ISM 50 - Business Information Systems

Lecture 9

Instructor: Mary Doyle and Geoff Ryder
UC Santa Cruz
April 27, 2009
Class announcements

- Folio Article 1 due today
- Assignment 3 due Wednesday

- Reading for next class
  - Messerschmitt Ch 5, Sun Case
  - Suggestion: Read Messerschmitt Ch5 first.

- Student Presentation Wednesday.
  - Alex Becker (Sun-N Tier Case)
Student Presentations

- Thomas Rowley (News)
- Theresa Mennell (News)
News Folio Presentation

ISM 50
Thomas Rowley
April 27, 2009
EXCLUSIVE: Best Western Pwned, new facts emerging
Thomas Rowley
27 August 2008
ITWire.com
Main Ideas

- Best Western customer information stolen via online booking system for a Berlin hotel.
- Best Western has management software that links all hotels to corporate.
- If someone higher up in Best Western had their login password breached as opposed to an employee at an individual hotel, what would the story look like?
Information Stolen

On August 21\textsuperscript{st}, a Best Western hotel in Berlin had their online booking system hacked into and robbed of customer information including credit card account numbers via login of a compromised employee password.

The original article was written by a reporter who individually discovered the hack and stated that the breach affected all European customers in the last year, totaling 8 million.

Statements released by Best Western confirm the breach was limited to Berlin and a total of 10 customers.
Management Software

Since 1997 Best Western has had all a modern hotel management software program linking all of their world-wide locations to corporate headquarters in Arizona.

“The hacker did not gain access to Best Western’s central database, where indeed millions of guest data are stored and processed, but to one individual hotels application.... Bookings can be made up to 50 weeks prior to arrival date and are logged by booking date. ” - Stated by BW employee.
Alternative Possibility

If all it takes is a single password to access consumer information, then Best Western the hacker only obtained the password of a low level employee.

With over 4000 hotels worldwide and with customer information stored for as long as a year if they book early, what sort of risk is Best Western, and companies that use similar software, exposing their clients to on a regular basis?
Summary of How Article Relates to ISM 50 Concepts

Information Systems are used to loosely link personal information of millions of individuals and over countless networks across the world.

The damage control arising from IT issues covered by the press can be very troublesome to businesses, especially when their investment in IT is in the order of millions.

Perhaps investment in safeguards for information systems are not a large enough and should be evaluated as having a higher share of IT investment cost.
Oracle Acquires SUN Microsystems

ISM 50
Theresa M. Mennell
4/27/2009
Main Ideas

- What is SUN?
- The Business of the deal
- The reality of the merger, and what it means for both companies
What is SUN?

- An Industry Developer
- Came up with Java, Jini, and utility computing
- Has had an unparalleled vision for identifying industry trends literally “before their time”.
- However SUN has been suffering for quite some time...
The Business of the Deal

Oracle purchased for $7.38 billion giving shareholders $9.50 per share.

Actual offer is about $5.6 billion.

SUN stock rose 37% on Monday to $9.15 per share.
What this means for both companies...

- MySQL users very nervous...

- Oracle is a software company that just acquired a hardware company.

- Overall Industry “vibe”


Midterm Review

- Midterm exam May 6th
- In-class review: 4/27, 4/29, 5/4
Tips for how to succeed on the midterm:

- Sit down in a quiet place and do all the assigned readings, jotting down words you don’t know to go back and review later.

- Attend lecture, to understand what parts of the material will be emphasized. Go to office hours if you need more help.

- Do the homework assignments (in particular H2), and look at any midterm review supplements we provide.
## Midterm exam covers:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Source</th>
<th>Pages</th>
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<tbody>
<tr>
<td>IT History</td>
<td>Reader, R. Nolan</td>
<td>pp. 3 - 33</td>
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<tr>
<td>Bus. I.S. Foundations</td>
<td>Reader, O’Brien I</td>
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<td>Competing with IT</td>
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<td>Sun Case</td>
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<tr>
<td>1 Royal Carribean</td>
<td>50</td>
<td>IT systems unproductive without leadership or business process co-design</td>
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<tr>
<td>2 Cisco Case</td>
<td>53</td>
<td>Virtual manufacturing/SCM exemplar; 70% gross margins</td>
</tr>
<tr>
<td>3 Clariant</td>
<td>68</td>
<td>IROR for an IT project can be 30% to 40%</td>
</tr>
<tr>
<td>4 Hershey</td>
<td>69</td>
<td>Due to complexity, IT projects can fail if rushed or not planned properly</td>
</tr>
<tr>
<td>5 Wesco</td>
<td>73</td>
<td>Example of an e-procurement ERP system that gave a huge ROI</td>
</tr>
<tr>
<td>6 Staples</td>
<td>81</td>
<td>“Clicks and bricks” ecommerce model, all coming together at the cash register</td>
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<tr>
<td>7 GE</td>
<td>87</td>
<td>Famous example of Total Quality Management (TQM)</td>
</tr>
<tr>
<td>8 Siemens AG</td>
<td>91</td>
<td>Knowledge management makes an agile company: Denmark - Malaysia teams</td>
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<tr>
<td>IT</td>
<td>SIS</td>
<td>SCM</td>
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<td>NPV</td>
<td>ROI</td>
<td>IROR</td>
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<td>ROR</td>
<td>B2B</td>
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<td>HHC</td>
<td>TPS</td>
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<td>SAP</td>
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<td>CIO</td>
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<tr>
<td>TQM</td>
<td>MIS</td>
<td>BPR</td>
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<td>POP (1)</td>
<td>POP (2)</td>
<td>ERP</td>
</tr>
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</table>
O'Brien (p. 39): framework for information systems knowledge needed by business professionals

- BPR decisions: streamline or reengineer
- Calculate NPV and make project decisions
- Productivity paradox, text p. 99
- Evaluation of Porter comp. model, strategy

- ERP types: text p. 79
- SIS
- TPS, MIS, DSS
- IT to enable Porter strategies
- IT to benefit Porter value chain

- HHC rollout, Frito Lay
- Company-wide ERP rollout, Cisco
- Struggling startup co., Alibris

- Business function vs. process; BPR
- Push vs. pull IT
- data vs. information; metadata
- Metcalfe's Law

Management Challenges

Information Systems

Specific Types of IT

Developmental Process

Foundational Concepts

Networked Application

- Middleware
- OS
- TCP/IP
- Ethernet

Business Applications
Review: elements of the Frito-Lay Case

- Many risks; first project of its kind
- Project rollout was complex
- Deployed in three “layers”

- Motivated sales force
- More time for sales force to sell salty snacks
- Reduced accounting errors
- Allowed factories to run at higher capacity = lower costs

- Two years developing back end
- Staged HHC rollout by region

- Data Center
- Minicomputers
- HHC

- HHC: example of push IT
- business process reengineered
Review: Frito-Lay corporate strategy

- Low-cost strategy
  - Innovation
  - Growth
  - Alliances

- Differentiation strategy
  - Innovation
  - Growth
  - Alliances

HHC
Data and information

by
David G. Messerschmitt
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Key concept

The key commodity manipulated by information technology is information.
To be manipulated in a computing/networking environment, information must be represented by data.

What is information?
Information

From a user (human) perspective...
....recognizable patterns that influence you in some way
(perspective, understanding, behavior...)

In the computing infrastructure, information has a somewhat different connotation as structure and interpretation added to data
Data

A bit is “0” or “1” — the atom of the information economy

Data is a collection of bits, like

- “0101110111010110”
- “0000011”
- “111011101011010110110111011011010”

Note: the terms data and information are not always used consistently!
Representation

- Take the place of the original
- Equivalent to, in the sense that the original can be reconstructed from its representation
- Often the original can only be approximately reconstructed, although it may be indistinguishable to the user
  - e.g. audio or video
ASCII

<table>
<thead>
<tr>
<th>Alphabet</th>
<th>Hex</th>
<th>Binary</th>
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<td>00111000</td>
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<td>&lt;9&gt;</td>
<td>/x39</td>
<td>00111001</td>
</tr>
<tr>
<td>:&gt;</td>
<td>/x3A</td>
<td>00111010</td>
</tr>
<tr>
<td>&lt;=</td>
<td>/x3B</td>
<td>00111011</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>/x3C</td>
<td>00111100</td>
</tr>
<tr>
<td>&lt;=&gt;</td>
<td>/x3D</td>
<td>00111101</td>
</tr>
<tr>
<td>&lt;/&gt;&gt;</td>
<td>/x3E</td>
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<tr>
<td>&lt;=&gt;</td>
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<tr>
<td>&lt;D&gt;</td>
<td>/x44</td>
<td>01000100</td>
</tr>
</tbody>
</table>

Note that this representation is not unique…

….this one happens to be a standard (ANSI X3.110-1983)
A picture

This picture conveys information

This information is represented in this computer, but how?
Representation of picture: image

Expanding a small portion of the picture, we see that it is represented by square pixels....

....300 tall by 200 wide.....

....with a range of 256 intensities per pixel

An approximation!

300 \cdot 200 \cdot 8 \text{ bits} = 480,000 \text{ bits (but it can be compressed)}
Compression example: JPEG and BMP of the image

Expanding a small portion of the picture, we see that it is represented by square pixels...

....300 tall by 200 wide.....

....with a range of 256 intensities per pixel

300 • 200 • 8 bits = 480,000 bits (but it can be compressed)
Color picture

A color picture can be represented by three monochrome images…

At the expense of three times as many bits
Terminology

Information

Representation

Data

Communicate data to another user or organization

Data processing

Information

Data

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Representation needs to be standardized - examples?

If the representation is not standardized, the information is garbled!

Communicate data to another user or organization

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Regeneration

- Make a precise copy of the data (copy bit by bit)
- If you know the representation, this is equivalent to making a precise copy of the information
- Each such precise copy is called a generation
- Process is called regeneration

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Information standards build markets, innovation

Real time scene

Sender’s PC

Webcam video encoder

WiFi Transmitter

WAP

Receiver’s PC

WiFi Receiver

PC video decoder

PC monitor

WAP

WAP

WAP
Replication of information

Anything that can be regenerated can be replicated any number of times.

This is a blessing and a curse.
Analog information cannot be regenerated

Analog information can be copied, but not regenerated

We will never know exactly what the original of this Rembrandt looked like
Discrete information can be regenerated

Regeneration can preserve data (but not its original physical form)

Regeneration is possible for information represented digitally (which is tolerant of physical deterioration)

\[ 0 + \text{noise} \xrightarrow{?} 0 \]
\[ 1 + \text{noise} \xrightarrow{?} 1 \]
Replication of information requires knowledge of representation.

Replication of information also presumes knowledge of its representation.

Replication preserves the integrity of the data, but that is not sufficient.

Every .xxx DOS file is a representation.
Implications

Digitally represented information can be preserved over time or distance in its precise original form by occasional regeneration

- digital library
- digital telephony

Replication of data is easy and cheap
Implications (con’t)

- Replication of information requires knowledge of the structure and interpretation
  - Standardization or some other means
- Extreme supply economies of scale
- You can give away or sell and still retain
- Unauthorized replication or piracy relatively easy
Architecture

by

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©Copyright David G. Messerschmitt, 2000. This material may be used, copied, and distributed freely for educational purposes as long as this copyright notice remains attached. It cannot be used for any commercial purpose without the written permission of the author.
What is Architecture?

Structure and organizing principles of any system

What does that mean?

How do you architect a solution?

Understand the higher purpose of the system
Identify the basic elements of the system
Decompose into subsystems
Understand the functions and interactions of the subsystems
Orchestrate the emergence of the higher purpose
A system is decomposed into interacting subsystems. Each subsystem may have a similar internal decomposition.
Three Elements of Architecture

- **Decomposition** - identification of interacting subsystems that make up the higher purpose of the system
- **Functionality** - capabilities assigned to each subsystem supporting the overall system purpose
- **Interaction** - how the subsystems communicate to support the system purpose
Three elements of architecture

- Decomposition
- Functionality
- Cooperation
- Organization
- Responsibility
- Interaction

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System examples

Let’s quickly look at some system decomposition examples

- US Government
- Automobiles
- Human anatomy
- A house

- Quick tour of information technology systems
System integration

Architecture
  -> subsystem implementation
    -> system integration

Bring together subsystems and make them cooperate properly to achieve desired system functionality

- Always requires testing
- May require modifications to architecture and/or subsystem implementation
Emergence

Subsystems are more specialized and simpler functionality

Higher-level system functionality arises from the interaction of subsystems

Emergence includes capabilities that arise purely from that interaction (desired or not)

- e.g. airplane flies, but its subsystems can't
Why system decomposition?

- Divide and conquer approach to containing complexity
- Reuse - (VERY important concept!)
- Consonant with industry structure (unless system is to be supplied by one company)
- Others?
Networked computing infrastructure

by

David G. Messerschmitt
Networked computing infrastructure supports common networked application functionality

- Communication across distance
- Communication across time (storage)
- Computation and logic (software)
- Interfaces
Major subsystems of networked infrastructure

Presentation

Application software

Logic Data

Infrastructure software

Infrastructure equipment

Client host

Network

Server host
Layering builds capability incrementally by adding to what exists.
Layering

Elaboration or specialization

Services

Existing layers
Features of infrastructure layering

- Layering is a type of decomposition
- Each layer is a server to the layer above
- Each layer is a client to the layer below
- Each layer interacts only with the layers above and below it
## Simplified infrastructure layering

<table>
<thead>
<tr>
<th>Application</th>
<th>Middleware</th>
<th>Equipment</th>
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<tbody>
<tr>
<td>Communications</td>
<td>Distributed object management</td>
<td>Operating system</td>
</tr>
<tr>
<td>Network software</td>
<td>Database management</td>
<td>Storage peripherals</td>
</tr>
<tr>
<td>Network equipment</td>
<td>File system</td>
<td>Storage</td>
</tr>
<tr>
<td>Communications</td>
<td>Storage peripherals</td>
<td>Equipment</td>
</tr>
</tbody>
</table>
Operating system functions

- Graphical user interface (client only)
- Hide details of equipment from the application
- Multitasking
- Resource management
  - Processing, memory, storage, etc
- etc
File system - part of the OS

Hides details of storage equipment from applications

File is:

- Unit of data managed for the benefit of the application
  - Size known, but unspecified structure and interpretation
- Name
- Location in naming hierarchy
Network equipment

- Hosts
- Switches
- Backbone links
- Access links
Messages and packets

Simplest network communication service is the message

- Smallest unit of communicated data meaningful to application
- Size, but unknown structure and interpretation
- Analogous to file in storage

Internally, the network may fragment a message into packets, and reassemble those packets back into a message
Packets

- IP packets contain a header followed by variable length data.
- Packet headers contain information about the contents including source, destination, length, and information to aid in reassembling the fragments of the message.

<table>
<thead>
<tr>
<th>Header</th>
<th>Source Destination Length, etc.</th>
<th>DATA</th>
</tr>
</thead>
</table>
Example

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Communication middleware

New application-specific communication services

Location independence
- makes distributed application look similar to centralized

Many possible other functions
Storage middleware

Database
- File with specified structure
- Example: relational table
- Oriented toward business applications

Database management system (DBMS)
- Manage multiple databases
- Basis of online transaction processing (OLTP)
<table>
<thead>
<tr>
<th>Year</th>
<th>City</th>
<th>Accommodation</th>
<th>Tourists</th>
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<tr>
<td>2002</td>
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</table>
Some DBMS functions

- Logical structure separated from physical structure
- Platform independence
- Implement standard queries
- Access from multiple users/applications
- Manage data as asset separate from applications
Time sharing

ASCII terminal
(no graphics)

Point-to-point wire
(no network)

Mainframe
(database and application server)
Two-tier client/server

Local-area network

Server/Mainframe
Three-tier client/server

Client

Application server

Enterprise data server
Inter-organizational computing

Global internet
Consumer access