

Engineering & Real-Time Applications

Dr Chen-Khong Tham

Dept of Electrical Engineering, NUS

Industry Requirements

- Short product cycles 짧은 Fast time to market
- Fast response to changing consumer tastes and demand
- Customised solutions/products
- Designs are more complex, more features need to be incorporated
- Safety and environmental concerns

Examples of Engineering Design Areas

- In Electrical/Computer, Mechanical, Chemical and Civil Engineering disciplines
- Telecommunications: pagers, mobile phones, satellite
- Microelectronics
- Machinery: engines, gears, aircraft structures, manufacturing
- Chemical processes: petrochemical, oil refinery, pharmaceuticals
- Construction projects: bridges, buildings

Engineering Applications I

- Design
 - Collaborative design environments, visualization
 - Distributed design databases, e.g. materials, standards, methods
 - Interactive design verification and consistency checking: ISO, PSB, IEEE
- Distributed simulation and performance analysis
- Sharing resources, e.g. expensive instruments, supercomputers (+ telemanufacturing)

Engineering Applications II

- Real-Time Engineering applications (“real-time” = has deadline)
 - command and control, management, process control
 - periodic transfer of full state or vital statistics information, and control or decision in the other direction
 - e.g. defence, network management
 - real-time simulation and decision-making
 - areas: defence, telecommunications, medicine

Real-Time Applications

- Real-time distributed multimedia
- Real-time interactive environments
- Remote control and monitoring
 - Example: Telemicroscopy
- Distributed process control, management and logistics
 - Examples: chemical processes, airport traffic control, manufacturing, e.g. LTA Integrated Transport Management
- Real-time data distribution
 - Examples: satellite, remote sensing equipment, stock exchange
- Distributed real-time simulation and computation
- Requirements:
 - QoS guarantees from network, especially bounded delay and high bandwidth (mission critical !)
 - Real Time Systems (RTOS and hardware), e.g. VxWorks, pSOS
- Currently only done in LAN environment
- But next generation networks with QoS guarantees make this feasible on the WAN/Internet2

Required Networking Technologies

- Network with predictable QoS parameters
 - delay, jitter
 - bandwidth
 - cell loss
- Real-Time Protocol (RTP)
- (Real-Time) Multicast
- Advanced networking support in (real-time) operating systems

Network Engineering

- Multimedia: video and audio codecs, set-top box
- Network interface cards: Fast Ethernet, ATM; access: ADSL, cable modem
- Network equipment: ATM switches, routers, optical fiber transceivers, Internet Phone telephony Gateways (IPG)
- Computer hardware and operating systems, Real-Time Operating Systems
- Network devices, thin clients
- Mobile computing devices

Plans

- Promote and create awareness for networked engineering and real-time apps in Singapore
- Seek partners in other APAN countries
- (Difficulties with engineering design software - commercial developers, e.g. Mentor Graphics
Broader issue: *role of industry* (USA, Canada))
- Create testbed for real-time applications in LAN, S-ONE, and over long distance
- Form competency group to advise developers
- Demonstrate engineering & real-time applications