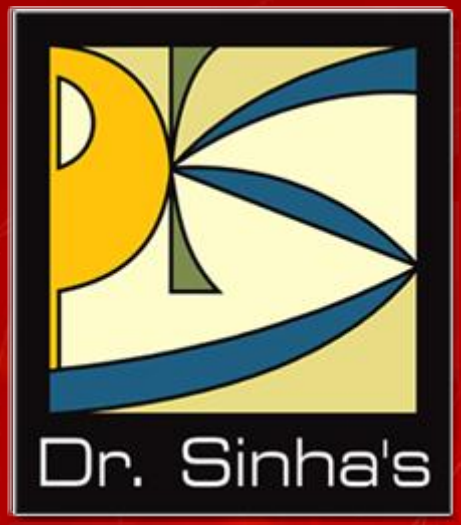


Views on

CHALLENGES IN INDIAN APPROACH TO EXASCALE COMPUTING

Dr. Pradeep K. Sinha
Vice Chancellor & Director
IIIT – Naya Raipur (CG)

December 2018

To Out-Compute Is To Out-Compete

- Council of Competitiveness

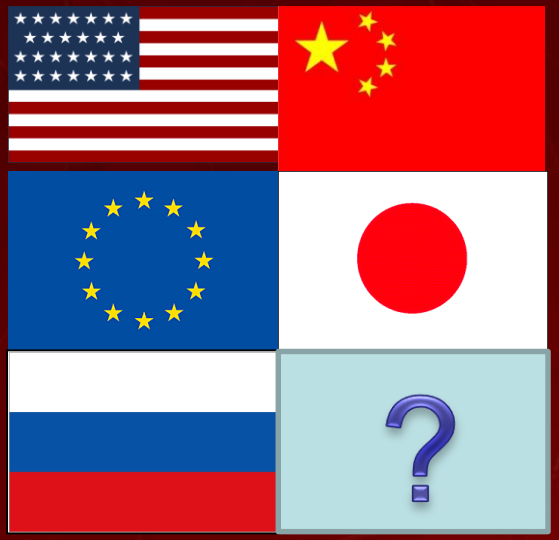
www.compete.org


Hence
Many Countries are
Vying for HPC Leadership


The Race Now
is for
Exascale Computing

Exascale Players

USA		2008
China	2009	
Europe		2010
Japan	2009	
Russia		2010
India		2013



Supercomputing Scenario

RIGHT NOW!

World's No. 1 System in November 2018

Summit –
IBM Power System AC922
IBM POWER9 22C 3.07 GHz NVIDIA Volta GV100
Oak Ridge National Lab, USA

- The World's Fastest Supercomputer
- 143.5 Petaflop
- 23,97,824 Cores

Country-wise Percentage (November 2018)

Country	No. of Systems	Percentage Share
1. China	227	45.4
2. USA	109	21.8
3. Japan	31	6.2
4. UK	20	4.0
5. France	18	3.6
6. Germany	17	3.4
15. India	4	0.8

India's Top500 Entries

Rank in India	Rank Globally (Nov 2018 List)	Site	System	Cores	R max	R peak
1	45	Indian Institute of Tropical Meteorology India	Pratyush - Cray XC40, Xeon E5-2695v4 18C	119232	3.7 PF	4.006
2	73	National Centre for Medium Range Weather Forecasting, India	Mihir, Cray XC40	83592	2.5 PF	2.808
3	337	Software Company (M), India	InC1- Lenovo C1040	38400	1.1 PF	1.413
4	488	Supercomputer Education and Research Centre (SERC), Indian Institute of Science, Bangalore	CRAY XC40	31104	0.9PF	1.244

Is India Part of Exascale League of Nations

We have built the CAPABILITY
And proved time and again

Latest Development - 2018

Pratyush Ranking (Weather/Climate)

Capacity 6.8 Petaflops.

India - at the 4th position after Japan, UK and USA for dedicated HPC resources for weather/climate community.

TOP 50

228

2013: India Initiates

NATIONAL SUPERCOMPUTING MISSION

2015: Cabinet Committee Approves NSM

NSM forms the basis of uplifting Indian science and engineering research to a much higher level than now with the usage of supercomputing systems and technologies

Mar 25, 2015, 10.24 PM IST | Source: PTI

Govt to launch Rs 4,500 cr National Supercomputing Mission

The Mission supports the government's vision of 'Digital India' and 'Make in India' initiatives.

7 0 Google + 0 2

The government on Wednes approved launch of National Supercomputing Mission to conn national academic and R&D institutions with a grid of over 70 high-performance computing facilities at an estimated cost of R 4,500 crore.

The Cabinet Committee on Economic Affairs, chaired by Prime Minister Narendra Modi, has approved the launch of the mission that will enable India to leapfrog to the league of world-class computing power nations, an official release said.

Takes a

Strategic Approach

Based on

Our Past Experiences

Past Experiences?

Learnings from the Past

- Being in the race for ranking
- Usage pattern
- Users readiness
- Energy (Power Consumption)
- Manpower

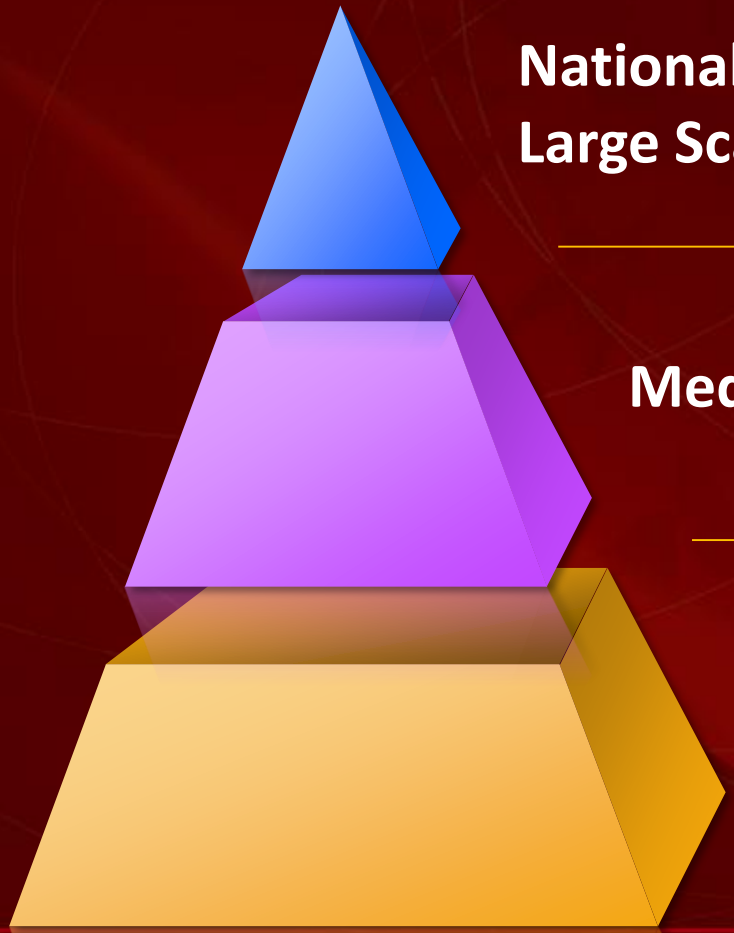
Hence NSM Takes Ensemble Computing Approach to Exascale Computing

Highlights of NSM

- Outlay : Rs. 4500 Crores
- Duration : Seven years
- Deliverables : Key deliverables
  - 70+ HPC installations
  - HPC Grid
  - Development of HPC Apps
  - Million-core cloud
  - HPC-aware manpower
  - R&D for next-gen HPC

NSM System Architecture

The Three-Tier Architecture



National level
Large Scale HPC Facilities

Medium Scale HPC Facilities

Grassroot level Small HPC Systems

All integrated seamlessly

Challenges in this Approach?

Challenges Identified in DARPA's Exascale Computing Study

- Programmability (Concurrency + Scalability + Locality)
- Performance (Processor + Interconnect + Storage)
- Resiliency (Hardware + Software)
- Energy (Power Consumption + Heat Generation)

Programmability

Redesign Applications

for

Ensemble Computing Architecture

Performance

Focus on application level performance tuning and optimization

Resiliency

- **Distributed system resiliency**
- **Application level resiliency**

Energy

Not a big Concern

Take care of usual power optimization mechanisms

Manpower

Train to develop expertise

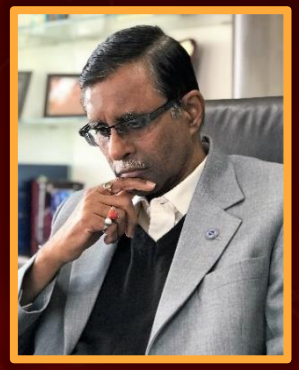
in both

Parallel Programming

&

Distributed Computing

Thank You



Dr. Pradeep K. Sinha

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Distinguished Engineer — Association of Computing Machinery

Fellow — Computer Society of India

Envisioning the Future of India by Grooming Young Minds