Chapter 2 Information Management and IT Architecture

IT at Work 2.1

When ISs Fail, the Problem May Be the IT Architecture

Questions

1. What problems did executives have with the EIS?

The executives found that half of the data generated from their EIS was irrelevant to corporate-level decision making concerning their Strategic Business Units (SBU) and that some of relevant timely data, crucial for decision making, was not available in the manner in which they needed it.

2. What were the two reasons for those EIS problems?

The application architecture was not designed for customized report generation. In the EIS system, the SBUs were reporting sales and revenue at different timeframes. In addition, the user interfaces were too complicated to get to the required information; so much so, that the analysts had to first extract KPI-related data and then work on them for producing the information required by the executives.

3. How did the CIO improve the EIS?

The CIO put in place a dedicated team to redesign and redevelop a new system that had an entirely new business-driven architecture (replacing financial-reporting driven architecture). The new system used standardized data formatting across the company, thus eliminating data inconsistencies.

4. What are the benefits of the new IT architecture?

The new system provided reliable KPI reports on inventory turns, cycle times and profit margins of all SBUs. It was easy to modify reports that eliminated ad hoc analyses. There was a reduction in resources required for maintaining the system. EIS use by executives improved since they got reliable data from the system.

IT at Work 2.2

Gartner's View of Enterprise Architecture

No questions.

IT at Work 2.3

Feedback and Incentives Improve Performance at 1-800-Contacts

Questions

1. What were the information and reporting problems the company faced?

The company had grown so much that the ISs could not provide the call center managers and business analysts with quick and easy access to real-time (up-to-date) sales data. The response time for access to data was several days, which caused an information bottleneck that created knowledge blind spots regarding sales and inventory levels.

2. How did business analysts get the data they needed?

Information dashboards, that were updated every 15 minutes, were implemented in the call centers, which allowed call center operators to monitor their performance. Operators were able to easily get their closing ratio, average sales, calls-per-hour and comparisons of their performance with other operators.

3. What was the effect of linking operators' pay to business performance? That is, how did feedback at the operator's level lead to improved performance at the organizational level?

By linking operators' pay to performance, sales increased by $50,000 per month. Operators were able to see the effect of their performance on their bonuses, which encouraged them to improve the overall quality of their performance to increase their bonuses.

4. Why do you think the dashboards updated frequently (every 15 minutes) instead of only at the end of the operator's workday?

Such rapid updates provided the operators with immediate results on their performance. This real-time data allowed them to know how they were performing and to make immediate adjustments to their actions, if necessary, rather than having to wait until the next day.

IT at Work 2.4

Cloud Pro Leverages iPad's touch: Benefits Start-Ups

Questions

1. Consider this statement: Cloud computing is about the flexible delivery of services at the point of need. Explain how Cloud Pro offers flexible delivery of network management (the service). Explain how it offers that service to network admins at the point of need (e.g., while on vacation or away from the office).

The Cloud Pro app allows network admins to use their mobile devices anytime anywhere to: turn on server backups; create a new server from stored backups; manage backup scheduling, and reboot, rename, resize and delete servers.

2. Discuss one benefit and one disadvantage of Cloud Pro for network admins.

There are several benefits such as allowing a network administrator to not be tethered to a server room, making it possible for fewer people to manage more servers thus reducing costs, and providing accessibility to resources that would not be affordable to smaller businesses.

However, these benefits can also be seen as disadvantages, as a network administrator might always be on call no matter where they are located; having fewer people manage more servers puts more responsibility and stress on a few people and reduces the number of IT jobs; and making applications available to more businesses increases the level of competitive rivalry.

3. Search and view a video demo of Rackspace's Cloud Pro for the iPad. Does the app have amazing features, as Mike Mayo described?

The app has the features described and more when you read the spec page listed at: http://www.rackspace.com/cloud/mobile/

IT at Work 2.5

Liberty Wines Improves Business Continuity with Virtualization

1. What business risks had Liberty Wines faced?

As their business grew, their IT facility could not handle the increased data volume. The systems were slow and required greater maintenance efforts. This meant loss of employee productivity, thus affecting its core business processes such as order processing and inventory management

2. How does Liberty Wines' IT infrastructure impact its competitive advantage?

The insufficient IT infrastructure negatively impacted their competitive advantage. The lack of IT capacity could result in the loss of customers since their orders may not be processed on time.

3. How did server virtualization benefit Liberty Wines and the environment?

The server virtualization reduced the number of physical servers from ten to four and the applications ran faster through better utilization which, in turn, resulted in better customer service and inventory management. The reduction in physical servers resulted in savings in hardware replacement and reduction in power consumption.

REVIEW QUESTIONS

2.1 Information Management in the 2010s

1. Explain information management.

These days, the variety of information an organization needs to manage goes beyond the structured types like numbers and texts and includes semi-structured and unstructured contents like video and sound. The digital library includes contents from social media, texts, photos, videos, music, documents; address books, events, and downloads. Maintaining—updating, expanding, porting—an organization's digital library's contents on a variety of platforms is termed here as Information Management. Specifically, Information Management deals with how information is organized and stored; and the speed and ease with which it is captured, analyzed and reported.

2. Why are information deficiencies still a problem in organizations?

The type of information stored, the technology for information management, and the load on information handling for compliance of legal and security requirements are all changing. The investments in IT changes with competing demands on an organization's budget that cannot cope with the unforeseeable ways in which technology changes. The other specific information deficiencies include: data silos (information trapped in departments' databases), data lost or bypassed during transit, user-fierce formats (poorly designed user interfaces requiring extra effort from users for analysis), use of non-

standardized data formats, and relying on fast changing data (that are expensive to keep pace).

3. What is a data silo?

A data silo is one of the data deficiencies that can be addressed. It refers to the situation where the databases belonging to different functional units in an organization are not shared between the functional units because of a lack of integration. The lack of sharing and exchange of data between functional units raises issues regarding reliability and currency of data. Data silos exist when there is no overall IT architecture to guide IS investments, data coordination and communication.

4. Explain KPIs and give an example.

Organizations have specific goals. To establish the achievement of these goals, organizations identify measurable Key Performance Indicators (KPIs). KPIs help reduce the complex nature of organizational performance to a small number of understandable measures for specific purposes (for example, sales/marketing). It is easy to understand achievement, or lack of achievement, in sales goals by comparing actual versus forecasted or sales over current year versus sales over previous year.

5. What three factors are driving collaboration and information sharing?

Forrester (forrester.com) identified three factors driving the trend toward collaboration and information sharing technology. These are:

1. Global, mobile workforce (a growing number of employees telecommute)
2. Mobility-driven consumerization (cloud-based collaboration solutions are on the rise)
3. Principle of *any* (there is growing need to connect anybody anytime anywhere and on any device)

6. What are the benefits of information management?

The following four benefits have been identified:

1. Improves decision quality (due to timely response using reliable data)
2. Improves prediction (through pattern seeking, matching and discovery)
3. Reduces risk (due to improved compliance with regulation resulting from better information quality and governance), and
4. Reduces cost (due to savings in time and effort through integration and optimization of repositories)

2.2 IT Architecture

1. Explain the relationship between complexity and planning. Give an example.

Organizations use complex ISs that need constant maintenance and enhancements. Complex ISs require appropriate long-range planning for realizing the benefits of IT investments. Instead of getting into a reactionary mode, organizations should devise a meaningful long-range plan for future IT investments.

2. Explain IT architecture.

IT systems have become unmanageably complex and expensive to maintain. Also, organizations find it difficult to keep their increasingly expensive IT systems aligned with business need. IT architecture is the roadmap that is used for controlling the direction of IT investments and it is a significant item in long-range planning. It is the blueprint that guides the build out of overall IT capabilities consisting of four sub-architectures (see question 3). The IT architecture defines the vision, standards, and plan that guide the priorities, operations, and management of the ITs supporting the business.

3. What are the four components of IT architecture?

The four components are:

1. Business Architecture (the processes the business uses to meet its goals);
2. Application architecture (design of IS applications and their interactions);
3. Data architecture (organization, storage, and access of enterprise data);
4. Technical architecture (the hardware and software infrastructure that supports applications and their interactions)

4. What are the uses and benefits of IT architecture?

Seven uses and benefits have been reported by Professor M. A. Cusumano:

1. Maintain a close alignment between IT deliverables and business requirements.
2. Improve ability to respond quickly to business changes.
3. Develop closer partnerships between business and IT groups.
4. Reduce the risk of failed or unnecessary ISs.
5. Reduce complexity of existing ISs.
6. Improve agility of new IT systems.
7. Ensure that legal and regulatory requirements are being met.

5. How are baseline architecture, sequencing plan, and target architecture related?

Once an agreed upon IT architecture is realized and its various architecture components are in place, it becomes a *baseline* IT architecture from which the organization benefits. Further changes to the baseline architecture require genuine commitment from both the technical and business executives in the organization. In order to get to the *target* architecture from the baseline, a sequencing plan (aka change management plan) is used. In this plan, the impacts of the required architectural changes are analyzed, commitments to the changes are agreed on, and appropriate actions are carried out to realize the target architecture.

6. Why should the organization's target architecture never be achieved?

While baseline architecture is being transformed into target architecture by going through the sequencing (change management) plan successfully, further changes for responding to newer requirements and for deploying newer technologies are recognized. This target architecture now becomes the new baseline for responding to further changes. This makes the target architecture a never static moving target. So, the target architecture is a vision of the future that evolves in advance of it being achieved.

2.3 Information Systems and IT infrastructure

1. Contrast data, information, and knowledge.

Data, or raw data, refers to a basic description of products, customers, events, activities, and transactions that are recorded, classified, and stored. Data is the raw material from which information is produced; and the quality, reliability and integrity of the data must be maintained for the information to be useful.

Information is data that has been processed, organized, or put into context so that it has meaning and value to the person receiving it.

Knowledge consists of data and/or information that have been processed, organized, and put into context to be meaningful, and to convey understanding, experience, accumulated learning, and expertise as they apply to a current problem or activity.

2. Define TPS and give an example.

Transaction processing systems are designed to process specific types of data input from ongoing transactions. TPSs can be manual, as when data is typed into a form on a screen, or automated by using scanners or sensors to capture data.

Organizational data is processed by a TPS--sales orders, payroll, accounting, financial, marketing, purchasing, inventory control, etc. Transactions are either:

- **Internal transactions:** Transactions that originate from within the organization or that occur within the organization. Examples are payroll, purchases, budget transfers, and payments (in accounting terms, they're referred to as *accounts payable*).
- **External transactions:** Transactions that originate from outside the organization, e.g., from customers, suppliers, regulators, distributors, and financing institutions.

TPSs are critical systems. Transactions that do not get captured can result in lost sales, dissatisfied customers, and many other types of data errors. For example, if accounting issues a check as payment for an invoice (bill), and that transaction is not captured, the amount of cash on the financial statements is overstated and the invoice may be paid a second time. Or if services are provided, but not recorded, the company loses that service revenue.

3. When is batch processing used?

Batch processing is used when there are several transactions that can be accumulated and processed at one time. These transactions are not as time sensitive as those that need to be processed in real time. The transactions may be collected for a day, a shift, or over a period of time and then processed. Batch processing is often used to process payroll in a weekly or bi-weekly manner.

4. When is real-time processing needed?

Online transaction processing (OLTP) or real-time processing is used when a system must be updated as each transaction occurs. The input device for entering transactions must be directly linked to the transaction processing system (TPS). This type of entry is used for more time sensitive data such as reservation systems in which the user must know how many seats or rooms are available.

5. Explain why TPSs need to process incoming data before storing it in a database.

Processing improves data quality, which is important because reports and decisions are only as good as the data they are based on. As data is collected or captured, it is validated to detect and correct obvious errors and omissions.

Data errors detected later may be difficult to correct, expose the company to legal action, or may never be detected and corrected. You can better understand the difficulty of detecting and correcting errors by considering identity theft. Victims of identity theft face enormous challenges and frustration trying to correct data about them stored in databases.

6. Define MIS and DSS and give an example of each.

General purpose reporting systems are referred to as management information systems (MIS). Their objective is to provide reports to managers for tracking operations, monitoring, and control.

MIS is used by middle managers and provides routine information for planning, organizing, and controlling operations in functional areas.

Decision support systems (DSS) are interactive applications that support decision making. Configurations of a DSS range from relatively simple applications that support a single user to complex enterprise-wide systems. A DSS can support the analysis and solution of a specific problem, to evaluate a strategic opportunity, or to support ongoing operations. These systems support unstructured and semi-structured decisions, such as whether to make or buy products, or what new products to develop and introduce into existing markets.

Decision support systems are used by decision makers and managers to combine models and data to solve semi-structured problems with extensive user involvement.

To provide such support, DSSs have certain characteristics to support the decision maker and the decision making process.

Three defining characteristics of DSSs are:

- an easy-to-use interactive interface
- models that enable sensitivity analysis, *what if* analysis, goal seeking, and risk analysis
- data from internal databases, external sources, and added by the decision maker who may have insights relevant to the decision situation.

Having models is what distinguishes DSS from MIS. Some models are developed by end users through an interactive and iterative process. Decision makers can manipulate models to conduct experiments and sensitivity, w*hat-if,* and *goal-seeking* analyses.

What-if analysis refers to changing assumptions or data in the model to see the impacts of the changes on the outcome. For example, if sales forecasts are based on a 5 percent increase in customer demand, a what if analysis would replace the 5 percent with higher and/or lower demand estimates to determine *what* would happen to sales *if* the demands were different. With goal seeking, the decision maker has a specific outcome in mind and needs to figure out how that outcome could be achieved and whether it's feasible to achieve that desired outcome. A DSS can also estimate the risk of alternative strategies or actions.

California Pizza Kitchen (CPK) uses a DSS to support inventory decisions. CPK has 77 restaurants located in various states in the U.S. Maintaining inventory of all restaurants at optimal levels was challenging. A DSS has made it easy for the managers to keep records updated and make decisions. Many CPK restaurants increased sales by 5 percent after implementing a DSS.

Summary of Support Systems

TABLE 2.2 Main Types of Information Support Systems.

Information Systems	Workers supported	Description
Management information system (MIS)	Middle managers	Provides routine information for planning, organizing, and controlling operations in functional areas
Decision support system (DSS)	Decision makers, managers	Combines models and data to solve semistructured problems with extensive user involvement
Business intelligence (BI)	Decision makers, managers, knowledge workers	Gathers and uses large amounts of data for analysis by business analytics and intelligent systems
CAD/CAM	Engineers, drafts people	Allows engineers to design and test prototypes; transfers specifications to manufacturing facilities
Electronic records management system	Office workers	Automates management, archiving, and flow of electronic documents
Knowledge management system (KM)	Managers, knowledge workers	Supports the gathering, organizing, and use of an organization's knowledge
Data mining and text mining	Knowledge workers, professionals	Enables learning from historical cases, even with vague or incomplete information
Automated decision support (ADS)	Frontline employees, middle managers	Supports customer care employees and salespeople who need to make quick, real-time decisions involving small dollar amounts

7. Why are databases inappropriate for doing data analysis?

Databases are used for recording and processing transactions. Due to the number of transactions, the data in the databases are constantly in a state of change making it difficult to use for complex decision making.

8. Define IT infrastructure.

IT infrastructure is the collection of hardware, software, processes, networks, and users.

What an organization's IT infrastructure can support is determined by five major components: (1) hardware, (2) software, (3) networks and communication facilities, including the Internet and intranets, (4) databases and data workers, and (5) information management personnel. When making decisions about how to acquire hardware, software, or any of these five components, the following four characteristics of an IT infrastructure need to be considered.

- **Dependable.** Dependability means that the infrastructure meets availability, reliability, and scalability requirements of the company's information systems (TPS, MIS, DSS, etc) and applications. Applications inherit their dependability from the IT infrastructure. That is, the dependability of applications is limited by (is only as good as) the dependability of the IT architecture.
- **Manageable.** IT infrastructure determines the complexity of managing hardware and software required to deliver dependable applications. A wireless infrastructure is necessary for interactivity and mobile computing applications.
- **Adaptable.** When additional application capacity is needed, organizations are able to scale up the infrastructure as needed.
- **Affordable.** In today's IT reality, dependability, manageability, and adaptability are not as significant as affordability. For example, older infrastructures may need expensive redundancy, or backup systems, to ensure these characteristics.

With this understanding of IT infrastructure, we can intelligently examine the reasons why enterprises are investing in new IT architectures, particularly those that are cloud-based.

2.4 Cloud Computing and Services

1. Describe cloud computing.

One definition for **cloud computing** is that it is Internet-based computing in which shared resources (such as hard drives for storage) and software apps are provided to computers and other devices on-demand, like a public utility. That is, it's similar to electricity--a utility that companies have available to them on-demand and pay for it based on usage. Companies don't generate their own electricity but obtain it from a vendor, which in this case, is an electric company. Major cloud vendors or providers are Google, Amazon, Microsoft, and Cisco. For example, Google Apps provides common business applications online that are accessed from a web browser while the software and data are stored on the servers.

2. What are the benefits of cloud computing?

Optimizing IT infrastructure became especially important during tough economic times when cost-cutting became a priority. During challenging times, making the most of IT assets becomes imperative for competitive advantage, and ultimately, survival. The cloud typically offers a steep drop in IT costs because applications are hosted by vendors and provided on demand, rather than via physical installations or seat licenses. This rental arrangement with vendors is a key characteristic of cloud computing.

Cloud computing is often used to describe services such as Google's online word-processing application and Salesforce.com's customer-service software, which are accessed online through a Web browser instead of stored on a computer. Another option is to pay to use Amazon.com's computing infrastructure, in effect, renting it, rather than buying more servers.

The concept is catching on in the business world. *The New York Times* uses Amazon.com's cloud service to upload images of archived newspapers and convert them into a more readable format. Nasdaq OMX Group Inc. uses Amazon.com's service to provide historical trading information. Both companies pay only for the computing resources or services they use.

3. Describe software-as-a-service (SaaS) and its benefi

Cloud computing makes it more affordable for companies to use *services* that in the past would have been packaged as software and required buying, installing and maintaining on any number of individual machines. A major type of service available via the cloud is called software-as-a-service.

Software-as-a-Service (SaaS) is an increasingly popular IT model in which software is available to users as needed. Other terms for SaaS are on-demand computing, utility computing, and hosted services. The idea is basically the same: instead of buying and installing expensive packaged enterprise applications, users can access software apps over a network, with an Internet browser being the only absolute necessity. Usually there is no hardware and software to buy since the apps are used over the Internet and paid for through a fixed subscription fee, or payable per an actual usage fee. The SaaS model was developed to overcome the common challenge to an enterprise of being able to meet fluctuating demands on IT resources efficiently.

Cloud services are expanding. For instance, the use of cloud computing to lower accounting costs is becoming widespread, particularly with smaller companies because there is practically limitless room for growth of the service. For example, a popular leading cloud software and services provider is *salesforce.com*. To emphasize their approach, their telephone number is 1-800-No-Software. Two of the clouds offered by Salesforce.com are:

- **Sales Cloud.** Sales Cloud is used by almost 80,000 companies. Sales representatives (reps) have almost everything they need to do their jobs in one place. They spend less time on administrative work and have more time with customers and closing deals. For sales managers, the Sales Cloud gives real-time visibility into their team's activities.
- **Service Cloud.** Service Cloud is a platform supporting customer service activities that range from call (contact) centers to social Web sites. Tools provided by the

Service Cloud include knowledge-as-a-service giving agents and customers the ability to find answers online, 24x7; Twitter integration for real-time service conversations; and analytics that provides dashboards and real-time reports to monitor performance.

4. How can cloud computing ease the problems of managing software licenses?

Optimizing IT infrastructure became especially important during tough economic times when cost-cutting became a priority. During challenging times, making the most of IT assets becomes imperative for competitive advantage, and ultimately, survival. The cloud typically offers a steep drop in IT costs because applications are hosted by vendors and provided on demand as needed, rather than via physical installations or seat licenses. This rental arrangement with vendors is a key characteristic of cloud computing.

5. List five major cloud vendors.

Table 2.3 lists five major cloud vendors to include:

Oracle (oracle.com)
IBM (ibm.com)
SAP (sap.com)
Salesforce.com
Microsoft Windows Azure (Microsoft.com)

6. When are private clouds used instead of public clouds?

Companies or government agencies set up their own private clouds when they need greater security and data confidentiality.

7. Explain three issues that need to be addressed when moving to cloud computing or services.

Four of the issues that need to be addressed when moving to cloud computing or services include:

- **Issues in moving workloads from the enterprise to the cloud** – There is a risk of disrupting operations or customers in the process of moving operations to the cloud. The network and WAN (wide area network) become more critical in the IT infrastructure. Network bandwidth is also an issue as enough is needed to support the increase in network traffic. Different management approaches as well as different IT skills are needed to handle moving part of the IT architecture to the cloud.
- **Strategic issues** such as deciding which workloads to export to the cloud; which set of standards to follow for cloud computing; how to resolve privacy and security issues; and how departments or business units will get new IT resources.

- **Vendor management issues** include defining and policing service-level agreements (SLAs) with vendors as well as handling the overall contract.
- **Infrastructure issues** – Cloud computing runs on a shared infrastructure so there is less customization for a company's specific requirements. With the cloud, the network and WAN (wide area network) become more critical in the IT infrastructure. Network bandwidth is also an issue as enough is needed to support the increase in network traffic.

2.5 Virtualization and VM (Virtual Machines)

1. How does a virtual machine (VM) function?

A virtual machine (VM) is a software layer that runs its own Operating System (OS) and apps as if it were a physical computer. A VM behaves exactly like a physical computer and contains its own virtual (software based) CPU, RAM, hard drive and Network Interface Card. An OS cannot tell the difference between a VM and a physical machine, nor can apps or other computers on a network tell the difference. (See Fig 2.13 for details)

2. Explain virtualization.

Virtualization is a concept that has several meanings in IT and therefore several definitions. The major type of virtualization is hardware virtualization, which remains popular and widely used. Virtualization is often key part of an enterprise's disaster recovery plan. In general, virtualization separates business applications and data from hardware resources. This separation allows companies to pool hardware resources—rather than to dedicate servers to applications—and assign those resources to applications as needed. The major types of virtualization are the following:

- *Storage virtualization* is the pooling of physical storage from multiple network storage devices into what appears to be a single storage device that is managed from a central console.
- *Network virtualization* combines the available resources in a network by splitting the network load into manageable parts, each of which can be assigned (or reassigned) to a particular server on the network.
- *Hardware virtualization* is the use of software to emulate hardware or a total computer environment other than the one the software is actually running in. It allows a piece of hardware to run multiple operating system images at once. This kind of software is sometimes known as a virtual machine.

Virtualization increases the flexibility of IT assets, allowing companies to consolidate IT infrastructure, reduce maintenance and administration costs, and prepare for strategic IT initiatives. Virtualization is not primarily about cost-cutting, which is tactical reason. More importantly, for strategic reasons, virtualization is used because it enables flexible sourcing, and cloud computing.

3. What are the characteristics and benefits of virtualization?

1. Memory-intensive: Since VMs have virtual hardware, they need a huge amount of memory.
2. Energy-efficient: VMs minimize energy consumed running and cooling servers in the data center—up to a 95 percent reduction in energy use per server.
3. Scalability and load balancing: The VMware infrastructure automatically distributes the load across a cluster of physical servers to ensure the maximum performance of all running VMs.

4. When is load balancing important?

When a big event happens such as the Super Bowl, millions of people hit a Web site at the same time. Virtualization provides load balancing to handle the demand for requests to the site.

5. Explain how software as a service (SaaS) reduces IT costs.

Software-as-a-Service (SaaS) is an increasingly popular IT model in which software is available to users as needed. Other terms for SaaS are on-demand computing, utility computing, and hosted services. The idea is basically the same: instead of buying and installing expensive packaged enterprise applications, users can access software apps over a network, with an Internet browser being the only absolute necessity. Usually there is no hardware and software to buy since the apps are used over the Internet and paid for through a fixed subscription fee, or payable per an actual usage fee. The SaaS model was developed to overcome the common challenge to an enterprise of being able to meet fluctuating demands on IT resources efficiently.

6. How does virtualization reduce TCO (total cost of ownership)?

Load balancing is key to solving many of today's IT challenges. Virtualization consolidates servers, which reduces the cost of servers, makes more efficient use of data center space, and reduces energy consumption. All of these factors reduce the total cost of ownership (TCO). Over a three-year lifecycle, a VM costs approximately 75 percent less to operate than a physical server.

QUESTIONS FOR DISCUSSION & REVIEW

1. Describe the relationship between IT architecture and organizational performance.

Companies need a well-designed set of plans, a blueprint or IT architecture, to guide and govern software add-ons and upgrades, hardware, systems, networks, cloud service and other IT. Having the right architecture in place cuts IT costs significantly and increases productivity by giving decision makers access to information, insights, and ideas where and when they need them. Thus, the IT architecture can improve an organization' performance and help it operate more efficiently and effectively.

2. Discuss how it's possible to have information deficiencies given today's powerful information technologies and devices.

In spite of having powerful technologies and devices, it is possible that the IT function may not get the required budget appropriation. The investments in IT change with competing demands on an organization's budget that cannot cope with the unforeseeable ways in which technology changes. The IT unit needs to ensure that it efficiently supports the information and decision needs of an organization. Information deficiencies can occur by not having appropriate IT architecture, policies, and procedures for providing the required information for the users at different levels. The other specific information deficiencies that can be managed include: data silos (information trapped in departments' databases), data lost or bypassed during transit, user-fierce formats (poorly designed user interfaces requiring extra effort from users), use of non-standardized data formats, and relying on fast changing data (that are expensive to keep pace with).

3. Assume a bank's data are stored in silos based on financial product—checking accounts, saving accounts, mortgages, auto loans, and so on. What problems do these data silos create for the bank's managers?

Such silos are unable to share or exchange data, and they cannot consistently be updated. When data are inconsistent across multiple enterprise applications, data quality cannot (and should not) be trusted without extensive verification. Data silos support a single function, and as a result, do not support an organization's cross-functional needs. With data silos, Bank managers will waste a lot of time and effort for including data from these silos in their business analysis. There is a greater chance of leaving out routinely messy but important data in their analysis.

4. Identify four KPIs for a major airline (e.g., American, United, Delta) or an automobile manufacturer (e.g., GM, Ford, BMW). Which KPI would be the easiest to present to managers on an online dashboard? Explain why.

Answers could vary. Make sure the KPIs are related to goals such as cost reduction, and profit optimization. Airlines: Trends on percentage of seat-occupancy and time lost in breakdown-maintenance; Auto Manufacturer: sales trend by car model, and trends in recall.

5. What factors are driving the trend toward collaboration and information sharing technology?

Forrester (forrester.com) identified three factors driving the trend toward collaboration and information sharing technology. These are

(1) Global, mobile workforce (a growing number of employees telecommute)

(2) Mobility-driven consumerization (cloud-based collaboration solutions are on the rise)

(3) Principle of *any* (there is growing need to connect anybody anytime anywhere and on any-device)

6. Discuss how IT architecture can support management's top business concerns.

The following are the five business concerns identified earlier on:

1. Business productivity and cost reduction
2. IT and business alignment

3. Business agility and speed to market
4. Business process reengineering (BPR)
5. IT reliability and efficiency

The IT architecture defines the vision, standards, and roadmap that guide the priorities, operations, and management of the ITs supporting the business. Consider the four components of the IT architecture. In the *business architecture*, business processes needed to achieve the goals are considered. This enables BPR and also helps align IT with business. The *application* architecture addresses both productivity and cost reduction while the *data* architecture addresses the IT reliability and efficiency. The *technology* architecture, together with the application architecture, improves business agility and speed to market.

7. Why is it important for data to be standardized? Give an example of unstandardized data.

When data are not standardized and reporting procedures are not aligned, additional effort is needed to include such data for important analysis. Non-standardized data could be left behind, resulting in unreliable information leading to poor decisions. Some examples of unstandardized data: Reporting data in different units (pounds and kilo-grams) or at different timeframes (daily and weekly).

8. Why are TPSs critical systems?

TPSs are critical systems because transactions that do not get captured can result in lost sales, dissatisfied customers, and many other types of data errors. For example, if accounting issues a check as payment for an invoice (bill), and that transaction is not captured, the amount of cash on the financial statements is overstated and the invoice may be paid a second time. Or if services are provided, but not recorded, the company loses that service revenue.

9. Explain what is meant by data volatility. How does it affect the use of databases for data analysis?

Data volatility means that data is constantly in the process of being changed. This is especially true in transaction processing systems. In order to effectively analyze data, the data to be analyzed must be extracted, transformed and loaded (ETL) from the operational databases into a data warehouse where it can be formatted and examined without slowing down or disrupting regular operations.

10. Discuss why the cloud is considered the great IT delivery frontier.

One definition for **cloud computing** is that it is Internet-based computing in which shared resources (such as hard drives for storage) and software apps are provided to computers and other devices on-demand, like a public utility. Major cloud vendors or providers are Google, Amazon, Microsoft, and Cisco. For example, Google Apps provides common business applications online that are accessed from a web browser,

while the software and data are stored on the servers. Society continues to become more mobile with people accessing data and applications using any type of mobile device from anywhere, thus the value of cloud computing continues to increase.

11. What are the benefits of cloud computing?

Optimizing IT infrastructure became especially important during tough economic times when cost-cutting became a priority. During challenging times, making the most of IT assets becomes imperative for competitive advantage, and ultimately, survival. The cloud typically offers a steep drop in IT costs because applications are hosted by vendors and provided on demand, rather than via physical installations or seat licenses. This rental arrangement with vendors is a key characteristic of cloud computing. Using cloud computing, companies are able to be more agile and responsive while significantly reducing costs and complexity through improved workload optimizations and service delivery.

Cloud computing is often used to describe services such as Google's online word-processing application and Salesforce.com's customer-service software, which are accessed online through a Web browser instead of stored on a computer. Another option is to pay to use Amazon.com's computing infrastructure, in effect, renting it, rather than buy more servers.

12. Explain virtualization and virtual machines.

Virtualization is a concept that has several meanings in IT and therefore several definitions. The major type of virtualization is hardware virtualization, which remains popular and widely used. Virtualization is often a key part of an enterprise's disaster recovery plan. In general, virtualization separates business applications and data from hardware resources. This separation allows companies to pool hardware resources—rather than to dedicate servers to applications—and assign those resources to applications as needed. The major types of virtualization are the following:

- *Storage virtualization* is the pooling of physical storage from multiple network storage devices into what appears to be a single storage device that is managed from a central console.
- *Network virtualization* combines the available resources in a network by splitting the network load into manageable parts, each of which can be assigned (or reassigned) to a particular server on the network.
- *Hardware virtualization* is the use of software to emulate hardware or a total computer environment other than the one the software is actually running in. It allows a piece of hardware to run multiple operating system images at once. This kind of software is sometimes known as a virtual machine.

Virtualization increases the flexibility of IT assets, allowing companies to consolidate IT infrastructure, reduce maintenance and administration costs, and prepare for strategic IT initiatives. Virtualization is not primarily about cost-cutting, which is tactical reason.

More importantly, for strategic reasons, virtualization is used because it enables flexible sourcing and cloud computing.

A virtual machine (VM) is a software layer (virtualization layer) that runs its own OS and apps as if it were a physical computer. A VM behaves exactly like a physical computer and is composed entirely of software with its own virtual software-based CPU, RAM, hard drive and network interface. An OS cannot tell the difference between a VM and a physical machine, nor can apps or other computers on a network. The VM also thinks it is a "real" computer.

13. How does virtualization reduce IT costs while improving performance?

VMs minimize energy consumed running and cooling servers in the data center—up to a 95 percent reduction in energy use per server. The VMware infrastructure automatically distributes the load across a cluster of physical servers to ensure the maximum performance of all running VMs. Virtualization consolidates servers, which reduces the cost of servers, makes more efficient use of data center space, and reduces energy consumption. All of these factors reduce the total cost of ownership (TCO). Over a three-year lifecycle, a VM costs approximately 75 percent less to operate than a physical server.

EXERCISES AND PROJECTS

14. Visit eWeek.com Cloud Computing Solutions Center for news and reviews at eweek.com/c/s/Cloud-Computing/. Select one of the articles listed under Latest Cloud Computing News. Prepare an executive summary of the article.

Answers will vary.

15. Visit Rackspace at rackspace.com/ and review the company's Cloud Pro products. Describe what Cloud Pro does. Explain how Rackspace Cloud Pro leverages the iPad's interface. What are the benefits of the iPad Cloud App?

Rackspace.com provides cloud-based solutions for managing several aspects of a company's IT operations such as Web sites and cloud-based applications.

One of their several offerings is Cloud Pro, which allows a network administrator to manage network resources remotely via a mobile device such as a smartphone or iPad. Cloud Pro allows users to: monitor network activity; turn on backups for a server; create new servers from backups; manage back-up scheduling; and re-boot, rename, resize and delete servers from a mobile device touchscreen.

Cloud Pro allows the user to use an app on a mobile device such as a smartphone or iPad to control cloud servers and cloud files from wherever they are located.

The Cloud Pro mobile app allows a network administrator to be anywhere and still manage network operations. The app provides greater freedom and mobility for network administrators as well as helping fewer people monitor more server resources.

16. Visit oracle.com. Describe the types of virtualization services offered by Oracle.

Oracle provides several virtualization products and solutions including:

Server virtualization provides over 100 pre-built templates to provide fully integrated enterprise management.

Data center virtualization reduces the complexity of enterprise management providing centralized control of the entire computing environment.

Desktop virtualization provides users with access to desktops and applications from a variety of client devices.

17. Visit oncloudcomputing.com. Click on one of the featured or recommended vendors. Review the vendor's cloud computing offerings. In a one-page report, explain what you learned.

Answers will vary.

18. Visit YouTube.com and search for two videos on virtualization. For each video, report what you learned. Specify the complete URL, video title, who uploaded the video and the date, video length, and number of views.

Answers will vary.

GROUP ASSIGNMENTS AND PROJECTS

19. Many of the cloud computing and virtualization vendors include case studies of some of their customers.

a. Each person on the team selects one vendor that posts recent case studies of customers.

b. Review the cases and select the one you consider most informative.

c. In a table, identify the business challenges facing the company; what the cloud or virtualization solution consisted of; and the benefits.

d. Integrate the tables into a single table ranking them in terms of benefits—from highest to lowest.

Answers will vary.

BUSINESS CASE

Case 1 – Opening Case: Paul McCartney's Artistic Legacy (and Its IT Architecture)

For Further Exploration:

1. Explain the state or condition of McCartney's private collection before this visionary project began in 2011.

McCartney has over five decades worth of recordings, videos of live concerts, short video clips, handwritten lyrics, photos, rolls of film, original works of art, and memorabilia in his personal collection. At the start of 2011, his personal collection of over 1 million artifacts were neither organized nor cataloged and a large portion was in paper or analog (non-digital) format.

2. Using your answer to #1, what had to be done to get McCartney's collection ready for the digital library?

In 2011, McCartney's MPL Communications (McCartney Productions Ltd.) started planning a new interactive portal, paulmccartney.com, to provide a fun and exciting experience for fans. MPL is the holding company for his post-Beatles business interests and work. MPL partnered with HP to first develop an IT architecture for a content-rich, interactive portal whose foundation was the digital library that contained Paul's collections. HP created the digital library by digitizing all the artifacts and cataloging them.

3. What are the benefits to fans of the new paulmccartney.com portal?

On this Web site, fans see and interact with content from the massive digital library. At paulmccartney.com a fan can find all of McCartney's post-Beatles albums, listen to songs before buying an album, and listen to others' playlists. The Rude Studio lets fans create their own playlist using McCartney songs, and then post the list on the site for other members to listen to and comment on. One can see all the albums a song was recorded on, the first time and location a song was played in concert, the number of times a song was played in concert, the date and location of every concert where each song was played and the set list for each of the concerts.

4. Why is it important to be able to offer real-time content from McCartney's concerts or other events on the portal?

The intent is to keep the library current (dynamically changing) so as to keep the fans engaged and also to maintain their continued interest in the library. Further, this keeps fans from going to other web resources for the latest material.

5. As new content was created, how did it get to the portal?

The digital library was built using HP servers, storage, networking, and management software. The digital library is stored on a private cloud and plugs directly into the backend of the portal. With this IT architecture, as soon as new content from concerts and other events is added to the library, it is pushed immediately to the site for fans to view.

Decide

6. Visit and review the features of paulmccartney.com. Consider what Jan Zadak, an HP executive vice president, said: "Fans expect a richer and deeper experience than ever before." Do you agree with this statement? Explain. What features of the portal created a richer and deeper fan experience?

Debate

7. According to MPL, the online music player Jukebox is unique. Not only can fans listen to songs and build their own playlists, but they can gain access to all information related to any particular song or album. Fans can listen to full tracks, buy albums, make dedications, and download Jukebox to their desktops. To encourage return visits, the site lets fans create a custom personal page with their profile, playlists, blogs, private messaging, and videos. Based on these features, debate whether or not the paulmccartney.com portal is a competitor of Facebook. Your debate should include the issue of whether or not it is a social media site.

Case 2 – Business case: Online Gamers' Statistics Stored in the Cloud

Questions

1. Visit and review the Mortal Kombat Online community at mortalkombatonline.com/ and Section 8 at s8stats.timegate.com/xbox. What did you learn about Agora Games' customers?

Agora Games' customers come from a variety of backgrounds, have a range of interests, and seem to have a creative bent. They are very serious about their gaming. They also take time to interact and share thoughts on current topics.

2. What factors influence Agora Games' business performance?

Since there are many competing games to choose from, factors that influence the satisfaction of the gamers and thus, the success of the business, include the game's online performance, the quality of the features and the speed of game reporting.

3. Explain how cloud storage can cut Agora's data storage costs.

Agora's data storage needs fluctuate unpredictably. Sufficient storage is required to provide acceptable performance levels; however, too much storage capacity provides unnecessary costs. Cloud storage can provide a flexible storage option providing the right amount of storage capacity as it is needed.

4. What changes occurred at Agora Games as a result of investing in enterprise cloud storage?

Agora selected a data center that provided the highest standards of security, availability, and power. They are able to get additional server capacity without service interruption. With their investment in cloud storage, Agora has complete control over its systems without having to manage hardware and provisioning. They also only have to pay for what they use. Agora's IT staff can focus their time on their core competency of building gaming environments.

5. Research two enterprise cloud storage vendors or service providers that provide sufficient information on the Web to assess them meaningfully. Compare and contrast at least four characteristics of these vendors or service providers.

Answers will vary.

Case 3 Video Case: Three Cloud Computing Case Studies

Questions

1. Visit http://www.soatothecloud.com/2011/10/video-three-cloud-computing-case.html

2. View the 11-minute video of the 3 case studies.

3. Explain the value or benefits of each organization's cloud investment.

Three case studies are about cloud computing usage. SaaS (Software as a Service), IaaS (Infrastructure as a Service), PaaS (Platform as a Service).

In the first one, students at a University access Google App e-mail (instead of university e-mail server) from their university portal via a link. No need to have e-mail server at the university.

In the second case, an organization leverages cloud computing through Terremark for managing their virtual server (infrastructure) requirements that may be changing dynamically. Optimizes cost of infrastructure; no need to pay for the peak-level resource requirement all the time.

In the third one, the connection is from the cloud (a Facebook App) to a company's API (a service offered to its customers) on its platform to attract more customers.

Data Analysis & Decision Making

DSS to Control and Manage Gasoline Costs

To do:

1. Using the spreadsheet that you download, calculate and compare the costs of driving a hybrid automobile Data Analysis & Decision Making and non-hybrid SUV from your location to a location 600 miles away.

Answers will vary.

2. You need external data. You need to know the gas prices in your starting and destination locations. Automotive.com provides a free application (a widget), a real-time, continually updated tool that monitors gas prices.

Answers will vary.

3. You have just been promoted to a fleet manager in a food company that uses 300 cars of different sizes. Prepare a DSS using Excel to show top management how to reduce gasoline costs if the price is at $4.00, $4.50, $4.75, and $5.00 per gallon.

Answers will vary.