



भौतिक अनुसंधान प्रयोगशाला, अहमदाबाद, भारत

Physical Research Laboratory, Ahmedabad, India

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**A Report on
Three Days HPC Training Workshop - “Parallel Programming and Concepts of AI”**

[A] About Workshop

The HPC Committee and CNIT Division of PRL organized three days High Performance Computing (HPC) training workshop on “Parallel Programming and Concepts of AI” during July 01-03, 2024. It was organized to celebrate the 1st anniversary of 1PF Param Vikram-1000 HPC facility which was installed and availed for scientific use in June 2023. The main objective of the training workshop was to:

- Foster a community of scientists, researchers and academicians in Parallel Computing and Artificial Intelligence (AI),
- Provide a platform for knowledge sharing and collaboration and
- Address challenges and opportunities in various research using HPC and AI.

In the inaugural address, Prof. Anil Bhardwaj, Director, PRL, mentioned how the combination of Parallel Programming and AI has opened up the new avenues for innovation and discovery. He also stated that the workshop is a testament to the dedication and enthusiasm of participations, speakers and PRL’s HPC committee and CNIT division in the HPC domain.



Prof. Bijaya Sahoo, Chair, HPC Committee, PRL, in his speech, highlighted that the parallel programming is a crucial aspect of an HPC which enables us to harness the power of multiple processors/cores to solve the complex scientific/research problems. He also said that this knowledge sharing will have a lasting impact on the advancement of HPC in various fields.

Prof. Pallamraju D., Dean, PRL expressed his view on AI and told that it has revolutionized the way we approach problems solving in various research domains.

Prof. Varun Sheel, Chair, Computer Committee said that the participants will get more insights through hands-on sessions which is a very important aspect to build the HPC aware application.

The external expert Mr. Kiran Kannappan, Founder, CEO of Vidatt delivered a series of lectures covering various topics related to the Workshop like Processor Architecture, OpenMP, MPI, Workload Manager Queue System, Debugging for Parallel Programming, Concepts of AI and Python. Mr. Sarath from Vidatt provided his support during Hands-On lab session and gave a few lectures on Python and other programming.

Mr. Vaibhav from CNIT demonstrated application performances over GPU and CPU. He also demonstrated how to use Conda to make application platform independently with respect to library and specific version of software requirement. Mr. Jigar Raval, Head, CNIT division presented a talk on the Param Vikram-1000 HPC facility infrastructure to all the participants.

Mr. Tejas Sarvaiya, Section Head, ITSN, Mr. Vaibhav Rathore, Sci./Engg.-SD, Mr. Hitendra Mishra, Sci./Engg.-SE and Mr. Alok Shrivastava, Sci./Engg.-SE moderated the sessions during the three days of workshop. The schedule of the said three-day workshop is attached here as an Annexure-I.

Prof. R D Deshpande, Registrar, in his speech during the valedictory function, emphasized over the topics that were covered in the three days. Specifically, he highlighted how we observed a vibrant exchange of ideas and knowledge among the participants through this workshop. He extended sincere gratitude to esteemed speakers for sharing their expertise and experience through insightful presentations, discussions and Hands-on sessions. He also said that the collaboration is key to success in the present complex and dynamic technology world. Let us continue to learn, collaborate, share and grow together.

Around 45 Scientific/Technical faculties and research scholars of PRL and Universities/Colleges participated in the workshop on invitation basis. The list of the attendees is attached herewith as Annexure-II. The participants gained valuable insights into parallel programming, concepts of AI along with hands-on lab sessions. They also performed hands-on lab exercises on Param Vikram-1000 HPC to understand nitty-gritty of parallel programming. We observed that the workshop fulfilled its objective by providing a platform for networking and collaboration among the HPC experts, researchers, academia and students. The workshop was very well appreciated by all the participants.

The HPC Committee and CNIT team sincerely thank the Director, PRL, for his constant encouragement and motivation in organizing the workshop. We also thank the Registrar, PRL, and Dean, PRL for their guidance. We thank Prof. Varun Sheel, Prof. Namit Mahajan and Dr. Shanmugam for their support in all the workshop preparation.

From the bottom our hearts, we convey our gratitude to all the participants who enthusiastically participated, provided their valuable feedback and encouraged us to conduct similar events in future. We also thank all the PRL users for their cooperation and help during the workshop.

[B] Overall Learning in Nut-shell

1. Parallel Programming and Concepts of AI are closely interconnected and essential for HPC.
2. Before writing parallel code, it is very crucial to understand the problem, selection of programming language, data synchronization, optimization of memory usage, use of libraries, task load balancing, scalability etc.
3. Hands-on lab exercise experience is crucial for practical understanding of parallel programming and AI.
4. Integrating parallel programming and AI can lead to significant performance gains in various research applications.

Annexure-I
HPC Training Workshop Schedule

Day 1 : 1st July, 2024		
Session	Topic	Timings
	Registration	09:00 To 09:30
	Inauguration	09:30 To 10:00
	Prayer	2 minutes
	Opening Remarks by Prof. Bijaya Sahoo Chair, HPC Committee, PRL	5 minutes
	Inaugural Address by Prof. Anil Bhardwaj Director, PRL	5 minutes
	Address by Prof. D. Pallamraju Dean, PRL	5 minutes
	Address by Prof. Varun Sheel Chair, Computer Committee, PRL	5 minutes
	Vote of Thanks	3 minutes
	National Anthem	52 seconds
	Group Photo	5 Minutes
	High Tea	10:00 To 10:30
[A]	Overall Coordination/Session Moderation: Mr. Tejas Sarvaiya	
1	Processor Architecture Fundamentals – Understanding the processor architecture relevant to programming, CPU/GPU and other compute architecture.	10:30 To 11:30
	Tea break	11:30 To 11:45
2	Processor Architecture Fundamentals – Understanding the processor architecture relevant to programming, CPU/GPU and other compute architecture.	11:45 To 12:45
	Lunch break	12:45 To 13:45
3	Software Engineering – Essentials of Programming, Ideas of OS, Compilers, Loaders, Linkers etc.	13:45 To 14:45
	Tea Break	14:45 To 15:00
4	Software Engineering – Essentials of Programming, Ideas of OS, Compilers, Loaders, Linkers etc.	15:00 To 16:00
5	Parallel Programming Models – Data/Task Parallel Machines	16:00 to 17:00
6	About PRL and Param Vikram-1000 HPC	17:00 to 17:30

Day 2 : 2 nd July 2024		
[A]	Overall Coordination/Session Moderation: Mr. Vaibhav Rathore	
Session	Topic	Timings
7	Programming with OpenMP 1 – Introduction, Programming Concepts and Construct	09:30 To 10:30
	Tea break	10:30 To 10:45
8	OpenMP Lab	10:45 To 12:45
	Lunch Break	12:45 To 13:45
9	Programming with OpenMP 2 – Advance Ideas in OpenMP	13:45 To 14:45
	Tea break	14:45 To 15:00
10	OpenMP Lab 2	15:00 To 16:30
11	Programming with MPI 1	16:30 To 17:30

Day 3 : 3 rd July 2024		
[A]	Overall Coordination/Session Moderation: Mr. Hitendra Mishra	
Session	Topic	Timings
12	MPI Lab 1 – A simple program to illustrate the concepts	09:30 To 10:45
	Tea break	10:45 To 11:00
13	Programming with MPI 2 – Advanced Topics	11:00 to 12:00
14	Parallel Programming in Python	12:00 To 12:30
	Lunch Break	12:30 To 13:30
15	MPI Lab 2 – Writing a complete MPI program to scale over multiple nodes.	13:30 To 14:45
	Tea break	14:45 To 15:00
16	Fundamentals of AI and Working with AI	15:00 To 16:30
17	Valedictory Function	16:30 To 16:45
	Address by Prof. R D Deshpande, Registrar	5 Minutes
	Feedback from participants	5 Minutes
	Vote of Thanks by Mr. Alok Shrivastava	5 Minutes

Annexure-II**Three Days HPC Training Workshop Participants List****[A] External Participants [06]:**

Sr. No.	Name	Institute	Designation
1.	Dr. Tulsidas V. Nakrani	Sakalchand Patel College of Engineering	Associate Professor
2.	Mr. Mehul S. Patel	Sakalchand Patel College of Engineering	Assistant Professor
3.	Ms. Archana Magare	GSFC University	Assistant Professor
4.	Ms. Mosam Patel	GSFC University	Assistant Professor
5.	Mr. Gaurav D Tiwari	Silver Oak University	Student/Research Scholar
6.	Ms. Monali Suthar	Silver Oak University	Student/Research Scholar

[B] PRL Participants [36]:

Sr. No.	Name	Division Name	Designation
1.	Mr. Akash Ganguly	Geoscience	Sci./Engg.-SD
2.	Ms. Pratheeksha Nayak	Geoscience	Sci./Engg.-SD
3.	Mr. Shivansh Verma	Geoscience	Sci./Engg.-SC
4.	Dr. Shashi Prabhakar	AMOPH	Asst. Prof.
5.	Ms. Rachita Nandan	AMOPH	JRF
6.	Mr. Arup Chakraborty	AMOPH	SRF
7.	Mr. Vaibhav Katyal	AMOPH	JRF
8.	Mr. Dharmendra K. Kamat	SPASC	SRF
9.	Ms. Akanksha Arora	SPASC	SRF
10.	Ms. Harithasree	SPASC	SRF
11.	Mr. Abhishek Kumar	SPASC	Sci./Engg.-SC

Sr. No.	Name	Division Name	Designation
12.	Mr. Jacob Sebastian	SPASC	Sci./Engg.-SC
13.	Mr. Aniket Kumar	SPASC	Sci./Engg.-SC
14.	Mr. Goldy Ahuja	A & A	SRF
15.	Mr. Rajiv Ranjan Bharti	PSDN	Sci./Engg.-SE
16.	Mr. Tirth Jyoti Kalita	PSDN	Proj. JRF
17.	Mr. Trinesh Sana	PSDN	SRF
18.	Mr. Satyendra Mohan Sharma	PSDN	JRF
19.	Ms. Aanchal Sahu	PSDN	JRF
20.	Dr. Partha Konar	THEPH	Professor
21.	Mr. Sourav Pal	THEPH	PDF
22.	Mr. Anupam Ghosh	THEPH	PDF
23.	Mr. Suraj Rathore	CNIT	COT
24.	Mr. Adit Mehta	CNIT	COT
25.	Mr. Parthiv Parmar	CNIT	COT
26.	Mr. Yagnik Lakum	CNIT	Technician-G
27.	Mr. Tejas Sarvaiya	CNIT	Sci./Engg.-SF
28.	Mr. Vaibhav Rathore	CNIT	Sci./Engg.-SD
29.	Mr. Alok Shrivastava	CNIT	Sci./Engg.-SE
30.	Mr. Hitendra Mishra	CNIT	Sci./Engg.-SE
31.	Mr. Girish Padia	CNIT	Sci./Engg.-SD
32.	Mr. Prashant Jangid	CNIT	Sci./Engg.-SD
33.	Mr. Rahul Sharma	CNIT	Sci./Engg.-SD
34.	Mr. Atul Manke	CNIT	Sci./Engg.-SE
35.	Mr. Dinesh Mehta	CNIT	Sci./Engg.-SE
36.	Mr. Jigar Raval	CNIT	Sci./Engg.-SF