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| Parallel Computing | |
| **SOURCE: 01** | **Parallel and Distributed Computing** | |
| 01 | [Introduction to Parallel and Distributed Systems and Why We Use It](https://www.youtube.com/watch?v=FuUd5LrWWkE&list=PLmfNYFrBr4j_fx8DkL-IY6SrFNTZxaA1l&index=1&pp=iAQB) | |
| 02 | Why Not to Use Parallel and Distributed Computing | |
| 03 | Speed Up Scalability and Amdhal’s Law Part-1 | |
| 04 | Hardware Architecture | |
| 05 | Networks of Workstations (NOW) and Distributed Memory | |
| 06 | Computer Clusters | |
| 07 | Software Architecture and Threads | |
| 08 | Processes and Message Passing Programming Paradigm | |
| 09 | Distributed Shared Memory (DSM) | |
| 10 | Research and Project Topics – Parallel and Distributed Computing | |
| 11 | Parallel Algorithms | |
| 12 | Concurrency and Synchronization in Parallel Computing | |
| 13 | Data and Work Partitioning | |
| 14 | Parallelization Strategies and Granularity Part-1 | |
| 15 | Parallelization Strategies and Granularity Part-2 | |
| 16 | Load Balancing | Characteristics of Tasks | Inter-Task Interaction | |
| 17 | Load Balancing | Static and Dynamic Load Balancing | |
| 18 | Shared Memory Programming | |
| 19 | Distributed Memory Programming | MPI and PVM | |
| 20 | Aurora Scoped Behavior and Abstract Data Type | Aurora Supercomputer | |
| **SOURCE: 01** | **Parallel and Distributed Computing** | |
| 21 | [Parallel and Distributed Computing – Introduction](https://www.youtube.com/watch?v=cbSoNeugIIw&list=PLmfNYFrBr4j86i8akA223SpKHUZzjKbdR&index=1&pp=iAQB) | |
| 22 | Horizontal Vertical Scalability | |
| 23 | Flynn’s Taxonomy (SISD, SIMD, MISD, MIMD) | |
| 24 | Multithreading, Super-Scalar Processors, Intel HT | |
| 25 | Shared Memory Architecture | |
| 26 | CPU to RAM Connection Strategies | |
| 27 | Distributed Memory Architecture | |
| 28 | Routing, Routing Table, Routing Mechanism | |
| 29 | Threads and Thread Models | |
| **SOURCE: 01** | **Parallel Computing and Distributed System** | |
| 30 | [Parallel Computing and Types of Architecture](https://www.youtube.com/watch?v=tWRL2VJL-FA&list=PL0s3O6GgLL5fbwQ8HBuK0Bh--GZzM8j1M&index=1&pp=iAQB) | |
| 31 | Flynn’s Classification or Taxonomy in Parallel Computing | |
| 32 | Pipelining Concept | |
| 33 | Synchronization in Process Distribution System Explained | Distributed System and Computing | |
| 34 | Lamport’s Logical Clock Algorithm Explained | Distributed System and Computing | |
| 35 | Bully and Ring Election Algorithm Explained | Distributed System and Computing | |
| 36 | Remote Procedure Call Explained | Distributed System and Computing | |
| 37 | Transparency in Distributed System | Distributed System and Computing | |
| 38 | Load Balancing Algorithm and Design | Distributed System and Computing | |
| **SOURCE: 01** | **Parallel Processing and Computing – Advanced Computer Architecture** | |
| 39 | [Parallel Processing and Computing | Introduction Part-1](https://www.youtube.com/watch?v=A37uXAK__LE&list=PL3R9-um41Jsz4as9nqgVB6YRR90rs0wE6&index=1&pp=iAQB) | |
| 40 | Parallel Processing and Computing | Introduction Part-2 | VonNeumann Architecture | |
| 41 | Parallel Processing in Uniprocessor System | Parallel Processing Mechanism | |
| 42 | Flynn’s Classification | SISD, SIMD, MISD, MIMD | |
| 43 | Feng’s Classification and Hardler’s Classification | |
| 44 | Amdahl’s Law in Parallel Processing | Speed Up Performance Law | |
|  | Principles of Scalable Performance | Performance Metrics | |
|  | Parallel Processing in Memory | Shared Memory | Distributed Memory | |
|  | Moore’s Law | |
|  | Parallel Algorithms | Parallel Algorithm Complexity | |
|  | System Attributes to Performance | CPU Performance Evaluation | |
|  | Numerical on System Attribute to Performance | Find CPI-MIPS-Execution Time | |
|  | Parallel Programming Models | |
|  | Cache Coherence | Cache Coherence Protocols | |
|  | Cache Coherence Protocols | Snoopy Bus Protocol | |
|  | Directory Based Protocol | Cache Coherence Protocols | |
|  | Conditions of Parallelism | Data, Control and Resource Dependence | |
|  | Numerical on Data Dependency and Resource Dependency Part-1 | |
|  | Numerical on Data Dependency and Resource Dependency Part-2 | |
|  | Bernstein’s Conditions of Parallelism | Conditions of Parallelism Part-2 | |
|  | Numerical on Detection of Parallelism Using Bernstein’s Condition | |
|  | Program Flow Mechanisms | Control Flow, Data Flow, Demand Driver | |
|  | Pipelining Concept | Example | Space Time Diagram | |
|  | Linear Pipeline Processor | Asynchronous and Synchronous | Pipeline vs Non-Pipeline | |
|  | Numerical on Pipelining and Performance Part-1 | |
|  | Numerical on Linear Pipelining Part-2 | |
|  | Numerical on Linear Pipelining Part-3 | |
|  | Non-Linear Pipeline Processor | Linear vs Non-Linear Pipeline | |
|  | Classification of Pipeline Processors | |
|  | General Pipeline and Reservation Table | Latency Analysis and Conflict-Free Schedule | |
|  | Numerical 1 on Reservation Table | Find Forbidden Latency, Collision Vector, Greedy Cycle, MAL | |
|  | Numerical 2 on Reservation Table | Find Forbidden Latency, Collision Vector, Greedy Cycle, MAL | |
|  | Numerical 3 on Reservation Table | Find Forbidden Latency, Collision Vector, Greedy Cycle, MAL | |
|  | Numerical 4 on Reservation Table | Find Forbidden Latency, Collision Vector, Greedy Cycle, MAL | |
|  | Numerical 5 on Reservation Table | Find Forbidden Latency, Collision Vector, Greedy Cycle, MAL | |
|  | RISC and CISC in Computer Architecture | COA | CSA | |
|  | Control Unit in Computer Architecture | Control Unit Block Diagram and Types | |
|  | Hardwired Control Unit in Computer Architecture | Block Diagram | Working | COA | CSA | |

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| Parallel Computing | |
| **SOURCE: 01** | **Parallel Programming in OpenMP** | |
|  | [Introduction to Parallel Programming](https://www.youtube.com/watch?v=a8R784VtXBg&list=PLJ5C_6qdAvBFMAko9JTyDJDIt1W48Sxmg&index=1&pp=iAQB) | |
|  | Parallel Architectures and Programming Models | |
|  | Pipelining | |
|  | Super pipelining and VLIW | |
|  | Memory Latency | |
|  | Cache and Temporal Locality | |
|  | Cache, Memory Bandwidth and Spatial Locality | |
|  | Intuition for Shared and Distributed Memory Architectures | |
|  | Shared and Distributed Memory Architectures | |
|  | Interconnection Networks in Distributed Memory Architectures | |
|  | OpenMP: A Parallel Hello World Program | |
|  | Program with Single Thread | |
|  | Program Memory with Multiple Threads and Multi-Tasking | |
|  | Context Switching | |
|  | OpenMP: Basic Thread Functions | |
|  | OpenMP: About OpenMP | |
|  | Shared Memory Consistency Models and The Sequential Consistency Model | |
|  | Race Conditions | |
|  | OpenMP: Scoping Variables and Some Race Conditions | |
|  | OpenMP: Thread Private Variables and More Constructs | |
|  | Computing Sum: First Attempt at Parallelization | |
|  | Manual Distribution of Work and Critical Sections | |
|  | Distributing for Loops and Reduction | |
|  | Vector-Vector Operations (Dot Product) | |
|  | Matrix-Vector Operations (Matrix-Vector Multiply) | |
|  | Matrix-Matrix Operations (Matrix-Matrix Multiply) | |
|  | Introduction to Tasks | |
|  | Task Queues and Task Execution | |
|  | Accessing Variables in Tasks | |
|  | Completion of Tasks and Scoping Variables in Tasks | |
|  | Recursive Task Spawning and Pitfalls | |
|  | Understanding LU Factorization | |
|  | Parallel LU Factorization | |
|  | Locks | |
|  | Advanced Task Handling | |
|  | Matrix Multiplication Using Tasks | |
|  | The OpenMP Shared Memory Consistency Model | |
|  | Introduction to Parallel Programming | |
|  | OpenMP and MPI Course Intro | |
|  | Parallel Architectures and Programming Models | |
|  | Application Distributed Histogram Updation | |
|  | Application Deep Learning | |
|  | Applications Finite Element Method | |
|  | Discussion on PMI Collectives Design | |
|  | Introduction to MPI and Basic Calls | |
|  | MPI Calls for Broadcasting Data | |
|  | MPI Call Send and Receive Data | |
|  | MIP Collective and MPI Broadcast | |
|  | MPI Gathering and Scattering | |
|  | MPI Non-Blocking Calls | |
|  | MPI Reduction and Alltoall Collectives | |
|  | Alltoal on the Hypercube | |
|  | An Improved Algorithm for Altoall on The Hypercube Using E Cube Routing | |
|  | Broadcast and Reduce with Recursive Doubling | |
|  | Characterization of Interconnects | |
|  | D Dimensional Torus | |
|  | Discussion of Message Sizes in Analysis | |
|  | Hockeney Model | |
|  | Hypercube | |
|  | Linear Arrays 2D Mesh and Torus | |
|  | Lower Bounds | |
|  | Pipeline Based Algorithm for Allreduce | |
|  | Pipeline Based Algorithm for Broadcast | |
|  | Reduce Scatter and All Gather with Recursive Doubling | |
|  | Reduce Scatter and All reduce on The Hypercube | |
|  | Revisiting Reduce Scatter on 2D Mesh | |
|  | Scatter and Gather with Recursive Doubling | |
|  | Trees and Cliques | |
|  | Introduction to Parallel Graph Algorithms | |
|  | Prims Algorithm | |
|  | Performance considerations | |
|  | OpenMP Based Shared Memory Parallelization for MST | |
|  | MPI Based Distributed Memory Parallelization for MST | |
|  | Distributed Memory Settings and Data Distribution | |
|  | Distributed BFS Algorithm | |
|  | Breadth First Search BFS Using Matrix Algebra | |
|  | BFS Shared Memory Parallelization Using OpenMP | |
|  | Sequential Algorithm Adaption from Prims | |
|  | Parallelization Strategy for Prims Algorithm | |
|  | Dry Run with The Parallel Strategy | |
|  | Johnsons Algorithm with 1D Data Distribution | |
|  | Speedup Analysis on A Grid Graph | |
|  | Floyds Algorithm for All Pair Shortest Paths | |
|  | Floyds Algorithm with 2D Data Distribution | |
|  | Adaptation to Transitive Closures | |
|  | Parallelization Strategy for Connected Components | |
|  | Analysis for Parallel Connected Components | |