



Distributed Systems

Prof. Rajiv Misra

Computer Science and Engineering
IIT Patna

INTENDED AUDIENCE: Any Interested Learners.

PREREQUISITES:

- Minimum: Data Structures and Algorithms
- Ideal: Basic networking concepts, Basic OS concepts (e.g., processes, threads, synchronization, file systems, scheduling etc.), Advanced Programming (Good knowledge in C and C++).

INDUSTRY SUPPORT: Microsoft Research has conducted this course. Various companies like Google, IBM, Cisco, etc, Distributed systems Group and Distributed systems start-ups are working on this field.

COURSE OUTLINE :

A distributed system is a software system in which components located on networked computers communicate and coordinate their actions by passing messages. The components interact with each other in order to achieve a common goal. Distributed applications (distributed apps) are applications or software that runs on multiple computers within a network at the same time and can be stored on servers or with cloud computing. This course provides an in-depth understanding of fundamental principles and models underlying the theory, algorithms, and systems aspects of distributed computing. Few Emerging topics such as Peer-to-Peer computing, Distributed Hash Table, Google File System, HDFS, Spark, Sensor Networks and Security in Distributed Systems will also be covered for significant impact. Upon completing this course, students will have intimate knowledge about how things work in a distributed environment.

ABOUT INSTRUCTOR :

Prof. Rajiv Misra is working in Department of Computer Science and Engineering at Indian Institute of Technology Patna, India. He obtained his Ph.D degree from IIT Kharagpur, M.Tech degree in Computer Science and Engineering from the Indian Institute of Technology (IIT) Bombay, and Bachelor's of engineering degree in Computer Science from MNIT Allahabad. His research interests spanned a design of distributed algorithms for Mobile, Adhoc and Sensor Networks, Cloud Computing and Wireless Networks. He has contributed significantly to these areas and published more than 70 papers in high quality journals and conferences, and 2 book chapters. His h-index is 10 with more than 590 citations. He has authored papers in IEEE Transactions on Mobile Computing, IEEE Transaction on Parallel and Distributed Systems, IEEE Systems Journal, Adhoc Networks, Computer Network, Journal of Parallel and Distributed Computing. He has edited a book titled as "Smart Techniques for a Smarter Planet: Towards Smarter Algorithms" for the "Studies in Fuzziness and Soft Computing" book series, Springer (2018). He has supervised four Phd students and currently four Phd students working under his supervision in the area of big data, cloud computing, distributed computing, and sensor networks. He is a senior member of the IEEE and fellow of IETE. He has completed as the Principal Investigator of R&D Project Sponsored by DeITY entitled as "Vehicular Sensor and Mesh Networks based Future ITS". He has mentored the online courses on Cloud Computing, Advanced Graph Theory and Distributed Systems in the platform of NPTEL.

COURSE PLAN :

Week 1: Introduction to DS, Message Passing, Leader Election, Distributed Models, Causality and Logical Time

Week 2: Logical Time, Global State & Snapshot and Distributed Mutual Exclusion-Non-Token and Quorum based approaches

Week 3: Distributed Mutual Exclusion-Token based approaches, Consensus & Agreement, Check pointing & Rollback Recovery

Week 4: Deadlock Detection, DSM and Distributed MST

Week 5: Termination Detection, Message Ordering & Group Communication, Fault Tolerance and Self-Stabilization

Week 6: Distributed Randomized Algorithms, DHT and P2P Computing

Week 7: Case Studies: GFS, HDFS, Map Reduce and Spark

Week 8: Case Studies: Sensor Networks, Authentication & Security in DS