Business and IT Trends

Ronald E. Giachetti, Ph.D.
Associate Professor
Industrial and Systems Engineering
Florida International University

Duane P. Truex, Ph.D.
Associate Professor
Department of Computer Information Systems
Georgia State University

Air Force Mentor-Protégé Program

Agenda

- A high level discussion of business and IT trends impacting industry and the enterprise system market
  - Business need for integration
  - ERP & EAI
  - Security
  - Supply chains and outsourcing
  - Data warehouses
  - Model and abstraction of software artifacts
  - Web services
  - RFID
Organization Structure Requires Integration

- Organization theory prescribes decomposing the complex organization into smaller units that are easier to manage.

- Give rise to two problems:
  - **INFORMATION PROBLEM**
    Units naturally erect barriers to flow of information.
  - **COORDINATION PROBLEM**
    The unit’s work must be coordinated with other units in order to meet overall organization goals.

- The functional differentiation must be accompanied by appropriate integration.

Enterprise Chaos
Air Force Mentor-Protégé Program

Why We Have Heterogeneity

- Systems are designed for local needs. Outside needs are extraneous.
  - Locally optimal hardware, software applications, and networks.
- Each distinct domain has its own ontology.
  - a set of well-defined terms, which delimit the domain of discourse
  - relationships among those terms, chosen from a limited set
  - The ontology may be formal (KIF, KQML) or not (XML)

PHYSICAL HETEROGENITY
APPLICATION HETEROGENITY
SEMANTIC HETEROGENITY

Air Force Mentor-Protégé Program

Economic Drivers

- NIST (1999) estimates the US automotive industry spends $1 billion per year due to poor interoperability
- Commercial ERP and related systems are sought after to integrate the enterprise and annual sales of these ERP systems are expected to exceed $20 billion by 2002 (Gartner Group 1999).
  - Even with ERP most companies must still integrate the ERP system with legacy and other systems (Thermistocleus 2001).

Organizations change due to mergers and acquisitions
Organizations must integrate into supply chain, virtual enterprise, outsource
Air Force Mentor-Protégé Program

Needed: The Horizontal View

Optimize the Enterprise
Drives the need to suboptimize some business units for the success of the business portfolio

Business Process 
Information
App System
Interfaces

Business Process 
Information
App System
Interfaces

Business Process 
Information
App System
Interfaces

Infrastructure
Relationships

Business Value

Air Force Mentor-Protégé Program

Just connecting not sufficient

Exchanging XML messages is the easy part.

Common semantics is the hard part.

Prices and Freight Charges
Product Catalog
Carrier Selection
Common Semantic Model
Ordering
Air Force Mentor-Protégé Program

Benefits of Integration

- Integration leads to improved enterprise performance
  - Decreasing delivery time (30-60%)
  - Product design time (20-50%)
  - Product design cost (15-30%)
  - Space (25-40%)
  - Inventory cost of raw materials (30-60%)
  - Direct manpower costs (20-35%)
  - Indirect manpower costs (30-35%)


Many varied approaches to Integration

- Database Approaches
  - STEP
  - Federated

- Middleware Approaches
  - CORBA, DCOM, JavaRMI

- Organization Approaches
  - Concurrent Engineering Mechanisms

- Process Approaches
  - BPR
  - Workflow

- Computer Science Approaches
  - Agents
  - Ontologies
Air Force Mentor-Protégé Program

ERP to the rescue!

- Integrates the entire business process.
  - Integrates Process (standard processes)
  - Integrates Application (a single application, i.e., the ERP package)
  - Integrates Data (standard common data)
- A single-vendor solution (thus avoid interoperability issues).
  - SAP, PeopleSoft, SSA (Baan), JD Edwards, Manuguistics, others.

Air Force Mentor-Protégé Program

ERP & the Reality of eliminating need for integration

- ERP lacks 100% coverage
- ERP versioning problems due to size and complexity
- Legacy applications are still around
- Mergers and acquisitions change organization and come with new systems.
- Still have integration problem with suppliers, partners, and customers.

August 25, 2005

Altman & Altman IP1, Feb 2004
EAI

- **Enterprise Application Integration** is the unrestricted sharing of data and business processes among any connected applications and data sources in the enterprise.
- To do this you should not have to make changes to the data structures or applications.
- Note, ERP has these properties within the ERP package but not necessarily with applications external to ERP (e.g. legacy systems).

EAI Market

- EAI in industry refers largely to the middleware market.
- This market is the software infrastructure to connect various applications.
- Some estimates put up to 70% of all code consisting of interfaces, protocols, and other procedures to establish linkages between systems.
Security has become an over-riding concern

Viruses, spam, worms, terrorism, identify theft, fraud, undiscovered threats …

One reason we are more vulnerable today is the increased integration of our world!
Air Force Mentor-Protégé Program

ERP Security

- Authorized Users with Username and Password
- Access based on authorization level and user roles
  - E.g., an accounts payable clerk should not have access to human resource modules
- data encryption which limits someone’s ability to export the database
- Audit logs within an ERP system track individual transactions or changes
  - system administrators can configure customized audit reports that employ simple logic to identify "outliers" - system transactions that fall outside of normal parameters, such as date and time, location of the user logging into the system and checks larger than a predefined setting
- continuous transaction and incident monitoring is a best practice to avoid security breaches

Air Force Mentor-Protégé Program

Security and People

- Often people are the weakest link in security.
  - Not checking credentials adequately.
  - Two examples:
    - When obtaining my new Florida Driver’s License the clerk in the Dept. of Motor Vehicles never opened my passport to verify that it was indeed my passport.
    - In a recent consulting job at a hospital the security guard who issues ID cards could not find the email requesting an ID for myself and then issued the card without ever checking any identification!
  - Need to train people in security policies and procedures.
  - Audit security.
  - Don’t rely on minimum wage workers for security.
- social engineering where users are tricked into freely divulging their credentials
Security during Maintenance

- As employees change positions, new employees, new partners, mergers, and other business events change the roles and authorization of users then the profiles must be updated.
- Need to establish new policies and procedures to handle these changes to maintain internal ERP controls.

Supply Chain

- Multinational organizations inherently involve supply chains
  - Link suppliers, customers
- A great deal of value in open systems
  - A major ERP trend since 1999
What is a Supply-Chain?

ERP-1
ERP-2
ERP-3

Manage Lifecycle
Commit Date
Buy
Build
Store
Ship

Suppliers
Supplier
Assemble/Package
Distribution Centers
Geo Ports of Entry

Air Force Mentor-Protégé Program

Process Map Example created in ARIS EasySCOR
<table>
<thead>
<tr>
<th>Air Force Mentor-Protégé Program</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outsourcing</strong></td>
</tr>
<tr>
<td>&quot;Offshore outsourcing is just one small part of a (US)$5 trillion global outsourcing market. This market is growing by more than 15 percent per year, and the offshore component is certainly among the fastest growing,&quot; Michael Corbett, president and CEO of New York-based Michael F. Corbett &amp; Associates</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air Force Mentor-Protégé Program</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IT Offshore Outsourcing</strong></td>
</tr>
<tr>
<td>A McKinsey Global Institute study reveals the extent of the mutual benefits.</td>
</tr>
</tbody>
</table>

| "In this way, offshoring, far from being bad for the United States, creates net value for the economy. It directly recaptures 67 cents of every dollar of spending that goes abroad and indirectly might capture an additional 45 to 47 cents—producing a net gain of 12 cents to 14 cents for every dollar of costs moved offshore." |

<table>
<thead>
<tr>
<th>Offshoring and beyond</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>The McKinsey Quarterly, 2003 Number 4</em></td>
</tr>
</tbody>
</table>
Outsourcing ERP

- When a large organization implements ERP, they often hire a consultant to operate it
  - Texas Instruments: transferred 250 IT personnel to Andersen Consulting
  - Rolls-Royce: transferred IT development to EDS
- While not called outsourcing, in effect it is
  - Technical difference – ownership of platform and rental of software

Data Warehouses

- Collects and stores data from multiple, distributed, and heterogeneous databases and related information sources.
- Users access the data warehouse and do not need to access the original data source.
- Power of data warehouse is the integration of multiple sources.
- Used for analytical decision-making.
- OLAP (On-Line Analytical Processing) versus the OLTP (On-Line Transaction Processing) of traditional databases.
Creating a Data Warehouse

**Figure 12.3 Creating a Data Warehouse**

- **Operational data**
  - Extract
  - Filter
  - Transform
  - Integrate
  - Classify
  - Aggregate
  - Summarize

- **Data extraction**

- **Data warehouse**
  - Integrated
  - Subject-oriented
  - Time-variant
  - Nonvolatile

---

Star Schema for Sales

**Figure 12.17 Star Schema for Sales**

- **Location**
  - LOC_ID
  - LOC_DESCRIPTION
  - REGION_ID
  - LOC_STATE
  - LOC_CITY
  - 25 records

- **Customer**
  - CUST_ID
  - CUST_DNAME
  - CUST_FNAME
  - CUST_INITIAL
  - CUST_DOB
  - 125 records

- **Sales**
  - TIME_ID
  - LOC_ID
  - CUST_ID
  - PROD_ID
  - SALES_QUANTITY
  - SALES_PRICE
  - SALES_TOTAL
  - 3,000,000 records

- **Product**
  - PROD_ID
  - PROD_DESCRIPTION
  - PROD_TYPE_ID
  - PROD_BRAND
  - PROD_COLOR
  - PROD_SIZE
  - PROD_PACKAGE
  - PROD_PRICE
  - 3,000 records
Information overload
Data starvation

- More databases
  - public & corporate
- Faster communication
  - digital
  - packeting: TCP-IP, ATM
- World-wide connectivity
  - Internet & Intranets
  - world-wide web
- Disintermediation
  - ubiquitous publishing

Air Force Mentor-Protégé Program

Change in Supply vs Demand

What information consumes is rather obvious, it consumes the attention of its recipients.

Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.

[Herbert Simon]
Air Force Mentor-Protégé Program

IT Trends

- Moving to higher levels of abstraction in order to understand, analyze, design, and build software systems
- Greater usage of off-the-shelf components
- More tool automation
- Other trends ???
TWO APPROACHES IN SYSTEM MODELING AND THEIR ILLUSTRATIONS WITH MDA AND RM-ODP

Andrey Naumenko, Alain Wegmann
Laboratory of Systemic Modeling, Swiss Federal Institute of Technology - Lausanne,
EPFL - M&CLAMÉ, 1015 Lausanne, Switzerland
Email: andrey.naumenko@epfl.ch, alain.wegmann@epfl.ch

August 25, 2005
Day 1 Module 4 Slide 33

Air Force Mentor-Protégé Program
Model Driven Architecture (MDA)

"These models belong to diverse independent domains of interest with regard to the universe of discourse that they represent."

"For a given domain of interest, its corresponding meta-model defines relations between different conceptual categories that exist in the domain models, as well as the meaning of each modeling concept."

Two approaches in system modeling and their illustrations with MDA and RM-ODP

RFID – What is it?

- Radio Frequency Identification

- Three parts to an RFID implementation:
  - Tag (chip and antenna)
  - Reader
  - Database & software

- Tag holds unique data – a serial number and/or other unique attributes of the item

August 25, 2005
Day 1 Module 4 Slide 34
RFID Uses

- Retail & Distribution
- Contactless Payment
- Keyless Entry
- Livestock Tagging
- Pharmaceuticals
- Logistics Assets (containers, trailers)
- Pet Identification

RFID Benefits

- More information
  - Individual item data & tracking

- Fast
  - No contact
  - No line of sight
  - Miliseconds
  - Simultaneous read of multiple items
### Air Force Mentor-Protégé Program

#### RFID Tag Attributes

<table>
<thead>
<tr>
<th></th>
<th>Active RFID</th>
<th>Passive RFID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag Power Source</td>
<td>Internal to tag</td>
<td>Energy transferred using RF from reader</td>
</tr>
<tr>
<td>Tag Battery</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Required signal strength</td>
<td>Very Low</td>
<td>Very High</td>
</tr>
<tr>
<td>Range</td>
<td>Up to 100m</td>
<td>Up to 3-5m, usually less</td>
</tr>
<tr>
<td>Multi-tag reading</td>
<td>1000’s of tags recognized – up to 100mph</td>
<td>Few hundred within 3m of reader</td>
</tr>
</tbody>
</table>
| Data Storage         | Up to 128 Kb or read/write & search                                          | 128 bytes of read/write                                                    

---

### Status Today

**Issue #1: RFID Mandate Madness**

- Still high risk decisions due to technology, standards, and procedures.
Air Force Mentor-Protégé Program

Status Today

Issue #3: Tag costs too high
- Goal is 5¢ tag; can’t afford $2 tag on 99¢ item
- Biggest limit on widespread business use

Air Force Mentor-Protégé Program

RFID adds to Data Glut

Issue #4: Lack of Software
- What to do with all that data?
  - Problem: “Petabytes”
  - Answer: “Middleware”
Web Services

- **Web Services** are self-contained, self-describing, modular applications that can be published, located, and invoked across the Web.
- **Web Services** allow the creation of new applications by aggregating the services of many other applications that exist locally or over the Internet.
- **Web Services** perform functions, which can be anything from simple requests to complicated business processes. Once a Web service is deployed, other applications (and other Web services) can discover and invoke the deployed service.
- **Examples are:**
  - currency conversion, language translation, shipping, and claims processing.

---

Web Services

- Web services provide a structured way to format data, a way to handle transactions, and a standard means to describe what the service does and make the services available to others.
- Web services are based on the standard protocols of XML, SOAP, and WSDL, which allow them to interoperate across platforms and programming languages.
- Web services are discrete units of code; each handles a limited set of tasks.
Web Services

Unlike websites, which are pictures of data designed to be viewed in a browser by a person, a Web service is designed to be accessed directly by another service or software application.

Web Services Technologies

- There are a suite of technologies to enable web services:
  - SOAP – protocol for exchange
  - WSDL – describes services
  - UDDI – registry to list available services
- All are based on XML and are standards defined by OMG.
- Microsoft’s .Net is built around these technologies.
Continuous Learning

- As we like to tell college students, you must develop a penchant for life-long learning