- Embedded system benefits: economy, efficiency, geographical separation, flexibility, reliability, scalability.
- Embedded system challenges:
- Definition for a computer system, in the process scale.
  - Minimal unit of an autonomous computer system, an instance of computer program execution.
  - Independent computational resource access.
  - Processes can communicate with other within the same machine, or across different machines (over a communication network).
- Thread may not have independent access to computational resources.
- Middleware provides transparency to hardware resources.
- Examples of distributed objects are: CORBA, DCOM, Java RMI.
- For messaging/event based communication, the explicitly timeout mechanism is required.
- Networks of Computers.
  - Network core: Interconnected global ISPs. Well connected topology. High bandwidth capacity.
  - Network edge. Local ISPs. Local networks in homes, institutes. And... mobile networks. Something about the last-mile congestion.
- Virtualization broadly refers to abstraction of resources in many aspects of computing. Concepts are: Hypervisor, Hardware virtualization, Software virtualization.
- Virtualization can reduce operation costs by consolidating services to fewer number of physical machines.
- Application of overlay networks are: robust networking, multicasting, and VoIP.
- Consistency ensures: Transparency among distributed processes and Correctness of data transactions spanning multiple databases.
- To guarantee consistency among distributed processes, it is necessary to provide mutual exclusion when accessing a critical section. For mutual exclusion, there are several types of algorithms, centralized, distributed, or token ring.
- Problems for these types of algorithms: centralized, coordinator crash; distributed, process crash; token ring, lost token and process crash.
- Life is hard but you have to get used to it. Victory or death, choose one.
- Transactions. We consider processes accessing multiple disparate databases. A transaction is an agreement between separate entities or objects, often involving the exchange of items of value.
- Properties of transactions: ACID. Atomic. Consistent. Isolated. Durable.
- Three-Phase Commit: add time-out into two-phase then we could abort prevent locking resource.
- Hiding failure from other processes using redundancy: time redundancy, physical redundancy and information redundancy.
- Recovery tries to correct errors due to faults. They could be divided into two types: backward and forward.
  - Backward: checkpointing, retransmit lost packages.
  - Forward: error=correction codes.
- Challenges for wireless communication: noise, shared communication medium, limited spectrum, mobility, energy efficiency.
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