Super Computing: India

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CDAC Pune, 8 Feb

Department of Electronics &IT (DeitY): Major thrust areas

1. **e-Government**
   - Establish IT Infrastructure on demand for delivery of e-services
   - focus on volume of e-transactions
2. **e-Industry**
   - Promotion of electronics hardware manufacturing
   - Promotion of MSMEs & domestic industry
3. **e-Innovation/R&D**
   - **Focus on Translation**
4. **e-Learning**:
   - development of Skills to implement Electronics & ICT Policies
5. **e-Security**
6. **e-inclusion**

eitY's current R&D areas

- Convergence Communication and Broadband Technologies
- High Performance Computing/ Mobile computing/ Cloud computing/ Green computing
- Electronic Components & Materials
- Electronics System Development & Applications
- Industrial Electronics & Automation
- Free and Open Source Software
- Bio-informatics
- Digital Preservation
- Microelectronics/VLSI
- Nanotechnology
- Innovation Promotion & IPR
- Cyber Security
- Medical Electronics & E-Health
- Perception Engineering
- Photonics
- Scientific Computing
- Strategic Electronics
- Ubiquitous Computing
- RF / Microwave Technologies, Devices and Applications
- Language Technologies
- E-Learning

ly present engagement:

Group Coordinator : R&D in IT

- CDAC – Advanced Computing
- IT Research Academy: enhancing the capabilities and capacities of R&D in ICT&E
- Nanoelectronics
- Free and open source software (FOSS)
- Bio-informatics
- Perception based Engineering
- Digital Preservation
- Ubiquitous computing, Green Computing
- R&D Policy /framework
- Innovation Promotion & Intellectual property rights and policy

- Media Lab Asia –ICT for development

DeitY R&D Framework- Strategies :

- Identify & prioritize the right themes
- Maintain the Right Balance between basic research, applied research and product development
- Enhance the quality and quantity of R&D
- Focus on Product Development
- Develop Entrepreneurship through promotion of Start ups, SMEs
- Protect Intellectual Property Rights and Patents
- Strengthen R&D Infrastructure
- Develop Human Resources
- Promote public-private partnership for R&D
- Promote International collaborations
- Focus on Translation :Transfer of Technology & Commercialization

Focus on Translation :Transfer of Technology & Commercialization

- Encourage academia and R&D organizations to file for patents before publication of their research results
- Technology transfer to industry/user agencies by academia and R&D organizations
- Further development of selected research results into technologies / products, leading to subsequent technology transfer to industry
- Support to prototyping and pilot production for selected technologies in cutting edge areas
- Setting up of a dedicated organization/institutional mechanism for promotion of technology transfer to industry from the academia and R&D organizations.

Supercomputing : India's Position

As on November 2012

- India has 8 systems on the Top 500 list ranking 82, 127, 186, 199, 200, 288, 364 and 386.
- CSIR -4PI, Bengaluru: Position 82 (Rmax: 303.9 Tflops/s)
- VSSC, ISRO Tiruvanthapuram: Position 127 (Rmax:188.7 Tflops/s)
- CRL, Pune: Position 186 (Rmax: 132.8 Tflops/s)
- IIT Madras, position 364 (Rmax: 91.1 Tflops/s)

GlobaL: Oak Ridge, USA, Position 1 (Rmax 17.59 Pflops/s)

Indian Organizations in Supercomputing

- User Agencies
  - IMD, NCMRWF, IITM, INCOIS
  - CSIR Laboratories, CCMB, CDFD, …
  - TIFR, IUCAA, ONGC, PRL, HAL, …
- HPC systems, Infrastructure and Research Organizations
  - C-DAC, CRL, CMMACS
- In house development and use
  - DRDO, BARC, NAL, ISRO
- Educational Institutes
  - Indian Institutes of Technology (IITs)
  - Indian Institute of Science (IISc)
- Government departments: DST, DeitY

Super Computer: Param Yuva II

- Developed by CDAC, Department of Electronics & IT
- 524 Teraflops RPeak
- 360.8 Teraflops Rmax
- Unveiled on 8 February 2013
- Would have ranked 62 in the November 2012 ranking list of TOP 500
- Would have ranked 33rd in the November list TOP Green Supercomputers of the world
- Cost: US$ 3 million
- Param Yuva II will be used for research in space, bioinformatics, weather forecasting, seismic data analysis, aeronautical engineering, scientific data processing and pharmaceutical development.

Demand Estimate : Present

- Domain-wise needs in next two years
  - Bioinformatics 2 PF/s
  - Weather Forecasting 1.5 PF/s
  - CFD 0.75 PF/s
  - Material Science 1 PF/s
  - Space 1 PF/s
  - Others 3 PF/s
- Demand is expected to be increase substantially

Super computing: India Approach

- Application-centric approach for building HPC systems and associated infrastructure
- Collaborative approach for applications development
- Standards based scalable architecture for growth
- Grid based national infrastructure for sharing of resources
- HPC manpower development
- R&D for Exascale computing

Super Computing: Key Application Areas

- Life Sciences & Drug Discovery
- Weather Forecasting
- Disaster Management
  - Earthquake Engineering
  - Flood/Cyclone Forecasting and Response
- Discoveries Beyond Earth (Space applications)
- Design of New Materials (Nano Structure)
- Oil/Gas/Energy Exploration
- National Security

Addressing the Issues

- Co-ordinated National Effort
- Application-centric effort in addition to system-centric effort
- Managing issues of power, space and cooling while enhancing compute power
- Initiatives to create HPC-aware manpower for building national HPC ecosystem

Proposed National HPC Infrastructure

Several Small Scale
(10 - 50 TF)
Supercomputers

Few Medium Range
(100 - 500 TF)
Supercomputers

Large scale (Petascale)
Computing Facilities

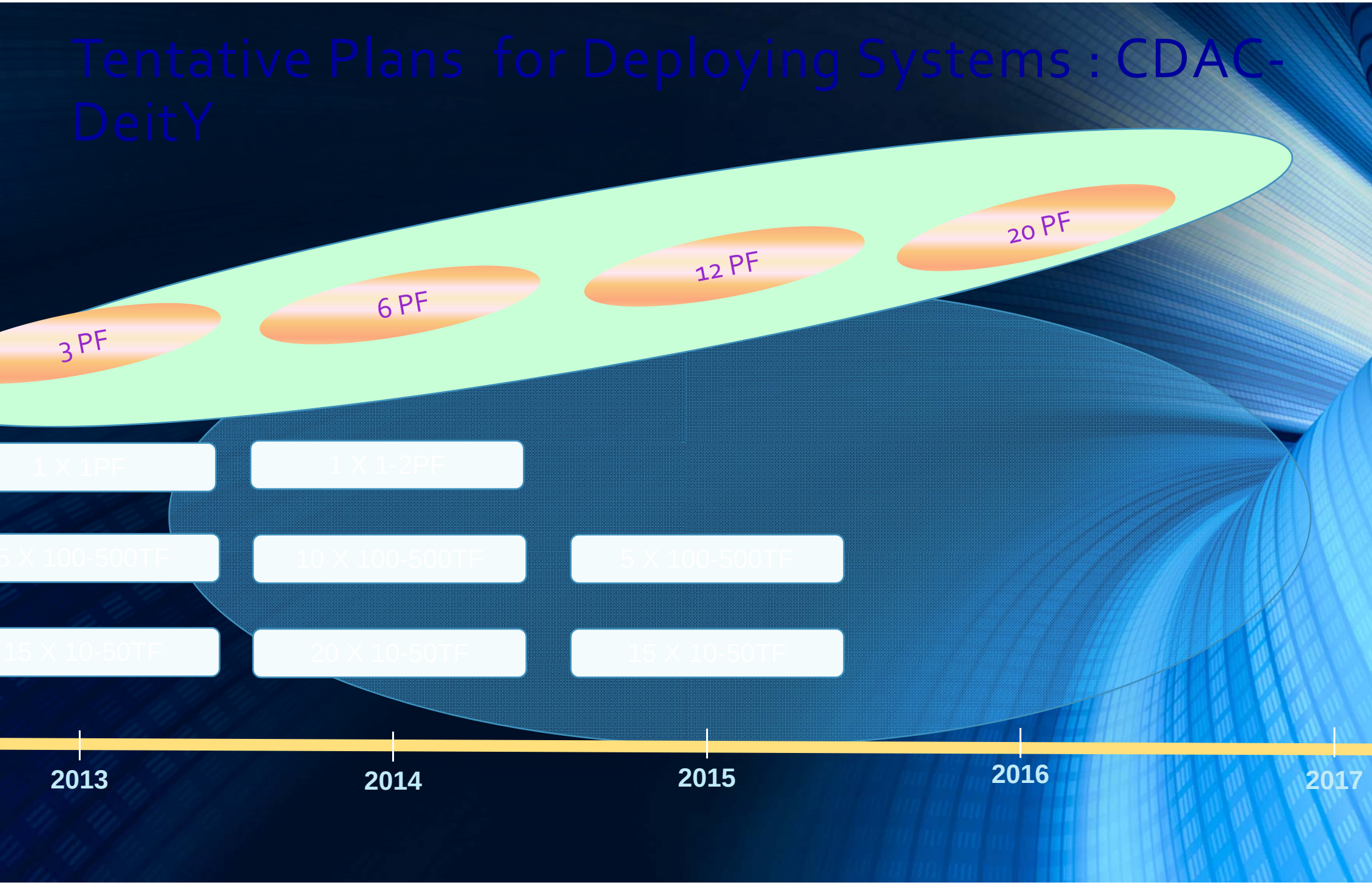
NKN

HPC Users

All systems with the vendor-neutral architecture, standardized and scalable hardware and software

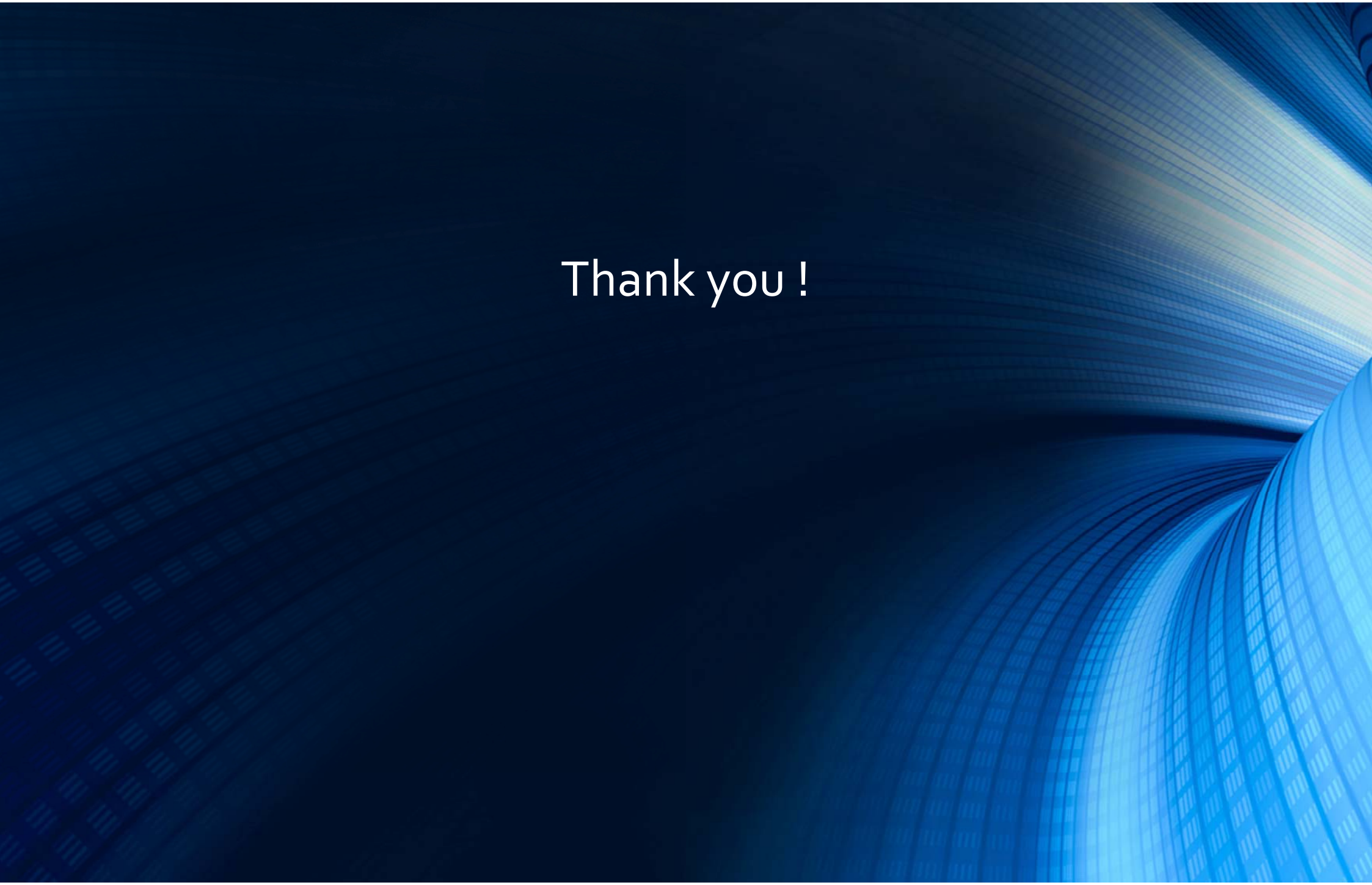
Combining Resources for Better Usage

Tentative Plans for Deploying Systems : CDAC-DeitY



R&D for Exascale Computing

- Exascale system architecture
- New methodologies and technologies for designing applications
- Adoption of applications for Exascale computing
- Redesigning software for Exascale system architecture
- Power optimization techniques


Thank you !