Chapter 9

Developing Information Systems

“All I have to do is want to do it and I do it”

Jesse Sullivan (on how to move his computerized artificial arms responding to his brain waves)
Learning Objectives

1. Understand the process used by organizations to manage the development of information systems.

2. Describe each major phase of the systems development life cycle: systems identification, selection, and planning; system analysis; system design; system implementation; and system maintenance.

3. Describe prototyping, rapid application development, object-oriented analysis, and design methods of systems development, along with each approach's strengths and weaknesses.

4. Understand the factors involved in building a system in-house, along with situations in which it is not feasible.

5. Explain three alternative systems development options: external acquisition, outsourcing, and end-user development.
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Information Systems Development

- Systems analysis and design
  - Process of designing, building, and maintaining information systems
  - Systems analyst

- Early IS development
  - Very unstructured
  - Programmer skills varied
Information Systems Development

• 1990s
  o Evolution from IS development as “art” to IS development as “discipline”
    • Software engineering
  o Benefits
    • Easier to train systems analysts
    • Systems would be easier to maintain
Options for Obtaining Information Systems

- Option 1: Build Information System
- Option 2: Buy Prepackaged System
- Option 3: Outsource Development to Third Party
- Option 4: End-User Development
IS Development in Action

• Structured process moving through steps
  • Problem decomposition
    o Problems broken up into simpler, smaller pieces
The Role of Users in Systems Development Process

• Systems users are involved in all phases of system’s development process
• Mutually respectful relationship necessary
• Organizational members need to understand the development activities well
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Steps in the Systems Development Process

- Systems development life cycle (SDLC)
  - Arrows flowing down represent flow of information
  - Arrows flowing up represent the possibility of returning to a prior phase
Phase 1: Systems Identification, Selection and Planning

- System Identification
- System Selection
- System Planning

System Identification, Selection, and Planning

System Analysis

System Design

System Maintenance

System Implementation

Information Systems Today: Managing in the Digital World
Phase 1

- Identify and select potential projects
  - Projects critical to mission, goals, and objectives
  - Selection process varies among organizations
    - Formal information systems planning process
    - Ad hoc process
  - Differential focus of projects based on selection source

<table>
<thead>
<tr>
<th>Project Source</th>
<th>Primary Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management</td>
<td>Broad strategic focus</td>
</tr>
<tr>
<td>Steering committee</td>
<td>Cross-functional focus</td>
</tr>
<tr>
<td>Individual departments and business units</td>
<td>Narrow, tactical focus</td>
</tr>
<tr>
<td>Systems development group</td>
<td>Integration with existing information systems focus</td>
</tr>
</tbody>
</table>
Evaluation Criteria for Systems Projects

Different criteria may be used to evaluate projects

Usually multiple criteria examined for each project

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic alignment</td>
<td>The extent to which the project is viewed as helping the organization achieve its strategic objectives and long-term goals.</td>
</tr>
<tr>
<td>Potential benefits</td>
<td>The extent to which the project is viewed as improving profits, customer service, and so forth, and the duration of these benefits.</td>
</tr>
<tr>
<td>Potential costs and resource availability</td>
<td>The number and types of resources the project requires and their availability.</td>
</tr>
<tr>
<td>Project size/duration</td>
<td>The number of individuals and the length of time needed to complete the project.</td>
</tr>
<tr>
<td>Technical difficulty/risks</td>
<td>The level of technical difficulty involved in successfully completing the project within a given time and resource constraint.</td>
</tr>
</tbody>
</table>
Phase 2: Systems Analysis

- Designers gain understanding of current processes
Key Elements to Development of a System

1. **Requirements**

2. **Data**

<table>
<thead>
<tr>
<th>Name</th>
<th>Class</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patty Nicholls</td>
<td>Senior</td>
<td>3.7</td>
</tr>
<tr>
<td>Brett Williams</td>
<td>Grad</td>
<td>2.9</td>
</tr>
<tr>
<td>Mary Shide</td>
<td>Fresh</td>
<td>3.2</td>
</tr>
</tbody>
</table>

3. **Data Flows**

4. **Processing Logic**

```plaintext
i = read (number_of_classes)
total_hours = 0
total_grade = 0
total_gpa = 0
for j = 1 to i do
    begin
        read (course [j], hours [j], grade [j])
        total_hours = total_hours + hours [j]
        total_grade = total_grade + (hours [j] * grade [j])
    end
    current_gpa = total_grade / total_hours
```
Collecting System Requirements

• Arguably the most important activity
• Requirements collected from
  o Users
  o Managers
  o Business processes
  o Documents
• System requirements collection techniques
  o Interviews
  o Questionnaires
  o Observations
  o Document analysis
Critical Success Factors Methodology

- Critical success factor (CSF)
  - Something that must go well to ensure success
- Systems analyst interviews individuals to identify their CSFs
- Organization-wide CSFs are identified
## Critical Success Factors Methodology (II)

- **Strengths and weaknesses of the CSF approach**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior managers intuitively understand the approach and support its usage.</td>
<td>High-level focus can lead to an oversimplification of a complex situation.</td>
</tr>
<tr>
<td>Provides a method for understanding the information needs of the organization in order to make effective decisions.</td>
<td>Difficulty in finding analysts trained to perform the CSF process that requires both understanding information systems and being able to communicate effectively with senior executives. Method is not user centered but analyst focused.</td>
</tr>
</tbody>
</table>
Joint Application Design

- Special type of group meeting
- Reduced time for requirements collection
## Strengths and Weaknesses of the JAD Approach

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group-based process enables more people to be involved in the development effort without adversely slowing the process.</td>
<td>Very difficult to get all relevant users to the same place at the same time to hold a JAD meeting.</td>
</tr>
<tr>
<td>Group-based process can lead to higher levels of system acceptance and quality.</td>
<td>Requires high-level executive sponsor to ensure that adequate resources are available in order to allow widespread participation.</td>
</tr>
<tr>
<td>Group involvement in the design and development process helps to ease implementation, user training, and ongoing support.</td>
<td></td>
</tr>
</tbody>
</table>
Modeling Organizational Data

- Systems analysts need to understand what data will be collected
  - Data modeling tools
    - Entity-relationship diagram
Modeling Organizational Processes and Logic

- Data flows
  - Movement of data through an organization
Processing Logic

• The way in which data are transformed

```
Processing Logic

i = read (number_of_classes)
total_hours = 0
total_grade = 0
total_gpa = 0
for j = 1 to i do
    begin
        read (course [j], hours [j], grade [j])
        total_hours = total_hours + hours [j]
        total_grade = total_grade + (hours [j] * grade [j])
    end
    current_gpa = total_grade / total_hours
```
Phase 3: System Design

- Designing Forms and Reports
- Designing Interfaces and Dialogues
- Designing Databases and Files
- Designing Processing and Logic

System Identification, Selection, and Planning

System Analysis

System Design

System Implementation
Designing Forms

- Forms are business documents
  - Contain some data
  - Collect additional data
Designing Reports

- Reports are business documents that contain predefined data

<table>
<thead>
<tr>
<th>REGION</th>
<th>SALESPERSON</th>
<th>SSN</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
<th>FOURTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest and Mountain</td>
<td>Wachter</td>
<td>999-99-0001</td>
<td>16,500</td>
<td>18,600</td>
<td>24,300</td>
<td>18,000</td>
</tr>
<tr>
<td></td>
<td>Mennecke</td>
<td>999-99-0002</td>
<td>22,000</td>
<td>15,500</td>
<td>17,300</td>
<td>19,800</td>
</tr>
<tr>
<td></td>
<td>Wheeler</td>
<td>999-99-0003</td>
<td>19,000</td>
<td>12,500</td>
<td>22,000</td>
<td>28,000</td>
</tr>
<tr>
<td>Midwest and Mid-Atlantic</td>
<td>Spurrier</td>
<td>999-99-0004</td>
<td>14,000</td>
<td>16,000</td>
<td>19,000</td>
<td>21,000</td>
</tr>
<tr>
<td></td>
<td>Powell</td>
<td>999-99-0005</td>
<td>7,500</td>
<td>16,600</td>
<td>10,000</td>
<td>8,000</td>
</tr>
<tr>
<td></td>
<td>Topi</td>
<td>999-99-0006</td>
<td>12,000</td>
<td>19,800</td>
<td>17,000</td>
<td>19,000</td>
</tr>
<tr>
<td>New England</td>
<td>Speier</td>
<td>999-99-0007</td>
<td>18,000</td>
<td>18,000</td>
<td>20,000</td>
<td>27,000</td>
</tr>
<tr>
<td></td>
<td>Morris</td>
<td>999-99-0008</td>
<td>28,000</td>
<td>29,000</td>
<td>19,000</td>
<td>31,000</td>
</tr>
</tbody>
</table>
Designing Interfaces and Dialogues

- Users interact with IS through various interfaces
  - E.g., text-based, menu-driven
  - User interface standards
    - Mac and Windows operating systems
      - Graphical user interface (GUI)
Designing Databases and Files

- Data modeling tools used for gaining understanding
  - Conceptual model – ERD
  - Physical data model – more detailed
Designing Processing and Logic

• Steps and procedures that transform raw data inputs into new or modified information
  o Pseudocode
    • Textual notation for describing programming code
    • Similar to actual programming code
  o Structure charts
  o Decision trees
  o Actual program code

```
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i = read (number_of_classes)
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total_grade = 0
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        total_grade = total_grade + (hours[j] * grade[j])
    end
    current_gpa = total_grade / total_hours
```
Phase 4: System Implementation

• Transformation of design into a working information system
Software Programming and Testing

- **Programming**
  - Transforming the system design into a working computer system
  - Processing and testing should occur in parallel
- **Tests conducted before system completion**

<table>
<thead>
<tr>
<th>Testing Type</th>
<th>Focus</th>
<th>Performed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmental</td>
<td>Testing the correctness of individual modules and the integration of multiple modules</td>
<td>Programmer</td>
</tr>
<tr>
<td>Alpha</td>
<td>Testing of overall system to see whether it meets design requirements</td>
<td>Software tester</td>
</tr>
<tr>
<td>Beta</td>
<td>Testing of the capabilities of the system in the user environment with actual data</td>
<td>Actual system users</td>
</tr>
</tbody>
</table>
System Conversion

- Installation of the new system

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Parallel</td>
<td>Old and new systems are used at the same time.</td>
</tr>
<tr>
<td>(b) Direct</td>
<td>Old system is discontinued on one day, and the new is used on the next.</td>
</tr>
<tr>
<td>(c) Phased</td>
<td>Parts of the new system are implemented over time.</td>
</tr>
<tr>
<td>(d) Pilot (single location)</td>
<td>Entire system is used in one location.</td>
</tr>
</tbody>
</table>
Documentation

- Information system documentation
  - Details of the inner workings of the system
  - Written by programmers

- User-related documentation
  - Written by professional technical writers
  - User and reference guides
  - User training and tutorials
  - Installation procedures and troubleshooting suggestions
User Training and Support

- Self-paced training and tutorials the least expensive
- One-on-one training the most costly

<table>
<thead>
<tr>
<th>Training Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorial</td>
<td>One person taught at one time by a human or by paper-based exercises</td>
</tr>
<tr>
<td>Course</td>
<td>Several people taught at one time</td>
</tr>
<tr>
<td>Computer-aided instruction</td>
<td>One person taught at one time by the computer system</td>
</tr>
<tr>
<td>Interactive training manuals</td>
<td>Combination of tutorials and computer-aided instruction</td>
</tr>
<tr>
<td>Resident expert</td>
<td>Expert on call to assist users as needed</td>
</tr>
<tr>
<td>Software help components</td>
<td>Built-in system components designed to train users and troubleshoot problems</td>
</tr>
<tr>
<td>External sources</td>
<td>Vendors and training providers to provide tutorials, courses, and other training activities</td>
</tr>
</tbody>
</table>

- Ongoing education may be necessary
System Maintenance

- Typically starts after software is installed
- The largest part of system development effort occurs at this stage
Types of Software Maintenance

- Corrective maintenance given higher priority
- Corrective maintenance most likely to occur after initial system installation

<table>
<thead>
<tr>
<th>Maintenance Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrective maintenance</td>
<td>Making changes to an information system to repair flaws in the design, coding, or implementation</td>
</tr>
<tr>
<td>Adaptive maintenance</td>
<td>Making changes to an information system to evolve its functionality to accommodate changing business needs or to migrate it to a different operating environment</td>
</tr>
<tr>
<td>Perfective maintenance</td>
<td>Making enhancements to improve processing performance or interface usability or adding desired but not necessarily required system features (in other words, “bells and whistles”)</td>
</tr>
<tr>
<td>Preventive maintenance</td>
<td>Making changes to a system to reduce the chance of future system failure</td>
</tr>
</tbody>
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Prototyping

• Used for development of less structured information systems
  - Hard to specify
  - Constantly changing
• Trial-and-error approach
Rapid Application Development

• Four-phase system development methodology
  o Requirements planning
  o User design
  o Construction
  o Move to the new system
• RAD becomes radical in phase 2; intensive user involvement
• System builders cycle between phases 2 and 3 until system is built
Object-Oriented Analysis and Design

• OOA&D approach done in terms of common modules (objects).

  Combines:
  o the “what” (data) with
  o the “how” (operations to be performed)

• Different methods used to better integrate various aspects of the system

• Preexisting objects can be used or adapted
Example: OOA&D Tools
## Strengths and Weaknesses of Prototyping, RAD and OOA&D

- Approaches try to overcome the limitations of a traditional SDLC

<table>
<thead>
<tr>
<th>Approach</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prototyping</td>
<td>Develops close working relationship between designer and users; works well for messy and hard-to-define problems</td>
<td>Not practical with a large number of users; system may be built too quickly, which could result in lower quality</td>
</tr>
<tr>
<td>Rapid Application Development</td>
<td>Active user involvement in design process; easier implementation due to user involvement</td>
<td>Systems are often narrowly focused—limits future evolution; system may be built too quickly, which could result in lower quality</td>
</tr>
<tr>
<td>Object-Oriented Analysis and Design</td>
<td>Integration of data and processing during design should lead to higher-quality systems; reuse of common modules makes development and maintenance easier</td>
<td>More difficult to train analysts and programmers on the object-oriented approach; unnecessary re-creation of common objects across different systems</td>
</tr>
</tbody>
</table>
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Need for Alternatives to Building Systems Yourself

Building systems in-house is always an option, unless you are faced with:

- Situation 1: limited IS staff
  - Staff may be too small
  - Staff may be occupied in other ways
  - Staff not capable of developing the system without additional hiring

- Situation 2: IS staff has limited skill set
  - Many organizations have outside groups manage their Web sites
    - Take advantage of specialized skills
Situations When In-House Systems Development Does Not Work

- **Situation 3: IS staff is overworked**
  - Staff does not have time to work on all required systems

- **Situation 4: problems with performance of IS staff**
  - Derailed IS departments
    - Staff turnover
    - Changing requirements
    - Shifts in technology
    - Budget constraints
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1. External Acquisition

- Purchasing an existing system is similar to the process of deciding which car best meets your needs.
Steps in External Acquisition

- Competitive bid process (find the best system for lowest possible price)
  1. System identification, selection and planning
  2. Systems analysis
  3. Development of a request for proposal
  4. Proposal evaluation
  5. Vendor selection
Development of a Request for Proposal

- A report detailing system requirements sent to prospective vendors

Areas covered in an RFP:

1. Summary of existing systems and applications
2. Reliability, backup, and service requirements
3. System performance and features
4. Evaluation criteria
5. Timetable
6. Budget
Proposal Evaluation

- An assessment of proposals received from vendors
  - May include system demonstrations
  - System benchmarking
    - Standardized tests to compare different proposed systems
    - Common system benchmarks
      - Response time given a specified number of users
      - Time to sort records
      - Time to retrieve a set of records
      - Time to produce a given record
      - Time to read in a set of data
## Commonly Used Evaluation Criteria

<table>
<thead>
<tr>
<th>Hardware Criteria</th>
<th>Software Criteria</th>
<th>Other Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock speed of CPU</td>
<td>Memory requirements</td>
<td>Installation</td>
</tr>
<tr>
<td>Memory availability</td>
<td>Help features</td>
<td>Testing</td>
</tr>
<tr>
<td>Secondary storage (including capacity, access time, and so on)</td>
<td>Usability</td>
<td>Price</td>
</tr>
<tr>
<td>Video display size</td>
<td>Learnability</td>
<td></td>
</tr>
<tr>
<td>Printer speed</td>
<td>Number of features supported</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training and documentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintenance and repair</td>
<td></td>
</tr>
</tbody>
</table>
Vendor Selection

- Usually more than one system will meet the criteria
- Need to prioritize/rank the proposed systems
  - Best ranking system is chosen

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Max Points (or weight)</th>
<th>Systems Being Evaluated (Score)</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk capacity</td>
<td>20</td>
<td></td>
<td>10</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Compatibility</td>
<td>50</td>
<td></td>
<td>45</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Usability</td>
<td>30</td>
<td></td>
<td>12</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Vendor Support</td>
<td>35</td>
<td></td>
<td>27</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Benchmark Results</td>
<td>50</td>
<td></td>
<td>40</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>185</td>
<td></td>
<td>134</td>
<td>121</td>
<td>92</td>
</tr>
</tbody>
</table>
2. Outsourcing

• Turning over responsibility for some or all of an organization’s IS development and operations to an outside firm

  o Your IS solutions may be housed in their organization
  o Your applications may be run on their computers
  o They may develop systems to run on your existing computers (within your organization)
Why Outsourcing? (I)

- **Cost and quality concerns** – higher quality or lower cost systems may be available through outsourcing.

- **Problems in IS performance** – IS departments might have problems meeting acceptable standards.

- **Supplier pressure** – aggressive sales force convinces senior management to outsource IS functions.

- **Simplifying, downsizing and reengineering** – focusing on core competencies.
Why Outsourcing? (II)

- **Financial factors** – liquidation of IT assets
- **Organizational culture** – external IS groups devoid of political ties
- **Internal irritants** – external IS group may be better accepted by other organizational users
Managing the IS Outsourcing Relationship

• Ongoing management of an outsourcing alliance needed
  1. Strong, active CIO and staff
  2. Clear, realistic performance measurements of the system
  3. Multiple levels of interface between customer and outsourcer

• Full-time relationship managers should be assigned
Not All Outsourcing Relationships Are the Same

- Outsourcing relationships
  - No longer just a legal contract
  - Different types of outsourcing relationships
    - Basic relationship – “Cash & Carry”
    - Preferred relationship – Set preferential pricing
    - Strategic relationship – Share risks/rewards
3. End-User Development

- Growing sophistication of users
- Actual future users of the system are the system’s developers
- Application development may be faster
  - No need to rely on external entities
Benefits of End-User Development

• Cost of labor
  - Cost can be reduced by just giving the required tools to the users to develop their own applications
Benefits of End-User Development (II)

• Development time
  - User needs may change between the request for proposals and implementation of system
    - System becomes obsolete before implementation
  - End-user development may “skip” the queue
    - Provide more timely systems
Benefits of End-User Development (III)

- Modifications and updates
  - End-user system development may be better at responding to changing needs
  - No need to wait for IS staff to make updates
Benefits of End-User Development (IV)

- Reduce work overload
  - Increase “development staff” by shifting work load to end users
Encouraging End-User Development

• Fourth-generation development (4GL) tools have made end-user development easier

• Categories of 4GLs
  1. Personal computer tools
     • E.g., spreadsheets, DBMS
  2. Query language/reporting generators
     • Improved searching
  3. Graphics generators
     • Extracting information and presenting it in graphical format
  4. Decision support or modeling tools
     • Support for analysis of more complex, multidimensional problems
  5. Application generators
     • Analysis specifications given in user-friendly language
End-User Development Pitfalls

• Users may not be aware of important standards
  o Need for adequate documentation
  o Built-in error checking
  o Testing

• Potential lack of continuity
End of Chapter Content
Opening Case: Online Gaming

• Today’s online gaming is more sophisticated with many different game genres

• Single player vs. multiplayer
  o Massive multiplayer games
    • MMOPRG, MMORTS
    • Computers connected via LANs or over the Internet

• Gaming industry very profitable
  o Game development – 1 to 3 years
  o Cost of development decreased by the use of international programmers

• Ban of explicit or violent content in some countries
Conquering Computer Contagion

- Blue Security
  - Israel-based Internet security company
  - Spam messages were returned to the advertiser
  - 6 of the top 10 spammers eliminated Blue Frog’s clients from mailing lists
  - PharmaMaster fought back
  - Blue Security was forced to fold the business
  - “White knights”

Top 10 viruses (April 2006)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Virus</th>
<th>Percent of Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>W32/NETSKY-P</td>
<td>18.5</td>
</tr>
<tr>
<td>2</td>
<td>W32/ZAFI-B</td>
<td>16.9</td>
</tr>
<tr>
<td>3</td>
<td>W32/NYXEM-D</td>
<td>8.5</td>
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<tr>
<td>4 (TIE)</td>
<td>W32/MYDOOM-AJ</td>
<td>3.9</td>
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<tr>
<td>5 (TIE)</td>
<td>W32/NETSKY-D</td>
<td>3.9</td>
</tr>
<tr>
<td>6</td>
<td>W32/MYTOB-FO</td>
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</tr>
<tr>
<td>7</td>
<td>W32/MYTOB-C</td>
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<td>8</td>
<td>W32/DOLEBOT-A</td>
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<td>9</td>
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<td>1.3</td>
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<tr>
<td></td>
<td>Others</td>
<td>35.8</td>
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</tbody>
</table>
Personalities of Broadband Users

- Netpop research findings for broadband-users’ personalities
  1. The content kings
     - Usually younger and interested in entertainment content
  2. The social clickers
     - Young or old, utilizing the Web for communication
  3. The online insiders
     - Producers and consumers of online user-created content
  4. The fast trackers
     - Seek news on politics, sports and other topics of interest
  5. The everyday pros
     - Use online tools to leverage everyday productivity
The Brain-Wave Interface

- Companies researching possible use of brain-wave navigation
- Honda
  - Hopes to link people’s thoughts with machines
- Medical field
  - Used for patients with amputations
  - Artificial limbs move based on thoughts
- Brain-wave typing
  - Combination of brain-waves, facial expressions and eye movements
  - Typing for people with disabilities
William (Bill) Henry Gates III, Chairman and Chief Software Architect, Microsoft Corporation

- Microsoft founded in 1974 by Bill Gates and Paul Allen
  - Both are multi-billionaires today
  - Gates has written two books
    - 1995 – The Road Ahead
    - 1999 – Business @ the Speed of Thought
  - Bill and his wife Melinda fund a foundation ($28.8 billion) dedicated to improving health and education around the world
  - Microsoft employs 71,000 workers
  - Microsoft’s revenues are more than $44 billion
  - Microsoft has subsidiaries in more than 100 countries
Hackers, Patches and Reverse Engineering

• Hackers
  o Break into computer systems to steal or manipulate data
  o Look for security holes
    • Study applications until they discover a hole
    • Follow other hackers’ guidelines
    • Reverse engineer patches

• Patches
  o Released by software producers
  o Plug security holes
Software Vendors and Clients

- Software consultants are often torn between two choices
  - Recommend the best software for a client?
  - Recommend the software made by a vendor who referred the client?
The “New” Web

- Companies that survived the dot-com failure have a few things in common – “Web 2.0”
  1. The Web is the business platform
     - The Web creates an advantage (Amazon.com – selling out-of-print books)
  2. The sites leverage all customers (small and large)
     - Giving an opportunity to small transactions (eBay)
  3. Increased use automatically improves the service
     - Taking advantage of users’ resources (peer-to-peer networks)
  4. The hyperlink feature is used to the fullest
     - Google revolutionized the search engine platform
  5. Lightweight programming
     - Use of open-source philosophy (Wikipedia)
The “New” Web (II)

- Web 2.0 – coined in 2001 to refer to the characteristics of successful online companies

- Some “older” technologies used by Web 2.0
  - Web services
  - Ajax
  - Web content syndication
    - RSS

<table>
<thead>
<tr>
<th>Web 1.0</th>
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<tbody>
<tr>
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<td>Flickr</td>
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<td>Upcoming.org and EVDB</td>
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<td>Screen scraping</td>
<td>Web services</td>
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<td>Participation</td>
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<td>Wikis</td>
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<tr>
<td>Directories (taxonomy)</td>
<td>Tagging (“folksonomy”)</td>
</tr>
<tr>
<td>Stickiness</td>
<td>Syndication</td>
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