CHAPTER II
LITERATURE REVIEW

2.1 E-commerce

E-commerce or electronic commerce, also known as e-business, refers to the transaction of goods and services through electronic communications. Although the general public has become familiar with e-commerce only in the last decade or so, e-commerce has actually been around for over 30 years. There are two basic types of e-commerce: business-to-business (B2B) and business-to-consumer (B2C). In B2B, companies conduct business with their suppliers, distributors, and other partners through electronic networks. In B2C, companies sell products and services to consumers. Although B2C is the better known to the general public, B2B is the form that actually dominates e-commerce in terms of revenue.1 The concept of e-commerce is related to notions of Internet economy and digital economy. All these concepts relate to the use of new information and communication technologies for economic activities, but with different focuses. Internet economy refers to the economic activities that generate revenue from the Internet or Internet-related products or services. [1]

Therefore, pre-Internet e-commerce, as will be detailed in the following section, cannot be called Internet economy. On the other hand, some activities, such as building Internet connections for commercial purposes, are a part of Internet economy, but they are not necessarily e-commerce. Digital economy is based on digital technologies such as computer, software, and digital networks. In most cases, digital economy is the same as e-commerce. However, not all activities in the digital economy are e-commerce activities. For example, purchasing computer gear from a storefront retailer is not an activity of e-commerce, although it certainly is a key component of the digital economy. Hence, e-commerce, Internet economy, and digital economy are closely related but have different concepts. [1]

E-commerce has been perhaps one of the most prevalent terms in this digital era. Although ecommerce was once looked upon simply as an expressway to wealth, it has actually transformed the way people conduct business. An historical analysis of e-commerce will provide insights into the evolution of the application of information and communication technologies in the commercial arena.
Furthermore, an analysis of the evolution of e-commerce in the past as well as its present state will enable us to project future trends in e-commerce. [1]

E-commerce was made possible by the development of electronic data interchange (EDI), the exchange of business documents from one computer to another in a standard format. EDI originated in the mid-1960s, when companies in transportation and some retail industries were attempting to create “paperless” offices. In the mid-1970s, EDI was formalized by the Accredited Standards Committee of industry representatives, and more varied companies began to adopt EDI through the 1970s and 1980s. As the first generation of e-commerce, EDI allowed companies to exchange information, place orders, and conduct electronic funds transfer through computers (Sawanibi, 2001). However, the diffusion of EDI was slow. By the late 1990s, less than one percent of companies in Europe and in the United States had adopted EDI (Timmers, 1999). The huge expense for getting connected to an EDI network and some technical problems limited the diffusion of EDI. The second generation of e-commerce is characterized by the transaction of goods and services through the Internet, which started as a research tool, but has generally evolved into a commercial tool. The inception of the Internet can be traced back to the 1960s, when the Advanced Research Projects Agency Computer Network (ARPANET), the precursor to the Internet, was established for research in high technology areas. The nodes of ARPANET increased from 4 in 1969 to 15 in 1971. The term Internet actually did not come into use until 1982, when the number of hosts on the ARPANET rose to 213. Then, in 1983, the Internet Protocol (IP) became the only approved way to transmit data on the Net, enabling all computers to exchange information equally. In 1986, the National Science Foundation (NSF), a government agency, launched the NSFNET, with the purpose of providing high-speed communication links between major supercomputer centers across the United States. The backbone of the NSFNET then became the cornerstone of the TCP/IP-based Internet (Anthes, 1994). By the end of the 1980s, the Internet had still maintained its noncommercial nature, and all of its networks were based on the free use of the NSFNET backbone, directly or indirectly. The primary users were still scientists and engineers working for the government or for universities. As a matter of fact, academics or researchers were the only ones capable of using the Internet,
because a sophisticated understanding of computer science and a high level of computer skills were necessary for Internet use at that time (Eccleson, 1999). It was the development of a graphical user interface (GUI) and the navigability of the World Wide Web (WWW) that changed the nature of Internet use. In the early 1990s, the creation of the hypertext markup language (HTML), with specifications for uniform resource locators (URLs) enabled the Web to evolve into the environment that we know today. The Internet was therefore taken “out of the realm of technical mystique and into common usage” as it became usable for ordinary people without sophisticated understanding of computer science and techniques (Eccleson, 1999, p. 70). Hence, with the increasing number of Internet users, the Internet became attractive to the business world. Perhaps the most significant milestone, however, came in 1991, when NSFNET decided to lift commercial restrictions on the use of the network, and thereby opened up opportunities for e-commerce. Advanced Network & Services (ANS), established by IBM, MCI Communications Corp., and Merit Network, Inc., provided Internet connection to commercial users without govern. [1]

2.2 Business to Customer (B2C)

B2C, or business-to-consumer, is the type of commerce transaction in which businesses sell products or services to consumers. Traditionally, this could refer to individuals shopping for clothes for themselves at the mall, diners eating in a restaurant, or subscribing to pay-per-view TV at home. More recently, the term B2C refers to the online selling of products, or e-tailing, in which manufacturers or retailers sell their products to consumers over the Internet. It is one of four categories of e-commerce, along with B2B (business to business), C2B (customer to business) and C2C (customer to customer). The B2C model is likely the model that most people are familiar with. If you've ever purchased an item online for your own use, you've e-tailed. Pretty much any product can be sold through e-tailing, also known as virtual storefronts. The concept was first developed in 1979 by Michael Aldrich, an English inventor, who connected a television set to a transaction processing computer with a telephone line and coined the term "teleshopping." As the Internet grew in the 1990s, hundreds of thousands of domain names began to register. The potential for e-tailing was seen early on in books like
"Future Shop: How Technologies Will Change the Way We Shop and What We Buy" (1992), which predicted the coming e-commerce revolution. There were, of course, security problems. When Netscape developed Secure Socket Layers (SSL) – encryption certificates, consumers began to feel more comfortable transmitting data over the Internet. Web browsers could identify if a site had an authenticated SSL certificate, helping consumers determine whether or not a site could be trusted. SSL encryption is still a vital part of Web security today. [2]

There are challenges for businesses in B2C, however. As websites continue to become flashier and more user-friendly, it's up to the business to keep their site intuitive and easy to navigate. The site must also be optimized to get consumer traffic — search engine marketing (SEM) is a necessity. Most consumers use search engines like Google, Bing and Yahoo! to find the products that they are looking to purchase. Customers generally choose websites on the first few pages of results after they've searched a specific keyword or phrase. If a site does not have a site with good SEM, they could get buried in the mix, lose site traffic, and thus lose potential customers. [2]

To ensure good SEM, businesses can consult with marketing managers or outside consultants who are well-versed and trained in this growing field. Companies can purchase paid listings to be ranked on the first few pages, as well as employing search engine optimization (SEO) tactics. [2]

Another challenge is the payment processing. SSL encryption lets people know that the site isn't compromised, but many people are hesitant to submit their credit cards to companies. Even if the site is safe, the place where the credit card numbers are stored is not. In 2004, the Payment Card Industry Security Standards Council (PCI) formed to create compliance standards for any company processing credit cards. Services like PayPal can perform the payment processing for online vendors, and has proven to be popular with online shoppers and businesses. PayPal currently manages more than 232 million accounts. [2]

2.3 Customer Relationship Management

CRM is a core business strategy that aims to create and deliver value to targeted customers at a profit. This clearly denotes that CRM is not just about IT. CRM integrates internal processes and functions. That is, it allows departments
within businesses to dissolve the silo walls that separate them. Access to customer-related data allows selling, marketing and service functions to be aware of each other’s interactions with customers. Furthermore, back-office functions such as operations and finance can learn from and contribute to customer-related data. Access to customer-related data allows members of a business’s external network, suppliers, partners, distributors to align their efforts with those of the focal company. Underpinning this core business strategy is IT: software applications and hardware. [3]

According Kalakota and Robinson, the purpose of the framework of CRM:
1. Using a pre-existing relationship between the company and its customers to increase corporate profits. This mean wider viewing angle to customers in maximizing the customer relationship with company for selling up-selling and cross-selling, which at the same time also increase corporate profits through the identification, withdrawal, and the best customer maintenance. [4]
2. Using the integrated information to create a satisfactory service. By using customer information to better meet customer needs, customers can save time and reduce frustration. [4]
3. Showing Consistency, procedures and process channel answer. [4]

2.3.1 Three Stages of Customer Relationship Management
According Kalakota and Robinson, CRM has three phases:
1. Acquire new customer by promoting excellence of products or services in term of innovation and ease because the value of a product or service for the customer is a better product, and is supported by satisfactory service. [4]
2. Increasing gains from existing customers by promoting a products or services complement and sale of products or services better than the product or services that is owned by the customer. [4]
3. Maintaining customer benefit, offering what is required by a specific customer is not required by the customer market, due to the value of the product or services for the customer is the most proactive value according to his needs. The company’s focus now is how to maintain
existing customers certainly benefit the company rather than how to get new customers who do not necessarily benefit. [4]

2.3.2 Customer Relationship Management Architecture

4. According Kalakota and Robinson, CRM Architecture is organizing the CRM processes around the customer and not on the company's internal functions. Feedback from customers becomes an integral part of the process to improve the CRM process that allows the CRM process to adapt to customer needs. In other words, the action taken by the company prioritizes on the company's overall goal to create customer satisfaction and not prioritized at the functional units of the company. The process should be done before is to restructure the process of interaction with customers because of the structure of the functional and organizational companies tend to segregate activities undertaken in providing customer service, thereby preventing the spread of information that is useful to all parts of the company that needs the information because the information can't be given by the company when customers need will hinder the establishment of close and personal relationship with the customer. [4]

5. Key capabilities that can be done by the CRM based on the opinions Kalakota and Robinson: Identifying the CRM process capabilities is very important because the company is not able to manage and develop the infrastructure manager CRM if the company does not have the same view of the CRM process capabilities that would be implemented in the company. [4]

2.3.3 The Three Main Component of CRM Framework

Some of the differences of opinion can be explained by considering that a number of different types of CRM have been identified: strategic, operational, analytical and collaborative.

1. Strategic CRM

Is focused upon the development of a customer-centric business culture. This culture is dedicated to winning and keeping customers by creating and delivering value better than competitors.
The culture is reflected in leadership behaviors, the design of formal systems of the company, and the myths and stories that are created within the firm. In a customer-centric culture you would expect resources to be allocated where they would best enhance customer value, reward systems to promote employee behaviors that enhance customer satisfaction and retention, and customer information to be collected, shared and applied across the business. [3]

2. Operational CRM

Automates and improves customer-facing and customer supporting business processes. CRM software applications enable the marketing, selling and service functions to be automated and integrated. Some of the major applications within operational CRM. [3]

3. Analytical CRM

Is concerned with capturing, storing, extracting, integrating, processing, interpreting, distributing, using and reporting customer-related data to enhance both customer and company value. Analytical CRM builds on the foundation of customer-related information. Customer-related data may be found in enterprise-wide repositories: sales data (purchase history), financial data (payment history, credit score), marketing data (Campaign response, loyalty scheme data) and service data. To these internal data can be added data from external sources: geodemographic and lifestyle data from business intelligence organizations, for example. With the application of data mining tools, a company can then interrogate these data. Intelligent interrogation provides answers to questions such as: Who are our most valuable customers? Which customers have the highest propensity to switch to competitors? Which customers would be most likely to respond to a particular offer? [3]

4. Collaborative CRM

Is the term used to describe the strategic and tactical alignment of normally separate enterprises in the supply chain for
the more profitable identification, attraction, retention and development of customers. For example, manufacturers of consumer goods and retailers can align their people, processes and technologies to serve shoppers more efficiently and effectively. They employ practices such as co-marketing, category management, collaborative forecasting, joint new product development and joint market research. Collaborative CRM uses CRM technologies to communicate and transact across organizational boundaries. [3]

2.3.4 Three Key Factors for Success CRM

According to Susanto, CRM success is determined by three main factors: People, Process and Technology, where:

1. HR (people) are all employees of the company starting from the lowest level to the highest. [5]
2. Process (process) is a business process within the company to ensure and measure customer satisfaction. [5]
3. Technology (technology) is an information and communication technology as an enabler factor for human resources and business processes to achieve customer satisfaction by more efficient and effective. [5]

When the SDM and the process has not been optimized for dealing with customers, the use of CRM technology will be in vain. When human resources and processes have been used to satisfy the customer, then the technology will accelerate the success of CRM and provide greater profits for the company. [5]

2.3.5 Benefit of Customer Relationship Management

Based on Single opinion, there are several benefits of Customer Relationship Management, namely:

1. Encourage customer loyalty

   CRM applications allow companies to rogue-use information from all points of contact with customers, both via web, call center, or through marketing and servicing staff in the field.
Consistency and accessibility this information allows sales and better services with important information on the customer. [6]

2. Improve operational efficiency

Automation of sales and service processes can reduce the risk of decline in the quality of services and reduce the burden on cash flow. The use of web technology and a call center, for example, will reduce red tape and costs and administrative processes that may arise. [6]

3. Improved time to market

CRM applications allows us to bring products to market faster with better customer information, the customer purchase trend data, through integration with ERP applications for better planning purposes. With the ability to sales on the web, then the barriers of time, geography, until the availability of data sources can be ruled out to accelerate the sale of these products. [6]

2.4 Website

A website is a collection of related web pages, including multimedia content, typically identified with a common domain name, and published on at least one web server. A website may be accessible via a public Internet Protocol (IP) network, such as the Internet, or a private local area network (LAN), by referencing a uniform resource locator (URL) that identifies the site. [7]

Websites have many functions and can be used in various fashions; a website can be a personal website, a commercial website for a company, a government website or a non-profit organization website. Websites are typically dedicated to a particular topic or purpose, ranging from entertainment and social networking to providing news and education. All publicly accessible websites collectively constitute the World Wide Web, while private websites, such as a company's website for its employees, typically a part of an intranet. [7]

Web pages, which are the building blocks of websites, are documents, typically composed in plain text interspersed with formatting instructions of Hypertext Markup Language (HTML, XHTML). They may incorporate elements
from other websites with suitable markup anchors. Web pages are accessed and transported with the Hypertext Transfer Protocol (HTTP), which may optionally employ encryption (HTTP Secure, HTTPS) to provide security and privacy for the user. The user's application, often a web browser, renders the page content according to its HTML markup instructions onto a display terminal. [7]

2.4.1 HTTP

The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. HTTP has been in use by the World-Wide Web global information initiative since 1990. HTTP is a generic and stateless protocol which can be used for other purposes as well using extensions of its request methods, error codes, and headers. The first version of HTTP, referred to as HTTP/0.9, was a simple protocol for raw data transfer across the Internet. HTTP/1.0, as defined by RFC 1945, improved the protocol by allowing messages to be in the format of MIME-like messages, containing met information about the data transferred and modifiers on the request/response semantics. However, HTTP/1.0 does not sufficiently take into consideration the effects of hierarchical proxies, caching, the need for persistent connections, or virtual hosts. In addition, the proliferation of incompletely-implemented applications calling themselves “HTTP/1.0” has necessitated a protocol version change in order for two communicating applications to determine each other’s true capabilities. [8]

2.4.2 Web Server

A web server is a computer system that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer to the entire system, or specifically to the software that accepts and supervises the HTTP requests. Web servers allow you to serve content over the Internet using the Hyper Text Markup Language (HTML).
2.4.3 HTML

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS), and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web. Web browsers receive HTML documents from a web server or from local storage and render them into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document. [9]

HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects, such as interactive forms may be embedded into the rendered page. It provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items. HTML elements are delineated by tags, written using angle brackets. Tags such as `<img />` and `<input />` introduce content into the page directly. Others such as `<p>...</p>` surround and provide information about document text and may include other tags as sub-elements. Browsers do not display the HTML tags, but use them to interpret the content of the page. [9]

HTML can embed programs written in a scripting language such as JavaScript which affect the behavior and content of web pages. Inclusion of CSS defines the look and layout of content. The World Wide Web Consortium (W3C), maintainer of both the HTML and the CSS standards, has encouraged the use of CSS over explicit presentational HTML since 1997. [9]

2.4.4 CSS

Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable. CSS handles the look and feel part of a web page. Using CSS, you can control the color of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, what background images
or colors are used, as well as a variety of other effects. CSS is easy to learn and understand but it provides a powerful control over the presentation of an HTML document. Most commonly, CSS is combined with the markup languages HTML or XHTML. [9]

CSS is designed primarily to enable the separation of document content from document presentation, including aspects such as the layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple HTML pages to share formatting by specifying the relevant CSS in a separate .css file, and reduce complexity and repetition in the structural content. Separation of formatting and content makes it possible to present the same markup page in different styles for different rendering methods, such as on-screen, in print, by voice (via speech-based browser or screen reader), and on Braille-based tactile devices. It can also display the web page differently depending on the screen size or viewing device. Readers can also specify a different style sheet, such as a CSS file stored on their own computer, to override the one the author specified. Changes to the graphic design of a document (or hundreds of documents) can be applied quickly and easily, by editing a few lines in the CSS file they use, rather than by changing markup in the documents. The CSS specification describes a priority scheme to determine which style rules apply if more than one rule matches against a particular element. In this so-called cascade, priorities (or weights) are calculated and assigned to rules, so that the results are predictable. The CSS specifications are maintained by the World Wide Web Consortium (W3C). Internet media type (MIME type) text/css is registered for use with CSS by RFC 2318 (March 1998). The W3C operates a free CSS validation service for CSS documents. [9]

2.5 Programming Language

A programming language is a formal language that specifies a set of instructions that can be used to produce various kinds of output. Programming languages generally consist of instructions for a computer. Programming languages can be used to create programs that implement specific algorithms.
2.5.1 PHP

PHP is a programming language for building dynamic, interactive Web sites. As a general rule, PHP programs run on a Web server, and serve Web pages to visitors on request. One of the key features of PHP is that you can embed PHP code within HTML Web pages, making it very easy for you to create dynamic content quickly. PHP is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. Originally created by Rasmus Lerdorf in 1994, the PHP reference implementation is now produced by The PHP Development Team. PHP originally stood for Personal Home Page, but it now stands for the recursive acronym PHP: Hypertext Preprocessor. [10]

PHP code may be embedded into HTML code, or it can be used in combination with various web template systems, web content management systems and web frameworks. PHP code is usually processed by a PHP interpreter implemented as a module in the web server or as a Common Gateway Interface (CGI) executable. The web server combines the results of the interpreted and executed PHP code, which may be any type of data, including images, with the generated web page. PHP code may also be executed with a command-line interface (CLI) and can be used to implement standalone applications. The standard PHP interpreter, powered by the Zend Engine, is free software released under the PHP License. PHP has been widely ported and can be deployed on most web servers on almost every operating system and platform, free of charge. The PHP language evolved without a written formal specification or standard until 2014, leaving the canonical PHP interpreter as a de facto standard. Since 2014 work has gone on to create a formal PHP specification. [10]
2.5.2 Javascript

JavaScript is a lightweight, interpreted programming language. It is designed for creating network-centric applications. It is complimentary to and integrated with Java. JavaScript is very easy to implement because it is integrated with HTML. It is open and cross-platform. A JavaScript program consists of statements and expressions formed from tokens of various categories, including keywords, literals, separators, operators, and identifiers placed together in an order that is meaningful to a JavaScript interpreter, which is contained in most web browsers. [11]

JavaScript is a high-level, dynamic, untipped, and interpreted programming language. It has been standardized in the ECMAScript language specification. Alongside HTML and CSS, JavaScript is one of the three core technologies of World Wide Web content production; the majority of websites employ it, and all modern Web browsers support it without the need for plug-ins. JavaScript is prototype-based with first-class functions, making it a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles. It has an API for working with text, arrays, dates and regular expressions, but does not include any I/O, such as networking, storage, or graphics facilities, relying for these upon the host environment in which it is embedded. [11]
Although there are strong outward similarities between JavaScript and Java, including language name, syntax, and respective standard libraries, the two are distinct languages and differ greatly in their design. JavaScript was influenced by programming languages such as self and Scheme. [11]

JavaScript is also used in environments that are not Web-based, such as PDF documents, site-specific browsers, and desktop widgets. Newer and faster JavaScript virtual machines (VMs) and platforms built upon them have also increased the popularity of JavaScript for server-side Web applications. On the client side, developers have traditionally implemented JavaScript as an interpreted language, but more recent browsers perform just-in-time compilation. Programmers also use JavaScript in video-game development, in crafting desktop and mobile applications, and in server-side network programming with run-time environments such as Node.js [11]

2.5.3 JQuery

Referred to “Learning JQuery: Better interaction, Design, and Web Development with simple JavaScript Techniques”. JQuery is a JavaScript library that is very concise and simple to manipulate components for the HTM document, regarding the event, animation, effects, and process interaction Ajax. JQuery is designed in such a way in order to make a program that using JavaScript becomes relatively very easy. As per its slogan, write less, do more. Write less code, but do more work.

JQuery was launched on January 2006 by John Resig. JQuery is a JavaScript library that is free and open source are the most popular today. Because of its sophistication, JQuery is used by large companies such as Google, Dell, CBS, dig, Netflix, Bank of America, Mozilla, Drupal, etc.

2.6 Database

Database is a collection of information stored in the computer in a systematic way so that it can be checked using a computer program to obtain information from the database. The software used to manage and call the query of database called database management system (DBMS). Database systems are
studied in information science. The basic concept of the database is a collection of records, or pieces of knowledge. A database has a structured description of the type of facts that are stored in it: this description called scheme. Scheme describes the object that represented a database, and the relationships between these objects. There are many ways to organize the scheme, or model the database structure: these are known as database models or data models. The model commonly used right now is the relational model, which according to layman's terms represents all information in the form of tables that are interconnected where each table consists of rows and columns (the true definition uses mathematical terminology). In this model, the relationship between tables is represented by using the same values between tables.

A database is an integrated collection of logically related records or files consolidated into a common pool that provides data for one or more multiple uses. The collected information could be in any number of formats (electronic, printed, graphic, audio, statistical, combinations). There are physical (paper/print) and electronic databases.

phpMyAdmin is a free and open source tool written in PHP intended to handle the administration of MySQL or MariaDB with the use of a web browser. It can perform various tasks such as creating, modifying or deleting databases, tables, fields or rows; executing SQL statements; or managing users and permissions.

2.6.1 DBMS

A database management system (DBMS) is a computer software application that interacts with the user, other applications, and the database itself to capture and analyze data. A general-purpose DBMS is designed to allow the definition, creation, querying, update, and administration of
databases. Well-known DBMSs include MySQL, PostgreSQL, MongoDB, MariaDB, Microsoft SQL Server, Oracle, Sybase, SAP HANA, MemSQL and IBM DB2. A database is not generally portable across different DBMSs, but different DBMS can interoperate by using standards such as SQL and ODBC or JDBC to allow a single application to work with more than one DBMS. [12]

A Database Management System (DBMS) consists of software that organizes the storage of data. A DBMS controls the creation, maintenance, and use of the database storage structures of organizations and of their end users. It allows organizations to place control of organization-wide database development in the hands of Database Administrators (DBAs) and other specialists. In large systems, a DBMS allows users and other software to store and retrieve data in a structured way. [12]

2.6.2 MYSQL

MySQL is an open source relational database management system (RDBMS) based on Structured Query Language (SQL). MySQL runs on virtually all platforms, including Linux, UNIX, and Windows. Although it can be used in a wide range of applications, MySQL is most often associated with web-based applications and online publishing and is an important component of an open source enterprise stack called LAMP. LAMP is a Web development platform that uses Linux as the operating system, Apache as the Web server, MySQL as the relational database management system and PHP as the object-oriented scripting language. (Sometimes Perl or Python is used instead of PHP.)

2.7 Unified Modeling Language (UML)

The UML is an international industry standard graphical notation for describing software analysis and designs. When a standardized notation is used, there is little room for misinterpretation and ambiguity. Therefore, standardization provides for efficient communication (a.k.a. “a picture is worth a thousand words”) and leads to fewer errors caused by misunderstanding.
The U in UML stands for unified because the UML is a unification and standardization of earlier modeling notations of Booch, Rumbaugh, Jacobson, Mellor, Shlaer, Coad, and Wirf-Brock, among others. The UML most closely reflects the combined work of Rumbaugh, Jacobson, and Booch – sometimes called the three amigos. The UML has been accepted as a standard by the Object Management Group1 (OMG). The OMG is a non-profit organization with about 700 members that sets standards for distributed object-oriented computing. [13]

2.8 Use Case Diagram

Use case diagrams are used during requirements elicitation and analysis as a graphical means of representing the functional requirements of the system. Use cases are developed during requirements elicitation and are further refined and corrected as they are reviewed (by stakeholders) during analysis. Use cases are also very helpful for writing acceptance test cases. The test planner can extract scenarios from the use cases for test cases. Note: The use case diagram is accompanied by a textual use case flow of events. The flow of events is not explained in this document. [13]

A use case, a concept invented by Ivar Jacobson (Jacobson, Christerson et al., 1992), is a sequence of transactions performed by a system that yields an outwardly visible, measurable result of value for a particular actor. A use case typically represents a major piece of functionality that is complete from beginning to end (Bruegge and Dutoit, 2000). [13]

![Sample Use Case Diagram](image)
2.9 **Class Diagram**

Class diagrams are used in both the analysis and the design phases. During the analysis phase, a very high-level conceptual design is created. At this time, a class diagram might be created with only the class names shown or possibly some pseudo code-like phrases may be added to describe the responsibilities of the class. The class diagram created during the analysis phase is used to describe the classes and relationships in the problem domain, but it does not suggest how the system is implemented. By the end of the design phase, class diagrams that describe how the system to be implemented should be developed. The class diagram created after the design phase has detailed implementation information, including the class names, the methods and attributes of the classes, and the relationships among classes. [13]

The class diagram describes the types of objects in a system and the various kinds of static relationships that exist among them (Bruegge and Dutoit, 2000). In UML, a class is represented by a rectangle with one or more horizontal compartments. The upper compartment holds the name of the class. The name of the class is the only required field in a class diagram. By convention, the class name starts with a capital letter. The (optional) center compartment of the class rectangle holds the list of the class attributes/data members, and the (optional) lower compartment holds the list of operations/methods. [13]

2.10 **Sequence Diagram**

Sequence diagrams are used in the analysis and design phases. Sequence diagrams are often used to depict the chronologically-structured event flow through a use case. By creating a sequence diagram, the objects that participate in the use case are identified. Additionally, pieces of the use case behavior are assigned to objects in the form of services. The process of creating a sequence diagram often results in the refinement of the use case, potentially identifying missing but desired behaviors. [13]
Sequence diagrams represent a system behavior based upon the needed interactions among a set of objects in terms of the messages that exchange among them to produce the desired result. Sequence diagrams highlight the sequence of messages through time. However, they do not show how objects are linked and may send messages to each other. [13]

In a sequence diagram, objects are shown in columns, with their object symbol on the top of the line. Similar to the class diagram, the object name appears in a rectangle. If a class name is specified, it appears before the colon. The object name always appears after a colon (even if no class name is specified). If an external actor (see the preceding Use Case Diagram section above) initiates any interaction, the stick figure can be used rather than a rectangle. [13]

A sequence diagram has two dimensions: the vertical dimension represents time; the horizontal dimension represents different objects. Initiation of the sequence starts in the top-left corner, and time proceeds down the page (from top to bottom). The vertical line is called the object’s lifeline. There is no significance to the horizontal ordering of the objects. [13]

![Sample Sequence Diagram](image)

**Figure 2.4 Sample Sequence Diagram [13]**

### 2.11 Tools

#### 2.11.1 XAMPP

XAMPP (/ˈzæmp/ or /ˈɛks.æmp/) is a free and open source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and
interpreters for scripts written in the PHP and Perl programming languages. XAMPP stands for Cross-Platform (X), Apache (A), MariaDB (M), PHP (P) and Perl (P). It is a simple, lightweight Apache distribution that makes it extremely easy for developers to create a local web server for testing and deployment purposes. Everything needed to set up a web application (Apache), database (MariaDB), and scripting language (PHP) is included in an extractable file. XAMPP is also cross-platform, which means it works equally well on Linux, Mac and Windows. Since most actual web server deployments use the same components as XAMPP, it makes transitioning from a local test server to a live server extremely easy as well.

2.11.2 PHPSTROM

JetBrains PhpStorm is a commercial, cross-platform IDE for PHP built on JetBrains' IntelliJ IDEA platform. PhpStorm provides an editor for PHP, HTML and JavaScript with on-the-fly code analysis, error prevention and automated refactorings for PHP and JavaScript code. PhpStorm's code completion supports PHP 5.3, 5.4, 5.5, 5.6 & 7.0 (modern and legacy projects), including generators, coroutines, the finally keyword, list in foreach, namespaces, closures, traits and short array syntax. It includes a full-fledged SQL editor with editable query results.

PhpStorm is built on IntelliJ IDEA, which is written in Java. Users can extend the IDE by installing plugins created for the IntelliJ Platform or write their own plugins. All features available in WebStorm are included in PhpStorm, which adds support for PHP and databases. WebStorm ships with pre-installed JavaScript plugins (such as for Node.js), which are available for PhpStorm as well at no cost.

2.12 Waterfall Model

Waterfall approach was first SDLC Model to be used widely in Software Engineering to ensure success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases. In Waterfall model, typically, the outcome of one phase acts as the input for the next phase sequentially. [14]
Following is a diagrammatic representation of different phases of waterfall model.

![Waterfall Model Diagram]

**Figure 2.5 Waterfall development life circle [14]**

1. **Requirement and Analysis**
   
   All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification doc. [14]

2. **Design**
   
   The requirement specifications from first phase are studied in this phase and system design is prepared. System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture. [14]

3. **Implementation**
   
   With inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing. [14]

4. **Testing**
   
   All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures. [14]

5. **Deployment**
Once the functional and non functional testing is done, the product is deployed in the customer environment or released into the market. [14]

6. Maintenance

There are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment. [14]

2.13 Black Box Testing

Black box testing, also called functional testing and behavioral testing, focuses on determining whether or not a program does what it is supposed to do based on its functional requirements. Black box testing attempts to find errors in the external behavior of the code in the following categories: (1) incorrect or missing functionality; (2) interface errors; (3) errors in data structures used by interfaces; (4) behavior or performance errors; and (5) initialization and termination errors. Through this testing, we can determine if the functions appear to work according to specifications. However, it is important to note that no amount of testing can unequivocally demonstrate the absence of errors and defects in your code. [15]

It is best if the person who plans and executes black box tests is not the programmer of the code and does not know anything about the structure of the code. The programmers of the code are innately biased and are likely to test that the program does what they programmed it to do. What are needed are tests to make sure that the program does what the customer wants it to do. As a result, most organizations have independent testing groups to perform black box testing. These testers are not the developers and are often referred to as third-party testers. Testers should just be able to understand and specify what the desired output should be for a given input into the program, as shown in Figure 2.6. [15]
Figure 2. 6 Black Box Testing [15]