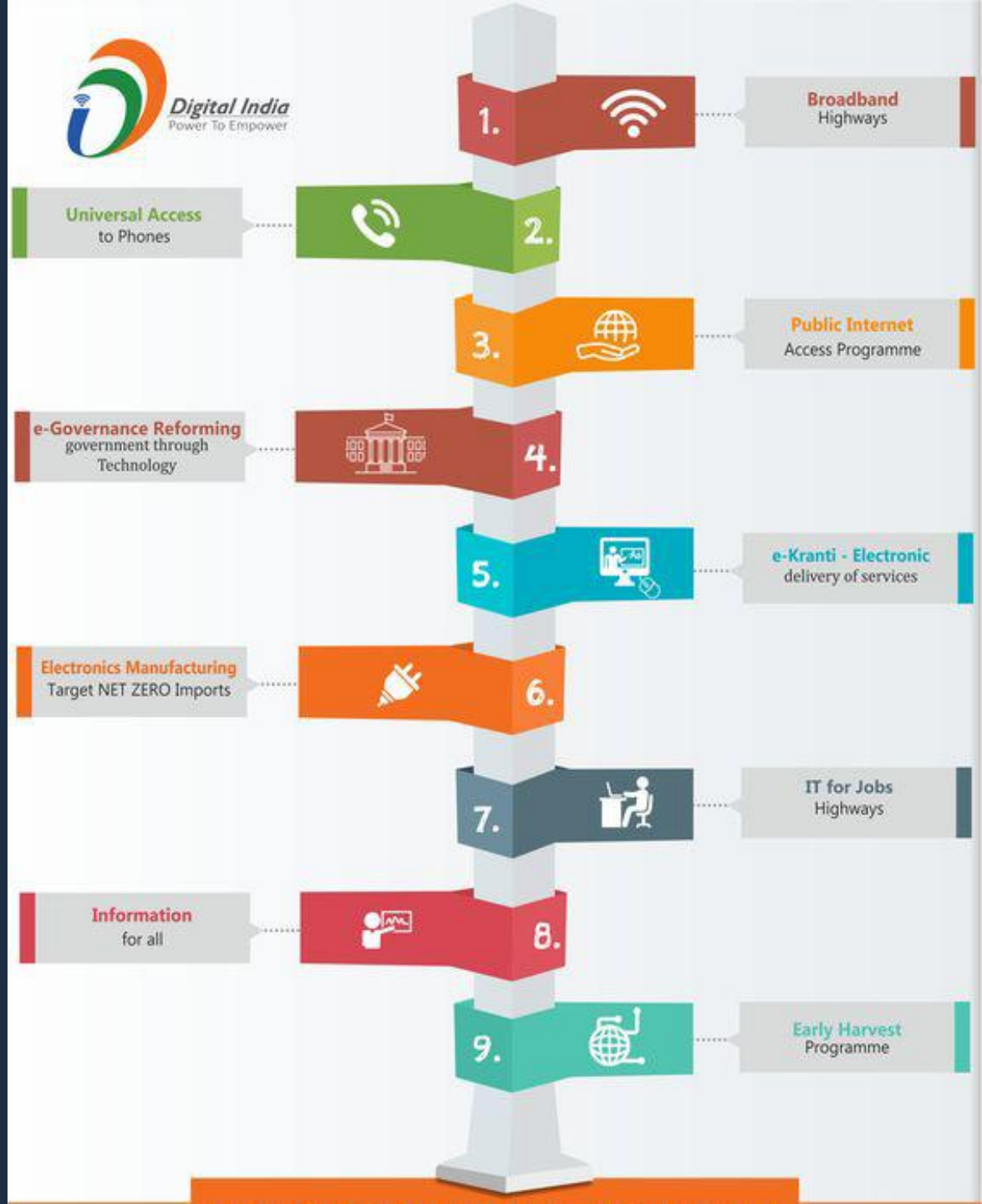
Digital India – 9 Pillars

Vision Area 1 – Infrastructure as a Utility to Every Citizen

Vision Area 2 – Governance & Services On Demand

Vision Area 3 – Digital Empowerment of Citizens

Overall Costs of Digital India: ~15 Billion USD in ongoing schemes



Digital India – Key Projects

- Digital Locker System
- MyGov.in
- eSign Framework
- The Online Registration System (ORS)
- National Scholarships Portal
- Digitize India Platform (DIP)
- Swachh Bharat Mission Mobile App
- Next Generation Network (NGN)
- Etc.,

Impact of Digital India – Internet Stats

1.34 Bn
Population in India

462+ Mn
Internet users in India

34.4%
Penetration

India has overtaken the United States as the
2nd largest Internet user base
in the World

Impact of Digital India – Mobility Stats

1.21 Bn
Total Mobile Subscriptions

88%
Mobile Penetration

16%
Smartphone Penetration

India has overtaken the United States as the
2nd largest smartphone market
in the World, trailing china

What will TMT explore?

- TMT will be a unique tool for probing many outstanding open questions in astronomy.
- Its adaptive optics and spectroscopic capabilities will allow astronomers to explore the mysterious period in the life of the universe when the first stars and galaxies were formed, providing information about the nature of "first-light" objects and their effects on the universe's evolution.