Chapter 6
Architecture and Infrastructure

Managing and Using Information Systems: A Strategic Approach

by Keri Pearlson & Carol Saunders

Introduction

- What is the architecture of an organization?
- What is the infrastructure of an organization?
- How should a manager influence a company's architecture and infrastructure?
- How does a company move from architecture to infrastructure?

Real World Examples

- In 1998 People's Bank decided that its existing IT architecture was limiting.
- They needed seamless links to external partners for support of real-time data transfer.
- They developed a new 4-tier architecture that was up and running by October 2000 – Figure 6.1 shows this 4-tier architecture.
- Benefits –
  - The ability to introduce new services more rapidly at lower costs, and improved operational efficiency in many areas.
  - Also, cut customer response time 30% and saved more than $100,000 on desktop administration.

Figure 6.1 Architecture/Infrastructure of People's Bank
From Vision to Implementation

- Architecture translates strategy into infrastructure (see Figure 6.2).
- The architect develops plans based on a vision of the customer of the system (or in this example a house) which is a blueprint of the companies systems.
- This “blueprint” is used for translating business strategy into a plan for IS.
- The IT infrastructure is everything that supports the flow and processing of information (hardware, software, data, and networks).

The Manager’s Role

- Must understand what to expect from IT architecture and infrastructure.
- Must clearly communicate their business vision.
- May need to modify the plans if IT cannot realistically support them.
- Manager MUST be involved in the decision making process.
From Strategy to Architecture

- Manager must start out with a strategy.
- This strategy must then be used to develop more specific goals as seen in Figure 6.3.
- Business requirements must be fleshed out for each goal in order to provide the architect with a clear picture of what IS must accomplish.
- Figure 6.4 shows how this detailed process is accomplished.
From Architecture to Infrastructure

• This stage entails adding more detail to the architectural plan.
• This detail comprises the actual hardware, software, data, and networking.
  – Figure 6.5 shows this phase.
• These components must be combined in a coherent fashion.
• Global level – focus at the enterprise level; Inter-organizational level – focus on communications with customers, suppliers or other stakeholders.

A Framework for the Translation

• Consider the following when developing a framework for transforming business strategy into architecture and then infrastructure:
  – Hardware – physical components.
  – Software – programs.
  – Network – software and hardware.
  – Data – quantity and format of data is of utmost concern.
• The framework that guides analysis of these components is found in Figure 6.6a.
Analysis of Components

• Managers must begin with an overview that is complete.
• The framework must answer the what, who and where questions for each infrastructure component.
  – What is the specific type of technology?
  – Who is involved (individuals, groups, departments)?
  – Where is everything located?
• Table 6.6b shows the connections between strategy and systems.

<table>
<thead>
<tr>
<th>Component</th>
<th>What</th>
<th>Who</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>Does fulfillment or our strategy require thick or thin clients?</td>
<td>Who knows the most about servers in our organization?</td>
<td>Does our architecture require centralized or distributed servers?</td>
</tr>
<tr>
<td></td>
<td>What size hard drivers do we equip our thick clients with?</td>
<td>Who will operate the server?</td>
<td>Must we hire a server administrator for the Tokyo office?</td>
</tr>
<tr>
<td>Software</td>
<td>Does fulfillment or our strategy require ERP software?</td>
<td>Shall we go with SAP or Oracle applications?</td>
<td>Does our geographical organization require multiple database instances?</td>
</tr>
<tr>
<td></td>
<td>Shall we go with 10BaseT Ethernet or ISDN lines to the home?</td>
<td>Who is affected by a move to SAP?</td>
<td>Does our VAN provide all the translation services we need?</td>
</tr>
<tr>
<td></td>
<td>Will we need encryption software?</td>
<td>Who needs an ISDN line to span the Atlantic?</td>
<td>Does Oracle provide the multiple-database functionality we need?</td>
</tr>
<tr>
<td></td>
<td>Do our vendors all use the same EDI format?</td>
<td>Who needs access to sensitive data?</td>
<td>Will backups be stored on-site or off-site?</td>
</tr>
<tr>
<td></td>
<td>Which VAN provides all the translation services we need?</td>
<td>Who needs encryption software?</td>
<td>Which storage service shall we select?</td>
</tr>
</tbody>
</table>

Figure 6.6b Infrastructure and architecture analysis framework with sample questions.

Architecture Examples

• The following are examples of architectures that are used in organizations.
  – Client/server - widely used and relies on clients that request services and servers that respond to these requests. The workload is shared and distributed.
  – Mainframe – employs a large centralized computer that handles all of the functionality of the system.
  – Peer-to-peer – networked computers share resources, every system is equal.
  – Wireless (mobile) – allow communication from remote locations.
• Managers must be aware each ones trade-offs.
• Figure 6.7 summarizes the characteristics of each of the architectures.

Other Frameworks

• Some companies apply even more complex frameworks.
• Two popular examples (built on an enterprise architecture) are:
  – Zachman – goes farther by asking how, when, and why?
  – TOGAF (The Open Group Architecture Framework) – seeks to provide a practical, standardized methodology to successfully implement an Enterprise Architecture into a company.
OTHER MANAGERIAL CONSIDERATIONS

Understanding existing architecture
- Understanding existing architecture allows managers to evaluate the IT requirements of an evolving business strategy vs. their current IT.
- Plans for the future architecture can then be compared with the current infrastructure to help identify which components of the current system can be used in the system being developed.

Relevant questions for managers:
- What IT architecture is already in place?
- Is the company developing the IT architecture from scratch?
- Is the company replacing an existing architecture?
- Does the company need to work within the confines of an existing architecture?
- Is the company expanding an existing architecture?

Strategic IT planning and legacy systems
- Managers usually must deal with adapting existing architectures as part of planning their new systems.
- In so doing they encounter both:
  - the opportunity to leverage the existing architecture and infrastructure and
  - the challenge to overcome the old system’s shortcomings.
Optimal conversion of legacy systems:

• The following steps allow managers to derive the most value and suffer the fewest problems when working with legacy systems:
  – 1. Objectively analyze the existing architecture and infrastructure
  – 2. Objectively analyze the strategy served by the existing architecture.
  – 3. Objectively analyze the ability of the existing architecture and infrastructure to further the current strategic goals.

Distinguishing Current vs. Future Requirements

• Strategic Time Frame
  – What is the life span of the system?
• Technological Advances
  – Can the infrastructure and architecture support these advances? SOA (Service Oriented Architecture) defines a service or an interface as a reusable piece of software.
• Growth Requirements
  – Will it meet future demand? Is it scalable?

Assessing Financial Issues

• Assessing Financial Issues
  – Evaluate on expected financial value.
  – Can be difficult to quantify.
  – Steps
    • Quantify costs
    • Determine the anticipated life cycles of system components
    • Quantify benefits
    • Quantify risks
    • Consider ongoing dollar costs and benefits

Assessing Technical Issues

• Assessing Technical Issues
  – Scalability.
    • Plight of AOL (improperly estimated growth).
  – Standards.
  – Maintainability.
  – IT staff skill set.
• Differentiating Between Architecture and Infrastructure
  – Figure 6.8 shows how architecture and infrastructure are evaluated based on the previous criteria.
### FROM STRATEGY TO ARCHITECTURE TO INFRASTRUCTURE: AN EXAMPLE

BluntCo. fictitious case

- BluntCo., a fictitious cigar clipper maker, serves to illustrate the process of creating IT architecture and infrastructure.
- The process includes four steps:
  - **Step 1**: Defining the Strategic Goals
  - **Step 2**: Define Related Architectural Goals
  - **Step 3**: Apply Strategy-to-Infrastructure Framework
  - **Step 4**: Evaluate Additional Issues

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Architecture</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic time frame</td>
<td>Very applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Technological advances</td>
<td>Very applicable</td>
<td>Somewhat applicable</td>
</tr>
<tr>
<td>Assessing financial issues</td>
<td>Somewhat applicable</td>
<td>Very applicable</td>
</tr>
<tr>
<td>Net present value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payback analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incidental investments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth requirements/scalability</td>
<td>Very applicable</td>
<td>Very applicable</td>
</tr>
<tr>
<td>Standardization</td>
<td>Very applicable</td>
<td>Very applicable</td>
</tr>
<tr>
<td>Maintainability</td>
<td>Very applicable</td>
<td>Very applicable</td>
</tr>
<tr>
<td>Staff experience</td>
<td>Very applicable</td>
<td>Very applicable</td>
</tr>
</tbody>
</table>

**Figure 6.8** Applicability of evaluation criteria to discussion of architecture and infrastructure.

**Figure 6.10** Blunt Co’s infrastructure components

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Software</th>
<th>Network</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 servers:</td>
<td>ERP system with modules for:</td>
<td>Cable modem to ISP</td>
<td>Database:</td>
</tr>
<tr>
<td>•Sales</td>
<td>•Manufacturing</td>
<td>Dial-up lines for backup</td>
<td>•Sales</td>
</tr>
<tr>
<td>•Manufacturing</td>
<td>•Accounting</td>
<td>Routers</td>
<td>•Manufacturing</td>
</tr>
<tr>
<td>•Accounting</td>
<td>•Inventory</td>
<td>Hubs</td>
<td>•Accounting</td>
</tr>
<tr>
<td>Storage systems</td>
<td>Enterprise Application Integration (EAI) software</td>
<td>Switches</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Firewalls</td>
<td></td>
</tr>
</tbody>
</table>

Copyright 2006 John Wiley & Sons, Inc.
**Step 1: Defining the Strategic Goals**

- Blunt Cos. business strategy is to respond to possible changes in demand by outsourcing clipper manufacturing.
- The company’s strategic goals are as follows:
  - To lower costs by outsourcing manufacturing
  - To lower costs by clipper distribution
  - To improve market responsiveness by outsourcing clipper manufacturing
  - To improve market responsiveness by outsourcing clipper distribution

**Step 2: Define Related Architectural Goals**

- Consider the first goal: outsourcing clipper manufacturing. How can the company’s IT architecture support this goal?
- It must provide the following interfaces to its new manufacturing partners:
  - Sales to manufacturing partners: send forecasts, confirm orders received
  - Manufacturing partners to sales: send capacity, confirm orders shipped
  - Manufacturing partners to accounting: confirm orders shipped, electronic invoices, various inventory levels, returns
  - Accounting to manufacturing partners: transfer funds for orders fulfilled

**Step 3: Apply Strategy to Infrastructure Framework**

- Translating the strategic goals to the architectural and infrastructural framework means asking the what, who and where questions discussed before.
- For example, for the network:
  - Arch.: What is the anticipated volume of transactions between BluntCo and its manufacturing partners?
  - High volume may require leased lines to carry transaction data, dial-up connections may suffice for low volume (i.e., what’s the best leased line to use?).
- See Fig. 6.7 for a detailed list of such questions

**Step 4: Evaluate Additional Issues**

- The last step is to compare managerial considerations such as strategic time frame, technological advances, etc., with the architectural goals listed in step 2.
- For example, regarding HR compatibility:
  - Architecture: The new model will displace some current human resources. BluntCo must analyze costs and the effect on morale.
  - Infrastructure: Current staff not familiar with EDI; must be trained, some new staff hired. BluntCo must analyze associated costs.
FOOD FOR THOUGHT: BUSINESS CONTINUITY PLANNING

Business Continuity Planning (BCP)

- BCP is an approved set of preparations and sufficient procedures for responding to a range of disaster events, such as:
  1. Planning stage – alternative business recovery operating strategies are determined
  2. Emergency Response Procedures – designed to prevent/limit injury to personnel on site, damage to structures/equipment and the degradation if vital business functions
  3. Employee Awareness and Training Programs – must be well communicated throughout the organization

Summary

- Strategy drives architecture.
- Managers must understand how to plan IT to realize business goals.
- Logical framework is used to guide the translation from business strategy to IS design.
- Know the state of existing architecture and infrastructure when translating strategy into architecture and then infrastructure.
- A business continuity plan is an approved set of preparations and sufficient procedures for responding to a disaster event.
- It is becoming more important that business managers effectively translate business strategy into IT infrastructure.