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Abstract

The project undertaken is **WAP Video Streaming System (WAP-VSS)**. This proposal consists of four parts. The first part contains the project overview, scope, objectives and limitations. It is then followed by the literature review/survey done on the proposed project from various sources. In this second part, I have also discussed on the related projects, which others have done earlier. The third part of this proposal discusses on the planning and methodology to develop this proposed project. Apart from that, this part of the proposal also discusses on the project consideration, whereby what are the consideration that have been considered prior to the proposal of this project. The last part of this proposal lay out the project flow, system design, interface and also the expected result.
Acknowledgement

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1.2 Project Scope

1.2.1 Introduction

People on the move need services, information and entertainment that can keep up with them. With access to mobile services, decisions and interactions happen here and now. The value of mobile services to end-users is boosted by three separate elements: personalization, time-sensitivity and location awareness. Combining these three effectively adds even more value.

Wireless application protocol (WAP) is a protocol that has successfully established a de facto standard for the way in which wireless technology is used for Internet access. WAP technology has been optimized for information delivery to thin-client devices, such as mobile phones.

Mobile services powered by WAP have been widely accepted by users. It is expected that WAP users will increase tremendously by in a couple of years. In part, this growth is driven by the introduction of General Packet Radio Service (GPRS), WAP 2.0, Bluetooth, 3G Technologies, Mobile Commerce etc.

What is the common use of a Personal Digital Assistant (PDA) or a mobile phone or a pocket PC these days? Many of us uses PDAs, mobile phones and even pocket PCs make and receive calls, to balance our checkbook while on the road, retrieving information of our clients, wireless emails etc. Have we ever thought about watching a few minutes streaming video clips? Due to this, we have thought about the possibility of customizing streaming content for mobile audiences. Therefore, we came up with this project – encoding streaming content for mobile devices.

From our research, we found that neither the mobile devices manufacturers nor streaming media encoding utility developers have done all they can to make the process – however the results are compelling.
1.2.2 Objective and Significance
The objective of this project is to enable streamed video to be accessed and viewed through WAP-enabled mobile devices. The completed project will enable streamed video to be accessed at anytime, anywhere through mobile devices.

1.2.3 Limitation
The development and testing will be done on the facilities provided by Nokia and Phone.com. As this proposed project has yet to be built by any mobile device manufacturers or media coding utility developers, therefore we were unable to have any references to refer. However, to develop any project, one should be aware of the significant hurdles involved.

- Device usability is the first trip-up point. The first furtive attempts to equip PDAs and other mobile devices for streaming were real memory-drainers. Memory of mobile devices has always deterred one from ‘upgrading’ the capabilities of mobile devices. Over the last year or so, internal and expandable memory PDAs and other mobile devices have increased significantly. However, the increased memory is still unable to support the additional function change.

- The main device problem is battery power. The ‘richer’ a presentation, the more juice it will demand from the device, thus the quicker its overall performance will deteriorate. There are still many PDAs and other mobile devices that run on AA batteries. Even Energizers Bunnies will be de-energised with too many streaming video clips!

- At times, even before the battery power finishes, the colour performance may degrade at the edges of the view screen. This is typically limited in size and resolution, and often cannot cope with colour.

- There is also the matter of the small display screen mobile devices.
• The other main hurdle has to do with distribution of streamed media clip of those elusive end-users. While it is possible to enable clips to be downloaded, most streaming clips – by nature – are Webcast over streaming servers by the Web sites that either created, or distributed, the content. The question then becomes how the mobile devices accesses to the clips.

• Mobile devices typically do not have keyboards, or if they do, they are limited in size. Therefore, input is more challenging than on a typical PC.
Chapter 2 : Literature Review

2.1 What is streaming?

Streaming is a technology for playing audio and video files (either live or pre-recorded) from a Web page. A user can view the audio or video files directly from the Web server for immediate playback. This avoids time consuming downloads of large files.

When audio or video is streamed, a small buffer space is created on the user's computer, and data starts downloading into it. As soon as the buffer is full (usually a matter of seconds), the file starts to play. As the file plays, it uses up information in the buffer, but while it is playing, more data is being downloaded. As long as the data can be downloaded as fast as it is used up in playback, the file will play smoothly.

![Figure 2-1 – The Principle of Streaming](A snapshot in time)

Usually there is a delay of 10-30 seconds before the audio or video starts to play. Streamed files do not require much bandwidth, so they can be played on computers that use modems to connect to the internet.

With streaming, one can access lengthy pre-recorded audio and video clips to enhance and enrich the studied topic. In the case of distributed learning, streaming audio and video can serve as the primary mode of content delivery.
In other words, streaming is basically a technique for transferring data such that it can be processed as a steady and continuous stream. Streaming technologies are becoming increasingly important with the growth of the internet because most users do not have fast enough access to download large multimedia files quickly. With streaming, the client browser or plug-in can start displaying the data before the entire file has been transmitted. For streaming to work, the client side receiving the data must be able to collect the data and send it as a steady stream to the application that is processing the data and converting it to sound or pictures. This means that if the streaming client receives the data more quickly than required, it needs to save the excess data in a buffer. If the data doesn't come quickly enough, however, the presentation of the data will not be smooth.

The people viewing the Web page need to have a player application to view the streamed files. The basic players are free, and are available for Windows, Macintosh, and UNIX computers.

2.1.1 Where do streams originate?
The audio and/or video file is streamed by either a Windows Media, Real Networks, or Quicktime Server. These Media servers act as a virtual jukebox that can play a file once, loop a file, or even broadcast a live encode to thousands of viewers across the Internet.

2.1.2 How do streaming audio/video different than downloading or a “progressive” download?
Streaming Media allows the end user to start viewing an audio/video file instantaneously once connected to a media server. Streaming allows for the end user to experience online media in a real time fashion, much like traditional T.V. A download, on the other hand, requires the end user to receive the entire file before viewing or accessing the content. Downloads can potentially take up hours of your time, while streaming allows for immediate viewing.
2.1.3 Why use Streaming Media?
Streaming media is a cost effective solution for multiple users to access audio and video content on the web in close to real-time. Audio and Video files can be digitized to be accessed by dial-up users and broadband users alike. Although quality is sacrificed at the lower bandwidths new technologies are making the dial-up users experience very enjoyable.

2.1.4 Steps to streaming videos
Streaming video is quite a bit trickier to set up. Below are the basic guideline to stream videos:

- Choose a streaming protocol (example: Xing Stream Works) and acquire and install the streaming encoder software.
- Set up a streaming server, or contract with a service provider that has one. If running own site, one will need to manage the site to insure enough capacity for the number of users expected.
- Encode videos in the appropriate streaming format. One needs to create and link a variety of versions to suit different connection rates.
- Create explanatory pages for users so they know how to stream, how to set up their browsers, and where to get the required player software. Because streaming is not generally well understood, these pages should also educate your users so their expectations are realistic. If the readers expect to use a modem and see full-motion video, they will be disappointed.
2.2 Wireless Application Protocol (WAP)

2.2.1 Introduction

WAP bridges the gap between the mobile world and the Internet as well as corporate intranets and offers the ability to deliver an unlimited range of mobile value-added services to subscribers— independent of their network, bearer, and terminal. Mobile subscribers can access the same wealth of information from a pocket-sized device as they can from the desktop.

WAP is a global standard and is not controlled by any single company. Ericsson, Nokia, Motorola, and Unwired Planet founded the WAP Forum in the summer of 1997 with the initial purpose of defining an industry-wide specification for developing applications over wireless communications networks. The WAP specifications define a set of protocols in application, session, transaction, security, and transport layers, which enable operators, manufacturers, and applications providers to meet the challenges in advanced wireless service differentiation and fast/ flexible service creation. There are now over one hundred members representing terminal and infrastructure manufacturers, operators, carriers, service providers, software houses, content providers, and companies developing services and applications for mobile devices.

WAP also defines a wireless application environment (WAE) aimed at enabling operators, manufacturers, and content developers to develop advanced differentiating services and applications including a microbrowser, scripting facilities, e-mail, World Wide Web (WWW)–to-mobile-handset messaging, and mobile-to-telefax access.

Because WAP is an open protocol, a number of manufacturers are producing a wide range of WAP-enabled devices. These manufacturers in turn are able to source from a large range of WAP-specified components because the server technology is also open. This general openness and adoption of common standards means that developers, manufacturers and content providers are able to adopt WAP with confidence and benefit from the economies of scale.
WAP uses a client/server architecture that employs an unsophisticated wireless-based microbrowser and requires only limited resources and a WAP gateway to deliver content from the server where it is stored. It is a standard independent of the air interface, the user interface and the underlying data bearer. Therefore, it is entirely interoperable. Because WAP is based on existing Internet technologies, it leverages the massive investment in similar conventional Web tools, applications, servers and their developers while considering the restricted bandwidth, processing power and memory currently available on wireless portable devices.

Web content is available over existing wireless communications network through a WAP gateway. Figure 2-2 illustrates how an established WWW infrastructure, based on the Hypertext Transfer Protocol (HTTP), uses a WAP gateway to interface with the wireless network by translating HTTP requests into wireless device requests.

![Figure 2-2 – WAP Gateway](image-url)
2.2.2 Benefits

2.2.2.1 Operators

For wireless network operators, WAP promises to decrease churn, cut costs, and increase the subscriber base both by improving existing services, such as interfaces to voice-mail and prepaid systems, and facilitating an unlimited range of new value-added services and applications, such as account management and billing inquiries. New applications can be introduced quickly and easily without the need for additional infrastructure or modifications to the phone. This will allow operators to differentiate themselves from their competitors with new, customized information services. WAP is an interoperable framework, enabling the provision of end-to-end turnkey solutions that will create a lasting competitive advantage, build consumer loyalty, and increase revenues.

2.2.2.2 Content Providers

Applications will be written in wireless markup language (WML), which is a subset of extensible markup language (XML). Using the same model as the Internet, WAP will enable content and application developers to grasp the tag-based WML that will pave the way for services to be written and deployed within an operator's network quickly and easily. As WAP is a global and interoperable open standard, content providers have immediate access to a wealth of potential customers who will seek such applications to enhance the service offerings given to their own existing and potential subscriber base. Mobile consumers are becoming more hungry to receive increased functionality and value-add from their mobile devices, and WAP opens the door to this untapped market that is expected to reach 100 million WAP-enabled devices by the end of the year 2000. This presents developers with significant revenue opportunities.

2.2.2.3 End Users

End users of WAP will benefit from easy, secure access to relevant Internet information and services such as unified messaging, banking, and entertainment through their mobile devices. Intranet information such as corporate databases can also be accessed via WAP technology. Because a wide range of handset manufacturers already supports the WAP
initiative, users will have significant freedom of choice when selecting mobile terminals and the applications they support. Users will be able to receive and request information in a controlled, fast, and low-cost environment, a fact that renders WAP services more attractive to consumers who demand more value and functionality from their mobile terminals.

As the initial focus of WAP, the Internet will set many of the trends in advance of WAP implementation. It is expected that the Internet service providers (ISPs) will exploit the true potential of WAP. Web content developers will have great knowledge and direct access to the people they attempt to reach. In addition, these developers will likely acknowledge the huge potential of the operators' customer bases; thus, they will be willing and able to offer competitive prices for their content. WAP's push capability will enable weather and travel information providers to use WAP. This push mechanism affords a distinct advantage over the WWW and represents tremendous potential for both information providers and mobile operators.

2.2.3 Why another protocol is needed?
Most people would agree that there are more protocols associated with computing than you could shake a stick at, and it can be challenging trying to keep up with them all. So why do we need another protocol? The answer is very simple - because phones are not PCs.

To be specific: most of the protocols in use today make a set of assumptions about the environment, such as the type of network that will be available (particularly from the point of view of bandwidth and reliability), the types of devices that will be accessing the services, and the types of services that will be accessed. These assumptions do not necessarily hold true in the wireless world.
There are a number of differences in terms of the device itself:

- **Form Factor** - A mobile device needs to be small enough to move around, and ideally to be able to fit in the palm of your hand or carry in a shirt pocket.

- **CPU** - In a mobile device, the CPU is not nearly as powerful as a desktop PC, and is almost certainly of a different architecture.

- **Memory and storage** - This is a lot more constrained than on a PC, because handset manufacturers are cost-sensitive, and thus reluctant to add any additional components unless it is really necessary. Also some mobile devices do not have a persistent storage of their own.

- **Battery** - Mobile devices are battery powered, and the need to have the device available for long periods of time means that the processing CPU cannot make significant demands on the battery.

- **Display** - This is typically limited in size and resolution, and often cannot cope with color.

- **Input** - Mobile devices typically do not have keyboards, or if they do they are limited in size. Therefore, input is more challenging than on a typical PC.

A wireless network is considerably different to a fixed-wire network. The bandwidth of the network is typically much smaller, at least at this point in time. Reliability profiles are considerably different, particularly where users move in and out of coverage areas, disappear into tunnels, and so on. Latency may also be an issue in wireless networks. An additional factor is that there are a number of mobile network standards in place across the world, and they do not interoperate seamlessly. Some countries even have incompatible standards in different regions.
Finally, it is important to realize that the market is different where wireless applications are concerned. The types of applications that are suitable for use on mobile devices are not the same as those that are popular on fixed-wire environments. Typical users of mobile applications are likely to be a broader subset of the population than PC users. Even the context in which the applications are going to be used will be different. This highlights the most important aspect of mobile application design, which is to make the application easy to use in the context, and on the device that it will be accessed from.

2.2.4 Why choose WAP?
In the past, wireless Internet access has been limited by the capabilities of handheld devices and wireless networks.

WAP utilizes Internet standards such as XML, user datagram protocol (UDP), and Internet protocol (IP). Many of the protocols are based on Internet standards such as hypertext transfer protocol (HTTP) and TLS but have been optimized for the unique constraints of the wireless environment: low bandwidth, high latency, and less connection stability.

Internet standards such as hypertext markup language (HTML), HTTP, TLS and transmission control protocol (TCP) are inefficient over mobile networks, requiring large amounts of mainly text-based data to be sent. Standard HTML content cannot be effectively displayed on the small-size screens of pocket-sized mobile phones and pagers. WAP utilizes binary transmission for greater compression of data and is optimized for long latency and low bandwidth. WAP sessions cope with intermittent coverage and can operate over a wide variety of wireless transports.
WML and wireless markup language script (WMLScript) are used to produce WAP content. They make optimum use of small displays, and navigation may be performed with one hand. WAP content is scalable from a two-line text display on a basic device to a full graphic screen on the latest smart phones and communicators.

The lightweight WAP protocol stack is designed to minimize the required bandwidth and maximize the number of wireless network types that can deliver WAP content. Multiple networks will be targeted, with the additional aim of targeting multiple networks. These include global system for mobile communications (GSM) 900, 1,800, and 1,900 MHz; interim standard (IS)-136; digital European cordless communication (DECT); time-division multiple access (TDMA), personal communications service (PCS), FLEX, and code division multiple access (CDMA). All network technologies and bearers will also be supported, including short message service (SMS), USSD, circuit-switched cellular data (CSD), cellular digital packet data (CDPD), and general packet radio service (GPRS).

As WAP is based on a scalable-layered architecture, each layer can develop independently of the others. This makes it possible to introduce new bearers or to use new transport protocols without major changes in the other layers.

2.2.5 WAP Protocol

WAP is a layered communications protocol, an implementation of which is embedded in all WAP-enabled user agents. Its structure is very similar to the well-established International Standards Organisation (ISO) network model with a transport protocol similar to the generally fixed-line HTTP. However, in this case, it is focused on broadcast requirements, which use less bandwidth. The WAP protocol architecture is shown in Figure 2-3 alongside a typical Internet Protocol stack. It consists of layers, which describe and specify the application/browser (WAE), sessions (WSP), transactions (WTP), security (WTLS), transports (WDP) and bearers (SMS, USSD, CSD, IS-136, CDMA, etc).
Wireless Application Environment (WAE)

The WAE is the top layer of the WAP stack and is of most interest to content developers because it contains, among other things, device specifications and the content development programming languages, WML and WMLScript. It is an application environment that is based on a combination of mobile telephony technologies and the World Wide Web. The purpose of the WAE is to establish an environment to build applications and services. The WAE includes a microbrowser environment that defines how the wireless device interprets and presents WML and WMLScript. It also contains components that specify the following:

- WML for creating WAP applications
- WMLScript to enhance the logic capabilities of WML
- Wireless Telephony Application Interface (WTAI), which provides telephony services for WML decks running on phone-based devices
- Content formats that define a set of data formats, including images, phone book records, and calendar information
WAE depends upon a WAP-compatible proxy server to translate between WAP and HTTP transactions and WAP and Internet Protocols.

ii) **Wireless Session Protocol (WSP)**
The WSP is a sandwich layer that links the WAE to two session services – one connection-oriented service that operates above the Wireless Transaction Protocol and one connectionless service operating above the Wireless Datagram Protocol. It is basically a binary-formatted tokenised version of HTTP, designed to provide low bandwidth browser handling on long latency networks. Unlike HTTP, WP has been designed by the WAP Forum to provide fast connection suspension and reconnection. It has also been designed to provide content push capabilities that allow unsolicited transmission of data to user agents, which in turn allows WAP device users to be alerted eg. incoming e-mails, telephone calls, and faxes.

iii) **Wireless Transaction Protocol (WTP)**
The WTP runs on top of a datagram service such a User Datagram Protocol (UDP) and is part of the standard suite of TCP/IP protocols used to provide a simplified protocol suitable for low bandwidth wireless stations. It offers three classes of transaction service – unreliable one-way request, reliable one-way request and reliable two-way request response. WTP supports protocols data unit concatenation and delayed acknowledgment to help reduce the number of messages sent and to attempt to optimise the user experience by providing the information that is needed when it is needed.

iv) **Wireless Transport Layer Security (WTLS)**
WTLS incorporates security features that are based upon the established Transport Layer Security (TLS) protocol standard. It includes data integrity checks, privacy, service denial and authentication services. Developers can access WTLS by using HTTPS instead of HTTP in the URL.
v) **Wireless Datagram Protocol (WDP)**

The WDP allows WAP to be bearer-independent by adapting the transport layer of the underlying bearer. The WDP presents a consistent data format to the higher layers of the WAP protocol stack, thereby offering the advantage of bearer independence to application developers.

vi) **Bearers**

Below the WDP sit all of the bearer (carriers) networks. These include Short Message Service (SMS), a facility for sending short messages; Unstructured Supplementary Service Data (USSD); Code Division Multiple Access (CDMA), for the reuse of scarce radio resources in adjacent areas; and Cellular Digital Packet Data (CDPD).

Through the Internet Protocol stack, the WAP client communicates with the WAP gateway, which sits between the wireless carrier’s network on one side and the public Internet or corporate intranet on the other. Gateways can be located within carrier or corporate firewalls or both. In addition to taking care of various housekeeping tasks such as keeping track of the WAP client’s bookmarks and managing its cache, the WAP server handles the interface between the two sets of network protocols, wireless (WAP) and wired (TCP/IP).
2.2.6 Handset Manufacturers and WAP Services

It is expected that mobile terminal manufacturers will experience significant change as a result of WAP technology—a chance that will impact the look and feel of the hardware they produce. The main issues faced by this arm of the industry concern the size of mobile phones, power supplies, display size, usability, processing power, and the role of personal digital assistants (PDAs) and other mobile terminals.

With over 75 percent of the world's key handset manufacturers already involved in the WAP Forum and announcing the impending release of WAP-compatible handsets, the drive toward new and innovative devices is quickly gathering pace. The handsets themselves will contain a microbrowser that will serve to interpret the byte code (generated from the WML/WMLS content) and display interactive content to the user. The services available to users will be wide-ranging in nature, as a result of the open specifications of WAP, their similarity to the established and accepted Internet model, and the simplicity of the WML/WMLS languages with which the applications will be written. Information will be available in push-and-pull functionality, with the ability for users to interact with services via both voice and data interfaces. Web browsing as experienced by the desktop user, however, is not expected to be the main driver behind WAP as a result of time and processing restraints.

Real-time applications and services demand small and key pieces of information that will fuel the success of WAP in the mobile marketplace. Stock prices, news, weather, and travel are only some of the areas in which WAP will provide services for mobile users. Essentially, the WAP application strategy involves taking existing services that are common within a fixed-line environment and tailoring them to be purposeful and user-friendly in a wireless environment.
Empowering the user with the ability to access a wealth of information and services from a mobile device will create a new battleground. Mobile industry players will fight to provide their customers with sophisticated, value-added services. As mobile commerce becomes a more secure and trusted channel by which consumers may conduct their financial affairs, the market for WAP will become even more lucrative.

2.2.7 WAP-enabled Device – PDA

Personal digital assistants (PDAs) are one of the fastest selling consumer devices in history. PDAs come in hand-held or palm-sized models. The hand-held computers tend to be larger than the palm-sized. Most, but not all, palm-sized PDAs can fit into a shirt pocket. Also, PDAs vary in their weight from 4 to 8 ounces (113 to 227 grams).

Most hand-held PDAs use a miniature keyboard for data entry. Often the keyboards are too small for easy or comfortable typing. In contrast, palm-sized PDAs use a stylus/touch-screen technology in combination with hand-writing recognition software. This involves learning some shorthand alphabet, such as Palm’s Graffiti, which can take some time to master fully.

All PDAs use solid-state memory, usually Flash memory; some are even incorporating removable forms of memory. PDAs usually come with 2 MB minimum of memory. One megabyte of memory can store up to 4000 addresses and 100 e-mail messages. However, many application programs take up memory space, so higher models of PDAs usually have more memory (5 to 32 MB). Also, PocketPC takes more memory space, so PDAs with this operating system usually have 16 or 32 MB. In some PDA models, the amount of memory is upgradeable.

In addition to communicating through a cable, many PDAs have an infra-red communications port that uses infra-red (IR) light to beam information to another PDA or PC (the PC must have a receiving IR sensor). Some PDAs also offer wireless methods to transfer data to and from a PC/PC network through a wireless e-mail Internet service.
provider like those available on new models of cell phones. Finally, some PDAs offer telephone modem accessories to transfer files to and from a PC/PC network.

2.2.8 WAP in the Competitive Environment

Competition for WAP protocols could come from a number of sources:

- **Subscriber identity module (SIM) toolkit**—The use of SIMs or smart cards in wireless devices is already widespread and used in some of the service sectors.

- **Windows CE**—This is a multitasking, multithreaded operating system from Microsoft designed for including or embedding mobile and other space-constrained devices.

- **JavaPhone™**—Sun Microsystems is developing PersonalJava™ and a JavaPhone™ API, which is embedded in a Java™ virtual machine on the handset. NEPs will be able to build cellular phones that can download extra features and functions over the Internet; thus, customers will no longer be required to buy a new phone to take advantage of improved features.

The advantages that WAP can offer over these other methods are the following:

- open standard, vendor independent
- network-standard independent
- transport mechanism—optimised for wireless data bearers
- application downloaded from the server, enabling fast service creation and introduction, as opposed to embedded software
2.2.9 Summary – WAP

WAP provides a markup language and a transport-protocol that open the possibilities of the wireless environment and give players from all levels of the industry the opportunity to access an untapped market that is still in its infancy.

The bearer-independent nature of WAP has proved to be a long-awaited breath of fresh air for an industry riddled with multiple proprietary standards that have suffocated the advent of a new wave of mobile-Internet communications. WAP is an enabling technology that, through gateway infrastructure deployed in mobile operator’s network, will bridge the gap between the mobile world and the Internet, bringing sophisticated solutions to mobile users, independent of the bearer and network.

Backed by 75 percent of the companies behind the world’s mobile telephone market and the huge development potential of WAP, the future for WAP looks bright.
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2.3 Wireless Markup Language (WML)

2.3.1 Introduction

Wireless Markup Language (WML) is to WAP and its handheld devices what Hypertext Markup Language (HTML) is to the Web and browsers such as Netscape and Internet Explorer. It describes how content is presented to the wireless device, allowing one to display information, present input options, and tell user agents (programs that interpret WML, WML Script and other forms of code — typically a microbrowser in a mobile phone) how to respond once an option has been selected using the keypad.

WML is a subset or an application of the extensible Markup Language (XML) and because WAP uses a similar model as the internet, it allows content developers to quickly become proficient with this relatively simple tag-based language while allowing a clear development path. WML is based on the World Wide Web Consortium (W3C) guidelines for wireless access and works similarly to HTML to deliver Web text using simple markup tags.

WML’s user interface is a WAP microbrowser optimised to map onto mobile wireless devices. A WML document is called a deck, which is comparable to an HTML page. Unlike the flat structure of HTML content, WML documents (or decks) are divided into separate units of user interaction. Each unit is called a card and WAP services are created by letting the user navigate between the cards of one or more decks in much the same way hyperlinks are used within and between HTML documents.

WAP gateways provide the interface between the network and internet or intranet services. From this gateway, WML content is accessed over the internet using the standard HTTP mechanism.
WAP developers and content providers can get up to speed quickly with WML, as it follows the same programming model as the Web development model. It is a tag-based language specified as an XML document type, so all existing XML tools and some HTML development environments can be used to develop WAP applications. As standard HTTP is used for communication between gateway and servers, developers can use off-the-shelf Web servers to deploy their applications. Standard tools such as ColdFusion and CGI scripting languages such as Perl, PHO and ASP generate content for dynamic WML applications.

The WML specification was developed by the WAP Forum and defines the syntax, variables and elements to be used in a valid WML file. The WML 1.1 Document Type Definition (DTD) is available from www.wapforum.org/DTD/wml 1.1.xml, and all WML applications must correspond to it. The microbrowser that all WAP-compliant wireless devices are loaded with is able to handle all entities in the WML 1.1 DTD.

2.3.2 Cards and Decks

WML applications use a card and deck metaphor. A user interaction is represented by a card while a complete task is represented by a deck. Application can be thought of as a series of tasks or a collection of one or more decks.

A deck is the smallest unit of WML that a Web server can send to a microbrowser, and it consists of one or more cards with which a user is likely to interact. Figure 2-4 illustrates the card and deck structure. When a user agent receives a deck, it usually activates the first card in the deck, although one can direct it to any card in the deck. Depending on the card definition, the user can respond by entering text or choosing an option. WAP-compliant wireless devices with larger displays typically present each card as a single screen. Some smaller devices present each card as a collection of screens.
As a deck consists of one or more cards, and a single interaction between a user agent and a user is a card, multiple screens can be downloaded from the server to the client in a single transaction. Using WMLScript, user selections or entries can be routed to and handheld by already loaded cards, thereby eliminating excessive communication with remote server and improving performance.

Figure 2-4 – Card and Deck Structure

The deck structure starts with a prologue that is followed by an optional header and then a sequence of cards. The WAP server uses the prologue to manage the compilation of WAP programs. As all WML programs are based on XML, they must always begin with a valid XML prologue, which for WML 1.1 is as follows:

```xml
<?xml version="1.0"?>
<DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN" "http://www.wapforum.org/DTD/wml_1.1.xml”>
```
WML defines elements and attributes that allow one to specify the user-interface components, or the cards. Wireless device microbrowsers can navigate from one card to another. A card can specify multiple user actions by including one or more of the following:

1. Formatted text, including text, images and links
2. Input elements, which let the user enter a string of text, including numbers
3. Fieldset elements, which act as organisational containers for other elements
4. Select elements, which let the user choose from a list of options

WMLScript enhances the capabilities of WML in a number of ways. For example, one can access user agent facilities, check user input, generate local messages, dialogues, and execute user agent software. This allows one to locally process things like error messages and alerts for faster viewing; add to one's local address book; and interrogate SIM cards.

The basic concept on how to use WMLScript is quite simple: put script code in separate files from your WML decks, with names ending in the extension .wmls. We can then use the WMLScript files by referring to them in our WML files. The code in WMLScript files is broken up into functions -- small blocks of script that each carry out a certain operation. Several functions may exist together in a single .wmls file and the act of using a function is usually referred to as calling the function.

### 2.4.3 WMLScript Characteristics

WMLScript is function oriented. This means that it does not have a main program from which all functions are called. Instead, a series of functions are stored in a file, on a server. Each file containing WMLScript is called a compilation unit or program. Just as the Web server stores WML files with the extension .WML, WMLScript files are similar, text files but with the extension .WMLS. When a user agent calls a WMLScript function,
2.5 3G Technologies

2.5.1 Introduction

Mobile telephony allows us to talk on the move. The internet turned raw date into helpful services that people found easy to use. Now, these two technologies are converging to create third generation mobile services.

In simple terms, third generation (3G) services combine high-speed mobile access with Internet Protocol (IP)-based services. But this doesn't just mean fast mobile connection to the world wide web, rather whole new ways to communicate, access information, conduct business, learn and be entertained — liberated from slow, cumbersome equipment and immovable points of access.

NTT DoCoMo launched the world's first commercialised third-generation “FOMA” mobile communication service on 1 October 2001. “FOMA” is the name used in Japan for NTT DoCoMo's 3G services.

The question of 3G's deployment is not a technical issue, but a regulatory and economic one. Subscribers' demand is the key factor; users' expectations for mobile services are being raised, and for any successful 3G's license bidder time to market will be critical. The way 3G rolled out in a particular market will depend entirely on the business plans of the mobile operators, and the license requirements imposed by the regulatory authorities.

2.5.2 What 3G mean to users?

With access to any service anywhere, anytime, from one terminal, the old boundaries between communication, information, media and entertainment will disappear, Service will truly converge.
"Mobility" will be offered with many services that we currently regard as "fixed" – indeed, mobile operators believes that mobility will become the norm for many communication services. People will be able to make video calls to office and surf the internet, or play interactive games with friends at home – in short, wherever we may be. But 3G are not just about applications that require high-speed date rates. However, it’s more about convenience and speed of access.

The packet based IP (Internet Protocol) technology that will form the core of the future services will mean we can be on-line constantly – email messages with file attachments will download to hand-held terminals instantaneously; at the push of a button we’ll be able to be connected to our company network. We will have this “anytime access” with charging geared more towards how much information we are sending than to how long we are connected.

There will also be a growing need for mobile users to interact with machines, and for machines to interact with other machines, over radio connections – reporting faults, ordering new stock, or relaying location details whenever required.

Increasingly, machine-to-machine communications will also be enabled and enhanced with future mobile network technology. Domestic appliances will have built-in radio modems to provide remote control and diagnostics. Refrigerators will have built-in sensors that will detect which items need replenishing/restocking and automatically send a reminder message to the owner’s PDAs. Alternatively, the refrigerator could be programmed to send an order direct to the groceries store. Likewise, vending machines will be able to tell the operators and the warehouse that the machines restocking.
2.5.3 3G Phones

There will be a wide range, from simple single-application devices such as voice-only phones, to multi-purpose communicators capable of handling several voice, data and video services in parallel.

To date, the “terminal” for accessing mobile services has been the mobile phones. With the coming of 3G, one can expect to see a broadening of this concept to include a whole host of new terminals. These will be both general-purpose computing and communications devices, and devices with more specific purposes to serve particular marker segments. There will still be recognisable mobile phones. But many of these will have larger screens to display internet pages or the face of the person being spoken to. There will be smaller “smart-phones” with limited web browsing and email capabilities.

The addition of mobile communications capabilities to laptop and palmtop computers will speed up the convergence of communications and computing, and bring to portable computing all the functions and features available on the most powerful desktop computers. There will be videophones, wrist communicators, palmtop computers, and radio modem cards for portable computers. Innovative new voice based interfaces will allow people to control their mobile communication services with voice commands.

3G have integrated into a very wide range of devices and products other than user terminals. For example, the “telephone-on-a-card” will allow mobile services to be built into business equipment, vehicles and household appliances, for dedicated applications. Devices such as phones, computers and digital cameras will also be able to communicate with each other using short-range radio. Digital cameras will be able to use wide-area radio communications in real time and reduce the need for bulky and huge memory and other components.
2.5.4 What are the effects of 3G?

Implementing 3G does not just mean standardising a new radio interface. New techniques and evolution strategies for delivering 3G are needed for all levels of the network.

When the current mobile standards were developed, they were generally applied right across the network. A GSM network is GSM at the handset, radio communications and core network levels. Much the same goes for TDMA (ANSI-136 digital mobile standard) and cdmaOne (ANSI-95, a CDMA-based digital mobile standard). In the case of 3G, a different approach is being taken. There is one standardisation process for the radio network and another for the core network. That is why, when the industry talks about 3G wideband Radio Transmission Technologies (RTTs), it is the only radio communications part of the network that is being discussed. The core network is being developed and standardised in parallel, and in many cases will be an evolution of today’s core networks. There will be a core network that has transport “pipes” for information flow, nodes that route the traffic, and mobile networks, to provide interconnectivity with the global telecoms networks. Connected to this core network will be the mobile radio network, providing the wideband interface for users.

Strategies for migration to these 3G capabilities from today’s GM, cdmaOne and TDMA networks envisage that evolved and new wideband radio networks will be able to share a common core network. History and commercial reality dictate that 3G will need to be provided across a wide range of radio frequencies and techniques, switching platforms and transmission technologies. Once standards have been agreed, the focus will be on the services and applications rather than the technologies used to deliver them.
2.5.5 The Speed

3G enable users to transmit voice, data, and even moving images. In order to realise these services, 3G improve the data transmission speed up to 144Kbps in a high-speed moving environment, 384Kbps in a low-speed moving environment, and 2Mbps in a stationery environment. 3G provide services like Internet connection, transmission of large-scale data and moving contents photographed by digital cameras and videos, and software downloading.

At present, maximum data transmission speed is 64Kbps offered by NTT DoCoMo’s 3G services. At the early stage of 3G services, a 144Kbps-transmission speed is expected. By around 2005, when 3G is in general use, a maximum speed of 2Mbps will be possible.

2.5.6 Key features of 3G

Key features of 3G systems are a high degree of commonality of design worldwide, compatibility of services, use of small pocket terminals with worldwide roaming capability, internet and other multimedia applications, and a wide range of services and terminals.

a) 3G system capabilities

Capability to support circuit and packet data at high bit rates:
- 144 kilobits/second or higher in high mobility (vehicular) traffic
- 384 kilobits/second for pedestrian traffic
- 2 Megabits/second or higher for indoor traffic

b) Interoperability and roaming

Common billing/user profiles:
- Sharing of usage/rate information between service providers
- Standardised call detail recording
- Standardised user profiles
c) Capability to determine geographic positions of mobiles and report it to both the network and the mobile terminal

Support of multimedia services/capabilities:
- Fixed and variable rate bit traffic Bandwidth on demand
- Asymmetric date rates in the forward and reverse links
- Multimedia mail store and forward
- Broadband access up to 2 Megabits/second

2.5.7 3G and earlier generation systems

<table>
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<th>TECHNOLOGY</th>
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<td>- enhanced calling features like caller ID</td>
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<td>- broadband data services like video and</td>
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<td>multimedia</td>
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<td>- enhanced roaming</td>
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2G Wireless | 2.5G Wireless | 3G Wireless
---|---|---
The technology of most current digital mobile phones | The best technology now widely available | Combines a mobile phone, laptop PC and TV
Features includes:
- phone calls
- voice mails
- receive simple email messages | Features includes:
- phone calls/fax
- voice mails
- send/receive large email messages
- web browsings
- navigation/maps
- new updates | Features includes:
- phone calls/fax
- global roaming
- send/receive large email messages
- high-speed Web
- navigations
- videoconferencing
- electronic agenda meeting reminder
Speed: 10kb/sec | Speed: 64-144kb/sec | Speed: 144kb/sec-2mb/sec
Time to download a 3min MP3 song: 31-41 min | Time to download a 3min MP3 song: 6-9mins | Time to download a 3min MP3 song: 11sec-1.5min

2.5.8 The Future
In the next few years, mobile phones will start to benefit from very high bandwidth capabilities. 2.5G and 3G communications systems will allow enhanced services such as full-motion video images, multimedia, high fidelity sound and fast access to the internet. The 2.5G and 3G systems will allow much higher capacity and data rates than can be offered by the restricted bandwidth currently available.

The rapid growth of the use of the internet and huge growth of the use of wireless technologies are creating a demand for wireless access to the internet, intranets and other data networks. People want at least the same speed and power as they can currently achieve when using the Web via a desktop (and more) as the are offered connection technologies such as ISDN, with bandwidths of around 64/128Kbp and the potential high-speed connections that will be available with the introduction of much faster services such as GPRS, EDGE and eventually 3G systems.
These wireless devices will be supported by a number of emerging technologies including the following:

i) GPRS (General Packet Radio System)
A packet-switched wireless system protocol with transmission rates from 115Kbps – 171 Kbps. It will be the first service available to offer full instant wireless access to the Web. It will require new handsets to support the higher data rates. A main benefit is that users are always connected and online, and will be charged only for the amount of data that is transported. A user can make and receive voice calls while at the same time downloading data. For GM providers, this new technology will increase data rates of both circuit switching (High Speed Circuit Switched Data [HSCSD]) and packet switching (GPRS) by a factor of 10 to 15 times.

ii) EDGE (Enhanced Data Rate for GSM Evolution)
A higher bandwidth version of GPRS with speeds of up to 384Kbps, or twice that available from GPRS alone. It evolved from GM which is the prevailing standard throughout Europe and the Asia Pacific region – some 50% of the world’s population. For GSM providers, this new technology will increase data rates of both circuit switching (HSCSD) and packet switching (GPRS) by a factor of 20 to 30 times.

iii) HSCSD (High Speed Circuit Switched Data)
A new high-speed implementation of GSM data techniques. It uses four radio channels simultaneously will enable users to access the internet via the GSM network at very much higher data rates than at present. Data rates can e transmitted at 38.4Kbps or even faster over GSM networks.
iv) **Bluetooth**

A specification for short-range radio links between wireless devices (a low-power radio technology being developed to replace cables and infra-red links with wireless transceivers fitting onto a single chip). Devices such as printers, desktops, mobile phones and PDAs will use the technology, and it has the potential to be used for wireless LANs. It is a de facto standard with a throughput of around 1Mbps and delivers opportunities for rapid ad hoc connections and the possibility of automatic connections between devices. Bluetooth is considered complementary to WAP technology and when used together, they can open up unlimited variety of applications such as long distance (WAP) remote control of home and office devices.
2.6 Related Projects

2.6.1 Windows Media Technologies

2.6.1.1 Introduction

Windows Media Technologies is a set of tools, services, protocols, and file formats that can be used to create, deliver, and play digital media content. Windows Media Tools is used to capture and encode content, convert existing content to an .asf file, and edit stored media files in a variety of ways, Windows Media Services can be used to distribute live or on-demand content, and Windows Media Player is used to play it.

Windows Media Technologies is used in the entertainment field, for communicating information and news to a mass global audience, in corporate communications, and even for distance learning.

2.6.1.2 Windows Media Technologies Components

i) Windows Media Tools

The tools component includes programs, plug-ins, and utilities for creating content. With several of the tools, one can convert other file formats, such as the Windows multimedia formats WAV and AVI, the Apple QuickTime format, and the Internet music format MP3, to the Windows Media format, which is called the Advanced Streaming Format (AFT). In addition to creating files, the Windows Media Encoder tool can be used to create a live stream, with which one can broadcast audio and video over a network. Windows Media Author can be used to create illustrated presentation by embedding graphics and scripting elements (script commands). Windows media ASF Indexer can be used to edit content after it has been encoded to the Windows Media format. Windows Media On-Demand Producer can be used to edit, process, and encode source content and to add markers and script commands.
ii) Windows Media Services

The Windows Media server components are a set of services running on Microsoft Windows NT Server. These services distribute audio, video and other media to players on end-user computers. Media can be in the form of a file or it can be a live stream. To broadcast a live stream, Windows Media Encoder encodes audio and video in real-time and then distributes the encoded stream to the Windows Media server for delivery to end-users over a network.

iii) Windows Media Player

End users play ASF streams and other multimedia content with Window Media Player. Intranet and Internet surfers can use Windows Media Player to play audio, illustrated audio (synchronised sound and still images), and full-motion video files, as well as many other multimedia data types.

2.6.1.3 Key features

Window Media Technologies includes powerful features for creating, delivering, and viewing content. Other features enhance the authoring and presentation of media. The key features include:

- **Highest quality of audio** – The Windows Media Audio codec provides FM-radio quality sound to all modem users and CD quality at half the bit of MP3.
- **Fast video encoding** – Windows Media Encoder encodes lengthy, on-demand content at the fastest rate in the industry.
- **Scalable to full screen** – The video playback window in Window Media Player can be used to enlarge to full screen.
- **Integration with other Microsoft products** – One can leverage one’s investment in other Microsoft products, such as Windows NT Server, Microsoft Site Server, and the rest of the Microsoft BackOffice family of products.
Digital rights management – Microsoft Windows Media Rights Manager enables content owners to make their intellectual property more secure and it is used to help control the distribution and preserve the rights of digital media on the internet.

PowerPoint 2000 Presentation Broadcasting – This feature is a complete system for synchronising the live presentation of Microsoft PowerPoint slides with audio and video over a network.

Other Windows Media Technologies features relate to the reliability and scalability of the stream delivered to an end user. Reliability means that the end users can connect, stay connected and receive an uninterrupted presentations. Scalability means that components can handle variations in bandwidth and the number of client connections to a server (server load). The client is the computer that is rendering or playing back a stream. The following features help ensure a quality end-user experience:

- **Wide bandwidth range** – Windows Media Technologies offers one of the industry’s widest range of bandwidth for high-quality streaming, from mono-quality audio at 2.4 kilobits/second (Kbps). Windows Media technologies provides high quality at every bit rate.

- **Intelligent streaming** – The Windows Media server monitors and automatically adjust the bit rate of each client stream according to current g/bandwidth. This ensures that the highest-quality stream is delivered to end users, regardless of network conditions.

- **Multiple bit rate encoding** – One can create a live stream or file containing multiple streams, each of which is encoded for a different bit rate. Multiple bit rate encoding is part of intelligent streaming.

- **High scalability** – Windows Media technologies supports more than 2,000 unicast clients connecting at 28.8 Kbps on a single-processor Pentium II server

- **Built-in multicast service** – Windows Media Technologies conserves network bandwidth by delivering a single multicast stream to support unlimited end users.

- **Seamless stream switching** – Windows Media technologies provides a smooth viewing experience by reducing the delay that occurs when switching between content in a playlist.
2.6.1.4 Streaming and downloading

Here are two (2) ways to deliver multimedia content to a client on a network by streaming the content and by downloading it. Windows Media Technologies components create and deliver files that are streamed. Other types of multimedia files can only be downloaded. Each method has its advantages. The choice of which to use depends on the nature of the content, how one would like it to be presented to an end-user, and the type of network that is used to deliver the content.

To implement the downloading method, simply place the multimedia content on a Web server. An end-user clicks the link on a Web page, downloads the media files to a local hard drive, and then renders it with an appropriate player. The main advantage of downloading is that the file can be of any type. The main disadvantages are that downloading takes time and the file takes up space on the end-user's hard drive. A 30-second video file can take 20 minutes to download on a slow network like the internet. Downloading the same file on a fast network can take only few seconds and may be good solution in some cases. Hard drive space and download time are also issues if the running time of the media is long or if the content is live.

To implement the streaming method, one need to place content that has been encoded in the ASF format on a Windows Media server. An end-user clicks a link, but instead of downloading a file, the content remains on the server and plays back to the client as a stream. Windows Media Player on the client computer renders the stream as soon as it is received. There is no 20-minutes wait and no downloaded file to take up space on the end-user's hard drive. The main advantage is that media of any length, even live media of an unlimited length, can be played by a client almost immediately.

The main disadvantage of streaming media is that real-time playback of the media is highly dependent on the bandwidth and quality of the network over which the stream is being delivered. The focus of Windows Media Technologies is to provide a system for creating and delivering streaming content that takes into account all of the limitations
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2.6.1.4 Streaming and downloading

Here are two (2) ways to deliver multimedia content to a client on a network by streaming the content and by downloading it. Windows Media Technologies components create and deliver files that are streamed. Other types of multimedia files can only be downloaded. Each method has its advantages. The choice of which to use depends on the nature of the content, how one would like it to be presented to an end-user, and the type of network that is used to deliver the content.

To implement the downloading method, simply place the multimedia content on a Web server. An end-user clicks the link on a Web page, downloads the media files to a local hard drive, and then renders it with an appropriate player. The main advantage of downloading is that the file can be of any type. The main disadvantages are that downloading takes time and the file takes up space on the end-user's hard drive. A 30-second video file can take 20 minutes to download on a slow network like the internet. Downloading the same file on a fast network can take only few seconds and may be good solution in some cases. Hard drive space and download time are also issues if the running time of the media is long or if the content is live.

To implement the streaming method, one need to place content that has been encoded in the ASF format on a Windows Media server. An end-user clicks a link, but instead of downloading a file, the content remains on the server and plays back to the client as a stream. Windows Media Player on the client computer renders the stream as soon as it is received. There is no 20-minutes wait and no downloaded file to take up space on the end-user's hard drive. The main advantage is that media of any length, even live media of an unlimited length, can be played by a client almost immediately.

The main disadvantage of streaming media is that real-time playback of the media is highly dependent on the bandwidth and quality of the network over which the stream is being delivered. The focus of Windows Media Technologies is to provide a system for creating and delivering streaming content that takes into account all of the limitations
inherent in networks, so that the end-user experiences a seamless and quality presentation.

2.6.1.5 Delivering streaming media over a network

A stream originates on a Windows Media server that is connected to the internet or intranet and is rendered by Windows Media Player on an end-user’s computer. To get from here to there, the data must be in a form that can be read by routers, modems, browsers and all of the other components that make up the network. A Windows Media server does this by streaming the data in packets. When Windows Media Player receives the stream, it disassembles the packets and renders the data as images and sound.

The rules that govern how the packets are to be assembled and disassembled are contained within various Internet Protocols. The Transmission Control Protocol (TCP) is used for transporting most types of data, such as Web pages, images, documents and other downloaded data. The User Datagram Protocol (UDP) is preferred for transporting streaming media because it allows Windows Media components greater control over how and when packets are sent.

To render a stream properly, a player must receive all of the data in time to recreate the audio waveform and video frames. The speed with which data must be transferred for the player to render the media properly is called the bit rate of the stream. The one greatest limitation to streaming on the internet is bandwidth. Bandwidth is the maximum bit rate that a connection can handle, and unfortunately, the bit rate of high quality audio and video is far higher than the bandwidth of most internet connection. Because of the popularity of streaming media, however, there have been many technological advances in networking, compression and media delivery.

The quality of a stream, therefore, is highly dependent on the quality and speed of the connection between server and player. The Windows Media server and Windows Media Player must work as a unit to regulate the flow of the stream, so that the data is received
by the player in time to render the media in a continuous fashion. Windows Media Technologies offers two methods of delivering a stream ie Unicast and Multicast.

2.6.1.6 Unicast and Multicast Streaming

Unicast and multicast streaming are two network transport methods that are used to deliver streaming content to end-users.

i) Unicast

Unicast has a one-to-one client/server connection during which the client receives a distinct stream from the server. No other client has access to the stream. Each client has its own connection to the server and a separate content stream must be generated for each client requesting content from the server.

The main advantage of a one-to-one connection is that data flows both ways between client and server. As the media is streamed to the client, control and feedback information is sent back to the server. Control information allows the end user to start, stop, pause and seek to different positions within a stream. Feedback information is used by the server to implement intelligent streaming and error connection. Below diagram (Figure 2-5) will show a unicast data flow:

![Unicast Data Flow](Figure 2-5)
Multicast

Multicast, as implemented by Windows Media technologies, is a connectionless data transmission method in which a server provides one stream from which many clients can receive data. Connectionless means that clients receive the stream but do not connect to the server. Because there is no connection, control or feedback information cannot be sent to the server.

For each event that is multicast, only a single stream is generated. This saves network bandwidth and reduces the load placed on the server. To distribute a multicast transmission, the network must have multicast-capable routers that have been enabled to forward multicast packets. Most of the internet is not yet multicast-capable but multicast can be used on many intranets. Below diagram (Figure 2-6) will show a multicast data flow:

![Multicast data flow](image-url)
2.6.3 VideoLAN

VideoLAN is a project of a group of French students from the Ecole Centrale Paris and developers from all over the world. VideoLAN allows users to stream MPEG-1, MPEG-2, MPEG-4 and Divx files, DVDs, digital satellite channels, digital terrestrial television channels and live videos on a high-bandwidth IPv4 or IPv6 network in unicast or multicast under many operating systems.

VideoLAN also features a cross-platform multimedia player, VLC (VideoLAN client), which can be used to read the stream from the network or display video read locally on the computer under Windows, Mac OS X, Linus, BeOS, BSD, Solaris etc. Users can use VLC to stream live from a camera or a webcam under Linux or using VLS (VideoLAN Server) to stream digital satellite channels and digital terrestrial TV channels.

2.6.4 Real

RealVideo from RealNetwork is another pioneering Web streaming format. It is a very popular player, which is widely distributed and available for all major OS platforms.

RealPlayer is up to version 8 and the latest generation codec, coupled with their SureStream technology, which is an automatic multi bit-rate technology that will adjust the streamed data rate to suit the client's connectivity. It also supported Synchronized Multimedia Integration Language (SMIL) which allows mixed multimedia content to be delivered in a synchronized way.

The native format file format for RealMedia is a RealMedia file or .rm. You will also see .ram files, which tell the player where on the server to find the .rm data. RealServer is also available for most OS platform but is only free for a basic 25-user license.
2.7 Active Server Pages (ASP)

The WML and WMLScript files that are used are static and not dynamic files. This means that once it is created, it remains the same. While WMLScript provides interactivity for the user, it does not allow dynamic content to be displayed. In a truly dynamic WAP application, all the information would be stored in a database that is accessible to the web server. Once the user has input, the web server could perform server-side and generate a deck containing the information that is required by the users. The technology that allows users to do this is Microsoft Active Server Pages (ASP).

Dynamic content generation, such is possible with ASP, has involved the following steps:

- a WAP browser requests for a file from the server
- the server then generates the requested file
- the server then sends the said file to the browser

ASP files will contain some ‘ordinary’ WML, but also contains script code (not WMLScript) that, when being executed, inserts the dynamic information into the file. Because this happens at the moment the .asp file is requested, the information being inserted can completely up-to-date.
Chapter 3: Methodology

3.1 Project Flow

To explain the proposed project flow, I have chosen the 'waterfall' model or the software life cycle.

The development flow for the WAP application is as follows (Figure 3-1):

![Figure 3-1 – Project Flow]
1) Identifying Opportunities and Objectives

Many portal sites offer streaming audio and video services for accessing news and entertainment content on the internet from a PC. However, with the existence of 3G systems, it will be able to provide high-quality streamed internet content to the rapidly growing mobile market. With this proposed project, we hope to develop a WAP video streaming application system. Activities in this phase consist of summarising the knowledge obtained, estimating the scope of the project and documenting the results. The output of this phase is a summary of the project overview and objectives.

2) Requirement Analysis

The activities involved are:

- Capturing the requirements of the proposed project through materials both in print (books, articles) and online (internet)
- Define what the application is capable of doing in order to accomplish the purpose of the proposed project
- Keeping abreast of the latest technologies which are WAP related eg WAP Forum
- Determine the software and hardware requirements in order to develop the WAP application in an efficient manner
- Determine the suitable tools for the proposed application

3) Application Design

After completion of this project proposal which has define the overall specification in high-level perspective to be understood by end-user, the design phase will continue to define the application specification in lower level programmable modules. Information collected is used to accomplish the logical design of the application. This design include access procedures, screen interface, menu design etc. A full schedule will be prepared to keep track of the application development progress.
4) Coding
During this phase, the modules are developed using the chosen programming language WML. Unit test plan will be prepared as an quality assurance plan to ensure modules are error free and functioning well.

5) Integration & System Testing
A test plan will be prepared in this phase to ensure quality plan. This test plan will function as a documents to keep track of all the errors that might surface and problems that might be encountered during testing. A part from this, all errors and problems faced will be rectified at this phase.

6) Operation and Maintenance
The final phase is basically the completion and delivery of the 'completed' proposed application. User guide will also be prepared to allow end user to use the application without any specific training.

3.1.1 The 'Waterfall' Model
It is called 'waterfall model' because of the cascade from one phase to another. In principle, the result of each phase is one or more documents, which are approved ('signed off'). The following phase should no start until the previous phase has finished. In practice however, these stages overlap and feed information to each other. During design, problems with requirements are identified, during coding design problems are found and so on. The software process is not a simple linear model but involves a sequence of iterations of the development activities.

Because of the costs of producing and approving documents, iterations are costly and involve significant rework. Therefore, after a small number of iterations, it is normal to freeze parts of development, such as the specification, and to continue with the later development stages. Problems are left for later resolution, ignored or are programmed around. This premature freezing of requirements may mean that the system won't do
what the user wants. It may also lead to badly structured systems as design problems are
circumvented by implementation tricks.

During the final life-cycle phase (operation and maintenance) the software is put into use.
Errors and omissions in the original software requirements are discovered. Program and
design errors emerge and the need for new functionality is identified. The system must
therefore evolve to remain useful. Making these changes (software maintenance) may
involve repeating some or all previous process stages.

The problem with the 'waterfall' model however is its flexible partitioning of the project
into these distinct stages. Commitments must be made at an early stage in the process and
this means that it is difficult to respond to changing customer requirements. Therefore,
the 'waterfall' model should only be used when the requirements are well understood.
However, the 'waterfall' model reflects engineering practice. Consequently, software
processes based on this approach are still used for software development, particularly
when this is part of a larger systems engineering project.
3.2 Project Consideration

To implement WAP-VSS, we require application with high bandwidth as it will be developed on wireless bearer network and terminals. The increase in bandwidth would result in higher power usage in the terminals, higher costs in the radio sections, greater use of RF spectrum, and increased network loading. Third generation (3G) services combine high-speed mobile access with Internet Protocol (IP)-based services. But this doesn't just mean fast mobile connection to the world wide web, rather whole new ways to communicate, access information, conduct business, learn and be entertained – liberated from slow, cumbersome equipment and immovable points of access. WAP has been designed to be as independent as possible from the underlying network 3G technology. WAP can be expected to optimize support for multimedia applications that continue to be relevant. If WAP is very successful in mass-markets on 2.5G networks, 3G networks may be needed purely for capacity relief.

The operating system used by PDAs are one of two types, Palm OS (3Com) or PocketPC (formerly called Windows CE, Microsoft). Palm OS takes up less memory, runs faster, and is easier to use. PocketPC easily supports colour displays, graphics, standard Windows packages (Word, Excel), and other devices (e.g., built-in MP3 players, MPEG movie players). However, PocketPC takes up more memory, is slower, and more complicated to use. After much consideration and research, we have decided to implement WAP-VSS on PDAs that are running on PocketPC operating system. The main reason for choosing PocketPC operating system was we were looking compatibility of softwares that we will be using. It is important, as it will be able to exchange files with other Windows packages. To develop WAP-VSS, we will also be using other tools by Microsoft ie development tools such as Microsoft Internet Information Server (IIS), Microsoft Windows 2000 Server (or Microsoft Windows NT Server 4.0), Microsoft Media Encoder Software Development Kit, Microsoft Mobile Explorer Emulator (MME) and Windows Media Player.
3.3 Requirements

This section will outline the basic requirements for application development ie functional requirements and non-functional requirements:

3.3.1 Functional Requirements

The functional requirements of the application consists of the following:

i) WAP-enabled device need to be configured to access to WAP pages and to install microbrowsers to view WAP content

ii) Setting-up of WAP gateway – for connection of wireless network and internet

iii) To install streaming player to view video

iv) To create User Module

- Video code – Users are required to provide the particular video code they want to view
- Verification – Users will also be required to re-confirm the video that they want to view after the video code has been provided. The title of the video will be displayed and users will be asked to verify if that is the correct video they want to view
- Notification – Users will be notified once the downloading of the video images has completed and also once the internet connection has been disconnected. Users will also be notified as and when the server is unavailable.

v) To create Display Module

- Graphics and images display
- “Back” button/option
- Options are sorted step-by-step
- “Next” option will display the following menu items
- “Exit” option will be available if at any point in time the user decides to quit and return to the previous menu.
3.3.2 Non-functional Requirements

Security
The application must provide sufficient measures to ensure the program runs smoothly without fear of being corrupted. Therefore, only administrators are authorised to control the application. This would also mean that only administrators will be able to authorise new users. Each user will need to log in by using user ID and password before they are allowed to access the application. Data privacy and data integrity issues should not be taken lightly. Administrators are not allowed to change users’ to avoid any misuse of authority. As such, password in the database will be encrypted. A firewall system could be designed to protect private networks from unauthorized access. Depending on how a firewall is set up, it might block or affect the quality of streaming audio or video. Basically, a firewall is a barrier to keep destructive forces away from your property.

Reliability
The application should be reliable in performing its function as expected by both user and administrator. The application will also provide the correct video required by the users. The application will also identify the correct login user to give the correct access to the correct user.

Availability
The application should be available to users through their WAP-enabled devices although users can obtain it through the internet browser. It should also be available at all time unless when the server is unavailable due to unforeseen circumstances.

Performance
The system should be capable of multicasting. This would actually judge the capability of the system. No users would want a system that is not able to support multicasting. Whenever the users have selected their choice of video, the time waiting to view the movie should be as minimal as possible. Users should be able to view the selected video in a fraction of time after submitting their request.
3.3.3 Usability Design

There are a few design constraints that are expected to arise during development of an application for a WAP browser device. However, users' experiences with an application may determine how critical these constraints are. As such, when developing an application, these factors are to be considered:

- Who are the targeted users
- What are the problems faced by users when using this application
- How to solve/minimise these problems efficiently
- Which device is more suitable for this application

Key principles for creating usable applications:

- Get to the value immediately – Deeply embedded information can cause the user to some how forget the goal and become frustrated. This frustration will cause the user to avoid the application in the future. Provide commonly used options quickly rather than requiring users to navigate deep menus.
- Limit the application to only necessary functionality – The browser does not have the display and navigation capabilities of a PC. As such, while browsing on a handheld device, the user is looking to find or submit information in the shortest time fraction possible. Try to scale down the application to directly target to the goals of the user and do not include extras. Provide access to the most commonly used features through menu choices, links or options and used simple language when naming the options.
- Make the application easy to navigate – Try the best possible to minimise the number of steps taken to access information. Eliminate or combine cards (if possible) without losing important information, choices or content. Try creating multiple paths to access information, whenever possible.
• Make the application consistent – Consistent applications are ‘intuitive’ for the users. That is why it is very important to make the text description as easy to follow/understand as possible. The list order should be logical to enable links and items easy to be searched. Although images and icons provide extra (and interesting to look at), try not to over-use them, as it would make the information looks messy and ‘pack’.

• Avoid text entry – Avoid queries that require users to enter long alphanumeric text. If this cannot be avoided, then try to use partial text searches instead.

• Ensure accuracy of data input – Anticipate situations in which users are likely to make errors. As such, the application should not allow the users to continue a task unless the data has been input correctly and all requirements are met.
3.4 Project Scheduling

We have split the proposed project into 2 parts ie Part 1 which will be completed by Mr Chua Chun Poo and Part 2 will be completed by Ms Michele Ooi Lay Sean. However, the tasks for both parts will be run concurrently. This is to minimise task dependencies to avoid delays caused by one task waiting for another to complete, as time factor is not favourable. We have scheduled our project (Figure 3-2) according to the below process and Figure 3-3 illustrates our activities' chart:

![Diagram of project scheduling process]

**Figure 3-2 – Project scheduling process**

T1 – We first met up with En Zaidi on 19 August 2003, who then briefed us on the requirements of this thesis project. We were given the outline on how to go about with the project.

T2 – After informing En Zaidi of our intention of collaborating effort for this project and submitting our project proposal and title, we both of us had our first discussion on 10 August 2003, whereby we have discussed on how we are to go about with the project. We also segregated our responsibilities for the project.

T3 – We each started on our research via internet, books and even articles.
T4 – We started on our project writing as and when we have gathered enough information to write on for each section/chapters. T1, T3 and T4 run concurrently. We would seek advice from En Zaidi as and when we faced problems while completing the report. Both of us had discussions frequently so as to avoid any over-lapping information/report writing and also passing of information to one another.

<table>
<thead>
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<th>Date/Task</th>
<th>19/07/03</th>
<th>02/08/03</th>
<th>16/08/03</th>
<th>30/08/03</th>
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<th>27/09/03</th>
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<td>T1</td>
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</tbody>
</table>

Figure 3-3 – Activities Timeline
### Development Tools

Streaming audio or video requires a computer system with an internet connection that can play the streamed files. Figure 3-4 shows the minimum system requirements needed:

| 1. System Requirements | a) Minimum Hardware Requirements  
<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>b) Web browser</td>
</tr>
<tr>
<td></td>
<td>c) Minimum connection speed</td>
</tr>
<tr>
<td>2. Player and Plug-ins</td>
<td>a) RealPlayer</td>
</tr>
<tr>
<td></td>
<td>b) Quicktime</td>
</tr>
<tr>
<td>3. Other Factors that affect Streaming</td>
<td>a) Firewalls</td>
</tr>
</tbody>
</table>

#### Figure 3-4: System Requirements

##### i) Minimum Hardware Requirements

The system must meet the minimum requirement in order to access the streaming audio or video. For Windows computer, it is recommended to have at least the following:

- 200MHz Intel Pentium processor or better
- 32MB or more RAM
- 56.6 Kbps or better modem
- Full Duplex Sound card and speakers
- 65,000 colour or better video display card
- Windows 95, Windows 98, Windows 2000, Windows 2000 ME (final release version only) or Windows NT 4.0 with Service Pack 4
ii) **Browser requirements**

A current version of Web browser software will be needed in order to access the streaming audio and video such as:

- Netscape version 4.0 or later
- Microsoft Internet Explorer version 4.0.1 or later

iii) **Connection Speed**

It is desirable to have a minimum connection speed of 56Kbps. A modem of 56 Kbps is a minimum requirement - a high speed Internet connection is optimal. Connection speed can vary depending on the time of day and level of traffic on the internet.

As network or web congestion occurs, the playback quality can degrade to the point where the video freezes, continually rebuffers and the audio breaks up. The more bandwidth required by a streaming file, the more likely network congestion problems would occur. Better quality is possible with higher bandwidths, but maintaining that bandwidth for an extended period can be a problem.

iv) **Firewalls**

A firewall is a system designed to protect private networks from unauthorized access. Depending on how a firewall is set up, it might block or affect the quality of streaming audio or video. Basically, a firewall is a barrier to keep destructive forces away from your property. In fact, that's why it's called a firewall. Its job is similar to a physical firewall that keeps a fire from spreading from one area to the next. If an incoming packet of information is flagged by the filters, it is not allowed through. With a firewall in place, the landscape is much different. The firewall can implement security rules.
3.5.1 Microsoft Windows NT Server 4.0

Windows NT Server 4.0 is a network operating system as it possesses multi-purpose servers. Its functionality is specific to build and deploy application faster and easier than before. It is used to enable testing through the use of UP.Simulator.

Other than being a complete environment in building applications, Windows NT 4.0 is chosen as the development platform because it poses the following benefits:

i) Easy to use – the user interface is friendly, has many icons that will make navigation between applications easier, and on top of that Windows NT looks similar to Windows 95 which is used widely and can be considered a very stable operating system.

ii) Security – Windows NT has a security unlike its precedent Windows 95 or Windows 98. One must be able to provide the correct password before being allowed to access/enter to the main window.

iii) NTFS – Windows NT uses New Technology File System (NTF), which was specifically used with Windows NT. The advantage of using NTFS is and any point the system fail, then the operating system can use the transactions logs to undo or redo any incomplete transactions. Secondly, NTFS can recover from disk errors caused by bad sectors by cluster remapping.

iv) Reliability – Windows NT is more reliable compared to Windows 95 or Windows 98 because it uses separate memory space for different 16-bit applications. If one application fails, it would not affect the rest of the other applications.
3.5.2 Microsoft Windows 2000 Server

The Windows® 2000 Server operating system is designed to the value of the existing investments while lowering overall computing costs. Specifically, Windows 2000 Server is easier to deploy, configure, and use because it provides centralised, customisable management services to reduce TCO (total cost of ownership). Further, these management services work with existing management solutions and mixed-platform distributed networks, thus getting maximum value from current infrastructure.

Windows 2000 Server provides services that build and deploy servers more quickly. The new Configure Your Server Wizard significantly reduces the time it takes to build a server and reduces the likelihood of error. Additional new Wizards reduce the time it takes to create new Web sites, create virtual directories, manage security settings, and manage security certificates. And, with the SysPrep utility (available in the Windows 2000 Server Resource Kit), this can dramatically reduce the time it takes to build completely configured Windows 2000-based servers as compared to installing and configuring those same servers by hand. Another feature available through the Resource Kit, the Windows Script Host, includes scripts for a number of commonly used administrative functions, such as logon scripting.

Windows 2000 Server allows network configuration more easily. It provides support for Plug and Play network adapters, significantly reducing device configuration time. It provides services that manage the trust relationships between domains in the organization, and it provides automated replication and local caching of DNS and DHCP information so your network is robust and responsive. Moreover, Connection Sharing Wizards provide an out-of-the-box network address management solution for small businesses.
3.5.3 Microsoft Internet Information Server (IIS)

IIS is an internet file and application server included in the Windows NT option pack. IIS is user friendly because it is easy to configure and can be used alone as a web server. IIS also guarantees the same security, networking and administration and user functionality because it inherits all Windows NT features. IIS also can help administrator secure websites and develop and deploy server-intensive web applications. Other than that, IIS can support a variety of applications such as Common Gateway Interface (CGI), Active Server Pack (ASP) and Server Socket Layer (SSL).

3.5.4 SDK

To test and develop the WML code, one will need to install a software development kit (SDK) or microbrowser emulator. One should not expect to WML code without testing it on some kind of microbrowser, and the SDKs are very useful for testing the WML pages even if WAP-enabled phones or other device are available. The SDK chose will depend upon variety of factors, such as the support wireless devices, the needed features and also personal preferences.

3.5.4.1 Microsoft Windows Media Encoder SDK

Windows Media Encoder is an authoring tool that produces media content in ASF. The processes supported by Windows Media Encoder include acquiring the content from a capture card or a stored file, compressing it by using both audio and video codecs; encapsulating it into AF format, which includes a timeline with synchronised audio, video and script commands streams; and then sending it to a Windows Media server, to an .asf file or to both.
The set of interfaces in Microsoft Windows Media Encoder SDK makes it easy for a developer to script the behavior of the encoder itself. This is an easy way to build a powerful media creation application on top of Windows Media Encoder 9 Series, and is ideal for building batch encoding tools or simplified encoding applications for end users. In addition to that, the supported operating systems are Windows 2000, Windows 98, Windows XP and Windows ME.

3.5.5 WAP Emulators

Instead of installing an entire WAP SDK, a WAP emulator can also do the work. An emulator simply lets one view the contents of the WML files as they would be seen on the screen of a WAP-enabled device. In many cases, a WAP SDK will provide little more than a WML emulator together with some example code. By using just an emulator one will, therefore, still be able to see the output of the WML code, and the download time will be much lesser. Again, while the emulators do a great job, they are however not prefect.

3.5.5.1 Windows Explorer Mobile Emulator (MME)

The Microsoft Mobile Explorer, or MME, is a sort of dual mode browser in that it accepts both HTML and WML code. This presents all sorts of interesting new problems such as when presenting the same content in either HTML or WML based on what browser is used, how to choose between HTML and WML when this browser supports both. This is not new, as the Opera browser is primarily a HTML browser, but supports WML. The MME does however present the data types in the correct order, i.e. HTML before WML, so if the browser detection code is correct, there should be no problems.

Note that the MME Emulator does not accept textual WML code, only tokenised WML (aka WMLC) requiring (like all WAP devices) a gateway to do the conversion from WML to WMLC.
The MME also accepts images of the JPEG and GIF format as well as WBMPs. In addition, the MME sends out a HTTP header string called HTTP-DISPLAY-AREA, which tells the content server (web server) what the display size is.

The MME identifies itself via the User Agent string as a Mozilla/1.22 compatible device. The complete id string for the MME Emulator is Mozilla/1.22 (compatible;MMEF20;CellPhone).

When using the MME Emulator, remember that the device operates in two modes. In one mode the device will talk to the content server (web server) directly, and read HTML and/or tokenised WMLC. Accessing a resource that outputs textual WML in this mode will not work unless the MME Emulator is ‘instructed’ where to find a WAP gateway. In this mode, all WAP requests are handled by the WAP gateway, and the device now (with the help of the WAP gateway) accepts textual WML.

### 3.5.5.2 TTemulator

Alternatively, TTemulator can also be used. TTemulator is free for non-commercial use and is a stand-alone product that can be licensed for use on the web site. TTemulator reads a WAP site page, converts it to HTML format and sends it back to the browser. This way one will be able to browse WAP sites with one’s browser without having to buy a real WAP device.

**Application type:**

CGI, developed in C++ language

**Platforms supported:**

Windows

Solaris

Linux
Features:

- no download required for web site visitors
- fast (only plain HTML data are transferred)
- phone skin can be changed to suit own preference
- location for home button can be changed

WML elements supported:

- forms
- text formatting (all)
- links (a, anchor)
- pictures
- variables (all, attribute for URL escaping var: e is ignored)
- tasks (all - go, prev, refresh, noop)
- events (all except 'onenterbackward')
- timer
- templates
- user input (both tags, input and select); input tag attributes supported: name, type, value, title; select tag: iname and ivalue are not supported
- WML script
3.5.6 Facilities Required

The facilities that are needed to carry out this WAP-VSS project are:

- A reliable and fast workstation (preferably Window 2000 with IIS 5.0 or Windows NT 4.0)
- Internet connection
- Microsoft Project 2000
- Microsoft Visio 2000
- Microsoft Media Encoder SDK
- Microsoft Mobile Explorer Emulator
- Reference books, articles, websites on WAP, WML, WMLScript, ASP and Video Streaming
Chapter 4: System Design

4.1 System Process Flow

Figure 4-1 illustrates the system process flow for WAP-VSS:

Firstly, raw video data (data output in a format supported by codec) will go through a process of encoding. After going through the encoder, the content would then be streamed to the Web servers, which hold the static content. The WAP server would then serve the content over a WAP network.

To enable WAP-enabled devices to access the streaming application on the Web server (via the Internet), the WAP gateway is needed to bridge the connection between the Internet network and the wireless network. Once the connection is made, a browser found in the WAP-enabled device would then be able to access the streaming video content.

Figure 4-1: System Process Flow
4.1.1 How the system process works?

Firstly, the raw video data (data output in a form supported by codec) will go through a process to encode the data. After going through the encoder, the content would then be uploaded into the streaming servers – for dynamic content and to the Web servers, which holds the static content. The WAP server would then serve the content over a WAP network.

To enable the WAP-enabled devices to access the WAP application on the Web server (via the internet), the WAP gateway is needed to facilitate the connection between the internet network and the wireless network. Once the connection is ready, the browser found in the WAP-enabled device would then be able to access the internet via the cellular network.
4.2 Accessing Streamed Media

It is very crucial to develop a technology that is fast and robust enough to handle streaming video clips as well as live video applications such as video conferencing and surveillance, over wireless networks. The architecture of a streamed media access is quite similar to that e-mail access service, but different technology and protocol are being used in the background to implement the service (Figure 4-2).

![Figure 4-2 - Streamed media access architecture](image)

The streamed media (Part 1) will be stored in the WAP server. The WAP server is connected to the WAP gateway by a HTTP network. The WAP gateway will display the WAP page to the users. To retrieve the video file, the system first compresses video files it sends to a mobile device by leaving out some data. To display the video, the receiving device uses a motion vector to approximate and then reinsert the missing material. However, mobile devices usually do not have resources to let the motion vector work as effectively as possible. This typically creates artifacts that yield poor-quality video.

Current technology also transmits the material at only 4 – 7 frames per second. According to Troung Nyugen, a professor of electrical engineering at the University of California, San Diego, a frame of at least 15fps is required for good quality wireless video. This would interpolate the new frames more accurately and completely, which creates fewer artifacts and at least doubles the frame rate, allowing smoother and less jerky presentations.
4.3 WAP Programming Model

The WAP programming model is simply standard Web programming with a WAP gateway in the middle of the request/response cycle. A cell phone or other wireless terminal requests, in byte code, a given URL (Internet-Standard Uniform Resource Locator); the WAP gateway server decodes and decompresses this, then sends it to the appropriate origin server as an ordinary HTTP request. The process is then repeated, in reverse, on the response side of the cycle.

Figure 4-3 illustrates this WAP programming model. A user presses a key on their WAP-enabled device. The key has a URL request assigned to it, which the client (user agent) passes to the WAP gateway using the WAP protocol. The WAP gateway then creates a normal HTTP request for the specified URL and passes it on to the origin server for processing. The URL may be referred to a static file or some form of script application. If a static file has been referenced, the origin server adds a HTTP header to the file. If a script application has been specified, then the origin server runs the application. The origin server returns the WML document (deck) incorporating the HTTP header or any output resulting from a script application. The WAP gateway then verifies the HTTP header and the WML content, encodes them into binary format, and creates a WAP response containing the WML that it sends to the client. Upon receipt of this response, the clients process it, and display the first card of the WML deck to the user.

WAP applications and content use format are based on World Wide Web formats, and a set of standard communication protocols is used to transport content. The WAP microbrowser acts in the same way as a Web browser, coordinating the user interface.
Figure 4-3: The WAP Programming Model
4.4 How to create a WAP site?

To create a WAP site, we will be using WML. I will use Notepad as an editor and name the file vs.wml. The WML extension indicates that it is a WML file.

1) To start, the following line (XML prologue) are need at the top:

```xml
<?xml version="1.0"?><!
DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
 "http://www.wapforum.org/DTD/wml_1.1.xml">
```

2) Then add the start tag: `<wml>`

3) To add the first card, `<card>` element is need. The card will be named First, and then add `<card id="First">` after the start tag.

4) To display text, add the `<p>` element followed by “WAP-VSS” and the end with `</p>`.

5) Re-write Step 4 to `<p align='center'>` and followed by `<b><big>WAP-VSS</big></b>`. By doing that, the text would be aligned to the center and the text would be written in bold-capital letters.

6) To end the code, add `</p>`, `</card>` and `</wml>`. 
4.5 Application Design

The flow of WAP-VSS is as follows (Figure 4-5):

1) The user will open the initial page via the WAP browser.
2) To login, the user is required to enter the ID no. and password. If the user decided to cancel the application, exit option is also available.
3) Upon verification, a login into the application is successful, the Main Menu will be displayed. If verification is unsuccessful, the user will be requested again to input the ID no. and password.
4) At the Main menu, the user will find that the user can choose which video category he/she would like to view. The categories are Comedy, Sci-Fi, Drama, and Cartoon.
5) Once the user selects the video category, the video will begin to be streamed. Exit option is also available, should the user does not want to view the videos.

![Diagram of WAP-VSS Flow]

Figure 4-5: WAP-VSS Flow
Explanation of Figure 4-5:

1) The user will open the initial page via the WAP browser.

2) To login, the user is required to enter the ID no. and password. If the user decided to cancel the application, Exit option is provided.

3) Upon verification, and login into the application is successful, the Main Menu will be displayed. If verification is unsuccessful, the user will be required again to input the ID no. and password.

4) At the Main Menu, the user will have the option to choose which video category he/she would like to view. The categories available are Comedy, Drama, Sci-Fi and Cartoon.

5) Once the user selects the video category he/she wants to view, the video will begin to be streamed. Exit option is also available should the user does not want to view the videos.
4.6 Graphical User Interface (GUI) Design

GUI is an important part to the end-users, as it is the end result that will be seen by the users. Users are not bothered how the application was developed but rather what they can obtain or benefit from the application. Since navigation is limited as users are have only the scroll up and down buttons to navigate, GUI has to be designed as attractive and user-friendly as possible to ease navigation and reduce confusion.

1) **Figure 4-6: First Page**

   ![First Page](image1)

   This page is the first page of the application.

2) **Figure 4-7: Second Page**

   ![Second Page](image2)

   The user is required to enter ID no. and password for verification.
Upon verification, the Main Menu will display the video categories for the user to choose – Comedy, Sci-Fi, Drama or Cartoon

Upon choosing the video categories, the application will display a list of video available for viewing. The application would then prepare to stream the selected video for viewing.

Conclusion
Application design is an important section in developing an application. It outlines how it functions accordingly and what is to be added into the design to make it user-friendlier. Therefore, the proposed application will be developed based on this design as a guideline.
Chapter 5: System Implementation

5.1 Introduction

System implementation is the process after the system design process. During this process, the system requirements are ‘transformed’ into program codes to make the system a workable software.

Since this project is joint-effort with Mr Chua Chun Poo, the system implementation process have been separated into two (2) parts ie Mr Chua Chun Poo will be responsible for the video streaming and setting up of the server and myself, Ms Michele Ooi Lay Sean will be responsible of the WAP programming and the user interface.

5.2 Development Tools Implementation

The WAP-VSS application is developed using Openwave Phone Simulator SDK 6.2.2., Microsoft Windows Media Technologies and Microsoft Internet Server (IIS). Some of the development tools are different from the tools proposed earlier due to the below reasons:

- Features enhancement / upgraded version of the tools
- Tools that provide better performance are used instead of the proposed tools

5.2.1 Openwave Phone Simulator SDK 6.2.2

The Openwave Phone Simulator is a free software development kit that makes creating innovative applications for the mobile Internet easier than ever before. This flexible and powerful programming tool features mobile phone simulators and includes the latest version of the Openwave Mobile Browser and Openwave Mobile Messaging client. Openwave Phone Simulator allows content developers to write, test and demonstrate their software as well as validate their mobile applications that generates XHTML Mobile Profile/CSS, MMS-SMIL, WAP Push, WML or cHTML. Openwave Phone Simulator includes debugging tools, sample code and documentation to help developers create powerful applications for the Openwave platform.
without altering the other language and font settings you established with the _lang argument (or, in release 6.2.2, in the Language options window). UTF8 is the popular UNICODE character encoding scheme.

- Openwave Mobile Browser 6.2 now maintains more information about your navigation history, supporting the SDK simulator's new Tools > Forward command.
- Mobile Browser 6.2.2 now supports transparent images in PNG format.

5.2.1.2 Openwave Phone Simulator 6.2.2 Main Package

The features in Openwave Phone Simulator 6.2.2 includes:

- Requires Windows 2000 approximately 5MB
- Contains WAP 2.0-compliant Phone Simulator running Openwave Mobile Browser 6.2.2 and Openwave Mobile Messaging Client 6.2.2, with documentation code for creating mobile applications using XHTML/CSS and MMS-SMIL
- Enhanced debugging with the network information window
- Configuration UI for device and server settings
- Supports connections over HTTP (no WAP gateway required)

5.2.1.3 Installing the SDK

Openwave SDK 6.2.2 can be installed on any computer running on:

- Microsoft Windows NT with Service Pack 6a
- Microsoft Windows 2000 with Service Pack 2
- Microsoft Windows XP with Service Pack 1

To install Openwave SDK 6.2.2,

- Download its InstallShield package from the Openwave Developer Program Web site (http://developer.openwave.com/dvl/tools_and_sdk/openwave_mobile_sdk/download2.htm), start it and follow it on-screen instructions.

Once the SDK is installed, the additional components, such as Openwave SDK 6.2.2. WAP simulator plug-in also can be installed.
3. To install, simply download its InstallShield package from the Openwave Developer Program Web site and install it in the same directory as the earlier installed Openwave SDK 6.2.2 package.

4. When the SDK is started for the first time, the SDK will send the user’s IP address and SDK version to Openwave to register the successful installation. When composing or reading a message, the Home, Go bar, and other navigation tools are not functional. However, user can back out of the messaging application by pressing the Back key. When you install the SDK with the default installation options, the installer creates an Openwave SDK 6.2.2 HTTP menu item in the Start > Programs > Openwave SDK 6.2.2 menu. You can choose this menu item to start the SDK in its default configuration.

5.2.2 Microsoft Windows Media Technologies
The two (2) components of Microsoft Windows Media Technologies which are used to develop WAP-VSS are Windows Media Tools and Windows Media Player. Windows Media Tools are used to create content and encode content into Advanced Streaming Format (ASF) whereas Windows Media Player is used to receive and render streams from a Windows Media server, play clips from a movie, render a music video hosted on a Web site and much more.

5.2.2.1 Windows Media Tools
Windows Media Tools includes the content creation and editing components of Windows Media Technologies. Windows Media Tools has components for authoring both live and on-demand content and for converting other file formats (such as WAV, AVI, QuickTime 2.0 or earlier, and MP3) to ASF.
5.2.2.2 Installing Windows Media Tools

Windows Media Tools Hardware and Software requirements are as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum Required</th>
<th>Recommended</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Intel Pentium 90</td>
<td>Intel Pentium II</td>
<td>The fastest processor available; a dual processor configurations is ideal</td>
</tr>
<tr>
<td></td>
<td>megahertz (MHz)</td>
<td>266 MHz or later</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>32 Megabytes (MB)</td>
<td>64 MB</td>
<td>128 MB or more</td>
</tr>
<tr>
<td>Network card</td>
<td>10-megabit TCP/IP</td>
<td>10/100-megabit TCP/IP</td>
<td>100-megabit TCP/IP Ethernet card</td>
</tr>
<tr>
<td>Available hard disk space</td>
<td>5 MB for Windows Media Tools</td>
<td>5 MB for Windows Media Tools</td>
<td>500 MB for content creation and editing</td>
</tr>
<tr>
<td>Audio card</td>
<td>Sound card compatible with Creative Labs Sound Blaster 16</td>
<td>High-quality card, compatible with Creative Labs Sound Blaster Live</td>
<td>High-quality card, compatible with Creative Labs Sound Blaster Live</td>
</tr>
<tr>
<td>Video capture card</td>
<td>Video capture card that supports Video for Windows</td>
<td>ViewCast, Osprey 100, or Winnov Video capture card</td>
<td>Osprey 100 video capture card</td>
</tr>
<tr>
<td>Software</td>
<td>Microsoft Windows 95 (real-time encoding if audio only)</td>
<td>Windows 98 or Microsoft Windows NT Server or Windows NT Workstation version 4.0 with Service Pack 4 or later</td>
<td>Windows NT Workstation 4.0 with Service Pack 5</td>
</tr>
</tbody>
</table>

After setting up a computer with the minimum hardware and software requirements, install Windows Media Tools according to the following steps:

1. Install and configure the audio and video capture devices used.
2. If there is an Intel Pentium III processor and wants the existing encoder to use the Windows Media codecs that have been optimized for the Pentium III Streaming SIMD Extensions, one of the following procedures has to be followed:
   - If Windows NT operating system version 4.0 Service Pack 4 is used, download and install the Intel Streaming SIMD Extension Driver from the Intel Web site.
- or -

- Install Windows NT Service Pack 5 (http://www.microsoft.com/NTServer/all/downloads.asp), which includes the Intel SIMD Extensions driver.

3. Insert the Windows Media CD into the CD drive. The CD should automatically start and open to the default HTML page.

4. When the HTML page opens, point to install it, point to Content Creation Tools, and then click Windows Media Tools. Select the appropriate processor and click wmttools.exe.

5. Read the End User License Agreement. Click Yes to accept the terms of the agreement and then click Next.

6. Choose an Installation Option, and then click Next.

7. Choose the directory in which the Windows Media Tools is to be installed and then click Finish.

Windows Media Tools is installed in the specified directory, and a program group is created on the Start menu. This program group includes:

- Windows Media Encoder
- Windows Media Indexer
- Windows Media Author

The PowerPoint add-ins and Adobe Premiere plug-in are available within the target applications.

After the installation is completed, the Windows Media Encoder and Windows Media Tools are ready to be used to create Windows Media contents.
2.2.3 Windows Media Player

Windows Media Player is a universal media player that can:

- Play audio and video in most popular formats. Windows Media Player automatically opens and plays a media file when an end user double-clicks a file icon or clicks a link in a Web page, as long as the file format has been associated with Windows Media Player.
- Read and perform commands scripted in an .asx (ASF Stream Redirector) file.
- Receive script commands, markers, and metadata such as clip title, author, and copyright.
- Play movie clips and music videos on a Web site.

2.2.4 Installing Windows Media Player

Windows Media Player requirements are as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum Required</th>
<th>Recommended</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Intel Pentium 90 MHz</td>
<td>Intel Pentium 120 MHz or better</td>
<td>Intel Pentium II 266 MHz</td>
</tr>
<tr>
<td>Memory</td>
<td>16 MB for Windows 95 or 32 MB for Windows NT</td>
<td>32 MB or more</td>
<td>64 MB</td>
</tr>
<tr>
<td>Network Card</td>
<td>10 megabit TCP/IP Ethernet card</td>
<td>100 megabit TCP/IP Ethernet card</td>
<td>100 megabit TCP/IP Ethernet card</td>
</tr>
<tr>
<td>Audio Card</td>
<td>16-bit sound card</td>
<td>Creative Labs Sound Blaster compatible 16-bit sound card</td>
<td>High-quality card compatible with Creative Labs Sound Blaster 16</td>
</tr>
</tbody>
</table>
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- Play audio and video in most popular formats. Windows Media Player automatically opens and plays a media file when an end user double-click a file icon or clicks a link in a Web page, as long as the file format has been associated with Windows Media Player
- Read and perform commands scripted in an .asx (ASF Stream Redirector) file
- Receive script commands, markers and metadata such as clip title, author and copyright
- Play movie clips and music videos on a Web site.

2.2.4 Installing Windows Media Player

Windows Media Player requirements are as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum Required</th>
<th>Recommended</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Intel Pentium 90 megahertz (MHz)</td>
<td>Intel Pentium 120 MHz or better</td>
<td>Intel Pentium II 266 MHz</td>
</tr>
<tr>
<td>Memory</td>
<td>16 megabytes (MB) for Microsoft Windows 95 or Windows 98; 32 MB for the Microsoft Windows NT operating system</td>
<td>32 MB or more</td>
<td>64 MB</td>
</tr>
<tr>
<td>Network card</td>
<td>10 megabit TCP/IP Ethernet card</td>
<td>100 megabit TCP/IP Ethernet card</td>
<td>100 megabit TCP/IP Ethernet card</td>
</tr>
<tr>
<td>Audio card</td>
<td>Creative Labs Sound Blaster compatible 16-bit sound card</td>
<td>High-quality card compatible with Creative Labs Sound Blaster 16</td>
<td></td>
</tr>
<tr>
<td>Video card</td>
<td>16-color display</td>
<td>16-bit color display</td>
<td>16-bit color display with DirectDraw support</td>
</tr>
<tr>
<td>------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Software</td>
<td>Windows 95; a Web browser such as Microsoft Internet Explorer 4.01 or Netscape Navigator 4.0 or later</td>
<td>Windows 95, Windows 98, Microsoft NT Server, or Microsoft Windows NT, Workstation version 4.0 with Service Pack 3; a Web browser such as Microsoft Internet Explorer version 4.01 or Netscape Navigator 4.0 or later</td>
<td>Windows NT Workstation 4.0 with Service Pack 4; Internet Explorer 5</td>
</tr>
</tbody>
</table>

After setting up a computer with the minimum hardware and software requirements, Windows Media Player can be installed using the Windows Media CD or downloading from the Internet.

1. Install a Web browser, such as Internet Explorer 4.01 with Service Pack 1 or later or Netscape Navigator 4.0 or later.
2. Insert the Windows Media CD into the CD drive. The CD should automatically start and open to the default HTML page.
3. When the HTML page opens, point to **install it**, and then click **Windows Media Player**.
4. Select **Media Player for i386** or **Media Player for Alpha**, and then follow the on-screen instructions.

Alternatively, to install Windows Media Player by downloading from the Internet and for the latest version, visit the Windows Media Web site at http://www.microsoft.com/windows/windowsmedia/ and follow the on-screen instructions to move further on.
5.2.2.5 Using and Configuring Windows Media Player

Windows Media Player is used to play a variety of media files, either as a stream or a stored file. Windows Media Player can also be used for multimedia presentations, for example Windows Media Player can be embedded in a Web page to play media directly from the Web site.

To control its behaviour, Windows Media Player can be configured according to users' preferences.

5.2.2.6 Setting the view

By selecting option from the View menu, end users can view for Windows Media Player.

- Select a view. End users can select one of the three predefined views from the View menu: Standard, Compact or Minimal. The view determines which components appear in the Windows Media Player window. The Standard view is not customisable and displays all of the components available.

- Turn on closed-captioned text. End users can turn on closed-captioned text by selecting Captions from the View menu. If a particular media file is accompanied by a Synchronised Accessible Media Interchange (SAMI) closed-captioned support file, closed-captioned text appears in a space below the video area when the file is played.
5.2.2.7 Customising playback

End users can customise playback options by clicking **Options** on the **View** menu and then clicking the **Playback** tab, shown in Figure 5-1.

*Figure 5-1 – The Playback tab*

- **Adjust volume and balance.** Under the **Audio** section, end users can change the volume levels and balance.

- **Set the number of times to play a media file.** Under the **Playback** section, the end user can specify whether to loop playback or set the number of times to play a clip.

- **Set the display size.** The end user can specify the size to play back media files by selecting a zoom value.
Disabling hardware acceleration. The hardware acceleration slider is new in Microsoft Media Technologies 4.0. With this option, end users can disable hardware video acceleration for Windows Media Player. Disabling hardware video acceleration can be useful for computers that exhibit video-rendering problems, which appear as colour distortion or as artifacts and distorted patches in the video. If video playback problems are experienced, the slider can be moved one notch to the left, towards None. End users can continue decreasing the hardware acceleration for maximum compatibility with older video drivers. This option only applies to video being rendered by Windows Media Player; this is not the same option as the Windows 98 system-wide option by the same name.

5.2.2.8 Setting the default behaviour of Windows Media Player

![Figure 5-2 - The Player tab](image)

End users can control the default behaviour of Windows Media Player by clicking Options on the View menu and then clicking the Player tab, shown in Figure 5-2.

- Specify how to display new clips. By setting options in the Open options section, end users can specify whether to open a new Windows Media Player
window for each clip that is played or to play the clip in an existing window. If the end user chooses to open a new window for each clip, the performance might decrease if multiple clips are viewed simultaneously over a slow connection.

- **Set the default view.** End users can select a default view for the Windows Media Player window in the View list. The views can be customised with the options on the Custom View tab.

- **Keep the player window on top of other windows.** To always keep the Windows Media Player window above other windows, the user can select the **Always on top** option. This option lets the end user view other applications, such as a Web browser, while playing media content.

- **Set the default display size.** When the Autozoom player option is selected, a clip is displayed using the default zoom level, which is set on the Playback tab. When the Autozoom player option is disabled, Windows Media Player uses the settings from the previous playback.

- **Show controls when viewing a clip in full screen.** End users can specify whether the player controls are displayed when a clip is viewed in full screen by selecting or clearing the **Show controls in full screen** option.
5.2.2.9 Customising the Compact and Minimal views

The Windows Media Player window contains various components that can be displayed or hidden. The Windows Media Player components are shown in Figure 5-3.

End users can choose which components to display in the Compact and Minimal views by clicking **Options** on the **View** menu and then clicking the **Custom Views** tab, shown in Figure 5-4. Programmers can also define the components to display; when embedding the Windows Media Player control in a Web page, use HTML scripting to set the appropriate properties of the control.
Configuring the way streaming media is received

End users can change settings for receiving Windows Media content by clicking **Options** on the **View** menu, clicking the **Advanced** tab, selecting **Streaming Media (Windows Media)**, and then clicking **Change**. On the **Advanced playback settings** tab, shown in Figure 5-5, end users can view and set options for buffering, protocols, and proxy settings.

![Figure 5-4 – The Custom Views tab](image.png)
5.2.2.10 Configuring the buffer

When Windows Media Player starts to receive a stream, Windows Media Player fills a data buffer on the client computer before rendering the media. Filling a data buffer provides a surplus amount of data for rendering during brief periods of network congestion. When network congestion occurs, causing bandwidth to fall below the bit rate of a stream, data in the buffer ensures continuous playback. If network bandwidth improves and is greater than the bit rate of the content, the buffer refills. If network congestion is heavy and the buffer becomes depleted, the player enters a buffering state, and rendering stops until the buffer refills.

An end user can change the amount of time that Windows Media Player buffers by selecting **Buffer** and entering a different value in **seconds** of **data**. A higher value increases the tolerance to network slow downs. A lower value decreases the time it takes to begin rendering content. The default buffering time of three (3) seconds is suitable for most applications, and end users should not have to change it unless frequent re-buffering
5.2.2.12 Associating file formats with Windows Media Player

End users can specify the file formats to play in Windows Media Player by clicking Options on the View menu and then clicking the Formats tab, shown in Figure 5-6.

![Figure 5-6 - The Formats tab](image)

The Windows Media Player installation uses passive file-association rules, which means that if another player has already assumed a default file format, Windows Media Player will honour this rule and not take over playback of the file format. However, the end user can manually select the file formats to associate with Windows Media Player. If a check box appears grey, Windows Media Player only partially owns the file format and may not play back of this type.

Windows Media Player can play the following types of media files:

- **Microsoft Windows Media formats.** File extensions include .avi, .asf, .asx, .wav, .wma, .wm, and .wax.
- **Moving Pictures Experts Group (MPEG).** File extensions include .mpg, .mpeg, .mlv, .mp2, .mp3, .mpa, and .mpe.

- **Musical Instrument Digital Interface (MIDI).** File extensions include .mid and .rmi.

- **Apple QuickTime, Macintosh AIFF Resource.** File extensions include .qt, .aif, .aifc, .aiff, and .mov.

- **UNIX formats.** File extensions include .au and .snd.

### 5.2.3 Microsoft Internet Information Server (IIS)

IIS is an Internet file and application server included in the Windows NT option pack. IIS is user friendly because it is easy to configure and can be used alone as a web server. IIS also guarantees the same security, networking and administration and user functionality because it inherits all Windows NT features. IIS also can help administrator secure websites and develop and deploy server-intensive web applications. Other than that, IIS can support a variety of applications such as Common Gateway Interface (CGI), Active Server Pack (ASP) and Server Socket Layer (SSL).

#### 5.2.3.1 Installing Internet Information Server

1. Click Start, Settings, Control Panel and Add/Remove Programs application.
2. Select Add/Remove Windows Components.
3. Under the Windows Component wizard, select the checkbox named Internet Information Services.
4. Then follow the on-screen instructions to install, remove or add components to IIS.
5. **C:\inetpub\wwwroot** is IIS’s root directory
6. To locate IIS after installing, click the Administrative Tools icon in the Control Panel, and then the Internet Information Services icon.
5.2.4 Steps of System Development

**Review the system documentation**

*This is to ensure that the implementation of the system runs smoothly as planned.*

**Design of the system**

*This is the process to show what the end result of the system would look like by developing logical solution to the programming problems. The logical solution is a step-by-step solution to a programming pattern.*

**Code the program**

*Processes of writing program instructions that will implement the program design. If the design is drawn in a detailed manner, the coding can be accomplished mechanically.*

**Test the program**

**Completing the system documentation**

*Figure 5-7 – System Development Flow Chart*
• **Test the program**
  
  Program is tested to ensure the program functions correctly and smoothly with zero errors defects before the program processes actual data and produces information on which user will be replying on.

• **Documentation of the system**
  
  Completing the program is essential for the successful operation and maintenance of the information system. Documentation includes the system’s user manual that may be handy to first time users.

### 5.2.5 Getting Started

The editing tools used to develop the WAP site is the Notepad. Here, a file named welcome.wml was created. The WML extension indicates that this is a WML file. The WAP server uses the XML prologue to manage the compilation of WAP programs. As all WML programs are based on XML, they must always begin with a valid XML prologue:

```xml
<xml? version="1.0"/>
<DOCTYPE! wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.1.xml"/>
```

To specify a card name, we use the following:

```xml
<card id="welcome"/>
```

To define the action that is executed when a button is pressed, the `<do>` element is used. The `<do>` element looks like the following:

```xml
<do type="accept" label="Enter">
<go href="#Username/>
</do>
```
This `<do>` element defines the Accept button so that it is labelled "Enter" on screen and when it is pressed, the card Username is displayed using the `<go>` element with the href attribute.

To allow users choose options from a list on-screen and then display a card depending on the chosen button option, we use the `<option>` element nested within the `<select>` element.

```
<select>
  <option onpick="http://localhost/Wap/DEFAULT.WAV">song.</option>
  <option onpick="http://localhost/Wap/DevilsElbowStatePark.jpg">Park.</option>
  <option onpick="http://localhost/wap/GladeCreekGristmill.jpg">Galde.</option>
</select>
```

Finally, application testing is done to ensure it works as a whole. This testing is made up of few stages namely:

1. **Integrity testing** - Check that the application does the job, following every link, using every available option and checking whatever object also available.
2. **Stability testing** - Testing by using different types of media files be it audio or video.
3. **Usability testing** - Performing "real users" on people, who are given basic description of the application and told to navigate with the system. Then see the people who are in the targeted users.

Each of these stages highlights areas where more "attention" should be given. If it turns out that the application does not fulfill the initial requirements, then changes need to be made.
Chapter 6: Application Testing

6.1 Introduction

Although application testing is executed after the implementation, continuous testing is done throughout the development and implementation of the application. The WAP application should be tested thoroughly to ensure that it is reliable, efficient and user friendly. It is very important that the user can understand by just one look on the interface or the layout of the application. Usually a good application is able to fulfill the user requirements and keep running without much error or if possible with zero errors.

To test the application, firstly, all cards must go through unit testing which is the simplest test of all, followed by module testing, which covers a wider scope of testing than unit testing. It takes a module and tests it out thoroughly. The result or output will be compared with the expected result. Then, an integration testing is performed to ensure the usability of the application. Furthermore, all links leading to all the modules are tested out. An important point to remember when naming the link is – the name of the links should be clear and not misleading.

Finally, application testing is done to ensure it works as a whole. This testing is made up of few stages namely:

- Integrity testing – taking the application from the top, following every link, using every available options and linking whatever video data available
- Stability testing – trying to break the application by using different types of media files be it audio or visual
- Usability testing – performing “cold tests” on people, who are given brief description of the application and told to ‘manipulate’ with the system. These are the people who are in the targeted users

Each of these stages is likely to highlight areas where more ‘attention’ should be given. If it turns out that the application does not fulfill the initial requirements, then changes need to be made.
6.2 User Acceptance Test
The below test was done using Openwave Phone Simulator 6.2.2

<table>
<thead>
<tr>
<th>Description</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Welcome card – the first card</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press “Enter” to link to the login screen</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td><strong>WAP-VSS login card</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input field – <strong>User ID</strong></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Press “Enter” to link to the next login screen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input field – <strong>Password</strong> (only displays asterisks)</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Press “Enter” to link to the Main Menu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After login in, Main Menu is showed</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

| **Main Menu Card**                 |     |    |
| Four links provided:               | Y   |    |
| 1. MTV                              |     |    |
| 2. Comedy                           |     |    |
| 3. Drama                            |     |    |
| 4. Thriller                         |     |    |
| Select “MTV”                        | Y   |    |

| **MTV Card**                       |     |    |
| Two links provided:                | Y   |    |
| 1. I will always love you          |     |    |
| 2. New Year Song                   |     |    |
| Select “I will always love you”    | Y   |    |
| Display “I will always love you” video | N   |    |
| Select “New Year Song” video       | Y   |    |
| Display “New Year Song” video      | N   |    |

*Exit application and Repeat all the steps until Main Menu card*
<p>| <strong>Comedy Card</strong>                    |     |    |
| Three links provided:              | Y   |    |
| 1. Pepsi                           |     |    |
| 2. Nike                             |     |    |
| 3. 2 Door                           |     |    |
| Select “Pepsi”                      | Y   |    |</p>
<table>
<thead>
<tr>
<th>Display “Pepsi” video</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select “Nike”</td>
<td>Y</td>
</tr>
<tr>
<td>Display “Nike” video</td>
<td>N</td>
</tr>
<tr>
<td>Select “2 Door”</td>
<td>Y</td>
</tr>
<tr>
<td>Display “2 Door” video</td>
<td>N</td>
</tr>
</tbody>
</table>

**Exit application and Repeat all the steps until** *Main Menu card*

<table>
<thead>
<tr>
<th>Select “Drama”</th>
<th>Y</th>
</tr>
</thead>
</table>

**Drama card**

<table>
<thead>
<tr>
<th>Three links provided :</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Park</td>
<td></td>
</tr>
<tr>
<td>2. Galde</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select “Park”</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display “Park” video</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select “Galde”</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display “Galde” video</td>
<td>N</td>
</tr>
</tbody>
</table>

**Exit application and Repeat all the steps until** *Main Menu card*

<table>
<thead>
<tr>
<th>Select “Thriller”</th>
<th>Y</th>
</tr>
</thead>
</table>

**Thriller card**

<table>
<thead>
<tr>
<th>Two links provided :</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ET 1</td>
<td></td>
</tr>
<tr>
<td>2. ET 2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select “ET 1”</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display “ET 1” video</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select “ET 2”</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display “ET 2” video</td>
<td>N</td>
</tr>
</tbody>
</table>

After testing through all the links in the MTV, Comedy, Drama and Thriller cards, the simulator is unable to display our streamed video files. As such, we then streamed an audio.
We then run the similar test on the audio file on Openwave Phone Simulator 6.2.2. The cards remain unchanged except for Drama card of which we have included a streamed audio file named “Song” into it.

<table>
<thead>
<tr>
<th>Description</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Input field – User ID</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Press “Enter” to link to the next login screen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input field – Password (only displays asterisks)</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Press “Enter” to link to the Main Menu</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>After login in, Main Menu is showed</td>
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<td></td>
</tr>
</tbody>
</table>

**Main Menu Card**

<table>
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<th></th>
</tr>
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<tbody>
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<td></td>
<td></td>
</tr>
<tr>
<td>2. Comedy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Drama</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Thriller</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Select Drama (for example)                | Y   |    |
| Press “Enter” to link to Drama Menu       |     |    |

**Drama Card**

<table>
<thead>
<tr>
<th>Three links provided:</th>
<th>Y</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Song</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Park</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Galde</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Select Song (for example)                 | Y   |    |
| Press “Enter”, to link to Song video file |     |    |
| Display Song audio                        | Y   |    |

*Exit application*
Chapter 7: System Evaluation and Conclusion

7.1 Problems Encountered and Solutions

<table>
<thead>
<tr>
<th>Problems</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to open streamed video file on phone simulator</td>
<td>Currently, no phone simulators support streamed video files and at the same time runs on OS Windows 2000</td>
</tr>
<tr>
<td>Openwave Phone Simulator cannot support file size more than 20KB</td>
<td>Instead of displaying a streamed video file, we displayed a static picture file (size 19.8KB) on the phone simulator</td>
</tr>
<tr>
<td>Phone Simulator cannot display streamed video file</td>
<td>The suggestion from our supervisor was to find a smaller size video file and stream the file or to make our video files' being streamed in smaller packets</td>
</tr>
<tr>
<td>Lack of knowledge in WAP and WML programming</td>
<td>Did researches via the Internet, reading reference books pertaining to WAP, WML, video streaming and other related technologies and seeking advise from our supervisor. Always have discussions among ourselves and our supervisor whenever we face problems and surf discussion forums.</td>
</tr>
</tbody>
</table>
7.2 Evaluation

Evaluation of this WAP-VSS system is a vital process in order to make it a useful and successful system when it is ready for deployment. WAP-VSS system is evaluated based on the following criteria:

- ease of navigation
- design or style
- innovation
- content
- overall

In this content, the WAP-VSS system is evaluated through the strength and constraints, as follows:

7.2.1 Strength

Usability

Usability refers to how "user-friendly" a system is. In addition to this, usability concerns the general outlook of the system. Although there is some restrictions imposed by WAP and microbrowsers that make designing more carefully done, at the same time, these restrictions can actually make it easier to enforce good design rules and produce a streamlined products ie without the ability to add things like enormous animated graphics, leaving the system with a 'clean' and simple application for exchanging textual, visual and audio information.

Minimum navigation by users

One of the features of WAP-VSS is for every click or option that users have made, they are provided with the information they are looking for ie they go directly to the information that they required. The substantial delay when navigating between decks is taken into consideration when designing the application. However, some WAP browsers do not allow for too many options to be provided at once, and it is better to limit the options to the most common ones.
Keeping User Input to a Minimum

The key point to bear in mind is to avoid requiring user input whenever possible and to keep it simple when it is necessary because entering text on a mobile phone keypad can be a bit of chore. In some circumstances, option lists might be suitable, providing an intuitive way of entering data and an assurance that invalid input is a lot less likely. For WAP-VSS, the users are given option of lists of movie categories and also list of movie titles in each category. Therefore users need not have to type in the movie title required, of which users might encounter an invalid input if the title does not match with the list in WAP-VSS. By giving users list of options, this can also help to save users’ time and allow users to view the video faster.

Keeping Text Volume to a Minimum

The small display that are characteristics of WAP user agents are really not suitable for lengthy passages text. For a well-developed WAP application, the types of services that are most suitable for mobile devices tend to be those that are not too verbose.

Keeping the volume of text down is something the developer should always consider when designing the WAP application. This does not mean just the body of the text but also implies keeping list options brief. For example, users can scroll down the movie title listing to choose the movie they intend to watch instead of having the “MORE” link which users will have to click the said link to go to the next list of titles.

Transparency

The system is transparency to the users, as they do not need to know where the database resides, how the system is structured. For example, users do not need to know how to retrieve and insert records into the database. All they need to do is submit data and then view necessary information required.

7.2.2 Limitation/Constraints

The code written for the WAP application (WML) is limited in the following ways:

- It has minimal error checking
- There is no measure of how much bytes in a WML deck that will be accepted by the current WAP browser
7.3 **Future Enhancement**

Nothing is perfect. No doubt this system contains some omissions, errors and inaccuracies and did not turn out to be completely what have been proposed earlier. Despite all these, the system can be further improved and enhanced to include more features and functions to make it more interactive and attractive.

7.3.1 **Enhancement to WAP application**

There are many aspects and areas that can be enhanced to make it more acceptable by all mobile devices’ users. Some of the enhancement that can be done includes:-

7.3.1.1 **User Interface**

The existing user interface can be made into more realistic and professional and would be applicable in the real WAP environment. To spice things up, WML Script and JavaScript can be used together to create a more dynamic interface. Apart from that, a WAP device’s cache can be used to increase efficiency of sending and retrieving data. Cache is used to reduce the amount of data traffic between the WAP device and the WAP gateway, and it accomplishes this by keeping a local store of information in the WAP device instead of repeatedly requesting it from the WAP server. This would definitely make the system more efficient.

7.3.1.2 **Internationalising WAP**

WAP is a global specification. This means people all over the world can expect to access WAP content using WAP-enabled devices. More importantly, developers should expect people all over the world to visit their WAP site.
Internationalisation is important. WAP sites will be accessible from all corners of the world, by users expecting content in their own language, with user agents expecting content in a particular format. Developers may lose a lot of potential visitors to their WAP site if they fail to internationalise it. Even if the WAP site is irrelevant to people on the other side of the world, it may still be accessed by visitors bringing their WAP devices to the developer’s country, for example a local amenities WAP site.

WAP device manufacturers produce devices for particular markets, especially in the case of cellular phones, which are determined by the prevailing local communication protocol—for example GSM in Europe and CDMA/TDMA in Northern America. When a WAP device is produced for a particular market, the device is specialised with regard to natural-language support and transfer encodings. This is known as localisation.

Where internationalisation is the method of making services generically applicable to all language, localisation is the method of tuning the internationalised service to a particular location. Note that localisation isn’t complete until all components of internationalisation have been considered. Some of the components include:

- Natural-language translation
- Character-encoding translation
- Numerical and monetary formats
- Date and time formats
- Sorting algorithms
- Text direction

What happens to a non-internationalised WAP site? The WAP site would probably deliver content in English using the default transfer encoding, which may be suitable for most site visitors expected to view the WAP site but it’s unreasonable to expect every user agent to be able to understand whatever that is delivered. Localised user agents contain only enough fonts to display the relevant local natural languages and understand only a limited number of transfer encodings; at worst, without localisation, the content delivered by the WAP site may not be displayed at all. If developers think the site may be viewed by users and user agents expecting content other than English, then this is one area that needs attention, modification, internationalisation and localisation on the WAP site.
7.3.1.3 WAP Security

Before beginning the investigation of WAP security, it is worth noting that there is no such thing as a “secured-system”. The phrase “secured-system” means one that cannot be compromised or accessed without authorisation. A particular system meets certain predefined security criteria in that it can be withstand attacks of a known type, and therefore considered secured enough for its intended purpose. What can be said is that no matter how “secured” a system is, there is always the possible that “somehow” or “somewhere” the system would give way and be corrupted and there will always be “someone” who will be able to overcome the system security.

It is only feasible to make the assertion that WAP is or is not “secured enough” for a particular application when we understand:

- the security requirements of a said application
- the environment in which that said application is to be deployed
- the likelihood that the said application will be subjected to attempts to compromise its security; and
- the nature of the attempts that is likely to be made

Even then the statement is only valid until something changes the environment, or someone discovers a new security exposure in the network, the environment, the technologies used or the platform on which the application is deployed.

Currently, the security level for the developed system is still very low. Therefore, future enhancement and improvement on the current system is important such as password encryption. Another way to improve security is to set up a separate web server that runs the WAP application and configure the server to the most secured limits possible.

There are two issues with regard to security in the WAP environment:

- the gateway
- user vs device
The Gateway

WAP gateway is a gateway to enable WAP-enabled devices to call into and to access WAP application. According to researches, there is a security gap in the WAP model in the form of WAP gateway. Because of the way WAP operates, it is not feasible to do away with the gateway, therefore we need to determine what the actual risk involved and alternative ways of addressing the risks.

It can be argued that the WAP gateway is not actually a security risk because the gateway vendors are aware of the issue and therefore take steps to ensure that the process of decrypting from WTLS and re-encrypting into TLS cannot be easily be done. The typical steps taken are to endure that:

- the decryption and re-encryption is done in memory
- keys and unencrypted data are never saved to the disk; and
- all memory used as part of the encryption and decryption process is cleared before being handed back to the operating system.

Therefore, to enable real implementation of the WAP technology, it is entirely possible for us to host our own gateway rather than hosted by a network operator that may not be able to tell whose implementation it is. Whoever hosts the gateway holds the responsibility of protecting it and the data that goes through it and also has access (potentially, at least) to all of the data that goes through the gateway in unencrypted form. Before doing so, the implication in terms of cost has to be considered thoroughly.

User vs Devices

The second issue to be considered with mobile device is the issue of who or what the certificate is authenticating. A certificate is a reasonably large and complex thing that:

- validate which mobile device is entitled to access the network, and serves to eliminate all of those mobile devices that do not have the required certificate
- provide access to data and services
In near future, the certificates are going to be stored on the mobile phone and the phone will take care of presenting and validating certificates as and when required. While this is very convenient, it does have some security implications and it will not be an acceptable solution where:

- the mobile devices are mobile and are therefore carried around. This may lead to the devices being lost, left on public transport, stolen etc.
- anyone who gets hold of the mobile device can make use of the owner’s certificate to gain access to data or services, which has to be strictly controlled.

The enhancement:

- one the mobile device is reported missing, the certificate should be placed on a certificate revocation list to ensure that it does not provide access in the future by someone else.
- to further validate that the current user of the authenticated device is the rightful owner, alterations to the system can be done, which vary from their complexity and robustness from a simple PIN number/password through to a SecureID token.
- while asking users to enter PIN numbers/password on a mobile device the necessary precautions must be taken, such as masking the numbers with asterisks (*), blank the data, and so on.

### 7.3.1.4 Wireless Network Enhancement

Mobile networks are growing in complexity and the cost of providing new value-added services to wireless users is increasing rapidly. In order to meet the requirements and needs of mobile network operators in the near future, solutions must be:

- Interoperable – terminals from different manufacturers communicate with services in the mobile network
- Scalable – mobile network operators are able to scale services to users’ needs
Efficient – provides quality service suited to the behaviour and characteristics of the mobile network; provide for maximum users for a given network configuration

Reliable – provides a consistent and predictable platform for deploying services

Secure – enables services to be extended over potentially unprotected mobile networks while still preserving the integrity of user data; protects the devices and services from security problems such as denial of service/access

It is expected that the next generation of WAP-based mobile devices will be driven by an increase in network bandwidth using the technologies such as GPRS (General Packet Radio Service), UTMS (Universal Mobile Telecommunications System, IP based network and also 3G technologies.

The next generation of WAP devices will be the increased sophistication of the mobile devices in the near future. WAP devices equipped with touch sensitive screens are emerging, which would certainly ease navigation of this sort. More advanced phone and server-based speech recognition will eliminate the need to use the keypad which is known as the long and frustrating process. The future mobile devices will be able to support almost all current multimedia features.

7.4 Conclusion

The Wireless Application Protocol (WAP) is a technology linking the Internet to wireless portable devices. It marks the dawning of the new age of wireless commerce, a means of communicating and performing wireless transactions that will represent a major change in the way we live and do business.

WAP bridges the gap between the Internet and the wireless world, offering the potential for an unlimited range of value-added services to be delivered to users irrespective of the network or device they are using. This convergence of the Internet and cellular telephony, two of the fastest growing technologies of the last decade, will allow the transformation of information on the Internet to a form that can be displayed on the restricted screen
sizes associated with cellular phones and other portable devices such as personal digital assistants (PDAs).

WAP is the essential link between the Internet viewed through a PC browser and the increasing capabilities of cellular phones and other wireless devices. It provides a single, industry-standard mechanism for wireless application interoperability called the Wireless Markup Language (WML), developed from the earlier Handheld Devices Markup Language (HDML). WML provides a clear way for application developers and content providers to create a range of services via WAP browsers installed on the new generation of wireless devices. WML is supported by a scripting language called WMLScript, which brings procedural logic to client services.

Wireless devices use WML and WMLScript to produce content, and they make optimum use of small displays and are designed to allow one-handed navigation. This WAP content is scalable from a two-line text display all the way up to the more sophisticated full-graphics-capability screens on the next generation of smart wireless devices.

7.4.1. The Next Internet Explosion

The Internet has changed the way people perceive and use the power of the computer. It has led to a revolution in the way we communicate and do business. And just as the revolution is beginning to influence the lives of the mainstream populations of most developed countries, the Internet is itself on the verge of an even more explosive revolution in the way we access it. Within the next couple of years, our ability to access the power of the Internet through wireless devices will start to become second nature as new WAP-enabled cellular phones and computing devices start to become commonplace.

A wireless device’s screen can display only a few characters, its bandwidth is extremely limited, and entering text is awkward. However, the success of WAP-enabled cellular phones will be driven by the facts that users will be able to access WAP application wherever they are and built-in billing mechanisms will allow service providers to automatically charge the device’s owner for accessing services.
This emerging market for wireless portable devices is being driven by the cash-rich telecommunications vendors who see a future as rosy for wireless commerce as the recent past (and present) has been for desktop-based-e-commerce. Leading telecom trailblazers Nokia of Finland and Motorola of the U.S. are ramping up for the anticipated wireless Internet explosion and are now making handsets with WAP capabilities and soon to be equipped with 3G technologies, of which will soon be rolled out into the market.

WAP will provide business with a new channel for existing and future services that can be reached by their customers day or night wherever they go. The uses of WAP-enabled portable devices are not restricted to only content push services such as accessing the latest sports results, news and weather. Users are now able to reserve seats at restaurants, theaters and hotels, and conduct transactions such as purchasing financial services and the latest technology allows users to send MMS via their cellular phones and even watch streamed CNBC news live.
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    - http://www.alltheweb.com
    - http://www.askjeeves.com
    - http://www.webopedia.com
Acknowledgement II

Once again, I would like to thank En Zaidi Razak for his endless guidance, advise and support throughout the whole tenure of this project, starting all the way back when the project was first proposed until the project is completed. Nevertheless, I would also like to thank once again to Mr Chua Chun Poo for assisting me throughout the implementation of this project. Without his co-operation and help, I would not be able to complete my task as there were many obstacles arises during the implementation of the system.

This project has taught me things that I could not be able to learn during lectures. The time and effort taken to learn a new programming language was not an easy task at all. Through discussions with Mr Chua and applying what I have learned throughout my course, I am able to understand the programming language much easier. Within a semester, I have learned how to stream a video file, WML programming language, new terms and technologies. As En Zaidi has always said – time is not a factor or problem for this project. It all lies to our time-management skills. This project has definitely improved my time-management skills.

The knowledge and experience that I have gained has helped me to be able to tackle any tasks given to me in the near future. I believe the exposure that I have gained, indirectly, will benefit me in the near future.

Apart from
WAP-VSS Access Application – User Guide

This WAP-VSS application is a mobile application that enables users to view streamed video files using a WAP simulator. This is a simple application with easy-to-use interface. This user manual will guide users step-by-step on how to use the core functions of the application.

System requirements

For the WAP-VSS to function properly, the following requirements are recommended:

Hardware

- 300 MHz Pentium or faster processor
- 128 MB of RAM (however, 256 MB is recommended)
- 100 MB hard disk space
- Network Interface Card with Modem/ISDN/LAN/WAN to connect to Internet or just an Internet connection
- Display set at 800 x 600 resolution, 16-bit colour

Software

- Windows 2000
- Microsoft Windows Media Tools
- Microsoft Windows Media Player
- IIS
- WAP phone simulator – Openwave Phone Simulator 6.2.2. is highly recommended. The simulator is freely available at http://developer.openwave.com

Deploying WAP-VSS Application

1. Insert CD into CD-ROM
2. Copy content into hard disk (C drive)
3. Launch the Openwave Phone Simulator 6.2.2.
4. Run the application on the simulator
5. Exit the simulator if finish
This is the first screen of the application. Press “Enter” link to enter to the login screen.
Figure UG-2 – Login Screen

The User ID is an input field. Enter the User ID. Press “Enter” link to enter the login2 screen
Figure UG-3 – Login2 Screen

The Password is an input field. Enter the password. Only “asterisks” are shown. Press “Enter” link to enter to the Main Menu.
Figure UG-4 – Main Menu Screen

User will then be directed to the Main Menu screen. Four links are provided:

1. MTV
2. Comedy
3. Drama
4. Thriller

Choose a link and press “Enter” to continue. (Assuming “Comedy” has been selected)
If Comedy is the desired video category, user will then be directed to the Comedy Menu screen. Three links are provided:

1. Pepsi
2. Nike
3. 2 Door

Choose a link and press “Enter” to continue. If “Pepsi” has been selected, the display will be shown in Figure UG-6
Pepsi video file is being executed but is unable to be displayed.

Figure UG-6 – Displaying “Pepsi” video

Choose a link and press "Enter" to continue. If option #1 is intended, the display will be shown in Figure UG-8.
If Drama is selected, three links will be provided:

1. Song
2. Park
3. Galde

Choose a link and press "Enter" to continue. If option #1 is selected, the display will be shown in Figure UG-8.
"Song" audio file is displayed. Users will be able to heard the audio file.
Name: Michele Ooi Lay Sean
Matrix No.: WQT000081
Title: WAP Video Streaming System (WAP-VSS)
Supervisor: En Zaidi Razak
Viva Date: 27 September 2003
Overview & Objective

- The undertaken project “WAP Video Streaming System (WAP-VSS)”. The project is mainly encoding streaming content for mobile devices (we are targeting on pocket PCs).

- Objective - to enable streamed video to be accessed and viewed through WAP-enabled mobile devices. The completed project will enable streamed video to be accessed at anytime, anywhere through mobile devices.

- This is a joint-effort project by Mr Chua Chun Poo and Ms Michele Ooi Lay Sean.

- Segregation of responsibilities –
  
  Mr Chua – server
  
  Ms Michele – client
Literature Review

• Streaming - technology for playing audio and video files (either live or pre-recorded) from a Web page. A user can view the audio or video files directly from the Web server for immediate playback. This avoids time consuming downloads of large files.

• WAP - bridges the gap between the mobile world and the Internet as well as corporate intranets and offers the ability to deliver an unlimited range of mobile value-added services to subscribers—dependent of their network, bearer, and terminal.

• Project Related – Windows Media Technologies, QuickTime, Real, VideoLAN
Project Consideration

- WAP-VSS requires high bandwidth – to be developed on wireless bearer network and terminal
- 3G technologies
- Handheld device – supported by PocketPC software (Windows CE, Microsoft).
- Development Tools – other Microsoft tools
Functional Requirements

- WAP-enabled device need to be configured to access to WAP pages and to install microbrowsers to view WAP content
- Setting-up of WAP gateway – for connection of wireless network and internet
- To install streaming player to view video
- To create User Module
- To create Display Module
Non-Functional Requirements

- Security
- Reliability
- Availability
- Performance
• Raw video data (data output in a form supported by codec) – encoder - process to encode data
• Content then being uploaded into the streaming servers. The WAP server would then serve the content over a WAP network.
• The WAP server is connected to the WAP gateway by a HTTP network. The WAP gateway will display the WAP page to the users.
• WAP gateway is needed to facilitate the connection between internet network and wireless network. Once the connection is ready, the browser found in the WAP-enabled device would then be able to access the internet via the cellular network.
WAP-VSS Flow

User

Open WAP Browser

Exit

Login

ID and Password

No

Success

Yes

Main menu

Exit

Comedy

Sci-Fi

Drama

Cartoon

Title

Title

Title

Title

Title

Title

Title

Title
1) Open initial page via the WAP browser.
2) To login, enter ID no. and password. If the user decided to cancel the application, Exit option is provided.
3) Upon verification, and login into the application is successful, the Main Menu will be displayed. If verification is unsuccessful, repeat Step (2)
4) At the Main Menu, the user will have the option to choose: Comedy, Drama, Sci-Fi and Cartoon.
5) Once the user selects the video category he/she wants to view, the video will begin to be streamed. Exit option is also available should the user does not want to view the videos.
User Interface

WAP-VSS
Sci-Fi:
1. Terminator
2. Matrix-Reloaded

WAP-VSS
Main Menu
1. Comedy
2. Sci-Fi
3. Drama
4. Cartoon

WAP-VSS
Please enter -
ID No. Password

WAP-VSS