

Development of Client/Server Information Systems

- Mainframe & central MIS department
 - MIS does application development, systems analysis & programming, network support, etc.
- Mainframe & central MIS department, coexisting with departmental LANs
 - Who owns the information? MIS? Dept?
- Enterprise networks — client/server information systems
 - Mainframe as corporate super-server
 - Departmental servers
 - Client PCs access servers over enterprise network
 - MIS in consulting role, application development in departments, users have easy access to information on their own

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C/S IS Logical Architectures

- P-A-D architecture
 - Presentation — user interface
 - Application — processing
 - Data — data management
- Where is each done?
 - Totally on client
 - Cooperatively between client and server
 - Totally on server
- 3x3 matrix
 - Presentation with local GUI processing vs. server processing for dumb terminal
 - Application processing in various places
 - Data managed locally on client, vs. distributed data management or database, vs. remote data management

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Distributed Computing Support for C/S Information Systems

- Client (front end) — runs on PCs
 - Provides user interface
 - Formats requests for data or processing from the server
 - Formats data received from server for output to the user
- Server (back end) — runs on dedicated server hardware
 - Retrieves and stores data as requested
 - Performs computation and application processing
- Transparency — clients & servers share processing load w/o regard for OS or hardware or protocol differences
- Scalability — clients can be added with little or no effect on processing load

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Technology Behind C/S Information Systems

- SQL and object-oriented databases
 - SQL (Structured Query Language) provides interoperability among vendors, object-oriented databases and middleware using CORBA / DCOM standards are becoming popular
- TP monitors
 - Oversee database transactions, load-balance execution of transaction among multiple servers
- Groupware (more on next slide)
 - Uses fact that workers are networked to increase productivity
- Middleware
 - Provides interprocess communication (remote procedure calls or message passing)

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Groupware

- Groupware is software that allows people to work together electronically:
- Fundamental groupware technologies:
 - Electronic mail
 - Calendars and schedules
 - Workflow
 - Real-time and non-real-time conferencing
 - Electronic meetings
- 4 main vendors / products:
 - Lotus cc:Mail, Notes & Domino Server
 - Microsoft Internet Explorer, Outlook, NetMeeting, & Exchange Server
 - Netscape SuiteSpot & Communicator
 - Novel Groupwise

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Components of Groupware

- Electronic mail
 - Typical IT worker gets 20-50 emails per day, manager gets 2x or 3x that number
 - Environments
 - Mainframe-based email
 - Online service-based email (AOL, AT&T Mail, MCIMail) — messages go through Internet Server Provider
 - LAN-based email (Microsoft Mail or Outlook, Lotus cc:Mail) — messaging server handles messages
 - Internet-based email — LAN-based email plus gateway to translate into SMTP/IP, with support for attached documents
 - Messaging server
 - Retrieving, sorting, & delivering email
 - Storing messages
 - Directory services (keep address books)

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Components of Groupware (cont.)

- Calendars and schedules
 - Capabilities provided
 - Share calendars, schedule meetings with others, manage shared resources (e.g., conference rooms), organize to-do lists
 - Products
 - Workgroup products / personal information managers (Lotus Organizer, Palm Pilot) — calendar, to-do list, addresses, note pad
 - Departmental products — Microsoft Outlook — email, calendar, to-do list, contacts, tasks
 - Schedule meetings and assign tasks for hundreds of users
 - Enterprise products — Oracle InterOffice, Russell Calendar Manager — calendars & schedules, document management
 - Schedule meetings and resources across the Internet for thousands of users
- Workflow (not discussed here)

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Components of Groupware (cont.)

- Conferencing
 - Real-time
 - Data conferencing — use shared whiteboards for diagrams and shared screens for chatting
 - Group document editing — MS Word — different people use different colors, can track changes, etc.
 - Audio and video conferencing — Microsoft NetMeeting, White Pine CU-SeeMe — see and hear people at other sites
 - Non-real-time — share information, even if everyone is not working at same time
 - Electronic mail
 - Bulletin boards — post and retrieve messages and files
- Electronic meetings — Facilitator.com, Ventanta GroupSystems — extension of conferencing

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Client Hardware and Software

■ Hardware

- Personal Computer (PC) — x86 CPU, usually Intel or AMD
 - “Typical” home PC (1/23/01) — Gateway 1000 — 1000 MHz AMD Athlon CPU, 64 MB memory, 17” monitor, graphics accelerator, 20 GB hard drive, 20x/48x CDROM, Microsoft Windows ME, Microsoft Works = \$1299
- Apple Macintosh
- Sun or HP workstations
 - RISC CPUs, bigger cache, better floating-point performance, more \$\$

■ Software

- Windows 95, 98, ME (most common)
- Macintosh OS 8.x, OS 9.x, OSX
- Windows NT, 2000
- Linux

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Server Hardware

- Types of servers: application, file, database, print, communication, CDROM, fax, video, web

■ Hardware

- Multiple processors — 2-8 high-speed Intel Pentium III Xeon CPUs
- Large memory — at least 256 MB
- Redundant hot-swappable cooling fans and power supplies
- Internal disk drives
- DAT tape drive for backups
- Monitor, keyboard, mouse ports (for configuring server when necessary)
- External uninterruptible power supply (UPS) in case of power outage
- External disk system for application or database servers, 100s of GBs

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Server Hardware — Some Details

■ Backup

- DAT tapes (2, 8, 24 GB), 8mm tape (5 GB), etc.
- Local backup on client for small data (< 2 B), server backup for medium data (< 4 GB), multiple backup devices on server for large data (maybe a dedicated backup server)

■ UPS

- Provide enough backup power in the event of a power failure to allow a normal system shutdown (~ 5 minutes)

■ Storage alternative — Redundant Arrays of Inexpensive Disks (RAID)

- Mirroring, striping, mirroring + striping

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