DESIGNING DISTRIBUTED AND INTERNET SYSTEMS

System Analysis and Design

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Introduction

Designing Distributed and Internet Systems

Designing LAN and Client/Server Systems

Cloud Computing

Designing Internet Systems

Electronic Commerce Application

LEARNING OBJECTIVES

- ✓Distinguish between file server and client/server environments and contrast how each is used in a LAN.
- ✓Describe cloud computing and other current trends that help organizations address ID infrastructure-related challenges.
- ✓Describe standards shaping the design of Internet-based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security.

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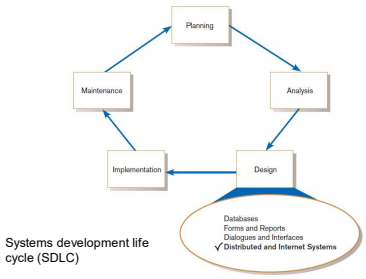
DESIGNING DISTRIBUTED AND INTERNET SYSTEMS



Systems development life cycle (SDLC)

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THE PROCESS OF DESIGNING DISTRIBUTED AND INTERNET SYSTEMS

This process is similar to designing single-location systems.

Due to multi-location deployment, numerous design issues must be considered.

There is more opportunity for failure due to number of components.

Main issues involve ensuring reliability, availability, survivability, performance.

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DELIVERABLES AND OUTCOME

Document that consolidates system design information:

- Description of each site
- Description of data usage for each site
- Description of business process for each site
- Contrasts of alternative IS architectures for site, data and processing needs of each site

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DESIGNING SYSTEMS FOR LOCAL AREA NETWORKS (LANS)

LAN: the cabling, hardware, and software used to connect workstations, computers, and file servers located in a confined geographical area

- Typically within one building or campus

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DESIGNING LAN AND CLIENT/SERVER SYSTEMS

LAN systems are either of these:

- LAN-based file server architecture.
- Client/server architecture.

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FILE SERVERS

File server: a device that manages file operations and is shared by each client PC attached to a LAN

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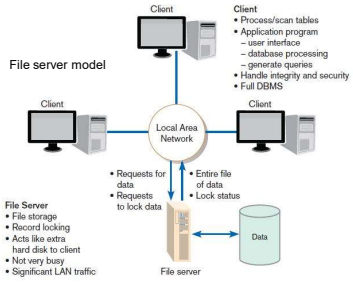

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LIMITATIONS OF FILE SERVERS

Excessive data movement
- Entire data table must be transferred, instead of individual records.

Need for powerful client workstations
- Each client workstation must devote memory to a full DBMS.

Decentralized data control
- Record concurrency control, recovery, and security are complicated.

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DESIGNING SYSTEMS FOR A CLIENT/SERVER ARCHITECTURE

Client/server architecture: a LAN-based computing environment in which central database server or engine performs all database commands sent to it from client workstations, and application programs on each client concentrate on user interface functions

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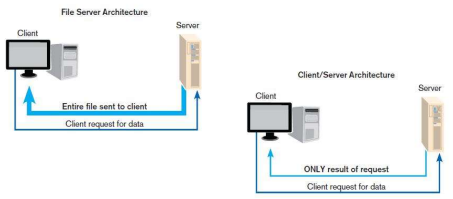
FILE SERVER VS. CLIENT/SERVER



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FILE SERVER VS. CLIENT/SERVER (CONT.)

TABLE 12-1 Several Differences between File Server and Client/Server Architectures

Characteristic	File Server	Client/Server
Processing	Client only	Both client and server
Concurrent Data Access	Low—managed by each client	High—managed by server
Network Usage	Large file and data transfers	Efficient data transfers
Database Security and Integrity	Low—managed by each client	High—managed by server
Software Maintenance	Low—software changes just on server	Mixed—some new parts must be delivered to each client
Hardware and System Software Flexibility	Client and server decoupled and can be mixed	Need for greater coordination between client and server

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DESIGNING SYSTEMS FOR A CLIENT/SERVER ARCHITECTURE

Application processing is divided between client and server.

Client manages the user interface.

Database server is responsible for data storage and query processing.

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DESIGNING SYSTEMS FOR A CLIENT/SERVER ARCHITECTURE (CONT.)

Database engine: the (back-end) portion of the client/server database system running on the server that provides database processing and shared access functions

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DESIGNING SYSTEMS FOR A CLIENT/SERVER ARCHITECTURE (CONT.)

Client: the (front-end) portion of the client/server database system that provides the user interface and data manipulation functions

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DESIGNING SYSTEMS FOR A CLIENT/SERVER ARCHITECTURE (CONT.)

Application program interface (**API**): software building blocks that are used to ensure that common system capabilities, such as user interfaces and printing, as well as modules are standardized to facilitate data exchange between clients and servers

- Common API interface can be used by any kind of DBMS (MySQL, Sybase, or Oracle)

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CLIENT/SERVER ADVANTAGES

Leverages benefits of microcomputer technology

Processing performed close to data source

- Improves response time
- Reduces network traffic

Facilitates use of GUIs

Encourages acceptance of open systems

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ADVANCED FORMS OF CLIENT/SERVER ARCHITECTURES

Applications are distributed between client and server in a variety of ways.

Components of an IS:

- **Data management:** functions that manage all interaction between software and files and databases (data retrieval/querying, updating, security, concurrency control, and recovery)
- **Data presentation:** functions the manage the interface between system users and the software (display and printing of forms and reports, validating system inputs)
- **Data analysis:** functions transform inputs into outputs, including simple summarization to complex mathematical modeling such as regression analysis

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ADVANCED FORMS OF CLIENT/SERVER ARCHITECTURES (CONT.)

Application server: a computing server where data analysis functions primarily reside.

Virtual machine: a software emulation of a physical computer system, both hardware and operating system, that allows more efficient sharing of physical hardware resources.

Virtualization: the act of creating virtual (rather than physical) versions of a variety of computing capabilities including hardware platforms, operating systems, storage devices, and networks.

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ADVANCED FORMS OF CLIENT/SERVER ARCHITECTURES (CONT.)

Three-tiered client/server: advanced client/server architectures in which there are three logical and distinct applications—data management, presentation, and analysis—that are combined to create a single information system.

Middleware: a combination of hardware, software, and communication technologies that bring data management, presentation, and analysis together into a three-tiered client/server environment.

Thin client: a client device designed so that most processing and data storage occur on the server.

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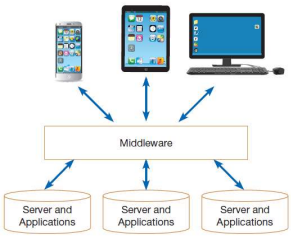
MIDDLEWARE ENVIRONMENTS



Middleware ties together diverse applications and devices

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ADVANCED FORMS OF CLIENT/SERVER ARCHITECTURES (CONT.)

Applications can be partitioned in a way that best fits the organizational computing need

Easier customization: application code resides on application server, so change done only in one place

Easier maintenance: data analysis is separate from user interface, so changing one can be done independently of the other

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CLOUD COMPUTING

Cloud computing: provision of applications over the Internet where customers do not have to invest in the hardware and software resources needed to run and maintain the applications, but are charged on a per-use basis.

Amazon Example: Amazon Web Services (AWS), Simple Storage Service (S3), Elastic Compute Cloud (EC2)

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CLOUD COMPUTING (CONT.)

Information systems infrastructure: The hardware, software, data, facilities, human resources, and services used by organizations to support their decision making, business processes, and competitive strategy.

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CLOUD COMPUTING (CONT.)

Utility computing: A form of on-demand computing where resources in terms of processing, data storage, or networking are rented on an as needed basis. The organization only pays for the services used.

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CLOUD CHARACTERISTICS

On-Demand Self Service
Rapid Elasticity
Broad Network Access
Resource Pooling
Measured Service

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SERVICE MODELS

Infrastructure as a Service (IaaS): provides basic processing, storage, and network capabilities

Platform as a Service (PaaS): customers run their own applications, using tools provided by the service provider.

Software as a Service (SaaS): applications are provided by the service provider

Services by SaaS, PaaS, and IaaS providers.

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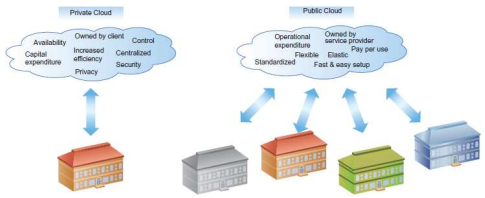
Public clouds versus private clouds.



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MANAGING THE CLOUD

Issues to consider when choosing service providers:

- **Availability/Reliability** – no cloud service is completely immune to errors, network outages, or hardware failures
- **Scalability** – this is the promise of the cloud, but there may be limits
- **Viability** – you want to make sure the service provider will last over time
- **Security, Privacy, and Compliance** – these are critical (e.g. Sarbanes-Oxley, HIPAA)
- **Diversity of Offerings** – which provider can offer services needed now and in the future?
- **Openness** – how interoperable is the service?
- **Cost** – how will cloud cost compare to internal, public vs. private?

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SERVICE-ORIENTED ARCHITECTURE

A **software** architecture

Business processes broken down into individual components (services)

Designed to achieve desired results for the service **consumer**
- Application
- Another service
- Person (user)

Principles:
- Reusability
- Interoperability
- Componentization

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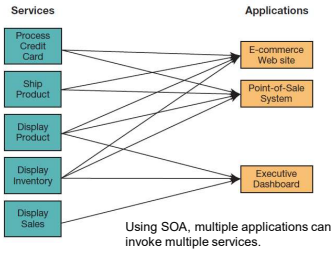

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WEB SERVICES

Web service: A method of communication between two electronic devices over a network.

eXtensible Markup Language (XML): An Internet authoring language that allows designers to create customized tags, enabling the definition, transmission, validation, and interpretation of data between applications.

JavaScript Object Notation (JSON): A lightweight data interchange approach that is relatively easy for humans to understand and for computers to generate or interpret.

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WEB SERVICES (CONT.)

- **Simple Object Access Protocol (SOAP):** A protocol for communicating XML data between web service applications and the operating system.
- **Representational State Transfer (REST):** A relatively simple and fast protocol for communicating JSON data between web service applications and the operating system.

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DESIGNING INTERNET SYSTEMS

Most new system development focuses on Internet-based applications (for internal processing, business-to-business, and business-to-consumer).

Main design issues: standards, separating content from display, future evolution, site consistency, site management and online data management

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STANDARDS DRIVE THE INTERNET

Internet design is simpler than client/server due to proliferation of standards.

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STANDARDS DRIVE THE INTERNET (CONT.)

Types of Standards:

- **Domain naming (BIND):** a method for translating domain names into Internet Protocol (IP) addresses
  - "B" refers to Berkeley, Ca. where first developed.
- **Hypertext Transfer Protocol (HTTP):** a communication protocol for exchanging information on the Internet
- **Hypertext Markup Language (HTML):** the standard language for representing content on the Web via command tags

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SITE CONSISTENCY

Professionalism requires a consistent look-and-feel across all pages of a Web site.

Cascading Style Sheets (CSSs): a set of style rules that tells a Web browser how to present a document

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SITE CONSISTENCY (CONT.)

eXtensible Style Language (XSL): a specification for separating style from content when generating HTML documents

- *Methods for transforming* XML documents into a generic comprehensive form
- *Methods for formatting* the generic comprehensive form into a device-specific form

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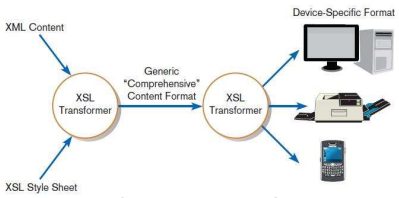

Combining XML data with XSL style sheet to format content

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OTHER SITE CONSISTENCY ISSUES

Two key issues should be considered:

- *Use unique titles.*
- *Choose words carefully.*

Major problem is users do not know where they are going when they follow a hyperlink.

- You should have link titles to explain hyperlinks.

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DESIGN ISSUES RELATED TO SITE MANAGEMENT

Customer Loyalty and Trustworthiness

- *Design quality*
- *Up-front disclosure*
- *Comprehensive, correct, and current content*
- *Connected to the rest of the Web*

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CUSTOMER LOYALTY AND TRUSTWORTHINESS

Personalization: providing Internet content to a user based upon knowledge of that customer

Customization: Internet sites that allow users to customize the content and look of the site based on their personal preferences

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WEB PAGES MUST LIVE FOREVER

Customer Bookmarks

Links from Other Sites

Search Engine Referrals

Old Content Adds Value

System Security vs. Ease of Use

- "Remember my password"
- Use of cookies

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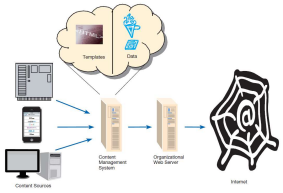
WEBSITE CONTENT MANAGEMENT

Content management system (**CMS**): a special type of software application for collecting, organizing, and publishing Web site content



A content management system allows content from multiple sources to be stored separately from its formatting to ease Website management

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ELECTRONIC COMMERCE APPLICATION: DESIGNING A DISTRIBUTED ADVERTISEMENT SERVER FOR PVF'S WEBSTORE

Benefits for including advertising:

- Potential to increase revenue generated from the WebStore
- Potential to create cross-promotions and alliances with other online commerce systems
- Potential to provide customers with improved service when looking for additional products that accessorize PVF's product line

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ADVERTISING ON PVF'S WEBSTORE

List of advertisement system concerns:

- Advertisement must be served quickly so that site performance is not affected.
- Advertisement must be uniform in size and resolution, so as not to disrupt the site layout.
- Advertisement links must not redirect the user's browser away from the WebStore.

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DESIGNING THE ADVERTISING COMPONENT

Transactional requirements are to

- Determine which advertisements apply, based on where the user is in the WebStore.
- Personalize the advertisement if the identity of user and preferences are known.
- Check for any seasonal or promotional advertisements.
- Log the transaction.

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DESIGNING THE MANAGEMENT REPORTING COMPONENT

Queries for top-management:

- "How many women, when shopping for desks, clicked on an advertisement for lamps?"
- "How many advertisements were served to shoppers looking at filing cabinets?"
- "How many people clicked on the first advertisement they saw?"
- "How many people clicked on an advertisement and then purchased something from the WebStore?"

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SUMMARY

In this chapter you learned how to:

✓Distinguish between file server and client/server environments and contrast how each is used in a LAN.

✓Describe cloud computing and other current trends that help organizations address ID infrastructure-related challenges.

✓Describe standards shaping the design of Internet-based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security.

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