POLYTECHNIC UNIVERSITY OF THE PHILIPPINES
COLLEGE OF COMPUTER AND INFORMATION SCIENCES
DEPARTMENT OF COMPUTER SCIENCE | DEPARTMENT OF INFORMATION TECHNOLOGY

Systems Integration and Architecture 1

INSTRUCTIONAL MATERIAL FOR STUDENTS

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Module 6: Enterprise Integration Technologies

Overview

This module will cover the technologies and vendor products that can be used to deliver into production the priority databases, activities, and processes identified in EA Methods.

It also introduces the concepts and technologies used by enterprise portals and discusses their use for rapid delivery of priority information and content resources in enterprise integration projects.

Web services concepts and technologies are introduced in this module, along with the evolution of Web services. It describes the technical foundations of Web services that are used for enterprise integration in this part. It discusses their use in enterprise portals with Web services for remote portals.

The technologies used by SOA and BPM languages will be discussed. Four BPM languages are described: Business Process Execution Language for Web Services (BPEL); Web Services Choreography Interface (WSCI); Business Process Modeling Language (BPML); and Business Process Specification Schema (BPSS) for ebXML. These offer the potential to transform systems development in twenty-first-century enterprises, with XML-based BPM languages automatically generated as executable code directly from workflow models or process models.

Lesson Outcomes

- To discuss the different Integrating Technologies used in an Enterprise Architecture.
- To describe the Direct to Point-to-Point, and Middleware approach in Integrations.
- To explain the concept of XML in enterprise application integration.
- To discuss the usage of Enterprise Portal in Enterprise Integration.
- To identify the different Web Service Technologies for Real Time Integration.
- To define Service-Oriented Architecture and its services for Integration.

Lesson 1: Integrating Technologies

The development of technology over the years has led to most systems within an organization existing in heterogeneous environments. Different applications were developed with varying languages, operate on different hardware and available numerous platforms. The problems lay in the fact that when implementing systems, decisions on the technology employed different from department-to-department and also had some dependence on the latest trends. These systems serve only the departmental needs. Information and process sharing across an organization is not accommodated for. These systems is what we known as “stovepipes”

stovepipes yun yung mga para lang sa department not for the whole organization

Stovepipe systems held independent data; it was recognized that customer information and the sharing of this information across departments was extremely valuable to an enterprise. Allowing the disparate systems to interoperate become increasingly important and necessary. As an organization grew, its desire to integrate key systems with client and vendors are essential.

The idea and implementing application integration is not new. What is new are the approach and ideas that Enterprise Application Integration (EAI) encompasses and techniques that can be utilized. The Success of applying EAI requires involvement of the entire Enterprise.

This involves:

- Business Processes
  - The key is to combine tasks, procedures, required input and output information and tools needed in each stage of the process. It is imperative, than an enterprise identifies all processes that contribute to the exchange of data within the organization. This allows organizations to streamline operations, reduce costs and improve responsive to customer demands.
- Application
  - Merging of one application data /functionality to another application.
- Data and Standard
  - This addresses the need to have a global standard by which data can be shared and distributed across an enterprise's network of systems. In order to achieve this, all data and its location must be specified, recorded and a metadata model built. Without this format, Business Processes and Application integrations will not be viable.
- Platforms.
  - This provides a secure and reliable means for corporation's heterogeneous systems to communicate and transfer data from one application to another without running into problems.

Two Types of Logical integrations Architecture in EA:

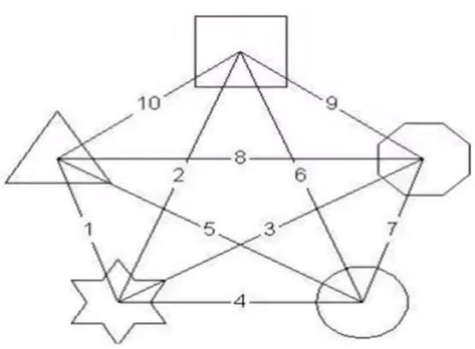
- Direct Point-to-Point
- Middleware-based integrations.

Direct Point-to-Point Integrations

Direct Point-to-Point integration is appropriate when dealing with few application. It is usually being pursued due to its easy and fast implementation. The efficiency of this method deteriorates as you try to integrate more systems. In this method, has a huge concern on scalability. Though you only have few systems, consideration must go into the future. The number of integration points is double the number of systems. This will be problematic because of the tight coupling between the systems. Alterations in one system could have adverse effects on another. Each Additional thus becomes more difficult to maintain and integrate

Middleware Integrations

To solve the issue of high amounts of integration points and thereby relieving the coupling problem, the use of middleware has been introduced where the number of integrations points will be equal to the number of systems.



A middleware is an intermediate layer provides generic interfaces through which the integrated systems are able to communicate. It perform tasks such as routing and data passing. Each of the interfaces-defines a business process provided by a certain application. Adding and replacing applications will not affect another application. Middleware is a technology that allows us to move information between enterprises.

There are two types of middleware models:

- Logical middleware model
  - Depicts how information moves throughout the enterprise conceptually
- Physical middleware model
  - Depicts both the actual method of information movement and the technology employed

Synchronous and Asynchronous Middleware

Asynchronous middleware moves information between one or many applications in an asynchronous mode i.e., the middleware software is decoupled from the source or target applications. Applications are not dependent on other connected applications for processing. Application can always continue processing, regardless of the state of the other applications.

Synchronous middleware is tightly coupled to applications. The applications are dependent on the middleware to process one or more functions calls at a remote application. Calling application must halt processing to wait for the remote application to respond.

Asynchronous is preferred over synchronous application integration solution. Synchronous middleware faces problems such as network or remote server problems. Therefore, application has to stop processing. Synchronous middleware eats up bandwidth because several calls must be made across the network in support of a synchronous function call.

Types of Middleware

- RPC
  - Oldest type of middleware. Provide ability to invoke a function within one program and have that function execute within another program on a remote machine. RPC are synchronous so RPC must stop the execution of the program. They also require more bandwidth than other types of middleware.
  - Advantage of RPC is its simplicity for mechanism and programming. Disadvantage is are its huge performance cost and inability to scale.
- Message-oriented middleware (MOM)

- MOM is queuing software that uses is messages as a mechanism to move information from point to point. MOM uses the notion of messages to communicate between applications, Direct coupling with the middleware mechanism and the application is not required. MOM rely on asynchronous paradigm. This allows application to function independently such as continue processing after making a middleware service request. Message is dispatched to a queue message, which ascertains that message is delivered to its final destination. Messages returning to the calling application are handled when the calling application finds the time. Managing are easy to manage using MOM as it has structure (schema) and content (data). MOM can be thought as one-record database that move between applications through message-passing mechanisms. MOM supports two communication models; Point-to-point, and Message queuing (MQ).

- Distributed objects
  - Small application programs that use standard interfaces and protocols to communicate with one another. Provide mechanisms for application development, providing enabling technology for enterprise, or enterprise-wide method sharing. There are two types of distributed objects in market today; Common Object Request Broker Architecture (CORBA) and Component Object Model (COM).

- Database-oriented middleware
  - Facilitates communication with a database, whether from an application or between databases. Can be used as mechanism to extract information to extract from either local or remote databases. Works with two basic database types; the first one is Call-level interfaces (CLI) - Common APIs that span several types of databases, providing access to any number of databases through a well-defined common interface such as Open Database Connectivity (ODBC).The second one is Native database middleware.

- Transactional middleware
  - Provides mechanism for coordination information movement and method sharing between many different resources. – Provides tightly coupled integration that requires changes with source and target applications. Based on concept of transaction a unit of work with a beginning and an end and application logic is encapsulated within a transaction that either completes or is rolled back completely.

  There are two types of transaction-oriented middleware:

  - TP monitors
    - Provide mechanism to facilitate the communication between two or more applications as well as a location for application logic. Provides scalability by sharing and processing transactions among other connected TP monitors. Provide connectors to databases, other applications and queues. Once connected these resources are integrated into the transaction and leveraged as part of the

transaction. TP monitors greatest performance value is in their load-balancing feature.

- Application servers
  - Provide application logic sharing and processing and for connections to back-end resources such as databases, ERP applications and even traditional mainframe applications. It also provide user interface mechanisms to deploy applications to the web platform

- Integration servers
  - Facilitates information movement between two or more resources and can account for differences in application semantics and platforms without any application necessarily understand anything about other applications it shares information with. It can also join many applications by using common rules and routing engines and transform the schema and content of the information as it flows between various applications and databases. It can broker messages between two or more source or target systems.

Lesson 2: Enterprise Application Integration Concepts

This module explains the concepts of XML and enterprise application integration. EAI applies both to integration of applications within an enterprise (intra-enterprise) as well as between enterprises (inter-enterprise). A good understanding of these EAI concepts is fundamental to appreciating the opportunities presented by some of the latest integration technologies used by enterprise architecture. We will first examine business-to-business (B2B) integration issues and B2B business drivers. We will look at trading communities and XML messaging standards.

intra-enterprise = within the enterprise
inter-enterprise = between enterprises

XML

- Stands for Extensible Markup Language.
- A Markup language that defines set of rules for encoding documents in a format that is both human-readable and machine-readable.
- It is normally used in website frontends, SW frontends, developing, and backend API development.
- The most API responses are JSON and XML.
- Extension file is .xml
- Internet Media Type are application-xml or text-xml.

XML Usage

- KEEP – it can keep data separated from your HTML.
- STORE – it can store data inside HTML documents.

- FORMAT – it can be used as a format to exchange information.
- STORE IN DATABASE – it can be used to store data in files or in database.

Basic XML Concepts

inindicate yung context nung data through TAGS

XML indicates the context of relevant data by surrounding that data with tags that define its meaning. For example, sales orders from ABC Company appear in XML as shown below:

<Customer>ABC Inc.</Customer>

But the Credit Control and Finance Departments use different terminology. They only recognize ABC by their relevant terms:

<Client>ABC Inc.</Client> for the Credit Control Department

<Debtor>ABC Inc.</Debtor> for Accounts Receivable in the Finance Department

The start and end tags clearly indicate the terminology that is used in each department. We can see from these XML data fragments that each department is dealing with the same enterprise: ABC.

Supposed a purchase order (PO) that is exchanged between both companies. This PO is issued by Smith and Co, a subsidiary of ABC. It is a PO expressed in XML. It will look like this:

ABC PO Format - Smith and Co

```
<PurchaseOrder>
  <Party Type="Buyer">
  <Reference>AB24567</Reference>
    <Name>Smith and Co</Name>
    <Street>123 High St</Street>
    <Town>Epping Forest</Town>
    <PostCode>E15 2HQ</PostCode>
  </Party>
  <Party Type="Supplier">
    ...
  </Party>
  <OrdNo>1234</OrdNo>
  <OrderItem>
    ...
  </OrderItem>
  <Tax Type="VAT" Percent="17.5">
    ...
  </Tax>
  ...
</PurchaseOrder>
```

Figure 21 Example of PO XML

XML Technologies used in Enterprises.

POWERFUL CORE TO THE ENTERPRISE

XML provides the very powerful core to the enterprises to get and synchronize their data across all devices and keep their record in databases. The XML provides the fast and reliable communication from database to the web interface or frontend of apps.

XML is also used to model Enterprise architectures using XML enterprise framework.

Enterprise Information Integration requires an accurate, precise, and complete understanding of the disparate data sources, the needs of the information consumers, and how these map to the business concepts of the enterprise. In practice, such integration takes place in context of any enterprise information system. Approaches to EII, its architecture as well as its association to enterprise application integration. We justify why XML technology contributes to finding sufficiently powerful support for EII. We present some features of XML technology, mainly its database part, and show how it is usable to EII.

Lesson 3: Enterprise Portal Technologies for Integration

An ***enterprise portal (EP)*** also called ***corporate portals*** or ***enterprise information portals*** is a gateway to the structured data and unstructured data resources of an organization. It shows how these resources are accessed from an enterprise portal, along with execution of business processes and application systems. This technology is important for integration, because it provides easy access to resources where access was often difficult before.

Definition of an Enterprise Portal

EP, generally defined as a single gateway via the network to relevant workflows, application systems, and databases, tailored to the specific job responsibilities of each individual.

Different Forms of Enterprise Portal

- Employee Portal
  - A single gateway that enables all employees to access the processes, systems, workflows and databases via the network to carry out their relevant job responsibilities, with full security and firewall protection.
- Customer Portal –
  - A single gateway via the network to details about products and services, catalogs, and order and invoice status for customers, tailored to the unique requirements of each customer.
- Supplier Portal
  - A single gateway to the purchase orders and related status information for the suppliers of an enterprise.
- Partner/Shareholder Portal
  - A single gateway for business partners or shareholders.

Basic Architecture of an Enterprise Portal

An enterprise portal is a Web-enabled, distributed environment with a single, common, managed user interface to information supporting all categories of end users. It facilitates and supports e-commerce, e-business, Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM), along with browser-enabled access for customers, suppliers, business partners, and employees. It supports operations such as virtual integration, knowledge-enabled processes, and cross-function delivery of applications.

A key characteristic of enterprise portals is support of a single sign-on function: enabling qualified users to sign on once to the portal and be automatically signed on to each application or resource that they are authorized to access for relevant sites in the enterprise network.

para lang sa mga employee nila to have access sa kailangan nilang tools

Enterprise Portal Characteristics:

- Provide a single point of content delivery and management.
- Collect and organize information, making it easy to navigate.
- Provide a customizable, personalized, Web-based user interface.
- Include a content management system that automatically scans, filters, and catalogs content from internal and external sources.
- Provide a capability to easily publish information and subscribe to information tailored to end users' specific needs.
- Include a search engine, content scanner, and Web crawlers to maintain, analyze, and locate information.
- Provide an interactive portal capability, interacting with the underlying corporate applications.
- Provide a role-based portal capability for users to manage and update corporate data.
- Utilize a single sign-on for password and authentication, ideally LDAP-compliant.
- Utilize and attach to the native security of the underlying applications.
- Provide support for and integration of structured and unstructured information.
- Provide integrated access to an enterprise business intelligence system.
- Provide access to query and reporting, spreadsheet, graphs, and OLAP functions.
- Provide integration at the metadata level with ERP, CRM, SCM, e-commerce applications, analytic applications, BI tools, and ETL tools.
- Support a standards-based infrastructure and environment, with support for HTML, HTTP/SSL, XML, LDAP, Java, JavaScript, ActiveX, Web services, and so forth.
- Utilize an architecture that supports XML messaging
- Provide event-driven alerts or notification to users on user-defined events.

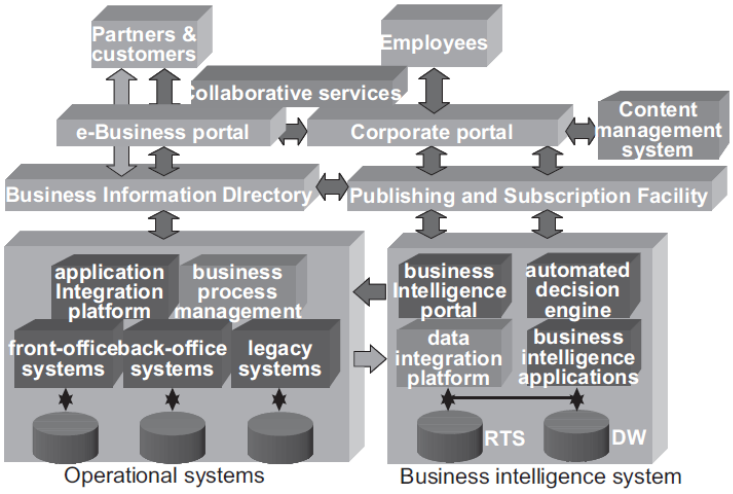


Figure 22 Typical enterprise portal architecture

Integration Using Enterprise Portal

An enterprise portal appears to deliver integration across many data sources presented in the separate windows. But this is deceptive; each window is typically independent of all other network.

An enterprise portal that provides a view to one of these redundant versions sees only those values for the relevant version. Hopefully these are up to date. But if they are out of date, that version must be synchronized with more recently updated versions that exist elsewhere in the enterprise.

A portal presents an appearance of integration. It supports presentation integration. But the underlying data themselves must first be integrated. Access through a portal to non-integrated, out-of-sync data is irresponsible and is the ultimate exercise in futility.

Enterprise Portal Product Categories

Portal products are generally categorized based on their predominant focus, but most also offer capabilities in other categories. This section provides a brief overview of the types of enterprise portal product

Enterprise Portals comprise three categories:

THREE CATEGORIES OF ENTERPRISE PORTALS

- Collaborative Portal Products

  Collaborative portals generally focus on unstructured knowledge resources, and typically offer access to Microsoft Exchange and Lotus Notes. Examples of such resources are documents, reports, e-mail, graphics, images, audio, and video. Collaborative portal products include the following:

  - IBM WebSphere Portal from IBM Corporation;
  - Plumtree Corporate Portal from Plumtree software (now BEA);
  - Microsoft SharePoint Portal Server from Microsoft Corporation;
  - Citrix NFuse Elite Portal from Citrix, Inc.

- Business Intelligence Portal Products

  Business intelligence portals generally focus on structured knowledge resources, with access to data warehouses and information system databases. These structured resources are accessed via business intelligence (BI), online analytical processing (OLAP), and other tools. Most data warehouse products are evolving into this BI portal category. Some representative BI portal products include:

  - Axielle from Ascential Software (now IBM);
  - CleverPath Portal from Computer Associates;
  - Cognos Upfront from Cognos, Inc.;
  - Enterprise Information Portal from Hummingbird.

- Integration Portal Products

Integration portals focus on easy integration between structured and unstructured knowledge resources existing in information systems and data warehouse databases, ERP environments, CRM, SCM, and others—within an enterprise via the corporate intranet, or between enterprises via the Internet. A popular integration portal product is SAP Enterprise Portal from SAP.

Lesson 4: Web Services for Real-Time Integration

Web Service Technologies:

WS is a service offered by an electronic device to another electronic device, communicating with each other via WWW.

It is a server running on a computer device, listening for requests at a particular port over a network, serving web documents (HTML, JSON, XML, and images) and creating web applications services, which serve in solving specific domain problems over the WWW.

Essential Functions of WS:

- Available over the internet or intranet networks.
- Standardized XML messaging system.
- Independent of a single Operating System or Programming Language.
- Self-describing via standard XML language.
- Discoverable through a simple location method.

Different Types of Web Services (4)

XML (Remote Procedure Call)

The most basic XML protocol to exchange data between varieties of devices on a network. It uses HTTP to quickly and easily transfer data and communication other information from client to server.

UDDI (Universal Description, Discovery, and Integration)

An XML based standard for detailing, publishing, and discovering web services. It's basically an internet registry for businesses around the world. The goal of streamline digital transaction and e-commerce among companies.

SOAP

An XML based Web service protocol to exchange data and documents over HTTP or SMTP (Simple Mail Transfer Protocol). It allows independent processes operating in disparate systems to communicate using XML.

REST

Provides communication and connectivity between devices and the internet API-based tasks. Most RESTful services use HTTP as supporting protocol.

Lesson 5: Service-Oriented Architecture for Integration

Service-Oriented Architecture (SOA) is a style of software design where services are provided to the other components, through a communication protocol over network. Its principles are independent of vendors and other technologies. It is basically a collection of services. The communication can involve either simple data passing or it could involve two or more services coordinating some activity. It is an evolution of distributed computing based on the request/reply design paradigm for synchronous and asynchronous applications. For example, a service can be implemented in.NET or J2EE, and the application consuming the service can be on a different platform or language.

SOA is an architectural approach, in which applications make use of services available in network. In this architecture, services are provided to form applications, through a communication channel over the internet.

Figure 23 Components of Service-Oriented Architecture

Three Roles within SOA

- Service Provider
  - A role that works in conjunction with the service registry, debating the whys and how's of the services being offered, such as security, availability, what to charge, and more. This role also determines the service category and if there need to be any trading agreements.
  - It is the maintainer of service and the organization that makes available one or more services for others to use.
- Service Broker

nagbibigay info about sa service

  - This role makes information regarding the service available to those requesting it. The scope of the broker is determined by whoever implements it.

- Service Requester/Consumer
  - It locates entries in the broker registry and then binds them to the service provider. They may or may not be able to access multiple services; that depends on the capability of the service requester.

Guiding Principle of SOA (7)

- Standardized service contract. KONTRATA
  - Specified through one or more service description documents.
- Loose Coupling HINDI DEPENDENT
  - Services are designed as self-contained components, maintain relationships that minimize dependencies on other services.
- Abstraction
  - It is completely defined by service contracts and description documents. They hide their logic, which is encapsulated within their implementations.
- Reusability
  - Designed as components, services can be reused more effectively, thus reducing development time and the associated costs.
- Autonomy
  - Services have control over the logic they encapsulate and from a service consumer point of view, there is no need to know about their implementation.
- Discoverability
  - Services are defined by description documents that constitute supplemental metadata through which they can effectively discovered. Service discovery provides an effective means for utilizing 3rd party resources.
- Composability
  - Using services as building blocks, sophisticated and complex operations can be implemented. Service orchestration and choreography provide solid support for composing services and achieving business goals.

Advantages of SOA (4)

- Service Reusability
  - Applications are made from existing services.
  - Service can be reuse to make many applications.
- Easy Maintenance INDEPENDENT SO MAS MADALI
  - As services are independent of each other they can be updated and modifies easily without affecting other services.
- Availability
  - SOA facilities are easily available to anyone on request.
- Reliability
  - SOA applications are more reliable since it is easy to debug small services rather than huge code.

Disadvantages of SOA

- High Overhead

- A validation of input parameters of services is done whenever services interact this decreases performance as it increases load and response time.

- High Investment
- Complex Service Management
  - When services interacts they exchange messages to tasks. The number of messages may go to millions. It becomes a cumbersome task to handle a large number of messages.

Introduction to Service-Oriented and Event-Driven Architectures (5)

DI KAILANGAN MALAMAN YUNG CODE

Service-oriented architecture is the term that has emerged to describe executable components, such as Web services, that can be invoked by other programs that act as clients or consumers of those services. As well as the execution of Web services, these services can also be complete modern—or even legacy—application programs that can be invoked for execution as a "black box." A developer does not need to know how the programs work; they need only know the input required, the output provided, and how to invoke them for execution. Software categories that provide this SOA flexibility are called Business Process Management (BPM) or business product integration (BPI) products.

Event-driven architecture is an approach for designing and building applications where business events trigger messages to be sent between independent services that are completely unaware of each other. An event may be the receipt by the enterprise of a sales order transaction from a customer for processing. An event may also be a change in a data value that requires a purchase order to be placed with a supplier, when the available quantity of a product in the warehouse falls below a minimum balance threshold.

The following are the Business Process Management (BPM) languages of SOA:

- Business Process Execution Language (BPEL)
  - Business Process Execution Language for Web services combines IBM's WSFL and Microsoft's XLANG. BPEL is designed to support implementation of any complex business process, as well as being used to describe interfaces of business processes.
- Web Services Choreography Interface (WSCI)
  - Web Services Choreography Interface is an alternative specification to BPEL. It is used to define the flow of messages exchanged by Web services participating in coordinated activities with other services. WSCI is not a "workflow description language" as such, but describes the behavior of Web services that interact with a workflow, or a system that implements a workflow.
- Business Process Modeling Language (BPML)
  - Business Process Modeling Language defines a formal model for expressing executable business processes. It defines simple and complex activities, transactions and compensation, data management, concurrency, exception handling, and operational semantics. BPML provides a grammar as an XML schema to enable the persistence and interchange of definitions across heterogeneous systems and modeling tools.
- ebXML Business Process Specification Schema (BPSS)
  - The ebXML Business Process Specification Schema (BPSS 1.0) defines a business process for physical business interchanges between parties so that collaborations and transactions can be carried out between commercial business partners. It works in

conjunction with the ebXML CPP and CPA. It also defines the automatic generation of BPSS code from UML diagrams. BPSS 2.0 uses BPMN instead of UML for process models.

- Business Process Modeling Notation (BPMN)
  - Business Process Modeling Notation is emerging as a way to specify business process models and diagrams. This is as an evolving standard for the specification of process logic for all of the above BPM languages. The Business Process Management Initiative (BPMI) and the Open Management Group (OMG) have announced they are merging their BPM activities to advance the use of BPMN as an open standard.

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Assessment

Answer the following questions:

1. What are the different types of Middlewares?
2. How middleware does addresses the redundant data version problem efficiently and inexpensively?
3. What is the difference of XML and HTML?
4. What is the advantages of implementing enterprise portal in enterprise integration?
5. Enumerate and explain each Web Service Technologies that can be used for Real Time integration.
6. Define a successful Service-Oriented Architecture?

Module 7: Enterprise Resource Planning

ERP =

Overview

The Enterprise resource planning (ERP) software market is one of the fastest growing markets in the software industry. It has seen a rocky start with several project failures and a huge shortage of skilled and experienced workers. The application such as Enterprise Resource planning aims at integrating enterprise systems across functional departments. It is an integrated computer-based application software used to manage internal and external resources.

It interfaces with all aspects of an organization: people, process, technology, systems, structure, skills, culture, and definitely available technology funds. Executives responsible for such projects must develop a very clear understanding of the tasks they are about to undertake and ensure that all the relevant variables are accounted for in the planning process and that time and effort are dedicated to them during and after the implementation.

Lesson Outcomes

- To discuss the role of Enterprise Planning to Physical and Logical Integrations.
- To assess the implications of ERP to Management.
- To distinguish ERP to E- Commerce.
- To identify the components of ERP and its Architecture.
- To discuss the ERP Implementations and Pros and cons in Business Level.
- To give examples of ERP Vendors.

Lesson1: Definition of Enterprise Resource Planning

Enterprise Resource Planning (ERP) systems are a major kind of information system allowing organizations to integrate different systems into one organization-wide application with an integrated database management system.

The goal of ERP is to integrate departments and functions across an organization into a single infrastructure sharing a common database and serving the needs of each department.

ERP systems replace an assortment of systems that typically existed in organizations. Moreover, ERP solves critical problem of integrating information from different sources and makes it available in real-time.

- Integrate systems
- have an integrated database and management systems
- integrate info

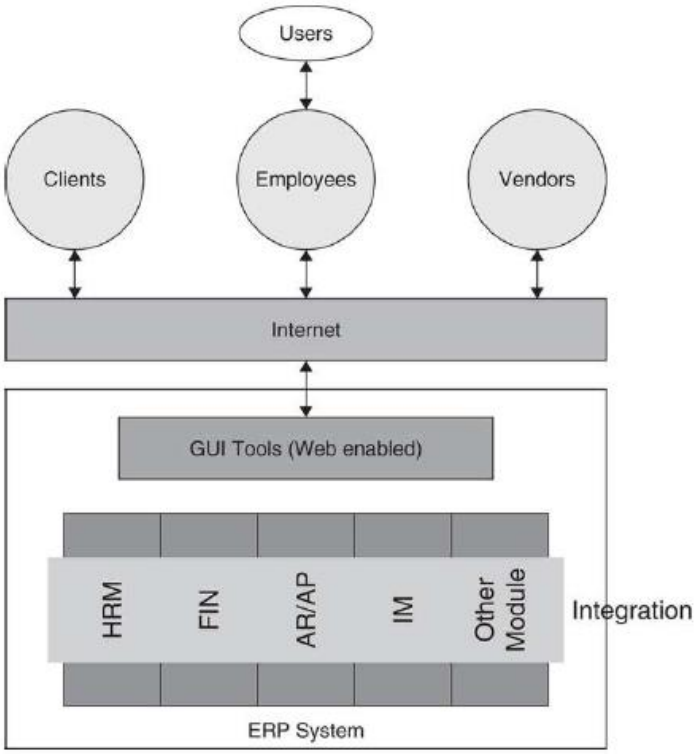


Figure 24 Integrated Systems - ERP

Lesson 2: ERP and Systems Integration

ERP systems are integrated, multi-module application software packages designed to serve and support several business functions across an organization. It is typically commercial software packages that facilitate collection and integration of information related to various areas of an organization. It enables the organization to standardize and improve its business processes to implement best practices for its industry.

ERP systems are the first generation of enterprise systems meant to integrate data and support all the major functions of ERP systems integrate various functional aspects of the organization as well as systems within the organization of its partners and suppliers.

The goal of an ERP system is to make the information flow dynamic and immediate, therefore, increasing its usefulness and value.

GOAL OF ERP SYSTEM: make the information flow dynamic, and immediate

Lesson 3: ERP's Role in Logical Integration

ERP systems require organizations to focus on business process rather than on functions. It comes with built-in processes for a wide variety of common business functions.

An ERP system implements best practices via specific built-in steps for processing a customer order in terms of:

FOCUS mapunta sa BP rather sa function

- Order entry.
- Routing through departments.
- Communication of output to various parties.

Lesson 3: ERP's Role in Physical Integration

Before installing the ERP system, an organization may have to upgrade or install middleware or get rid of their legacy system's hardware and software. Integration is also required at the Data level, Client level, and at the Application level.

A good ERP implementation improves operational efficiency with better business processes that focuses on organizational goals rather than on individual departmental goals. Improved efficiency with a paperless flow and electronic data interchange (EDI) or business-to-business (B2B) commerce environment with partner

the business processes implemented focuses sa ORGANIZATIONAL GOALS rather than the individual departmental goals.

Lesson 4: ERP implications for Management

In the early days of ERP implementation most management did not understand the magnitude of issues an organization has to consider before, during, and after implementation. ERP systems are very different from conventional packaged software, such as Microsoft Office and others.

- ERP systems implementation is a complex organizational activity.
  - There are no shortcuts when it comes to implementing an enterprise system.
- It is important to evaluate and learn from the successes and failures.
- ERP systems implementation requires strong project management oversight.

Lesson 5: Comparison of E-Commerce and ERP

E- Commerce

link ng EXTERNAL PARTNERS

- Focuses on linking a business with its external partners and stakeholders
- Disruptive technology
  - Totally transformed the way a business operates in terms of buying and selling, customer service, and relationships with suppliers.

ERP

LINK NG MGA FUNCTIONAL SILOS NG ORGANIZATION

- Focuses on integrating the internal functional silos of the organization into an enterprise application.
- Adaptive technology
  - Merged the early data processing and integration efforts within an organization.

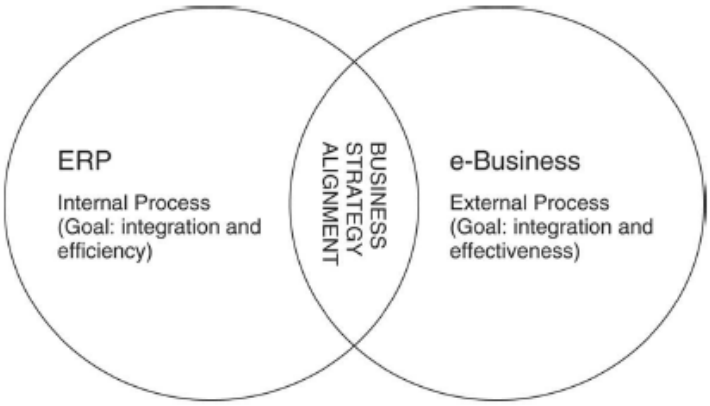


Figure 25 Venn Diagram of E-Commerce and ERP Approach

Lesson 6: ERP- Architecture and Components

ERP Systems Components

ERP consists of the following:

- Hardware
  - Servers and peripherals
- Software
  - Process Operating systems and database
- Information
  - Organizational data from internal and external sources
- Process
  - Business processes, procedures, and policies
- People
  - End users and IT staff

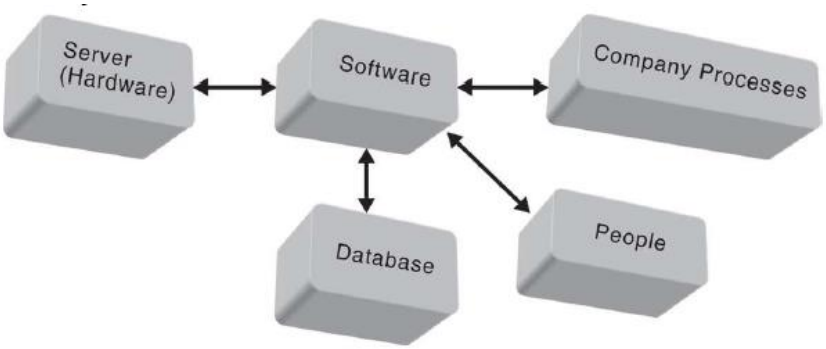


Figure 26 ERP Systems Components

ERP Architecture

The architecture of an ERP system influences the cost, maintenance, and the use of the system. The ERP architecture helps the implementation team build the ERP system for the organization. If purchased, ERP architecture is often driven by the vendor (Package-Driven Architecture).

the vendor essentially provides everything you need to get the system up and running

There are two types of architectures.

- Logical Architecture
  - Focuses on the supporting needs of the end users.

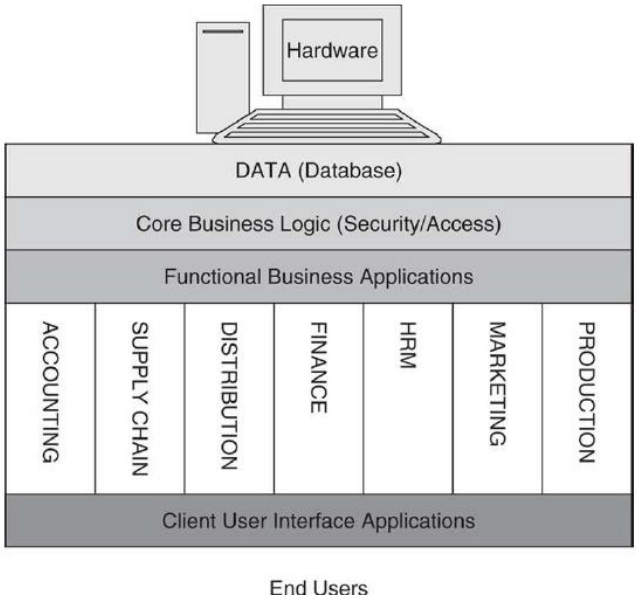


Figure 27 Logical Architecture or ERP Systems

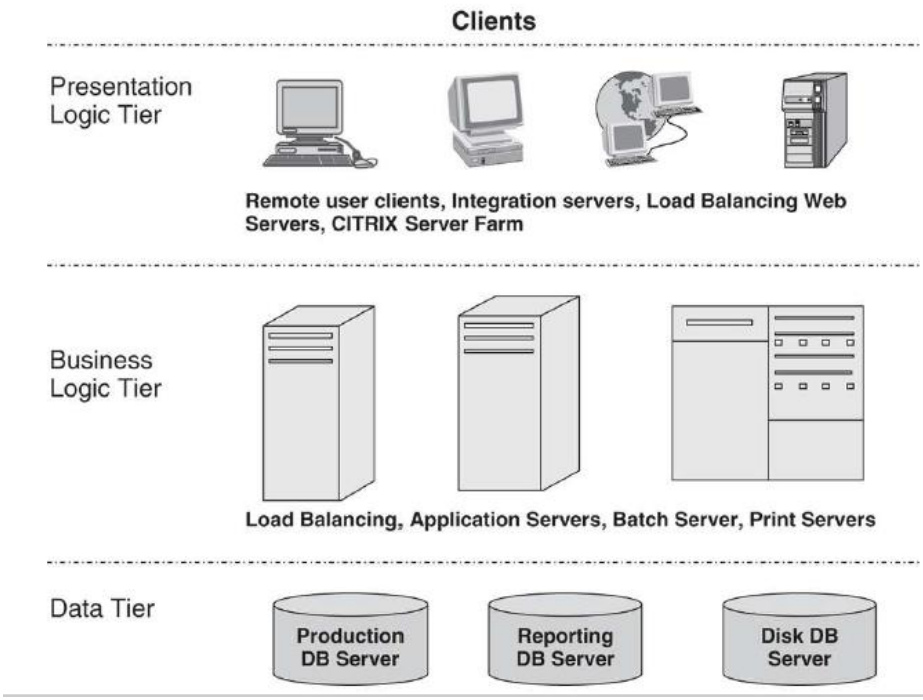


Figure 28 Example of Tiered Logical Architecture of ERP Systems

- Physical Architecture
  - Focuses on the efficiency of the system.

Benefits and Limitations of ERP

System Level	
Benefits	**Limitations**
Integration of data and applications across functional areas (i.e., data can be entered once and used by all applications; thus improving accuracy and quality of the data)	Complexity of installing, configuring, and maintaining the system increases, thus requiring specialized IT staff, hardware, and network facilities
Improvements in maintenance and support as IT staff is centralized.	Consolidation of IT hardware, software, and people resources can be cumbersome and difficult to attain.
Consistency of the user interface across various applications means less employee training, better productivity, and cross-functional job movements.	Data conversion and transformation from an old system to a new one can be tedious and complex process.
Security of data and applications is enhanced due to better controls and centralization of hardware.	Retraining of IT staff and end users of the new system can produce resistance and reduce productivity.

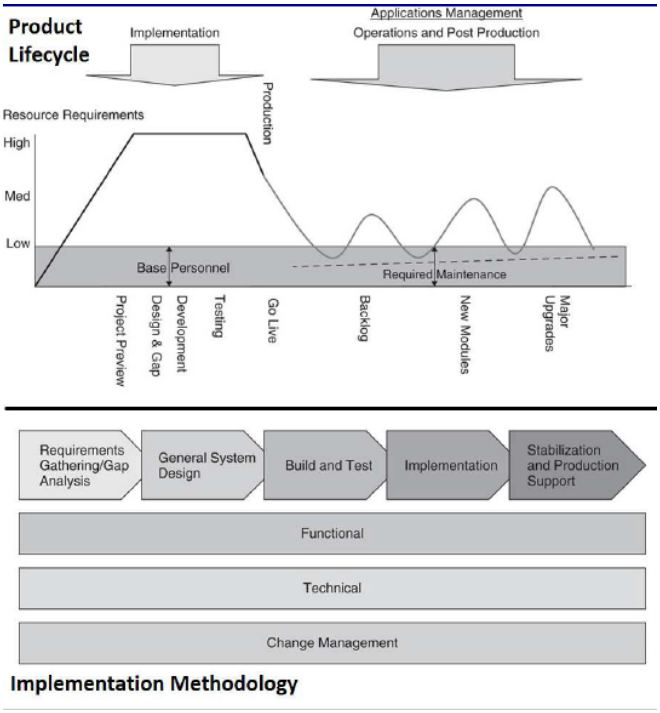
(4) (4)

Business Level	
Benefits	**Limitations**
Agility of the organization in terms of responding to changes in environment for growth and maintaining market share	Retraining of all employees with the new system can be costly and time consuming.
Sharing of information across functional areas helps collaboration between employees	Change of business roles and department boundaries can create upheaval and resistance to the new system.
Linking and exchanging information in real-time with supply-chain partners improves efficiency leading to lower costs.	
Better customer service due to quicker information flow across departments.	
Efficiency of business processes are enhanced due to the re-engineering of business processes.	

(5) (2)

Lesson 6: ERP Implementations

Before implementing ERP, an organization has to plan and understand the life cycle of these systems. The key to a successful implementation is to use a proven methodology, take it one step at a time, and begin with an understanding of the ERP life cycle. ERP system implementations are very risky, and using a well-defined project plan with a proven methodology will assist in managing those risks. There must be a strong well-communicated need to make the change from the existing information stems/applications to an ERP system.



1. Reqs Gathering/Gap Analysis
2. General System Design
3. Build and Test
4. Implementation
5. Stabilization and Production Support

Figure 29 ERP Implementation

Software and Vendor Selection

It is best for an organization that does not have experience in developing ERP systems to purchase one on the market. Before selecting a vendor, the organization must carefully evaluate its current and future needs in enterprise management. Review the organization's existing hardware, network, and software infrastructure, and the resources available for implementation.

Vendor Evaluation

The following are consideration in evaluating potential vendor:

- Business functions or modules supported by their software.
- Features and integration capabilities of the software.
- Financial viability of the vendor as well as length of time they have been in business.
- Licensing and upgrade policies.
- Customer service and help desk support.
- Total cost of ownership.
- IT infrastructure requirements.
- Third-party software integration.
- Legacy systems support and integration.
- Consulting and training services.
- Future goals and plans for the short and long term.

Considerations on Operations and Post-Implementation

Going live ("Go-live") is one of the most critical points in a project's success. It is vital to focus the efforts of all project teams to ensure that task and activities are completed before going live.

Five areas of stabilization are important:

- Training for end-users.
- Reactive support (i.e., help desk for troubleshooting).
- Auditing support to make sure data quality is not compromised by new system.
- Data fix to resolve data migration and errors revealed by audits.
- New features and functionalities to support the evolving needs of the organization.

People and Organizations

Below are the members or people of Organizations: (5)

- Project Management
  - For an ERP system to be implemented successfully, project management must provide strong leadership, a clear and understood implementation plan, and close monitoring of the budget.
- Consultants
  - It is often the case for organizations without much ERP implementation experience to use implementation partners such as consultants.
- Change Management
  - Role is essential because it prepares for changes to how business is done. In implementing new systems, communicating, preparing, and setting expectations is as important as providing training and support.
- Business Process Re-engineering
  - Business processes will need to be changed, adjusted, or adapted to the new system to use the functionality of an ERP system fully.
- Global, Ethical and Security Management
  - Outsourcing overseas, ethical issues, and problems with system security have also attracted a lot of attention in ERP implementation.

Sample ERP Vendors: (5)

- SAP ALL TYPES
  - SAP is the recognized global leader among ERP vendors with over 12 million users. Its solutions are for all types of industries and for every major market.
- Oracle/PeopleSoft per INDUSTRY CATEGORY
  - As the second largest ERP vendor, Oracle provides solutions divided by industry category and promises long-term support for customers of PeopleSoft- (acquired in 2004).
- Microsoft Dynamics
  - Formerly Microsoft Business Solutions or Great Plains, Microsoft Dynamics is a comprehensive business management solution built on the Microsoft platform.

- Infor
  - The world's third largest provider of enterprise software. It delivers integrated enterprise solutions in supply chain, customer relationship and suppliers management.
- Lawson
  - Industry-tailored software solutions that include enterprise performance management, distribution, financials, human resources, procurement, and retail operations.

Sample Vendors

Tier I	Tier II	Tier IIII
SAP	Epicor	ABAS
Oracle	Sage	Activant Solutions Inc.
Oracle—e-Business Suite	Infor	Bowen and Groves
Oracle—JD Edwards	IFS	Compiere
Oracle—Peoplesoft	QAD	Exact
Microsoft Dynamics	Lawson	NetSuite
	CDC Software	Visibility
		CGS
		Hansa World
		Consona
		Syspro

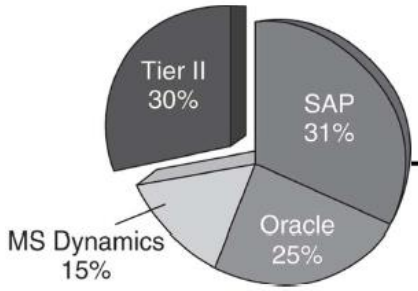


Figure 30 Sample Vendors

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Assessment

Answer the following questions:

1. What is Enterprise Resource Planning?
2. What is the difference of ERP to Supply Chain Management and Customer Relationship Management Application?
3. Why an organization undertake ERP?
4. What are the advantages of having Outsourcing and Insourcing of ERP? And what are the disadvantages?

Module 8: Other EA Enabling Technologies

Overview

There are different technologies that enables the Enterprise Architecture Integration nowadays and one of these is Cloud Computing. The role of information in Cloud Computing as a new delivery model and information delivery in a WWW rounds off key aspects of the EIA. It provides capabilities to further facilitate both the breadth and depth of capabilities required for a true Enterprise Information Architecture. The Cloud Computing capability is necessary for many enterprises today and represents a new delivery model for IT. However, the Cloud Computing delivery model is more than just a new way of billing for IT resources. A new set of IT capabilities has been developed and significant changes to existing IT components have been applied.

Another technologies that provides as a motivation to the enterprise's operation is Business Intelligence. Under Business Intelligence are concepts of Data Warehousing, Data Mining, OLTP and OLAP.

Lesson Outcomes

- To discuss how internet becomes a service for Information Systems.
- To explain the role of Cloud Computing in IT and Business Enterprise.
- To discuss the common cloud models of cloud providers.
- To explore the future of enterprise cloud computing.
- To determine the different approaches that Business Intelligence can offer in an enterprise.
- To discuss the Data Warehousing Process
- To illustrate some text and Data mining approaches in BI.
- To distinguish the OLAP and OLTP Processing tool.

Lesson 1: Cloud Computing

Cloud computing promises to revolutionize IT and business by making computing available as a utility over the internet. Software architects primarily need to assess the impact of such a transformation. It explains the evolution of the internet into a cloud computing platform, describes emerging development paradigms and technologies, and discusses how these will change the way enterprise applications should be architected for cloud deployment.

Enterprise Computing

also known as IS

Enterprise computing means the use of computers for data processing in large organizations, also referred to as 'information systems' (IS), or even 'information technology' (IT) in general. The use of computers for enterprise data processing began in the 60s with the early mainframe computers. Over the years enterprise computing paradigms have changed dramatically with the emergence of new technology.

With each of these advances, enterprise systems have dramatically improved in terms of scale and ubiquity of access. At the same time their complexity, and consequently cost, has increased as well.

Now, cloud computing offers the potential for revolutionizing enterprise computing once more, this time by transforming computing itself into a utility that can be accessed over the internet.

DATA PROCESSING BEGAN WITH MAINFRAME

Mainframe Architecture

The history of enterprise computing began in the advent of '3rd generation' computers in the 60s; these used integrated circuits as opposed to vacuum tubes, beginning with the IBM System/360 'mainframe' computer and its successors, which continue to be used to date, e.g. the IBM z-series range.

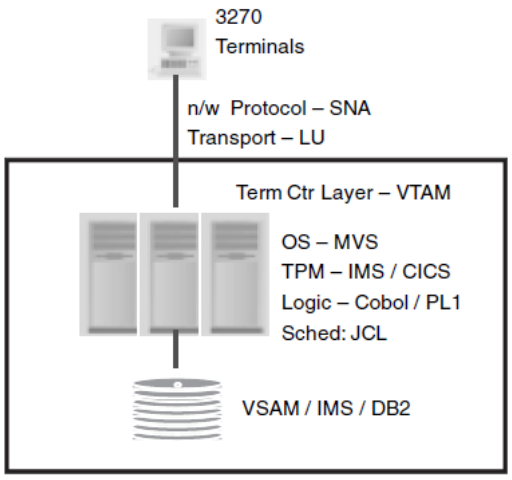


Figure 31 Mainframe Architecture

Client-Server Architecture NAGMOVE NA FROM MAINFRAME, PWEDE SA DESKTOP PC

The microprocessor revolution of the 80s brought PCs to business desktops as well as homes. At the same time minicomputers such as the VAX family and RISC-based systems running the UNIX operating system and supporting the C programming language became available. It was now conceivable to move some data processing tasks away from expensive mainframes to exploit the seemingly powerful and inexpensive desktop CPUs. As an added benefit corporate data became available on the same desktop computers that were beginning to be used for word processing and spreadsheet applications using emerging PC-based office-productivity tools.

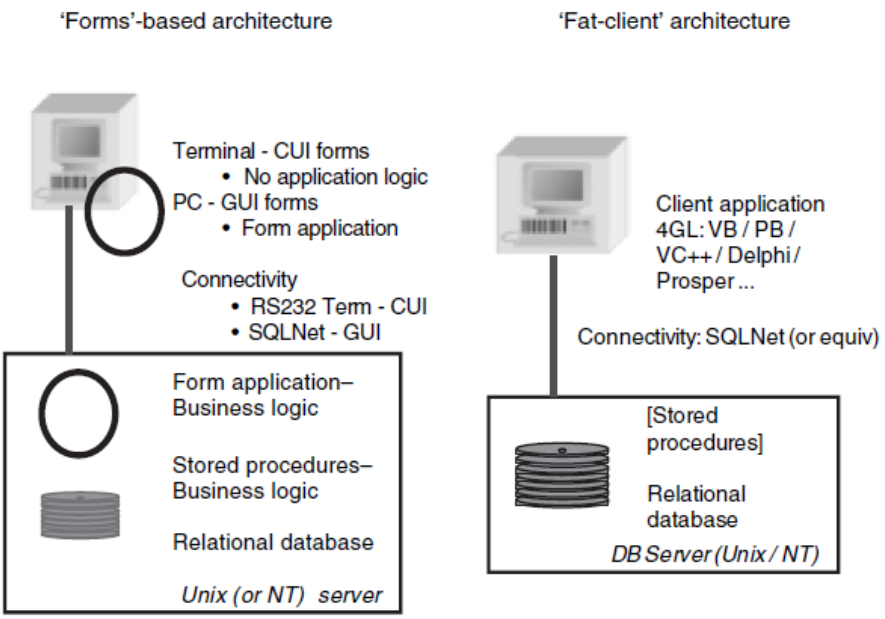
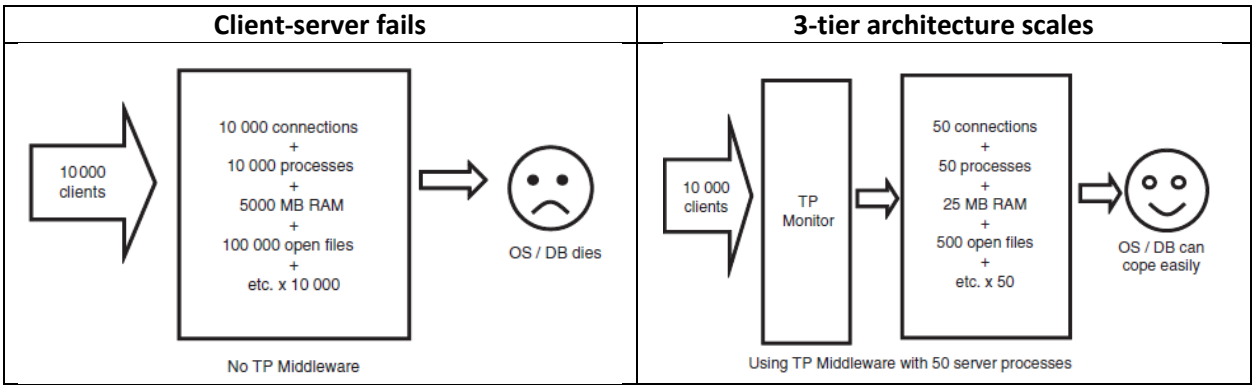


Figure 32 Client-Server Architecture

3-TIER ARCHITECTURES WITH TP MONITORS

In late 90s, RISC CPUs had exceeded mainframes in raw processing power. However, unlike the mainframe, client-server architectures had no virtual machine layer or job control systems to control access to limited resources such as CPU and disk.

Client-server architectures fail to scale for high volume transaction processing because the CPUs were inferior to mainframes.



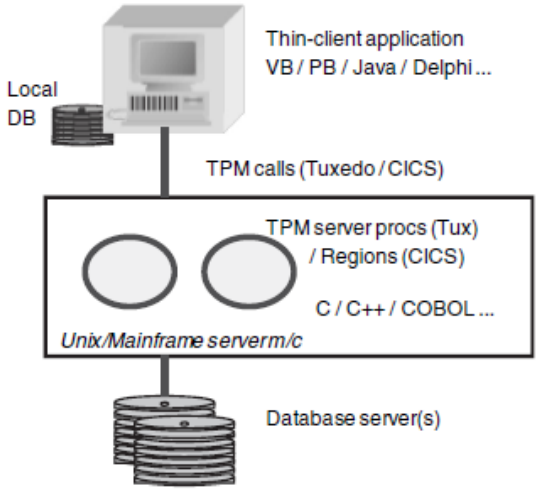


Figure 33 3-tier TP monitor architecture

Internet as a Platform

The internet was born as a communication infrastructure for data sharing soon grew to include academic institutions across the world. Using a browser, information 'published' over the internet could be accessed anonymously by the public at large, giving rise to the 'world wide web'. The subsequent history of the commercialization of the web and the dot-com boom is also well known. The internet also evolved into a platform for enterprise applications, eventually giving birth to the cloud computing paradigm.

INTERNET TECHNOLOGY AND WEB-ENABLED APPLICATIONS

Internet-based applications rely fundamentally on HTTP, the HyperText Transfer Protocol, and HTML, the HyperText Markup Language; both are now standards defined by the World Wide Web consortium (W3C). Browsers, such as Internet Explorer, and servers, such as HTTPD (HyperText Transfer Protocol Daemon) implement these standards to enable content publishing over the internet. Other technologies such as XML and SOAP are also important, the essential aspects of these underlying technologies that are critical to understanding internet-based enterprise applications and cloud computing.

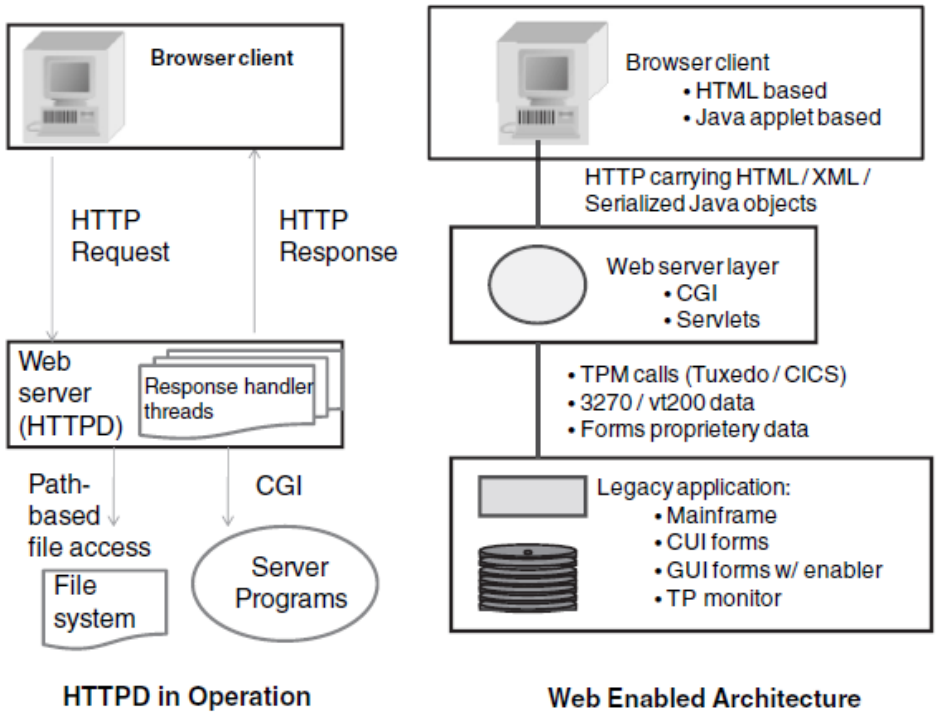


Figure 34 Internet technology and web-enabled applications

WEB APPLICATION SERVERS

In a web-enabled application architecture, processing logic, including database access, took place outside the web server process via scripts or programs invoked by it, using CGI for inter-process communication. Each such 'CGI-script' invocation included the costly overhead of launching the required server program as a fresh operating-system process.

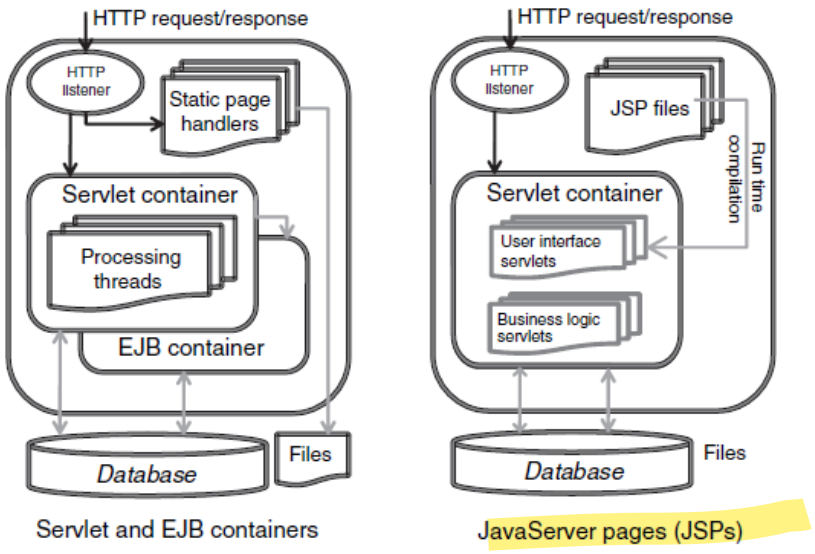


Figure 35 Web application server

The invention and proliferation of the Java language, designed to be portable across machine architectures with its interpreted yet efficient execution model made possible alternative approaches to execute application functionality inside the web-server process, leading to the birth of the 'application server' architecture.

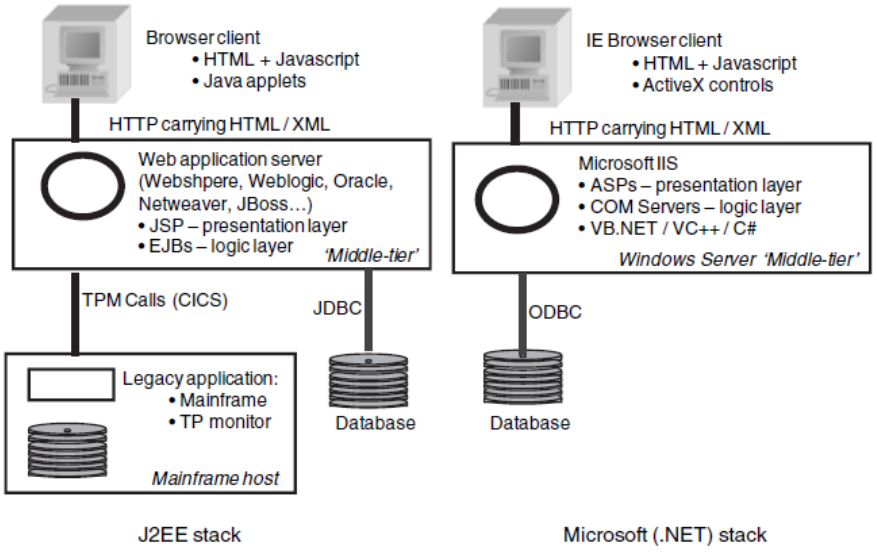


Figure 36 Web application server technology stacks

Through the 2000s, the application server architecture has become pervasive across enterprise IT, virtually replacing all other alternatives for new application development. The only major choice to be made has been between a Java or Microsoft stack.

INTERNET OF SERVICES

Once applications began to be web-enabled, it became natural to open up access to some of their functionality to the general public. For example, web-based access to back-end applications meant that end-users could themselves perform tasks such as tracking courier shipments, getting quotations for services, or viewing their bank balances; soon secure payment mechanisms were also developed that enabled users to place orders and make payments online.

Programmatic access allowed applications to communicate with each other over the internet.

With web-based access to applications becoming uniformly available to users through a browser interface, the next step was programmatic access to the same applications over the internet. This was open to abuse and malicious behavior (denial of service attacks etc.). Web services were developed initially to address this need.

yung mga attacks

need for security

The W3C defines a 'web service' as interoperable machine-to-machine interaction over HTTP. The HTML format for data exchange over the internet, was used extensively in the mainframe world for generating reports. While hugely successfully, HTML was less suited for machine-to-machine communications as its syntax is not 'well-formed. In 1997 W3C published XML (extensible markup language), using which one could also write well-formed HTML (XHTML), thereby driving browsers to support XML in addition to HTML.

This, together with XML as a basis for interoperable message formats, laid the foundation for formal web service standards. The XML-RPC standard mimics remote procedure calls over HTTP with data being transferred in XML. Like RPC, XML-RPC limits itself to simple data types, such as integers, strings etc. To support complex, nested (object oriented) types, the SOAP protocol was developed, whereby the schema of the messages exchanged as input and output parameters of published 'services' was defined using an XML format called WSDL (web services description language) and communicated over HTTP as SOAP messages (another XML format). Using SOAP, applications could call the web services published by other applications over the internet.

RPC, XML-RPC : simple data types
SOAP: complex, object oriented types

It allows independent processes operating in disparate systems to communicate using XML.

Simple Object Access Protocol

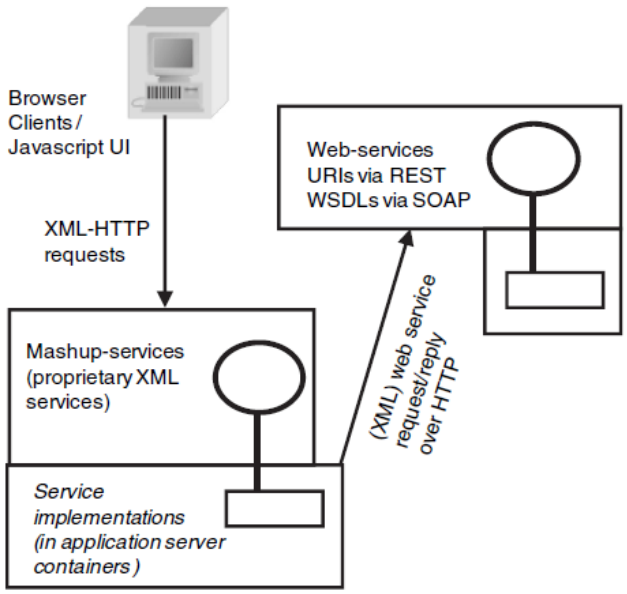


Figure 37 Internet of services

An alternative to the SOAP protocol, called REST (representational state transfer), which is rapidly emerging as preferred protocol for remote data access especially in the context of cloud computing.

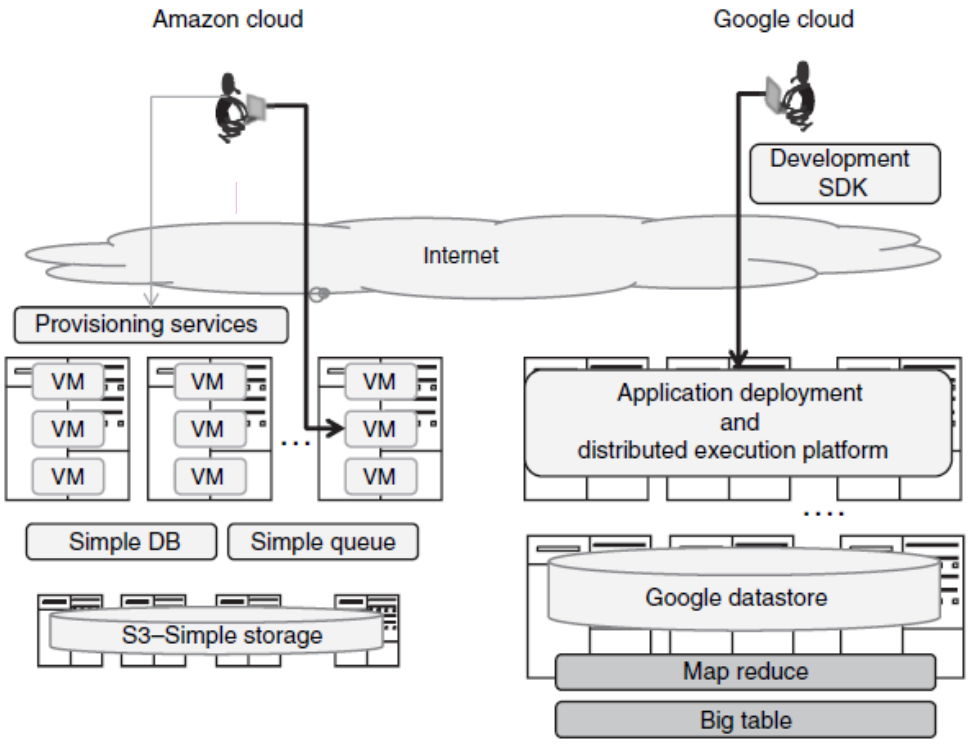
Cloud computing

Whereas software as a service is about packaged applications made available over the internet, cloud computing makes a lower level of infrastructure and tools available over the internet in data centers maintained by a cloud provider. To understand the additional features that account for the surge of interest in cloud computing, we first need to trace the evolution of cloud computing by the pioneers in the field. Amazon and Google.

Amazon, the first 'cloud' provider, faced a different set of challenges as it grew from an online bookseller to an online retail hub, but solved them in a highly innovative and reusable manner, leading eventually to a new cloud computing business. First, the complexity of Amazon's application suite; to display one page featuring a book, a number of services from fairly complex applications are needed, such as reviews, recommender systems, and collaborative filtering. Next, the peaks and troughs of the seasonal retail business necessitated Amazon to continuously monitor load and automatically provision additional capacity on demand. Finally, as they became a retailer catering to the 'long tail' of small niche products, they saw the need to support their suppliers with some minimal IT, many of whom had no systematic computing systems apart from a few personal computers.

For Google, the scale of computing power needed to support large-scale indexing of the web, the immense volume of searches, and machine-learning-based targeting of advertisements across this volume meant

orders of magnitude larger computational needs as compared to even the largest enterprise. Large banks today often have tens of thousands of servers; Google, on the other hand is estimated as running over a million servers, as of today. Google developed innovations in programming models for large-scale distributed processing, such as the Map Reduce model for partitioning a sequence of tasks to be performed on a very large data set and executing it in parallel across a very large set of machines.



Cloud models

Future of enterprise cloud computing

The ecosystem of technologies related to the enterprise adoption of cloud computing is constantly evolving. As cloud computing matures, many of the concerns surrounding its use for enterprise applications are likely to be addressed. In the meantime, there are a few quick-wins that can result in immediate benefits by leveraging available cloud platforms. In the longer term, cloud computing will itself evolve in hereto unknown directions, and we speculate on a few of these:

- Commoditization of the data center
- Inter-operating Virtualized Data Centers
- Convergence of private and public clouds
- Generalized 'cloud' services

Lesson 2: Business Intelligence, Analytics and Search

Another equally important motivation to maintain data about an enterprise's operations is to unearth hidden patterns and discover knowledge that can improve business strategy or optimize operational processes. Such knowledge discovery tasks are supported by analytical applications. Additionally, with the advent of the web and the ubiquity of internet search, any knowledge discovery or creation exercise today includes web search as an integral supporting activity. This naturally leads to the question of whether similar search technologies can be applied to enterprise information retrieval.

Interest in enterprise search has also been fueled by the increasing amounts of text (and other unstructured) information generated and maintained by large enterprises and the use of search technologies to index such data. There also interest in exploring whether search techniques apply to structured data.

An end-user's view of a business intelligence application is that of a variety of reports that aggregate operational details of the enterprise summarizing business performance. For example, sales analysis may require viewing quarterly sales of products from different categories (such as 'consumer' versus 'enterprise'), segregated by region.

Quarterly product revenue by category and region

Category →	Consumer				Enterprise			
Region ↓	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
US	100	130	120	150	90	100	110	120
UK	50	40	35	29	65	68	64	60
EMEA	80	95	100	120	80	75	70	65
APAC	10	20	15	18	45	50	55	60

Figure 38 Example of Summary of Report arrive using BI

Data Warehousing

Actual operational data maintained by the enterprise is in terms of orders placed by customers, shipments dispatched, invoices raised and payments made. Further, the number of such records can be very large. For example, a large global retail chain might generate a few million such records a day. Operational data needs to be transformed into a form on which a variety of reports can be computed. The process of extracting and transforming operational data into such a 'reporting database' is called **data warehousing**.

Data Warehousing Process

Data Warehousing is not as simple a process as may appear at first glance; data warehousing usually involves steps such as:

1. Removing all purely operational data, such as remarks or shipping reference numbers.
2. Time stamping and related restructuring of data so that it represents historically valid snapshots: For example, the category of a product may change over time; therefore the product category at

the time of sale needs to be stored along with a sales record instead of in a separate product category table, so that even if a product changes category, historically correct information is maintained.

3. Computing and inserting derived data, such as the location of a sale, which is possibly defined by the city and country specified in the customer's address, if available, or by the address of the retail store where the sale was made.
4. Aggregating measures by the lowest expected granularity required for reporting, such as aggregating sales figures at a weekly level rather than by date, if it is determined that this is the finest level to which reporting may be needed.
5. Computing any required aggregates based on the desired semantics. For example, is a 'sales record' an order, a payment, or an invoice? The period in which a sale may be counted may be different in each case. Moreover, some invoices may be unpaid or some orders rejected. Such facts would need to be accounted for while creating 'sales records' in the data warehouse.

Usually an enterprise data warehouse aggregates many different measures of enterprise performance. Thus, in addition to sales, other measures such as income, costs, shipment delivery times and average manufacturing production throughput are also captured along with relevant dimensions. Such a large data model becomes difficult to navigate and query; therefore purpose specific data is often extracted from the enterprise data warehouse into a data mart. For example, a sales data mart would include only sales information with relevant dimensions, leaving out dimensions such as manufacturing location, or product cost.

OLTP and OLAP

OLTP stands for On-line Transaction Processing. OLTP is transactional system and deals with the operation in a system with lot of short transactions on-line i.e. INSERT, UPDATE, and DELETE. OLTP focus on very fast query processing. It is quite efficient to maintain data in multi-accessed environments. The data is frequently updated.

MABIBILIS LANG

OLAP stands for On-line Analytical Processing. OLAP is analytical system and deals with historical data with low volume of transactions. Response time is an effective measure of the OLAP systems. Data is stored in multi-dimensional schemes and is aggregated. Queries are quite complex here. Its processing speed depends upon the amount of data involved.

QUERIES ARE COMPLEX

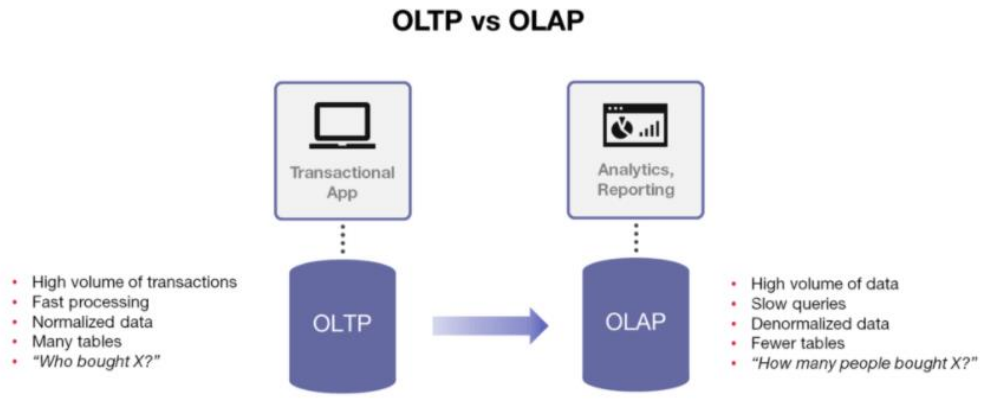


Figure 39 High Level Differences of OLTP and OLAP

Key Differences between OLTP and OLAP (11)

- OLTP stands for On-line Transaction Processing while OLAP stands for On-line Analytical Processing.
- OLTP provides data to data warehouse while OLAP analyze this data.
- OLTP deals with operational data while OLAP deals with historical data.
- In OLTP queries are simple while in OLAP queries are relatively complex.
- Processing speed of OLTP is very fast while in OLAP processing speed depends upon the amount of data.
- OLTP requires less space for data as compare to OLAP.
- Database design of OLAP is highly normalized with many tables while in OLAP the database design is de-normalized with few tables.
- In OLTP database transactions are short while in OLAP database transaction are long.
- IN OLTP volume transactions are high while in OLAP volume transaction are low.
- In OLAP transaction recovery is necessary while in OLTP transaction recovery is not necessary.
- OLTP focuses on updating data while OLAP focuses on reporting and retrieval of data

OLAP on a star schema

Business intelligence tasks aggregate measures of business performance along a set of dimensions. At a data mart level, the star schema is a popular data model for capturing multidimensional information, especially where dimensions are hierarchical. The name 'star' comes from its structure: A central fact table surrounded by associated dimension tables. The dimension tables capture the hierarchical structure of each dimension, such as time period in days, weeks and months, or product category in terms of a hierarchy of categories (such as board games, toys, entertainment, and consumers).

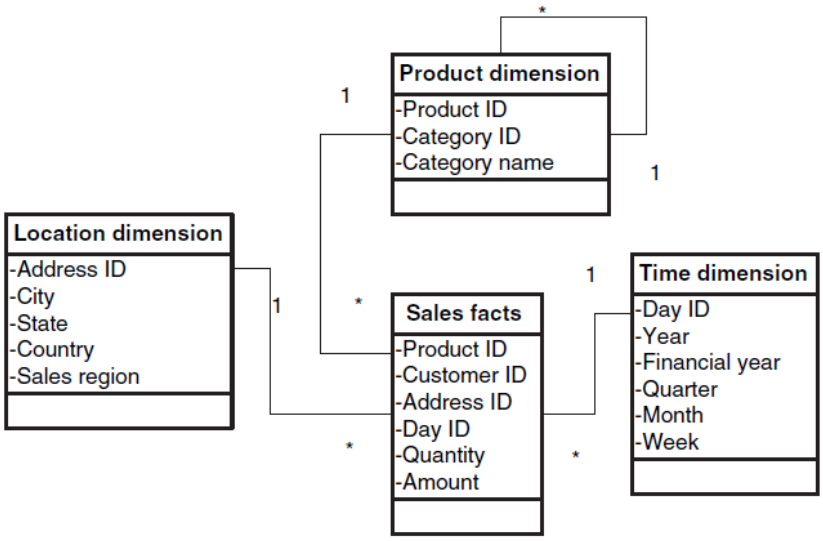


Figure 40 Star schema

TEXT AND DATA MINING

A similar analysis could also evaluate customers, or employees. On the other hand, detecting fraud, finding patterns in product purchases or identifying trends and opinions, are more difficult, and are perhaps impossible to achieve solely through OLAP. Further, when the number of dimensions on which data needs to be analyzed becomes large, slicing and dicing becomes difficult to comprehend and results in a trial-and-error process of iteratively choosing dimensions to see if they yield insight.

Instead, the data mining approach mathematically models the analysis task. This results in a few broad categories of problems that can be solved (using a variety of computational techniques), rather than relying on human analysis alone:

masosolve: (5)

- **Classifying** data by manually assigning labels (e.g. 'valuable') to a known subset of data, and using this to construct a classifier, i.e. a mathematical model, which can then be used to automatically assign the labels for remaining data, or for new records as they arrive.
- **Clustering** data into groups that are more 'similar' to each other than to other clusters, for example to determine which documents discuss the same set of topics, or which customers exhibit similar buying patterns.
- Identifying **anomalies**, which are records very dissimilar from the vast majority of data, such as in fraud detection, or crime and intelligence investigations.
- Analyzing **patterns** in subsets of data that have particularly strong connections to each other, especially in conjunction with other techniques, such as anomaly detection or clustering: For example, automatically characterizing anomalous behavior in terms of 'explanations' that yield deeper insight, or describing the actual behavior patterns of customers belonging to the same cluster.
- Making **predictions** by choosing hypotheses that might explain data, by constructing probabilistic models, such as in tracking a moving target, modeling price movements or fault diagnosis.

References

DadiaRajeenOLTP vs. OLAP. [Online][Cited: 27 September 2020.]https://www.youtube.com/watch?v=Zd4VK3gHYs0&feature=youtu.be.

GautamShroff *Enterprise Cloud Computing: Technology, Architecture, Applications*. New York, Cambridge University Press, 2010.

GHarold OLTP vs. OLAP. [Online][Cited: 19 September 2020.]https://diffzi.com/oltp-vs-olap/.

Assessment

Answer the following questions:

1. How can Cloud computing be an impact to the new delivery models on operational service qualities?
2. Who pioneered the design of cloud models in cloud computing fields? What are their major differences?
3. Define Internet as a Service.
4. What do we mean about Commoditization of the data centers?
5. What is Data Warehousing?

APPENDIX A. Course Syllabus

POLYTECHNIC UNIVERSITY OF THE PHILIPPINES
College of Computer and Information Sciences
Department of Information Technology

COURSE TITLE	**Systems Integration and Architecture**
COURSE CODE	**COMP 30033**
CREDIT UNITS	**3 UNITS / 3 HOURS**
COURSE PREREQUISITE	
COURSE DESCRIPTION	This subject should develop skill in enterprise architecture planning and enterprise application integration. By creating an enterprise architecture plan, the student should be able to define and describe the data, the applications, and the technology needed to support the organization. Application integration should cover creating strategic business solutions using technology integrating it with the, business functionalities and processes.

Institutional Learning Outcomes	Program Outcomes	Course Outcomes
1. Creative and Critical Thinking Graduates use their imaginative as well as rational thinking abilities to life situations in order to push boundaries, realize possibilities, and deepen their interdisciplinary and general understanding of the world.	Apply knowledge of computing, science, and mathematics appropriate to the discipline. Analyze complex problems, and identify and define the computing requirements appropriate to its solution. Identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems.	Combine lessons from previous subjects to come up with an integrated solution at the enterprise level
2. Effective Communication Graduates are proficient in the four macro skills in communication (reading, writing, listening, and speaking) and are able to use these skills in solving problems. Making decisions and articulating thoughts when engaging with people in various circumstances.	Communicate effectively with the computing community and with society-at- large about complex computing activities through logical writing, presentations, and clear instructions.	Document data gathered in every step of the process. Create reports on progress updates. Create project presentations on the application
3. Strong Service Orientation Graduates exemplify the potentialities of an efficient, well-rounded and responsible professional deeply committed to service excellence.	Function effectively as a member or leader of a development team recognizing the different roles within a team to accomplish a common goal.	Perform tasks, depending on the role assignment Contribute expertise to other members of the team. Solve problems, whether technical and or non-technical issues that may arise.

4. Community Engagement Graduates take an active role in the promotion and fulfillment of various advocacies (educational, social and environmental) for the advancement of community welfare.	Analyze the local and global impact of computing information technology on individuals, organizations, and society. Integrate IT-based solutions into the user environment effectively.	Design and develop solutions which are relevant to the changing needs of the stakeholders
5. Adeptness in the Responsible Use of Technology Graduates demonstrate optimized use of digital learning abilities, including technical and numerical skills.	Apply knowledge through the use of current techniques, skills, tools and practices necessary for the IT profession Understand best practices and standards and their applications. Design, implement, and evaluate computer-based systems, processes, components, or programs to meet desired needs and requirements under various constraints. Assist in the creation of an effective IT project plan.	Design and develop solutions that will cater to the needs of the organization
6. Passion to Lifelong Learning Graduates are enabled to perform and function in the society by taking responsibility in their quest to know more about the world through lifelong learning.	Recognize the need for and engage in planning, self-learning, and improving performance as a foundation for continuing professional development.	Plan knowledge sharing with the team for lessons which will be applied in the design.
7. High Level of Leadership and Organizational Skills Graduates are developed to become the best professionals in their respective disciplines by manifesting the appropriate skills and leaderships qualities.	Function effectively as a member or leader of a development team recognizing the different roles within a team to accomplish a common goal.	Perform the role of a leader and organize the team so that each member will be able to maximize his full potential
8. Sense of Personal and Professional Ethics Graduates show desirable attitudes and behavior either in their personal and professional circumstances.	Understand professional, ethical, legal, security and social issues and responsibilities in the utilization of information technology.	Design solutions which will be useful or beneficial to the well-being of the stakeholders
9. Sense of National and Global Responsiveness Graduates' deep sense of national compliments the need to live in a global village where one's culture and other people culture are respected.	Analyze the local and global impact of computing information technology on individuals, organizations, and society.	Design solutions which will be useful or beneficial to the broader segment of the community

Course Plan					
Week	**Topic**	**Learning Outcomes**	**Methodology**	**Resources**	**Assessment**
Week 1	**Introduction to the Course** **Introductions (Faculty and Students)** **Discussion of Course Syllabus including Grading System and General rules** **Classroom Management**	**a. Demonstrate an understanding of what the subject is all about, what will be in scope for the semester, and what students are expected to learn** **b. Explain the importance of this subject and how it can synthesize with other subjects learned before** **c. Communicate with fellow students and teacher and begin to establish rapport** **d. Identify and explain the course assessment and validation criteria , including grading system to understand how to pass the subject** **e. Explain what are the do's and don'ts while the class is on-going**	**Orientation** **Self-Introduction (On-line)**	**University Student Handbook** **College Manual** **Course Syllabus** **Online application**	**Quick recitation using online application to get students' understanding of what has been discussed**
Week 2	**Introduction to Systems Integration and Enterprise Architecture** **a. Importance of IT in Organizations** **b. Defining Systems Integration** **c. Defining Enterprise Architecture**	**a. Discuss the role of IT and its importance in an Organization** **b. Define an Enterprise integration and explain its goals in an enterprise.** **c. Distinguish Enterprise Integration to System Integration,** **d. Elaborate the four stages of System Integration.** **e. Articulate the Enterprise Architecture and explain its goals, and advantages.** **f. Enumerate the common Enterprise Architecture Frameworks**	**Online Class Discussion** **Reading Assignment**	**Instructional Manual** **Online application** **Slide Presentation**	**Online quiz**
Week 3-4	**Overview of Enterprise Architecture Frameworks** **a. The Enterprise Architecture Framework** **b. The Zachman Framework for Enterprise Architecture** **c. The Open TOGAF Framework**	**a. Explain the need of Enterprise Framework for designing and implementing an Enterprise Information Systems.** **b. Develop a knowledge on how the Zachman Framework depicts entire artifact of an enterprise architecture.** **c. Enumerate the Advantages and the Drawbacks of using Zachman Framework.** **d. Recognize another known EA framework such as TOGAF.**	**Online Class Discussion** **Reading Assignment**	**Instructional Manual** **Online application** **Slide Presentation**	**Online quiz**

		e. Discover TOGAF Composition, Use and Benefits.			
Week 5	Components of Enterprise Architecture a. Enterprise Architecture and its Components	a. Enumerate and explain each components of Enterprise Architecture b. Differentiate the approach of IT on development and support of Enterprise Architecture	Online Class Discussion Reading Assignment	Instructional Manual Online application Slide Presentation	Online quiz
Week 6-7	Enterprise Information Architecture Concepts a. EIA Data Domains, Information Governance, and Information Security b. Conceptual and Logical View of Enterprise Information Architecture c. Component Model and Operational Model of Enterprise Information Architecture	a. Examine the different data domains that is being used in the line of business of an enterprise. b. Determine the different areas IT governance that tightly coupled in business strategies and objectives. c. Identify the different aspects of IT security and Information Privacy services. d. Acquire knowledge on Conceptual and Logical views of Enterprise Information Architecture. e. Design the Component Model of an Enterprise Information Architecture and to assemble the corresponding Operational Model.	Online Class Discussion Reading Assignment	Instructional Manual Online application Slide Presentation	Online quiz
Week 8	Enterprise Architecture Methods a. Evolution of Systems Development Methodology b. Strategies for Enterprise Architecture Implementation c. Enterprise Architecture Incremental Build Context	a. Review the evolution of systems development methodologies. b. Identify the different strategies for enterprise architecture implementations c. Plan EA based on Incremental Build Context	Online Class Discussion Reading Assignment	Instructional Manual Online application Slide Presentation	Online quiz
Week 9	MIDTERM				Online Midterm Examination
Week 10-11	Enterprise Integration Technologies a. Integrating Technologies b. Enterprise Application Integration Concepts c. Enterprise Portal Technologies for Integration	a. Discuss the different Integrating Technologies used in an Enterprise Architecture. b. Describe the Direct to Point-to-Point, and Middleware approach in Integrations. c. Explain the concept of XML in enterprise application integration.	Online Class Discussion Reading Assignment	Instructional Manual Online application Slide Presentation	Online quiz

	d. Web Services for Real-Time Integration e. Service-Oriented Architecture for Integration	d. Discuss the usage of Enterprise Portal in Enterprise Integration. e. Identify the different Web Service Technologies for Real Time Integration. f. Define Service-Oriented Architecture and its services for Integration.			
Week 12	Enterprise Resource Planning a. Definition of Enterprise Resource Planning b. ERP and Systems Integration c. ERP's Role in Logical Integration d. ERP's Role in Physical Integration e. ERP implications for Management f. Comparison of E-Commerce and ERP g. ERP- Architecture and Components h. ERP Implementations	a. Discuss the role of Enterprise Planning to Physical and Logical Integrations. b. Assess the implications of ERP to Management. c. Distinguish ERP to E- Commerce. d. Identify the components of ERP and its Architecture. e. Discuss the ERP Implementations and Pros and cons in Business Level. f. Give examples of ERP Vendors	Online Class Discussion Reading Assignment	Instructional Manual Online application Slide Presentation	Online quiz
Week 13-14	Other EA Enabling Technologies Cloud Computing Business Intelligence, Analytics and Search	a. Explain the role of Cloud Computing in IT and Business Enterprise. b. Discuss the common cloud models of cloud providers. c. Explore the future of enterprise cloud computing. d. Determine the different approaches that Business Intelligence can offer in an enterprise. e. Discuss the Data Warehousing Process f. Illustrate some text and Data mining approaches in BI. g. Distinguish the OLAP and OLTP Processing tool.	Online Class Discussion Reading Assignment	Instructional Manual Online application Slide Presentation	Online quiz
Week 15-17	Project Discussions/Presentations	Demonstrate the ability to integrate heterogeneous systems into a cohesive application.			Project Online Submission of Documentation/ Online Presentation
18	Final Examination				Online Final Examination

Suggested Readings and References

REFERENCES

1. **The Art of Enterprise Information Architecture: A Systems-Based Approach for Unlocking Business Insight , 2010, by Mario Godinez, Eberhard Hechler, Klaus Koenig, Steve Lockwood, Martin Oberhofer, Michael Schroeck**
2. **Enterprise Systems Integration by Judith Myerson**
3. **Enterprise Integration , An Architecture for Enterprise Application and Systems Integration, 2002 by Fred A. Cummins**
4. **Business Intelligence Guidebook, from Data Integration to Analytics, by Rick Sherman**
5. **Principles of Data Integration by AnHai Doan, Alon Halevy, Zachary Ives**
6. **System Architecture with XML, 2003, Daum Berthold, Merten Udo**
7. **Enterprise Cloud Computing: Technology, Architecture, Applications, 2010, by Gautam, Shroff**
8. **SOA- Based Enterprise Integration: A Step by Step Guide to Service-Based Application Integration, 2009, by Roshen, Waseem**
9. **Handbook of Systems Engineering and management, 1999, by Sage, Andrew P., Rouse, William B**
10. **Handbook of Enterprise Integration, 2010, by Sherif, Mostafa Hashem**

Note: Extended readings may be assigned by the professor.

Project Rubrics

CRITERIA	EXCELLENT 96-100	GOOD 86-95	SATISFACTORY 76-85	POOR 60-75	FAILED Below 60
Content (50%)	Analysis and integration of the subject matter is clear and convincing	Analysis and integration subject matter is clear and effective	Analysis and integration subject matter is under developed	Analysis and integration subject matter is unsophisticated	Did not submit
Organization (30%)	Paper shows exceptionally clear organization, purpose and focus	Paper shows good organization, purpose and focus	Paper lacks clear organization, purpose and focus	Paper is disorganized and confusing	
Grammar (10%)	Free of most grammatical errors	Some grammatical mistakes but generally shows successful grammar usage	Frequent grammatical errors	Appropriate grammatical knowledge not displayed for current language level	
Timeliness (10%)	Assignment turned in earlier than the deadline	Assignment turned in on time		Assignment turned in late	-

Course Grading System

COURSE ASSESSMENT& EVALUATION CRITERIA (GRADING & REQUIREMENTS)

Assignments / Quizzes / Exercises

Major Requirements

- **Midterm and Final Exam**
- **Faculty in charge will decide what Project to be provided.**

GRADING SYSTEM:

FIRST GRADING = Class Standing (70%): Quizzes, Recitation, Assignment, Exercises, Project; Midterm Examination (30%)

SECOND GRADING = Class Standing (70%): Quizzes, Recitation, Assignment, Exercises, Project; Final Examination (30%)

FINAL GRADE = (FIRST GRADING + SECOND GRADING) / 2

Online Class Policy

Aside from what is prescribed in the student handbook, the following are the professor's additional house rules:

1. **The course is expected to have a minimum of four (4) quizzes.**
2. **Assignments and research projects/report works will be given throughout the semester. Such requirements shall be due as announced in class. Late submission shall be penalized with grade deductions (5% per day) or shall no longer be accepted, depending on the subject facilitator's discretion. Assignments and exercises are designed to assist you in understanding the materials presented in class, and to prepare you for the exams.**
3. **Students are required to attend online classes regularly as scheduled, including possible make-up classes. The student will be held liable for all topics covered and assignments made during his/her absence. The university guidelines on attendance and tardiness will be implemented.**
4. **Any evidence of copying or cheating during any examinations may result in a failing grade from the examination for all parties involved. Note that other university guidelines shall be used in dealing with this matter.**
5. **Students are advised to keep graded work until the semester has ended.**
6. **Contents of the syllabus are subject to modification with notification.**
7. **Student are required to interact with the learning management system (LMS).**
8. **During the online class student are expected to be actively participating in the course.**
9. **Withdrawal and dropping from the subject should be done in accordance with existing university policies and guidelines regarding the matter.**

Consultation Time: Online Consultation under pre-determined time.

***** Course Syllabus taken from the University of the Sunshine Coast, Queensland, Australia (ICT 321 Architecture and Systems Integration)***

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