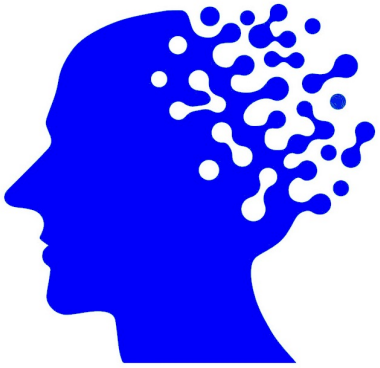

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Distributed Computing
- Course Introduction

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> Heartiest Welcome to ALL

- Welcome to the
  Distributed Computing course

IIITS Welcomes YOU ALL

> Distributed Computing?

- How will you design a distributed algorithm?

- Implement solutions using discrete events / MPI

> About Distributed Computing

- This course covers
  - Essential aspects that every serious programmer needs to know about
    - **Distributed algorithms**
    - **Design principles and their analysis**,

  with emphasis on

    - **Real-time implementations** and
    - **Scalable applications development**

> Scalability vs Efficiency

- How do you find the correct solution?

- Whether do Your Solutions solve the given problem?
- How will you improve you solution so that you can show a better performance?

What do we learn?

Distributed Computing (DC)

- ➔ Core Theoretical Concepts
- ➔ Design Principles of DC
- ➔ Discrete Events Simulations
- ➔ Experimental Evaluations
- ➔ Designing Efficient Solution(s) ??
  - ➔ To Solve Some Interesting Problems !!

➔ An Overview of Distributed Computing

➔ ➔ Simple to advanced?

An Overview

Basic Problem-Solving:

- What are the constraints in solving a specific problem?
- How to do problem-solving in a sequential machine?
- How do we parallelize the solution?
- How to make the systems to co-ordinate to solve the specific problems given the specific constraints?

Distributed Computing

➔ A Study of Distributed Systems

What is a Distributed System?

➔ A model in which components communicate among themselves by passing messages and coordinate (regulated by interaction or interdependence) to accomplish a specific task / problem given to them

➔ Is it different from parallel processing?

Parallel vs Distributed

- Parallel System?
  - Having n processors with a common shared memory
- Distributed System?
  - Having n processors but NO common shared memory

More Formally …

A Distributed System:

- A collection of independent systems that appears to its users as a single coherent system
- A system in which hardware and software components of networked computers communicate and coordinate their activity only by passing messages
- A computing platform built with many computers that:
  - Operate concurrently
  - Are physically distributed (have their own failure modes)
  - Are linked by a network
  - Have independent clocks

Characteristics

- Concurrent execution of processes:
  - Non-determinism, Race Conditions, Synchronization, Deadlocks, and so on
- No global clock
  - Coordination is done by message exchange
  - No Single Global notion of the correct time
- No global state
  - No Process has a knowledge of the current global state of the system
- Units may fail independently
  - Network Faults may isolate computers that are still running
  - System Failures may not be immediately known

Need of Distributed Systems

Why do we need distributed systems?

- People are distributed but need to work together
- Hardware needs to be physically close to people (who are distributed)
- Information is distributed but needs to be shared (trustworthily)
- Hardware can be shared (increases computing power by doing work in parallel; more efficient resource utilization)

Examples of DS

- Intranets, Internet, World Wide Web
- Distributed / Supercomputers
- Grid / Cloud computing – AWS-EC2
- Electronic banking
- Airline Reservation Systems
- Railway Reservation Systems
- Peer-to-peer networks
- Sensor networks – IBM systems
- Web Searching / Web Crawling

. . . and so on

Course Content

- Course is divided into several modules:
- Covers Basics to Advanced Components
  - At least one example problem with detailed analysis in each topic
- Course is supposed to be an interactive course
- Class performance bonus would be given to students who solve a set of problems efficiently

➔ Course Content follows …

Course Content - Topics

- Introduction
- A Model of Distributed Computations
- Logical Time
- Global State/Snapshot Recording Algorithms
- Topology Abstraction and Overlays
- Message Ordering and Group Communication
- Termination Detection
- Distributed Mutual Exclusion Algorithms

Course Content – Topics (contd…)

- Deadlock Detection in Distributed Systems
- Distributed Shared Memory
- Check Pointing and Rollback Recovery
- Consensus and Agreement Algorithms
- Self-Stabilization Algorithms
- Authentication in Distributed Systems
- Peer-to-Peer Computing and Overlay Graphs

and Practice Problems …

Case Studies

- Discrete Event Simulations
  - Distributed Sorting on a Line Network
  - Distributed Sorting on Various Interconnection Networks
- Map Reduce and Big Data
  - How to process a huge volume of data
  - Specific focus would be on scalable data processing especially in text format

- Authentication & Security in DS
  - We will focus more on Decentralized Application development

Examinations

- Mid 1 Semester : 15 Marks
- Mid 2 Semester : 15 Marks
- End Semester : 20 Marks

- Practice Components: 35 Marks
  2 Assignments (20) + One Mini Project (15)

- Total Weightage (100) = Exams (50)
  + Practice Components (35) + Quiz (10)
  + Class Performance (5)

- Academic Code of Conduct
  - Explore PENALTIES

Subject to the Approval of The Class Committee

Assignments

- Two Assignments
- Must be solved by individuals & must be finished before the deadline specified
- All Assignments are COMPULSARY

- Total Weightage: 20%

- Solutions would be cross checked !!
- Solutions submitted after the deadline will not be considered for evaluation
- Submission Procedure would be given.

Mini Projects

- Mini Project spans over 4 weeks
- Must be solved by individuals & must be finished before the deadline specified

- Mini Project is COMPULSARY
- Total Weightage: 15%

- Solutions would be cross checked !!

- Solutions submitted after the deadline will not be considered for evaluation
- Submission Procedure would be given.

Scheduled Quizzes

- There would be at least two Scheduled Quizzes:
  - One before Mid Semester
  - One before End Semester
- Must be answered by individuals
- These quizzes will be conducted online until the physical classes resumes in the campus

- These quizzes are COMPULSARY
- Total Weightage: 10%;
- Date would be announced in prior and responses submitted after the deadline will not be considered for evaluation

Innovative Solutions

- There would be multiple chances:
  - A few would be held before MID Semester
  - A Few would be held after MID Semester
- Must be answered by individuals
- These challenges will be given in the classroom
- Total Weightage: 5%
- Dates WILL NOT BE announced in prior
- Responses submitted after the deadline will not be considered for evaluation

Penalties

- Every Student is expected to strictly follow a fair Academic Code of Conduct to avoid penalties

- Penalties is heavy for those who involve in:
  - Copy and Pasting the code
  - Plagiarism (copied from your neighbor or friend – in this case, both will get "0" marks for that specific take home assignments)
  - If the candidate is unable to explain his own solution, it would be considered as a "copied case"!!
  - Any other unfair means of completing the assignments

Assistance

- You may post your questions to me at any time
- You may meet me in person on available time or with an appointment
- You may ask for one-to-one meeting

Best Approach

- You may leave me an email any time
  (email is the best way to reach me faster)

Questions
It's Your Time

Contact Information

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