ADVANCED DISTRIBUTED SYSTEMS

PRE-REQUISITES: Data structures (2nd year level), Operating Systems

INTENDED AUDIENCE: UG and PG students (Computer Science and Electrical Engineering)

INDUSTRY SUPPORT: IBM, Amazon, Google, Microsoft

COURSE OUTLINE:

This course is on Advanced Distributed Systems. It will start with epidemic and gossip based algorithms and then move on to peer-to-peer networks. The core focus in this part will be on distributed hash tables (DHTs). Then, the course will focus on theoretical aspects such as vector clocks, distributed leader election, the FLP result, and the CAP theorem. The last part of the course will focus on practical technologies such as the Paxos and RAFT consensus protocols, commit protocols, Bitcoin and blockchains, distributed file systems, and distributed programming languages.

ABOUT INSTRUCTOR:

Prof. Smruti R. Sarangi is the Usha Hasteer Chair Associate Professor in the Department of Computer Science and Engineering, IIT Delhi. He has a joint appointment in the department of Electrical Engineering, the school of IT, and the Bharti school of Telecom Technology. He has published roughly 100 papers in the areas of computer architecture, VLSI design, and software technologies in prestigious conferences and journals. Prior to his joining IIT Delhi, he has worked in IBM Research Labs, and Synopsys Research Labs. He has obtained an MS and Ph.D from the University of Illinois at Urbana-Champaign, and a B.Tech from IIT Kharagpur. He is a member of the IEEE and ACM. Prof. Sarangi takes a keen interest in teaching. He has written two popular textbooks in computer architecture: Computer Organisation and Architecture (McGrawHill, 2015), and Advanced Computer Architecture (McGrawHill, 2021).

COURSE PLAN:

Week 1: Epidemic and gossip based algorithms
Week 2: Napster and Gnutella
Week 3: DHTs: Chord, Pastry and BitTorrent
Week 4: Logical clocks, Mutual Exclusion Algorithms
Week 5: Distributed Leader Election
Week 6: Distributed minimum spanning tree, the FLP result
Week 7: Consistency models and the CAP theorem
Week 8: Paxos and Raft
Week 9: Byzantine General’s Problem, Virtual synchrony
Week 10: Bitcoin and Blockchains
Week 11: Amazon Dynamo, Facebook Cassandra, Google Percolator
Week 12: Voldemort (LinkedIn), Condor, and Microsoft DryadLINQ