Final Year Project Report
Session 2000/2001

WebTV

Dissertation submitted by

Leong Soon Hing
WET 98056

Submitted to:

Faculty of Computer Science and Information Technology
University of Malaya

In partial fulfillment of the requirements for the Degree of Bachelor of Information Technology

Under supervision of

Prof. Madya Dr. Selvanathan Narainasamy

Abstract

This graduation project report was a partial requirement of the Bachelor Degree of Information Technology. This project focused on the testing and implementation of streaming multimedia files using multicast and unicast technology through Local Area Network with conserving network resources. It is also an effort being carried out to provide a multimedia and interactive web base entertainment system for Faculty of Computer Science and Information Technology.

Multimedia has become a popular catchword during the last few years. The idea behind a multimedia network is a single network combining an improving all current technologies that realizes fast and convenient access for the customer to voice, data and video applications.

The WebTV concept is first conceived to solve the weaknesses of traditional television in this demanding social. The WebTV is designed to be a multimedia environment, utilizing state-of-the-art currently powerful technology to accommodate user requirement.

Since the study of multimedia broadcasting is still a new topic in computer world, only limited streaming technology available for this project. The core technology deployed in this project is Microsoft Windows Media Services 4.1, which is a powerful streaming technology use for stream all on-demand and live broadcasting TV programs to users.

Finally, it conclude that WebTV can be implemented using either unicast or multicast stream and all streams will be able to provide the optimum quality if implemented in Local Area Network.

Acknowledgement

First and foremost, I would like to take this opportunity to express my gratitude and appreciation to my supervisor, Prof. Madya Dr Selvanathen Narainasamy. Without his valuable guidance and advice, this project will not be a reality.

Next, I would like to thank my moderator, Puan Rohana Mahmud for being most considerate and kind. I would also like to extend my appreciation to Mr. Ling Teck Chaw for his precious advice and insightful comments throughout the implementation of the project.

Last but not least, I would like to thank my fellow friend, Ms Foo Siew Ping, Mr. Che Choong Lee, Mr. Leong Kee Foo, Mr. Hong Wye Kean who have been very kind, helpful and have provided me with their helping hands whenever I faced problems and their motivated encouragement.

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Chapter 1
Introduction

1.1 Project Overview

Television and Internet are the most powerful technologies for information transmission across the world. The ultimate question is will these two powerful technologies from the world, television (broadcast video) and the Internet (the Internet Protocol and the Hypertext Markup Language "HTML") to be combine? The answer is YES! The development of streaming technology with brief download time, television and Internet can be combine to provide an informative and entertaining service to computer users. Streaming is the delivery of media content over the Internet using data compression and this process allows the user to start playing the material as it downloads. This saves having to download the entire file before users can play it. For example when users receive streamed videos or files, they can start to view them immediately without waiting for the entire movie or audio clip to download to their computer, thus avoiding frustrating delays. With WebTV computer users can watch their favorite television programs using their own computer.

This project, WebTV is concentrate on the development of a web base interactive television broadcast via Local Area Network (LAN) using streaming technology. Beside television broadcast, this project will also include music-on-demand and video-on-demand using the same technology. The viewer can watch both live television programs and recorded movie file or listen to some recorded music on-line. This entertainment system will use as a supporting to the weakness of the conventional television.

Information and entertainment delivery from convention television was just one-way communication. Home users can only watch television programs from television station, but their can not sent some opinion and comment to local television station or requests some feedback from television station. This made the convention television was not interactive for all home users. Beside that, the cost for a television system was also very expensive which include the cost of that television and installation. It was impossible for an organization or institution to provide each staff one television because the cost requires was very high. With the development of WebTV all these constraints can be solve because it provides interactive between user and television station and it also cheep compare to the convention television system.

1.2 Project Objective

The main objectives of this project are as follow:

i.) To provide an informative, innovative, interactive, and user-friendly web base entertainment system for Faculty of Computer Science and Information Technology (FSKTM).

ii.) To test and implement live streaming and encoding technology using multicast through FSKTM's Local Area Network (LAN).

iii.) To test and implement multiple unicast streaming with conserving network resources.

1.3 Project Scope

This project was developing base on some constraint, which limited the scope of the project. Below were the scopes of this project:

i.) This entertainment system is design and develop for the used within LAN. For example FSKTM's LAN or UM's LAN because of the bandwidth requirement was the boundary for outsider from accessing this system.

ii.) Users can only watch local television programs only for example RTM (Rancangan Televisyen Malaysia), TV3, and NTV7 television programs only because this system can receive local television station broadcast only.

iii.) All television programs stream to users will no guarantee quality of service (QoS) because all streaming are through Ethernet.

iv.) This system can only provide limited songs and videos for On-Demand streaming because video files require a lot of hard disk storage space.

1.4 Project Schedule

This project started from July 2000 and planned will be finish at January 2001, which require about seven months to complete this project. To ensured that the development of this project easier to control and to be complete on time, this project would divide into 5 phases:

i.) Literature review and system study

ii.) System requirement definition

iii.) System analysis and design

iv.) System development and testing

v.) Documentation

Below was the project schedule planning.

Activities	Jun	Aug	Sep	Oct	Nov	Dec	Jan
Literature review							
System requirement definition							
System analysis and design							
System development and testing							
Documentation							

Figure 1.1 Planning Schedule

1.5 Project Organization

This report was organization in 8 chapters. Below is the summary of each chapter of the report

Chapter 1: Introduction

This chapter introduces the overview of WebTV system and define system objective. Besides, it also includes project scope and schedule.

Chapter 2: Literature Study and Analysis

This chapter summarizes all the literature review and analysis work being done. The contain mainly conclude technology, which has been review such as, existing system, system architecture, database, server, development platform, and development tools.

Chapter 3: System Analysis

This chapter defines the development methodology and system requirement for the system. Functional and non-functional requirement are define. In addition, it also includes the requirement for development platform, database server, web server, web publishing technology, streaming technology, and development tools.

Chapter 4: System Design

This chapter concentrates on the design of the system architecture. Besides, it also defines the functional and database design for the system. Graphical user interface design was also define in this chapter.

Chapter 5: System Implementation

This chapter systematically defines the implementation of the system from the very beginning. It provided the information to setup a development environment and how to develop the system module by module.

Chapter 6: System Testing

This chapter extensively defines the procedure carried out a testing to the system. Unit testing, module testing, integration testing and system testing were include in this chapter.

Chapter 7: Project Finding

This chapter briefly explains the achievement of the system implementation. The content mainly focus on the evaluation of the system, problems encounter and its solutions, and also future enhancement. It also includes a shot description about the knowledge gain. Finally, review of goal was defined.

Chapter 8: Conclusion

This chapter concludes the success of the system.

Chapter 2
Literature Study and Analysis

2.1 Finding

Literature review for this project was divided into three parts, the first part will discuss about existing system, which people had developed and currently is using. And the second part will focus on streaming solution provider, which provide facilities or solution for an enterprise or an organization. The last part will be focus on the discussion of some technologies and tools that are available in market for the use of development of this project.

2.1.1 Existing Broadcasting System

There are a lot of existing systems, which had been developed and were similar to this project specification and requirement for example CNN Online, ABC (Australian Broadcast Cooperation) Online, AdventureTV, Dvrplayer, Hollywood online, ESPN sport online, CNBC Dow Jones online, liketelevision, Fox Sport, MusicVideo.com, and NBCi. All these system can be category in to 5 major types, which was news, entertainment, documentary, sport, and business.

2.1.1.1 CNN Online

CNN was the world's largest news organization. CNN News was a web base informative system, which provides comprehensive on-demand news to all Internet users across the world using streaming technology. All latest news and information, which had happen at any corner from the world, can be access from this web site. Beside provide latest news it also provides other services for example video on demand, video archive, audio on demand, and point cast. This interactive web base system was developed using technology from Microsoft Windows Media technology and realplayer technology with UDP/IP unicast streaming. CNN online also enable Internet users to choose their desired bandwidth, which suitable for them hardware performance. [1]

2.1.1.2 AdventureTV.com

AdventureTV.com provided useful information and documentary regarding natural environment, flora, and fauna around the world. This web base broadcasting system enables Internet users request an on-demand of prerecorded documentary video. All on-demand streaming to Internet users will attach some useful information and brief explanation about that documentary. For example a documentary regarding journey to Sabah had include information about the country name, area-park, location, brief explanation and contact information for Internet user to get further information. AdventureTV.com was using Microsoft Media Technology only for broadcasting and streaming all on-demand requests to Internet users. [2]

2.1.1.3 Dvrplayer.com

Dvrplayer.com Private Limited was a subsidiary of Airtime Management & Programming Private Limited (AMP) [3], which is providing online radio transmissions through its web site at www.dvrplayer.com. Internet users can go on the Internet to listen to their favorite radio station. AMP had managed five radio stations: Hitz FM, Mix FM, Light & Easy, Era, and My FM. The real-time radio broadcasts had included more than just music, with information on the song currently playing (album title, track and artiste name), as well as the next song and artiste. The dvrplayer.com site will in future include webcasting, in which webcams will be placed at select studios, and e-commerce tie-ups. For example, it would then be possible to click on a related link to the track currently playing, so those listeners can purchase the album online.

2.1.1.4 ESPN Sport

ESPN Sport was one of the subsidiaries of ESPN Inc., which provide latest news and information regarding all kind of sport event around the world. This broadcasting system provided video and audio on-demand streaming, which mostly about the highlights of a sport event for example ESPN radio, TV listings, video highlight, and audio highlight. Like CNN online it provide two types of streaming service and bandwidth to Internet users via Microsoft Media technology and realplayer technology [4].

2.1.1.5 NBC Internet, Inc

NBC Internet, Inc. (NBCi), a global integrated media company, was founded in November 1999. NBCi integrates access to major media platforms, including Internet, broadcast and cable television, and radio. NBCi was created through the combination of Snap, XOOM.com, NBC.com, NBC Interactive Neighborhood, AccessHollywood.com, VideoSeeker and a 10 percent equity stake in CNBC.com. NBCi offers access to a combination of on-air and online services. Online, NBCi's flagship Web site, Snap (http://edition.snap.com/), provides a comprehensive online experience to users worldwide via Internet search & directory, community, shopping, e-commerce, multimedia and entertainment services across all bandwidths. In addition to high-quality free Web services, such as search and a directory of Web sites, Internet users also provided other free services such as home-page building, chat rooms, downloadable software, message boards and greeting cards. NBCi also offers innovative NBC content, including certain full-motion video programming, original extensions of NBC shows – including sites for "Saturday Night Live" and "The Tonight Show with Jay Leno," – and localized community guides connected to local NBC stations [5].

2.1.1.6 CNBC Dow Jones Online

CNBC Dow Jones was a business video provider, which offers innovative services to business community via Internet. CNBC Dow Jones business video is the leader of providing video on the web. CNBC Dow Jones Business Video provides business and financial professionals with live and archived coverage of market moving events, interviews and analysis on a subscription basis. The unparalleled Web site allows subscribers to see, and hear CEOs, Analysts, and Management adding an important layer in the investment decision-making process. Content contains over 17,000 archived pieces from CNBC worldwide, in addition to exclusive analyst and CEO interviews conducted by the CNBC Dow Jones Business Video team of reporters. CNBC/Dow Jones Business Video also offers customized daily news packages, called *Newspacks*, which provide Web sites with up-to-the-minute video news and commentary, increasing daily viewer ship [6].

2.1.2 Streaming Solution Provider

Finding also includes several streaming technology solution providers, which provide services for transmits or streams data through Internet or Intranet for all Internet content provider and enterprises. All streaming application services provided were ready to use, users just need included the data or files that need to transmit or broadcasting for example Cisco-IP/TV and Akamai-FreeFlow.

2.1.2.1 Cisco IP/TV

The Cisco IP/TV is design for streams high-quality video programs to computer users over an enterprise network. IP/TV was a powerful multipurpose system. It delivers TV-quality video programming to desktop PCs by leveraging IP/TV software and IP/TV 3400 Series Server. The new IP/TV product family consists of the Cisco IP/TV 3400 Series Servers: the IP/TV 3411 Control Server, the IP/TV 3422 and 3423 Broadcast Servers, the IP/TV 3431 Archive Server, and the IP/TV 3415 Video Starter System, all running robust IP/TV 3.0 software and the IP/TV Viewer client-side software [7].

The Cisco IP/TV family distinguishes itself by offering high-quality video broadcasting and video-on-demand services, industry-leading management capabilities, built-in scalability, network-friendly technologies such as IP multicast, and an easy-to-use viewer interface. With Cisco IP/TV, organizations can send training classes, corporate communications, management seminars, university classes and more, right to employee desktops in order to provide more efficient communications and better-informed and more productive employees.

Cisco IP/TV software is built on Microsoft's Windows Media Technologies, which offer key components like Windows Media Tools for creating and editing live and on-demand ASF content. Advanced compression software such as Windows Media Audio and MPEG-4; and Windows Media On-Demand Producer, which lets users synchronize Web pages or an audio or video track to create a multimedia

presentation. Cisco IP/TV products use standard protocols running on existing IP networks and are backed by Cisco superior service and support.

2.1.2.2 Akamai-FreeFlow

Akamai was a streaming application services provider, which offers world class streaming media services for Internet content providers and enterprises. Streaming solution provided by Akamai was more bases on hardware and network solution. Akamai delivers live event Webcasts (complete with video production, encoding, and signal acquisition services), streaming media on demand, 24/7 Webcasts and a variety of streaming application services. Company like Apple and FOX Sport rely on streaming application service provided by Akamai (FreeFlow) [8].

FreeFlow is a revolution Internet content and applications delivery service that transforms the Internet from an inconsistent transport medium into a high-performance network. FreeFlow's innovative and patent-pending technology is based upon the simple concept that delivering content and applications from the optimal server located closest to the users dramatically improves performance. Akamai has deployed thousands of servers in major networks and access points around the world. This vast network enables FreeFlow to deliver content and applications faster and more reliable than web site owners can deliver themselves.

Concept of implementing FreeFlow is simple and non-intrusive. Companies migrate their Web site content with Akamai's software utilities, which tags web site content for delivery from Akamai's network. When end users request web site content, the Akamai network serves it from the nearest or highest-performing server available rather than from a distant or overloaded one. By eliminating problems caused by network bottlenecks and server overloads, FreeFlow enables web-intensive business to deliver dynamic, secure and media-rich content which results in more page views, advertising revenue, and eCommerce transactions. Figure 2.1 and figure 2.2 show the different between traditional network and Akamai's network for delivery data.

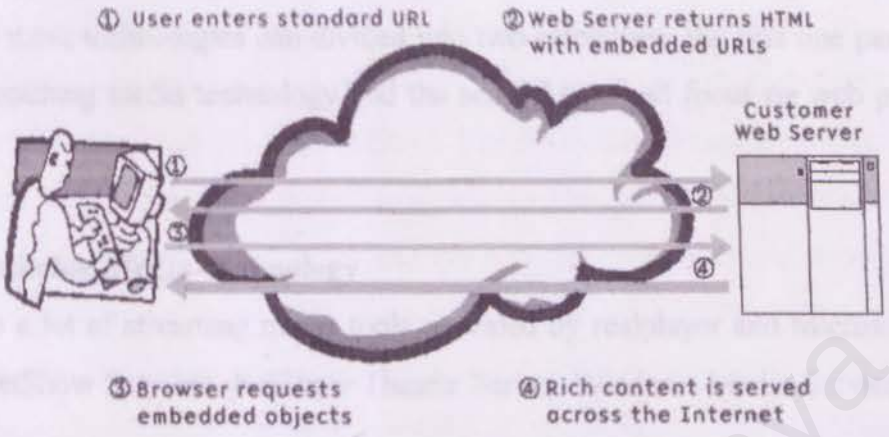

Figure 2.1 Traditional Network Approach

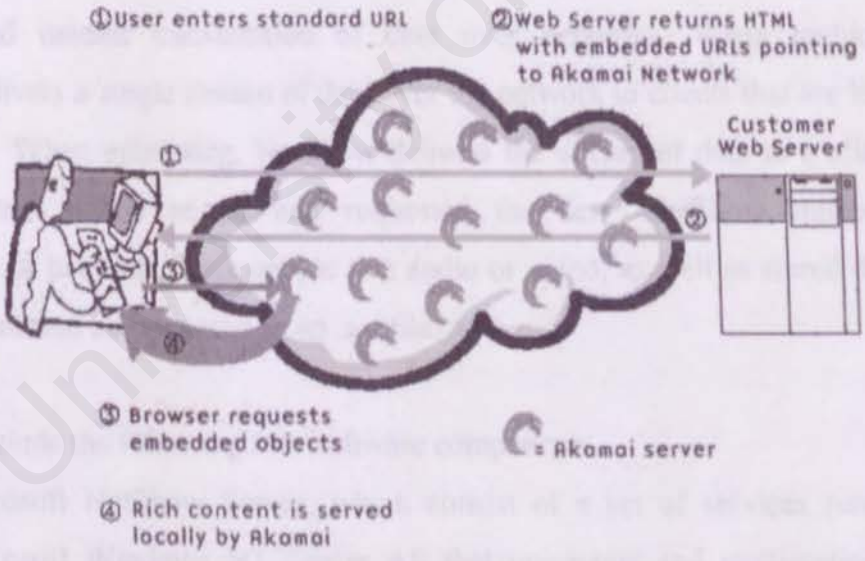

Figure 2.2 Akamai Network Approach

2.2 Development Technology

There were a lot of development technologies available for the development of this project. All these technologies can divided into two categories, the first one part was used for streaming media technology and the second part will focus on web publish technology.

2.2.1 Streaming Media Technology

There were a lot of streaming media tools provided by realplayer and Microsoft, for example NetShow Services, NetShow Theater Server, Windows Media Services, and Real G2.

2.2.1.1 Microsoft NetShow Services 2.0

NetShow services 2.0 can use for stream audio, illustrated audio, video, and files over corporate Intranets, LANs, and the Internet [9]. NetShow supports both multicast and unicast transmission of data over networks. When multicasting, NetShow delivers a single stream of data over the network to clients that are listening for the data. When unicasting, NetShow delivers the stream of data to a client that has connected to the server and requested the data. NetShow supports the transmission of live data, for example live audio or video, as well as stored data, for example illustrated audio stored as an .asf file.

NetShow include the following four software components

i.) Microsoft NetShow Server, which consist of a set of services running on Microsoft Windows NT Server 4.0 that unicasting and multicasting audio, video, and files to clients.

ii.) NetShow Administrator. A set of administrative tools manages NetShow channels, programs, and streams; and configures and monitors NetShow services.

iii.) NetShow Client. Client software, which requires Windows 95, Windows 98, or Windows NT, can receive and readers streams from NetShow Server. NetShow includes four clients: Nsplayer.exe, Nsplay.ocx Nsrtpaud.ocx, and

Nsfile.ocx. Nsplayer.exe and Nsplay.ocx render Active Streaming media that can include video, audio, images, URLs, and scripts. Nsrtpaud.ocx renders audio received via RTP. Nsfile.ocx handles multicast file transfers.

iv.) NetShow Content and Conversion Tools. Content tools include the ASF Real-Time Encoder and the ASF Editor. The Real-Time Encoder converts live audio and video to Active Streaming format and allows users to add command strings to the stream. Use the ASF Editor to assemble, synchronize, and compress audio and video files into a single .asf file. The ASF Editor can also add command strings and URLs to ASF presentations. AsfChop, a command-line utility, edits the length of .asf files and indexes them. The conversion tools include VidToAsf and WavToAsf, which are command-line utilities that users can use to convert .mov, .avi, or .wav files to .asf format.

NetShow support the following stream types:

i.) Active Streaming format (ASF). ASF supports the greatest variety of data, including video, audio, images, URLs, and scripts. Administrator can generate live ASF streams that contain audio and video using the NetShow Real-Time Encoder, or use the tools provided with NetShow or those from third parties to create and store ASF files that administrator can stream. An ASF stream can combine different types of data. For example, administrator want to use NetShow to present a lecture that includes slides, administrator can stream audio while also streaming .gif files of the slides. By using NetShow channels, ASF provides the greatest flexibility for various network situations. NetShow can multicast or unicast ASF streams. When multicasting an ASF stream, administrator can also configure NetShow to provide a unicast source for the stream so that clients, which are unable to receive the multicast can automatically receive it as a unicast.

ii.) RTP Live Audio. RTP Live Audio streams audio fed into the server's sound card. NetShow supports RTP Live Audio multicasts, but not unicasts. Multicasts that stream RTP Live Audio are easy to set up. However, because channels do not support RTP Live Audio streams, connection information

must be coded in the embedded control that clients use to receive and render the multicast.

iii.) RTP WAV Audio. RTP WAV Audio streams audio recorded as .wav files. NetShow supports RTP WAV Audio multicasts, but not unicasts. Multicasts that stream RTP WAV Audio are easy to set up. However, because channels do not support RTP WAV Audio streams, connection information must be coded in the embedded control that clients use to receive and render the multicast.

iv.) File transfer. File transfer supports the streaming transfer of directories and files. NetShow supports file transfer multicasts, but not unicasts. Multicasts that stream file transfers are easy to set up. However, because channels do not support file transfer streams, connection information must be coded in the embedded control that clients use to receive and render the multicast.

Figure 2.3 show a high-level view of the functionality available in NetShow. It shows the types of media NetShow handles the NetShow services used to encode and stream data and the software components used to render streams on clients.

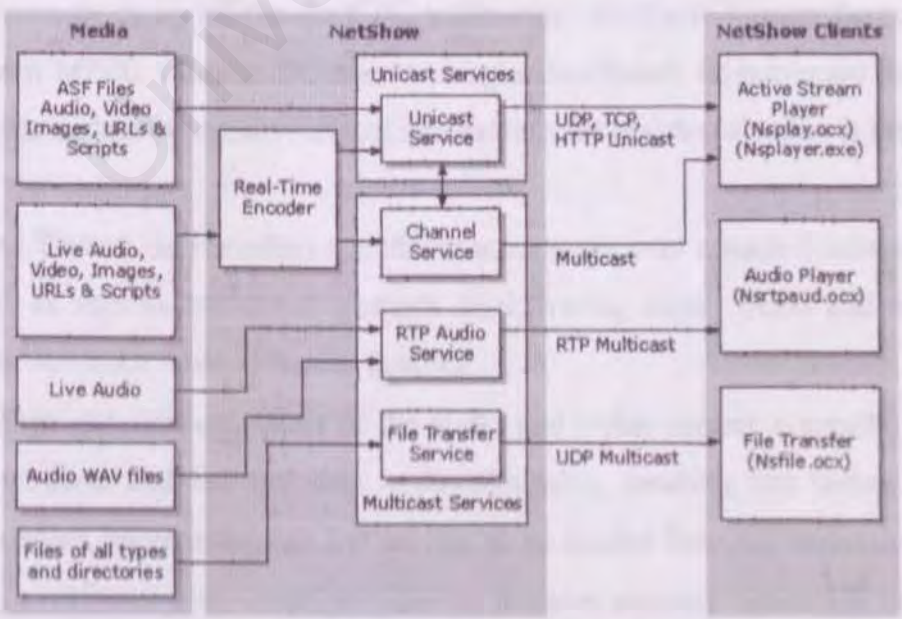

Figure 2.3 NetShow Schematic Overview.

2.2.1.2 Microsoft NetShow Theater Server

Microsoft NetShow Theater Server is the most powerful, flexible streaming media solution for delivering broadcast-quality MPEG video [10]. NetShow Theater Server extends the streaming media services of Windows NT Server NetShow Services too much higher bandwidths, allowing you to deliver stunning, full-motion, full-screen video with guaranteed performance across high-bandwidth networks.

Microsoft NetShow Theater Server enables interactive multimedia applications and streams high quality MPEG1 and MPEG2 video that take advantage of dial-up and local area networks ranging in bandwidth from 500Kbps to 8Mbps. NetShow Theater Server has the power and flexibility to meet any demand for interactive applications on public and private networks and in residential cable networks or telephone systems where high-bandwidth networks are available. It provides the ideal multimedia platform for developing custom solutions when rich video and audio content are called for.

Until now, multimedia solutions required proprietary supercomputers, special hardware for effective fault-tolerance, and massive memory to store only a few hours of content. Microsoft NetShow Theater Server solves these challenges efficiently and cost-effectively using off-the-shelf PC technology. NetShow Theater Server streams full-screen MPEG video to PC clients using a distributed, fault-tolerant architecture that makes it ideal for mission-critical applications for which scalability is important.

NetShow Theater Server offers significant advantages over outdated videotape-based systems, as well as traditional methods of delivering digital video and audio over Intranets. NetShow Theater Server features:

i.) Fast and efficient. Most of the audio and video content currently hosted on intranets and Internet sites is downloadable, meaning that before it can be played, users must wait for the title to be copied from the server to their PC. In addition, users must provide the massive memory necessary to store the content before and after playback. The streaming media technology employed by Microsoft NetShow Theater Server delivers content to the client as a

continuous flow of data, minimizing the wait before playback and eliminating the massive storage requirements for rich content. In applications for which the privacy or security of the content is required, streaming data provides the added advantage of not storing content on clients.

ii.) Software-base solution. The software-based solution offered by NetShow Theater Server offers strength and flexibility that are unmatched in hardware-based systems. The advantages of implementing a software solution are numerous:

- Whereas other distributed video solutions require the installation of expensive, proprietary hardware, NetShow Theater Server runs on off-the-shelf PCs. This hardware independence allows you to select the most cost-effective platform available, be it an existing network installation or competitively priced new servers.
- Software provides flexibility by adapting system capabilities to the evolving consumer marketplace. Unlike hardware, where even evolutionary changes can require a new product, software can be modified and implemented relatively easily.
- Software solutions can benefit from advances in technology. The system can take advantage of new, more powerful hardware, as it becomes available to improve performance. Likewise, as new software becomes available, it can be integrated into your system to add additional features.

iii.) Unlimited Customization. In the Microsoft tradition of using open, industry standards and providing an extensible platform, NetShow Theater Server enables you to incorporate streaming media into custom business solutions and value-added products. Using the Microsoft NetShow Theater Server software development kit (SDK), software developers can augment their own products with NetShow Theater Server functionality or provide compatible add-ons.

iv.) A scalable, extensible solution. NetShow Theater Server can be scaled to run on a range of implementations, from a single PC, to a department-sized multiple-server system, to a large system designed to serve many thousands of users. As your organization expands or your user needs grow, NetShow

Theater Server can be reconfigured to include more content servers and content drives to increase the amount of content storage, or to increase the number of users simultaneously watching video. As content servers and disks are added, capacity and bandwidth increase simultaneously.

As a component of a larger overall network structure, Microsoft NetShow Theater Server can be used in conjunction with other network and Internet services to take advantage of your investment in the installation and provide multipurpose applications for a wide variety of needs. Video content is streamed to users over a high-bandwidth IP network, using either switched Ethernet or ATM technology. Transport networks using xDSL and cable modem networks can be used in residential applications. Because it supports both Switched Ethernet and ATM network technologies, NetShow Theater Server can stream video over the same networks as other corporate applications, such as e-mail, printing, and file sharing, provided that there is sufficient bandwidth.

NetShow Theater Server is a distributed system hosted on a collection of standard personal computers running Windows NT. The core of the NetShow Theater Server system is a single title server and one or more content servers connected by a high-speed network.

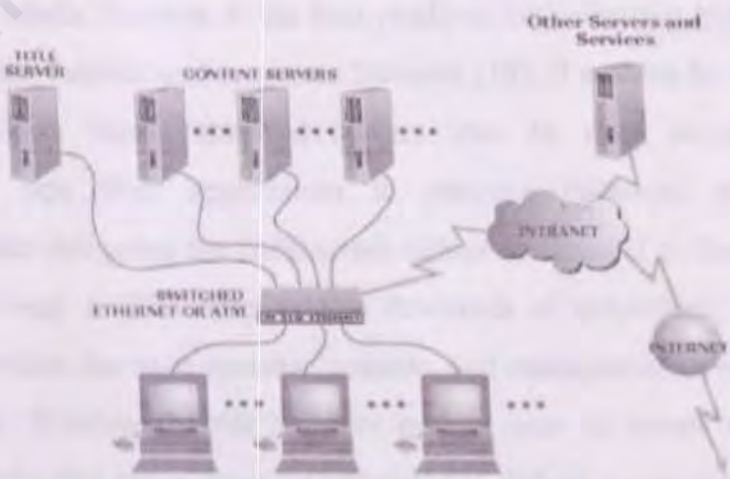

Figure 2.4 NetShow Theater Server's architecture.

The title server receives and forwards client requests to the content servers, keeps the system clock, manages system resources, and provides configuration information to the system administration tools. No data flows through the title server.

Content servers manage the schedule, retrieve data, and deliver data to clients. Each content server has 1-20 dedicated content drives that store the data in the NetShow Theater Server file system. These content drives use a proprietary Microsoft format. All content servers in a particular system are the same types of computer, with the same type of network interface and the same number and type of content drives. SCSI adapters can be added to increase the storage capacity even more.

NetShow Theater Server communications are independent of network protocol. Incoming requests from the client must be sent over a reliable network protocol, TCP/IP. Output streams require a high-bandwidth link, but do not require a reliable protocol. It is more important that the data arrive on time than that it is perfect but late. Content servers use UDP/IP because it provides timely data delivery. Microsoft NetShow Theater Server has been designed to work in either Switched Ethernet or asynchronous transfer mode (ATM) networks.

2.2.1.3 Microsoft Windows Services

Microsoft Windows Media Services is the best platform for delivering high-quality digital media across the Internet and corporate Intranets [11]. It enables the seamless integration of Windows Media-formatted content into the most popular Web browsers, enabling rich Web applications to integrate enhanced multimedia presentations. Whether delivering the latest music videos on demand to thousands of consumers, or streaming a CEO broadcast to thousands of employees, Windows Media Services provides the most scalable, reliable, and manageable server to meet digital media needs. Windows Media Services enables user to stream multimedia content over networks that range from low-bandwidth, dial-up Internet connections to high-bandwidth, local area networks.

Windows Media Technologies supports data delivery over a wide variety of networks and protocols. Windows Media Format describes a transmission file format for arranging and organizing synchronized multimedia data. It is optimized for streaming the data over networks and rendering the data on a client computer. Windows Media Format specifies the format of live presentations that are being streamed across the network as well as prerecorded files.

One specialized use of Windows Media files is in streaming audio files compressed with the Windows Media Audio codec (compression/decompression system). This codec combines very high-quality audio output with significant improvements in file compression. Of great importance to many content providers is that these files can be made much more secure from piracy by using the digital rights management (DRM) encryption system.

Servers running Microsoft Windows Media Services support unicasting (sending a stream to each client requesting it) and multicasting (broadcasting a single stream across the network so that it can be rendered by many clients at the same time). Unicasting enables the user to start, stop, pause, fast-forward, or rewind stored stream data at will (if the stream is indexed). However, sending a stream to each client can require a lot of bandwidth. Multicasting, on the other hand, makes better use of available bandwidth. Much like tuning into a TV or radio broadcast, multicasting restricts the user's ability to pause, rewind, or fast-forward the presentation.

Microsoft Media services are the appropriate choice for:

i.) Internet compatibility. User's application must run over the Internet. Windows Media Services were designed with the Internet in mind, but will work equally well over Intranets and extranets.

ii.) Limited Bandwidth. Users have a limited amount of network bandwidth to work with. Windows Media Services were optimized to work with low-to mid-bandwidth networks, starting at 2.4 kilobits per second (Kbps) and going up to 3.5 megabits per second (Mbps). The majority of applications that use

Windows Media Services is 128 Kbps (ISDN rates) and below. The server's Intelligent Streaming feature allows it to adapt to varying network conditions, maintaining high quality over lossy networks like the Internet.

iii.) Multicast. Users want to have multicast in addition to unicast capabilities. Multicast allows user to send a single stream to many users simultaneously, thereby conserving network resources.

iv.) Multiple Data Type in a Stream. Users are interested in combining audio, video, data, JPEG, URLs, script commands, and other rich media in a single data stream. Windows Media Services stream data using the highly flexible and industry standard Advanced Streaming Format (ASF) to combine many data types into one stream.

v.) ASF Format. Users want to author content in ASF. This allows user to choose from a wide variety of contents authoring and encoding tools. It also ensures compatibility across streaming media clients, servers, and tools.

vi.) Codec Independence. Users require or prefer a certain codec for encoding and decoding a stream. The codec independence that is provided with Windows Media Services allows user to ensure the highest-quality streaming by providing the best compression schemes and allowing content authors to choose the most appropriate codec for their application, including MPEG-4.

vii.) Live Software Encoding. Users require live encoding with software instead of hardware. Windows Media Services support software capturing and encoding of live analog streams at up to 3.5 Mbps. No special and expensive encoding hardware is required.

viii.) Ad Insertion. Users require ad insertion. This allows easy, dynamic, and personalized insertion of ads into video streams and Web pages through integration with Site Server ad services.

Figure 2.5 and Figure 2.6 depicts Windows Media Services's architecture and how protocols are used to communicate between the components of a Windows Media Services system.

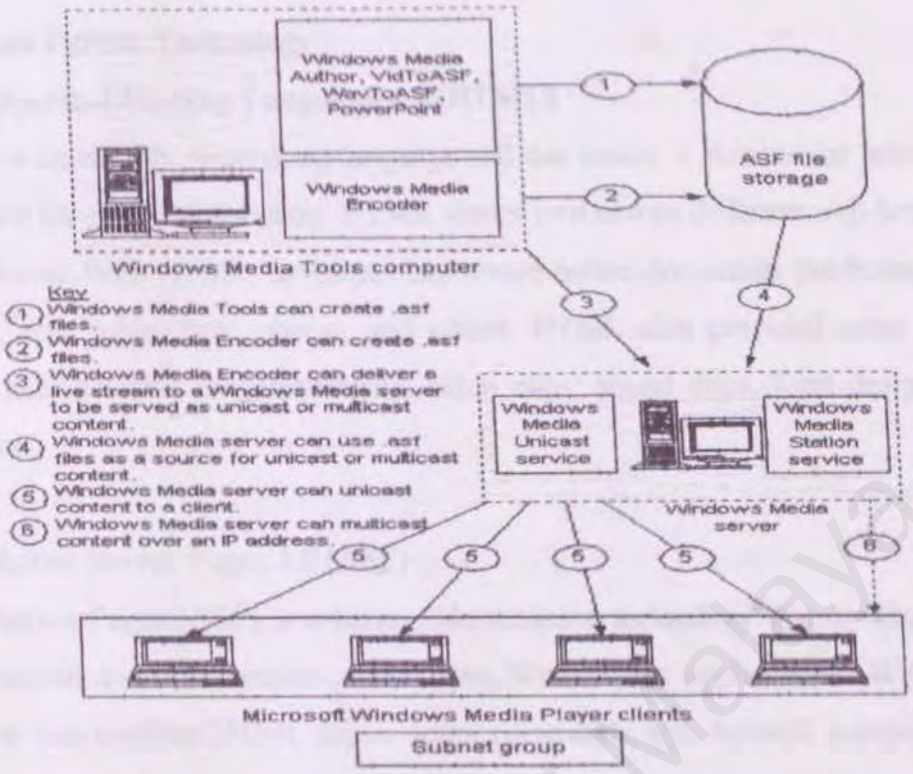

Figure 2.5 Window Media Services architecture.

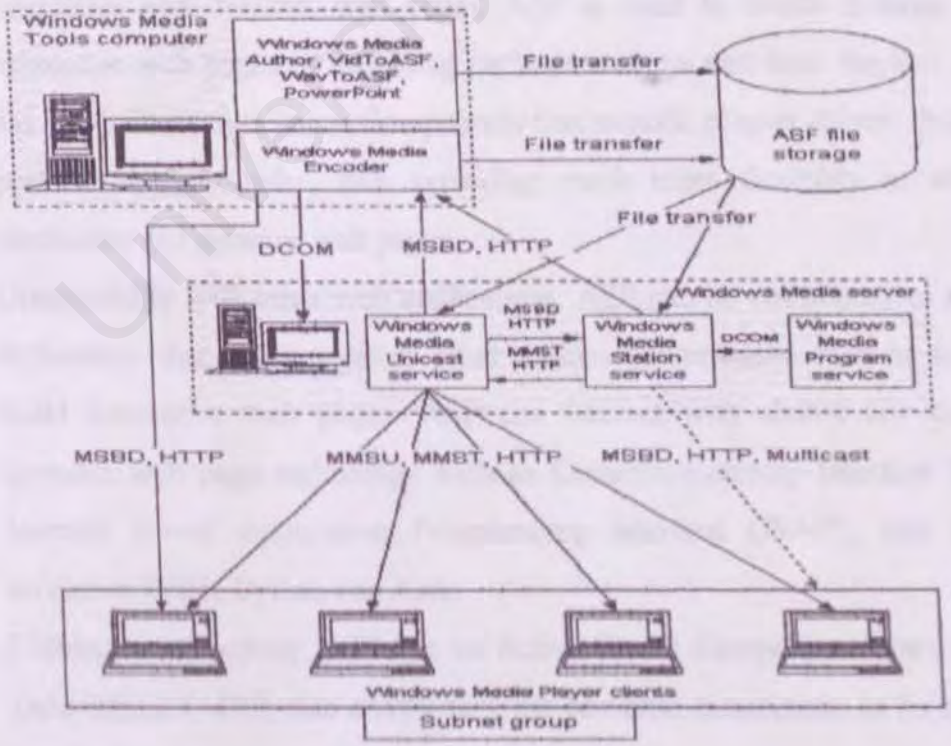

Figure 2.6 Window Media Services protocol used.

2.2.2 Web Publish Technology

2.2.2.1 Hypertext Markup Language 4.0 (HTML)

HTML is a universally understood language and this makes it suitable for publishing information for global distribution. HTML works well across different web browsers and platforms. With HTML, developer can create online documents publishing with headings, text, table, lists, photos, and others. HTML also provided some useful features like inclusion of spreadsheets, video clips, sound clips, form design, and hyperlinks.

2.2.2.2 Active Server Pages 3.0 (ASP)

Active Server Pages (ASP) is a server-side scripting technology that developer can use to create and run dynamic, interactive Web server applications. With ASP, developer can combine HTML pages, script commands, and ActiveX components to create interactive Web pages or powerful Web-based applications. ASP applications are easy to develop and modify. ASP unique features are listed below:

i.) Interactive and dynamic web pages. ASP is used to create dynamic and interactive web pages by including ActiveX controls and Java Applets. ASP has pre-built Active Server Components that provide plug-in objects that will perform specific tasks, thus providing much more flexibility in writing interactive and dynamic web pages.

ii.) Compatibility with other web applications. ASP can be considered as a glue technology that binds together other various server-based systems to help build interactive web pages. ASP can interact with almost any existing dynamic web page technology such as Common Gateway Interface (CGI), Internet Server Application Programming Interface (ISAPI), and scripts written in PERL, Python and Awk.

iii.) Database connectivity. ASP has an Active Server Component named Active Data Object (ADO) that allows easy but powerful connections to be made to almost any database system available.

iv.) Scripting languages. ASP is compatible with any ActiveX scripting language. ASP includes native support for VBScript and JScript, Microsoft's

implementation of JavaScript. JScript does not offer some facilities found in VBScript. Multiple scripting languages can be used interchangeably in the same ASP file.

v.) Error handling and debugging. ASP's error handling and debugging features are minimal. There is no control over the way that the code is executed. To debug the script, values of variables have to be inserted into the page.

2.2.2.3 Command Gateway Interface (CGI)

The Common Gateway Interface (CGI) is a standard for interfacing external applications with information servers, such as HTTP or Web servers. A plain HTML document that the Web daemon retrieves is static, which means it exists in a constant state: a text file that doesn't change. A CGI program, on the other hand, is executed in real-time, so that it can output dynamic information [12].

Since a CGI program is executable, it is basically the equivalent of letting the world run a program on your system, which isn't the safest thing to do. Therefore, there are some securities precautions that need to be implemented when it comes to using CGI programs. Probably the one that will affect the typical Web user the most is the fact that CGI programs need to reside in a special directory, so that the Web server knows to execute the program rather than just display it to the browser. This directory is usually under direct control of the Webmaster, prohibiting the average user from creating CGI programs. There are other ways to allow access to CGI scripts, but it is up to your Webmaster to set these up for users.

A CGI program can be written in any language that allows it to be executed on the system, such as:

i.) C/C++
ii.) Fortran
iii.) PERL
iv.) TCL
v.) Any Unix shell
vi.) Visual Basic
vii.) AppleScript

2.2.2.4 JScript

JScript is the Microsoft implementation of the ECMA 262 language specification. It is a full implementation, plus some enhancements that take advantage of capabilities of Microsoft Internet Explorer. JScript is an interpreted, object-based scripting language. Although it has fewer capabilities than full-fledged object-oriented languages like C++ and Java, JScript is more than sufficiently powerful for its intended purposes.

JScript is not a cut-down version of any other language (it is only distantly and indirectly related to Java, for example), and it is not a simplification of anything. It is, however, limited. You cannot write standalone applications in it, for example, and it has little capability for reading or writing files. Moreover, JScript scripts can run only in the presence of an interpreter, either in a Web server or a Web browser. JScript is a loosely typed language. That means we do not have to declare the data types of variables explicitly. Moreover, in many cases JScript performs conversions automatically when they are needed. For instance, if we try to add a number to an item that consists of text (a string), the number is converted to text.

2.2.2.5 VBScript

Microsoft Visual Basic Scripting Edition (VBScript) is a subset of the Microsoft Visual Basic language. VBScript is currently available as part of Microsoft Internet Explorer and Microsoft Internet Information Server. When used in Microsoft Internet Explorer, VBScript is directly comparable to Microsoft JavaScript. VBScript code, like JavaScript, does not produce standalone applets but is used to add intelligence and interactivity to HTML documents.

VBScript is a pure interpreter that processes source code embedded directly in the HTML. It is implemented as a fast, portable, lightweight interpreter for use in World Wide Web browsers and other applications that use Microsoft ActiveX Controls, Java applets and Automation server.

VBScript provides three separate classes of objects, namely objects provided by the VBScript engine, Internet Explorer, and web page author. The VBScript engine provides the core run-time functionality. Microsoft Internet Explorer provides the vast majority of objects used in scripting. In generally useful is provided directly in VBScript.

2.3 System Architecture

There is generally two type of client/server architecture use for development purposes. They are two-tier and three-tier architecture. Each type of architecture had advantages and disadvantages. The choice between a two- and three-tier architecture should be based on the scope and complexity of a project, the time available for completion, and the expected enhancement or obsolescence of the system [13].

2.3.1 Two-tier Architecture

The two-tiered architecture contains two computers: a client and a server with areas of logic combined on the client. The three components of an application-presentation, processing, and data-are divided among two software entities or tiers: client application code and database server. A robust client application development language and a versatile mechanism for transmitting client requests to the server are essential for a two-tier implementation. Presentation is handled exclusively by the client, processing is split between client and server, and data is stored on and accessed through the server. The PC client assumes the bulk of responsibility for application (functionality) logic with respect to the processing component, while the data base engine-with its attendant integrity checks, query capabilities, and central repository functions-handles data intensive tasks. In a data access topology a data engine would process requests sent from the clients as show in figure 2.7. Currently, the language used in these requests is most typically a form of SQL. To send the SQL, the client must know the syntax of the server or have it translated by an API (application program interface). Data returned to the client can be manipulated at the client level for further subsection, business modeling, what-if-analysis, and reporting.

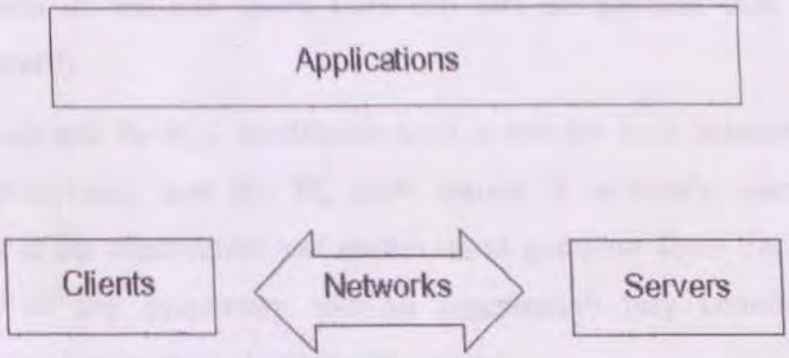

Figure 2.7 Two-tier System Architecture

2.3.1.1 Advantages of Two-tier Architecture

i.) Application development speed is the most compelling advantage of a two-tier environment. In most cases, a two-tier system can be developed in a small fraction of the time it would take to code a comparable but less-flexible legacy system.

ii.) Most tools for two-tier are very robust and lend themselves well to iterative prototyping and rapid application development (RAD) techniques, which can be used to ensure that the requirements of the users are accurately and completely met.

iii.) Two-tier architectures work well in relatively homogeneous environments with fairly static business rules. They are less suitable for dispersed heterogeneous environments with rapidly changing rules.

2.3.1.2 Disadvantages of Two-tier Architecture

i.) Because the bulk of application logic exists on the PC client, the two-tier architecture faces several potential version control and application redistribution problems. A change in business rules would require a change to the client logic in each application in a corporation's portfolio affected by the change.

ii.) System security in the two-tier environment can be complicated because a user may require a separate password for each SQL server accessed. The

proliferation of end-user query tools can also compromise data base server security.

iii.) Client tools and the SQL middleware used in two-tier environments are also highly proprietary, and the PC tools market is extremely volatile. The volatility of the client/server tool market raises questions about the long-term viability of any proprietary tool an organization may commit to and complicates implementation of two-tier systems.

2.3.2 Three-tier Architecture

The components of three-tiered architecture are divided into three layers: a presentation layer, a functionality layer, and the data layer. Each of these layers must be logically separate. The three-tier architecture attempts to overcome some of the limitations of the two-tier scheme by separating presentation, processing, and data into separate distinct entities. Figure 2.8 shows three-tier system architecture. The same types of tools can be used for presentation as were used in a two-tier environment, however the tools are now dedicated to handling just the presentation. When the presentation client requires calculations or data access, a call is made to a middle-tier functionality server. This tier performs calculations or makes requests as a client to additional servers. The middle-tier servers are typically coded in a highly portable, nonproprietary language such as C. Middle-tier functionality servers may be multithreaded and can be accessed by multiple clients, even those from separate applications. Although three-tier systems can be implemented using a variety of technologies, the calling mechanism from client to server in such a system is most typically the remote procedure call, or RPC (remote procedure call). Because the bulk of two-tier implementations involve SQL messaging and most three-tier systems utilize RPCs, examination of the merits of these respective request/response mechanisms is warranted.

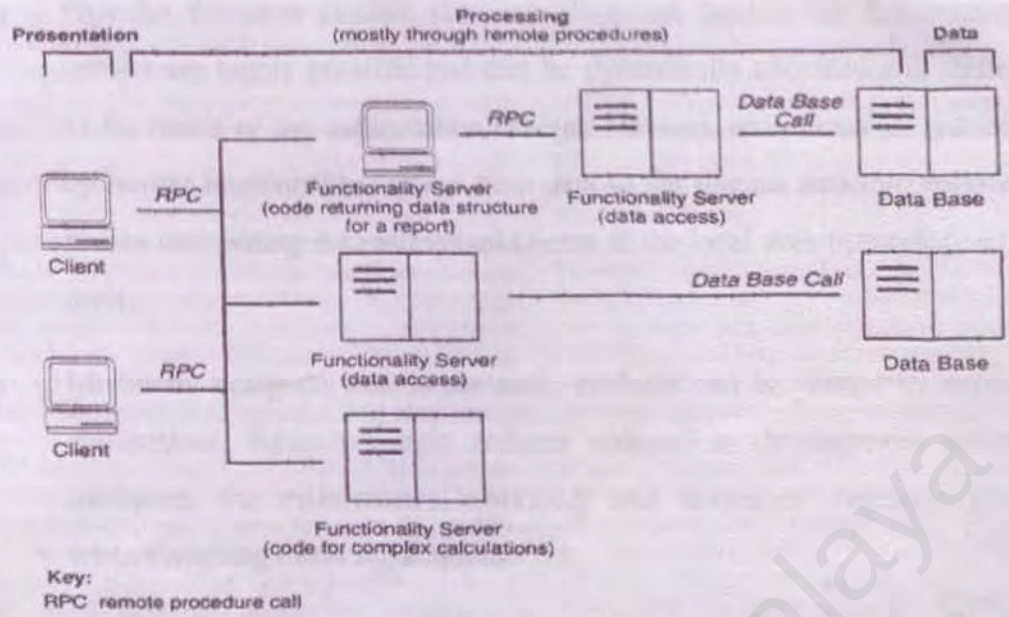

Figure 2.8 Three-tier System Architecture

2.3.2.1 Advantages of Three-tier System Architecture

i.) RPC calls from presentation client to middle-tier server provide greater overall system flexibility than the SQL calls made by clients in the two-tier architecture. This is because in an RPC, the requesting client simply passes parameters needed for the request and specifies a data structure to accept returned values.

ii.) Unlike in most two-tier implementations, the three-tier presentation client is not required to understand SQL. As such, the organization, names, or even the overall structure of the back-end data can be changed without requiring changes to PC-based presentation clients. Because SQL in no longer required, data can be organized hierarchically, relationally, or in object format. This added flexibility allows a firm to access legacy data and simplifies the introduction of new data base technologies.

iii.) Having separate software entities allows for the parallel development of individual tiers by application specialists.

iv.) Provides for more flexible resource allocation. Middle-tier functionality servers are highly portable and can be dynamically allocated and shifted as the needs of the organization change. Network traffic may be reduced by having functionality servers strip data to the precise structure required before distributing it to individual clients at the local area network (LAN) level.

v.) Modularly designed middle-tier code modules can be reused by several applications. Reusable logic reduces subsequent development efforts, minimizes the maintenance workload, and decreases migration costs when switching client applications.

vi.) A three-Tier system such as Open Software Foundation's Distributed Computing Environment (OSF/DCE) offers a variety of additional features to support distributed applications development.

2.3.2.2 Disadvantages of Three-tier System Architecture

i.) Three-Tier brings with it an increased need for network traffic management, server load balancing, and fault tolerance.

ii.) Current tools are relatively immature and require more complex 3GLs for middle-tier server generation. Maintenance tools have underdeveloped facilities for maintaining server libraries a potential obstacle for simplifying maintenance and promoting code reuse throughout an IS organization.

2.4 Database

Database technology is used in a variety of applications. Some serve only a single user on a single computer while others are for multiple users. There are variety types of database like Microsoft SQL Server 7.0, Oracle 8i, Sybase, Informix and also Microsoft Access. In order to choose a reliable database, the database must be able to ensure the safety and security of the data. The database is at the core of all mission-critical applications. Choosing the wrong database can have drastic downstream results. The investment in software, implementation, and development of a database

system is substantial; it needs to be able to evolve with the changing requirements of a growing company.

2.4.1 Microsoft SQL Server 7.0

Microsoft SQL Server is a significant tool in many regards. From data warehousing to applications that require not only a large amount of information, but also many different simultaneous users, SQL server is a key component in answering data management requirement. It is a powerful and comprehensive database [14].

Microsoft SQL Server is a perfect example of an n-tier system. The user can manipulate the data directly from the client side. Most of the time, the data is validated first before it is updated into the database in server side. It is tightly integrated with the Microsoft BackOffice family product to enable organization to improve decision-making and streamline the business process. It is the best database for Windows NT Server.

Microsoft SQL Server maintains referential integrity and security and ensures that operation can be recovered in the event of numerous types of failure. SQL server can control the access for the type of information that can be retrieved by the user.
SQL Server supports Internet database integration. It allows the user to automate the publishing of database information in HTML documents. It allows us to build active web sites and let us conduct processes on the Internet. When combining with Internet Information Server and the SQL server Internet Connector, it gives user the complete Internet database publishing capabilities. It provides the function for transparent distributed transactions. This means that it provides automatic distributed update capability across two or more SQL Server transparent to the desktop application, making it a simple to use. It guarantees the integrity of transaction of updating spanning multiple servers.

2.4.2 Oracle 8I

Oracle is the world's leading vendor of database software. Oracle's ability to have all data and documents stored in a small number of high-performance databases benefits customers by centralizing all their data, making information management and access easier, more reliable, and less expensive [15]. The ground-breaking capabilities of Oracle8*i*'s Internet File System (iFS) provides a single, easy to use data management interface for all data types, thus minimizing customers' reliance on a proprietary operating system. Oracle is an open solution and it supports all kind of platform.

Oracle's advanced security features allow for enforced granular privileges, advanced auditing, enhanced access control, secure distributed processing and replication, and the ability to use additional external authentication mechanisms. Oracle uses a Java-based utility that provides everything needed to get a pre-tuned and pre-configured Oracle8*i* database up and running. Oracle Enterprise Manager provides a single integrated management console for central administration of multiple servers. It also contains some advance functionality for tuning and diagnosing the database, and managing complex change in the database environment.

2.5 Web Server Technology

2.5.1 Apache 1.3

Apache 1.3 is a great web server, which serves pages for the vast majority of the web [16]. Apache modules may now be loaded at runtime; this means that modules can be loaded into the server process space only when necessary, thus overall memory usage by Apache will be significantly reduced. DSO currently is supported on FreeBSD, OpenBSD, NetBSD, Linux, Solaris, SunOS, Digital UNIX, IRIX, HP/UX, UnixWare, NetWare, AIX, ReliantUnix and generic SVR4 platforms. Apache now experimentally supports the Windows NT and Windows 95 operating systems and also NetWare 5.x operating systems. But there are things Apache 1.3 can't do. Firstly, it isn't particularly scalable on some platforms. AIX processes, for example, are very heavy weight and a small AIX box serving 500 concurrent connections can become so heavily loaded that it can be impossible to telnet to it. In situations like this, using processes is not the right solution.

2.5.2 Internet Information Server 4.0 (IIS)

Microsoft Internet Information Server 4.0 is fully integrated at the operating system level, which allows publication and distribution of information on the Internet. IIS 4.0 is optimized for Windows NT Server 4.0, and takes advantage of the security that NT Server provides. IIS 4.0 consists of three different components: World Wide Web (WWW) server, File Transfer Protocol (FTP) server, and Gopher server, which support virtual servers, virtual directories, logging to ODBC database, Common Gateway Interface (CGI), Internet Server Application Programming Interface (ISAPI) and Secure Sockets Layer (SSL) [17].

Virtual Server allows allocation of several IP addresses to any single NIC. This means that it is possible to have one machine act as though it is several different servers. By assigning a different Home directory to each IP address, type of access to each of those Home directories can be customized. Another added benefit of a virtual server is that it allows all IIS services to reside on one machine, instead of having to use separate hardware for each server needed.

Document meant for publishing is usually located in specific home directory. This will simplify the process of configuring the directory for publishing purposes. However, if the information resides in different directories or in several computers for that matter, copying those files to the home directories can be a daunting task. Virtual directories enable the specification of those locations without the need to copy those files to the intended directory. In other words, virtual directories make sharing information a simple process.

IIS helps in ensuring that the log files maintained by the administrator do not occupy too much disk space. IIS provides two options in logging server activities. The first option is to log those activities in text files. The second option is to log the activities into an ODBC-compliant database. This will require setting up the database. The information saved consists of the client's IP address and username, the date and time, the name and IP address of the server, the service used, the processing time, bytes received and sent, and a few others bits.

In security aspect, IIS uses two methods, password authentication and access control to access services. For password authentication, IIS requires a valid username and password for authentication in order to gain access to the information. The usernames must be valid usernames on the computer running IIS, or from a Windows NT domain accessible from the IIS machine. As for access control, the server is made available to only machines within the IP domain. Restricting access to a certain individual IP address can also be done. Securing data transmitted is done with Secure Sockets Layer (SSL) that provides communications via data encryption.

2.6 Development Platform

Different kinds of application will run in different platform. However, most of the application available in the market is only support one kind of platform. Following are the platform that takes into consideration:

2.6.1 Microsoft Windows NT Server

Microsoft Windows NT is one of the powerful operating systems for business computing. It combines the ease-of-use of Windows 95 with the power and reliability of Windows NT. NT is also a powerful OS that reliable, secured, multithreaded, symmetric processing, support client/server system [18].

There is an extensive security support in NT. NT can control the access control of user in accessing certain file or application. Besides, NT supports a wide range of networks protocol and Remote Access Protocol. This makes it easy for us to develop the distributed application. Windows NT Server is a complete platform available for building and hosting web-based application. It is the best platform to publish and share information securely over corporate Intranet and Internet. It is so reliable that when an application have problem it doesn't crash the whole program.

Windows NT allows Object Linking and Embedding (OLE). It can combine the information from several applications into one compound document using the special OLE capabilities of window-based application. Windows NT also enables the

capabilities of integrating applications on a single computer or even across multiple computers.

2.6.2 UNIX

UNIX is an increasingly popular operating system. Traditionally used on minicomputers and workstations in the academic community, UNIX is now available on personal computers and the business community has started to choose UNIX for its openness.

UNIX, like other operating systems, is a layer between the hardware and the applications that run on the computer. It has functions that manage the hardware and functions that manage the executing of applications. UNIX includes the traditional operating system components. In addition, a standard UNIX system includes a set of libraries and a set of applications. It includes the file system and process control and a set of libraries.

One of the greatest strength of UNIX is the consistent way in which it treats files. It is very easy for the users to work with files because users don't need to learn special commands for every new task. Besides UNIX is not known only for its longevity and versatility as an operating system, but also for the variety and number of utility programs that called tool.

2.7 Development Tools

2.7.1 Microsoft Visual InterDev 6.0

Visual InterDev 6.0 (VI) was part of Microsoft's suite of professional programming tools, known as Visual Studio [19]. Visual InterDev 6.0 is the team-based development environment for rapidly designing, building, and debugging data-driven Web applications. Unique features of VI 6.0 are:

i) RAD Environment. The new customizable IDE provides a complete set of rapid application development (RAD) tools to let professional developers design, build, debug, and deploy data-driven Web applications faster than

ever before. These include: Source code-preserving WYSIWYG page editor with full support for Dynamic HTML; Microsoft IntelliSense-enabled source code editor, which supports both Microsoft Visual Basic® Scripting Edition and Microsoft JScript™; Complete, end-to-end debugging tools for both client and server-side code; Site design and management tools.

ii.) Standards-Based Web Development. Build with integrated support for the latest W3C approved standards, including HTML 4.0, Cascading Style Sheets Level 1, ECMA-262 compatible JScript, HTML Document Object Model, and more.

iii.) Integrated Database Tools. Visual InterDev 6.0 provides a complete set of tools for integrating databases with dynamic Web applications. Database features include: Drag-and-drop binding of databases to HTML forms and reports; Database design tools for creating and modifying SQL Server databases; Complete support for Internet Explorer 4.0 Dynamic HTML data binding.

iv.) Improved Web Application Programming Model. Visual InterDev 6.0 simplifies the inherent complexities of building Web applications by providing an intuitive programming model. The programming model includes object-based, event-driven programming model for Web applications; simple, consistent programming model for both broad-reach and Dynamic HTML-based applications.

v.) Team-Based Development Support. Visual InterDev 6.0 provides support for multi-functional, team-based development efforts and integrates application components built with other tools and editors. Team support includes Local Working Mode, which allows individual developers to build, test, and debug portions of the application in isolation from the rest of the team. Optional source code control with Visual SourceSafe Improved interoperability with Microsoft FrontPage 98 Web site creation and management tool as well as the other Visual Studio tools.

vi.) Support for Enterprise Application Development. Visual InterDev 6.0 provides a range of new capabilities for building scalable, enterprise-wide Web applications. This includes full participation in the Windows Distributed

Internet Application framework, improved integration of middle-tier, reusable business components, Universal Data Access, and better integration with middle-tier services such as Microsoft Transaction Server.

2.7.2 Microsoft FrontPage 2000

Microsoft FrontPage 2000 comes as part of Microsoft's Office 2000 suite, which is another tool for creating and designing web pages [20]. It is easier application to use, and it costs a lot less than Visual InterDev. Unique feature of Microsoft FrontPage 2000:

i.) FrontPage 2000 gives users everything they need to create exactly the site they want. Users can use Dynamic HTML to animate, use Cascading Style Sheets 2.0 to wrap or layer text and images, and get just the colors they want with enhanced color tools.

ii.) FrontPage 2000 makes site management easy. FrontPage automatically fixes hyperlinks when files are renamed or moved, and 13 new management reports summarize the status of a site at a glance.

iii.) FrontPage 2000 makes creating a Web site easier than ever. FrontPage shares toolbars, menus, Themes, background spell checking, and Format Painter with Microsoft Office. FrontPage 2000 also makes adding forms and databases into sites easier than ever.

iv.) FrontPage 2000 gives Web developers ease and power. FrontPage won't reformat imported HTML code, and users can even specify how they want new code formatted. Users can quickly author in HTML view by using buttons and menu items.

v.) FrontPage 2000 allows working together easier than ever. Microsoft Office users can save documents directly to FrontPage-based Webs, and FrontPage provides check-in/check-out and workflow reports to help teams collaborate on Web content.

vi.) FrontPage 2000 is easy to own and maintain. FrontPage 2000 uses the same installer as Microsoft Office, which provides installation on demand, run from server and the ability to self-repair. FrontPage is also available in 15 languages.

Chapter 3
System Analysis

3.1 Overview

The development methodology used in the WebTV project was a combination of the waterfall model and the incremental prototyping model. The waterfall model used in the implementation of the overall WebTV project development while the incremental prototyping model will use in the development of coding and programming modules only. Figure 3.1 shows the various phase of the development of the WebTV development progress.

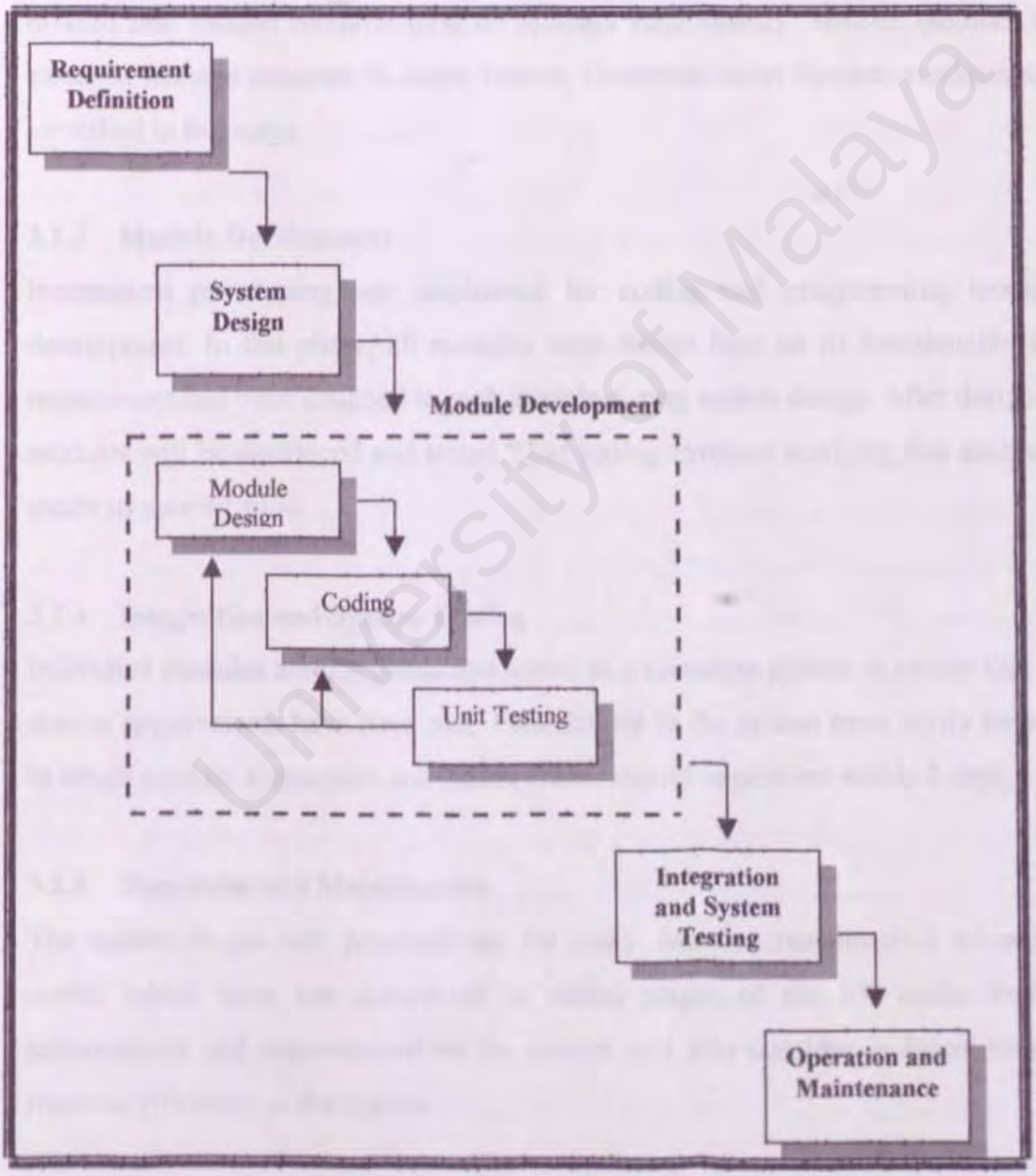

Figure 3.1 Development Methodology

3.1.1 Requirement Definition

Determine the system's services, constraint, and goals. Development tools and technology require also consider during this phase base on the information from research, study, and analysis on literature, which had been collected.

3.1.2 System Design

Overall system architecture was built up and establishes in this phase. System was divided into smaller modules base on system's functionality. Smaller modules are easier to manage compare to larger system. Communication between modules also identified in this stage.

3.1.3 Module Development

Incremental prototyping was implement for coding and programming modules development. In this phase, all modules were design base on its functionality and requirement had been assigned to each module during system design. After design all modules will be developed and tested. Unit testing involves verifying that each unit meets its specification.

3.1.4 Integration and System Testing

Individual modules are integrated and tested as a complete system to ensure that the system requirements have been met. Each failure in the system must verify belongs to which module. Correction and enhancement should implement within 3 days.

3.1.5 Operation and Maintenance

The system is put into practical use for users. Maintenance involves correcting errors, which were not discovered in earlier stages of the life cycle. Further enhancement and improvement on the system will also consider in future time to increase efficiency of the system.

3.2 System Requirement

The WebTV system requirements were determined using various method. Research and study on existing system had been done to find out how existing systems were developed and implemented. All related information collect from literature review are from reading newspaper, senior report, and article from Internet. Brainstorming is used in preparing system requirement base on the result from analysis on all information collected from literature review. System requirements for WebTV can be divided into two segments, functional requirement and non-functional requirement.

3.2.1 Functional Requirement

WebTV's functional requirements describe the services that the system should provide to fulfill the system requirements and also describe the interaction between the system and its environment.

3.2.1.1 Watching TV programs

The system should enable users watching local TV station programs using their own computer within Faculty of Computer Science and Information Technology's Local Area Network by just click on a hyperlink. The hyperlink should bring users to a web page, which Windows Media Player had embedded as an object in the page. Users should also provide a schedule about what type of TV programs will online.

3.2.1.2 Listening to music

WebTV system's users should also provide services for listening to prerecorded music on-demand from system's database, which had been listed only. In this function users can play their favorite songs or video from SQL database.

3.2.1.3 Searching

The system should allow users to search and play their favorite music in system's database. This search should enable user to determine the song or video required. The results from the database search should only provided songs or video that the users are allow to access only.

3.2.1.4 Contact

An interactive facility should provide to all system's users. Users can send some comment or suggestion to local TV station via email for example NTV7 and TV3. Users can also contact WebTV administrator for any information or provide some useful suggestion for the improvement of WebTV system.

3.2.1.5 Related links

The system should also provided extra linking to others services, which had provided by others company or organization for example CNN online and CNBC online. User should provide a list of available linking and a brief description about what type of programs provided by those organizations.

3.2.2 Non-functional Requirement

Non-functional requirements on the other hand describe the properties and restrictions on the system that limits the choices for constructing a solution for the problems. Consideration for non-functional requirements are describes below.

3.2.2.1 Reliability

Reliability is an important issue in the development of WebTV because it will greatly influence the performance of the streaming process. This system should not produce costly failure and unexpected operation when it used in a normal condition. Any disconnection should not occur during streaming process to clients.

3.2.2.2 Scalability

The scalability is to promise the capability of the system to support the increase usage of the system. Scalability in this system is maximum streaming can be done in one time. To maintenance the scalability of this system, distributed system architecture was implemented. Broadcast and encoding functionality are located in different machine.

3.2.2.3 Flexibility

The system should have the capability to take advantage of new technologies and resources. The system should be able to be implemented in the changing environment.

3.2.2.4 Usability

The system should be developed in such a way that it is easy to use. It will enhance and support rather than limit or restrict the user processes. For this requirement Graphical User Interface (GUI) will be consider as a major approach in the development of this project.

3.2.2.5 On-Time

The system should be developed within the given time frame. In this period of time, all the requirement and also testing should be completed.

3.2.2.6 Manageability

The modules within the system should be easy to manage. This will make the maintenance and enhancement works simpler and not times consuming.

3.2.2.7 Efficiency

Respond time for the system for any user request should be within a reasonable time frame for example searching song in system's database and establish connection to broadcast server. However reliability will consider as main requirement compare to efficiency because these two properties are exclusive to each other.

3.3 System Analysis

Through system analysis, tools and technology suitable for the development of this project had been determine. These tools technology include development platform, database, web server, web publish technology, streaming technology, and development tools.

3.3.1 Development Platform

Microsoft Windows NT Server 4.0 was chosen as the operating system on which the WebTV will be implemented. This operating system is selected due to its user friendliness, stability feature and it provides the NT authentication and files system that can be used in the system's data repository components. Another factor for choosing this operating system because it is less costly compared to other network operating systems.

There are several advantages for using Microsoft Windows NT compare with UNIX:

i.) There is a lot of supporting software for Windows NT especially the free downloadable option packs.

ii.) UNIX is hard to install compared to Windows NT 4.0. Sometimes it take one weeks to configure a UNIX machine but only one day to set up a NT box.

iii.) Windows NT 4.0 supports the Microsoft Back Office Product but UNIX doesn't.

iv.) To use a UNIX OS, a lot of command needs to be entered. Compared to NT, it provides user-friendly interface that eases the job of the user.

3.3.2 Database

Microsoft SQL Server 7.0 is choosing as the back end database for WebTV project. Microsoft SQL Server 7.0 is chosen for its scalability, reliability and high performance. The fact that it is designed to meet the requirement of distributed client-server computing makes it a suitable candidate for the WebTV project. Ease-

of-use is accomplished through SQL Server's graphical management tools was also one of the main factor why Microsoft SQL Server 7.0 is chosen.

There are several advantages Microsoft SQL Server 7.0 was chosen compare Oracle 8I:

i.) SQL Server is more ease-to-use system compared to the oracle database. It provides more user-friendly graphical tools for installation, configuration and administration.

ii.) SQL Server can run only on windows but for oracle the operating system will essentially become irrelevant. Oracle supports all kind of platform.

iii.) With integrated management of text, images, audio and video, Oracle8*i*'s inter-media enable customers to take advantage of the multimedia nature of the Web. For SQL, it advocates a strategy of storing non-traditional data in flat files in separate servers and linking them together using OLE-DB.

iv.) Microsoft SQL Server 7.0 tightly integrated with other Microsoft Products

- Seamless integration with Windows NT provides security, a web application environment and Microsoft Transaction Server support
- Integration with Microsoft Exchange Server provides reliable and scalable Internet and Intranet collaboration and messaging - supporting SQL server initiated trigger and store procedure-based messaging and replication of Exchange public folders.

3.3.3 Web Server

Internet Information Server (IIS) is chosen as the web server because it is bundled with Microsoft NT Server, which makes it really ease to implement even faced with a limited budget for project development cost. In a broader sense, IIS provides a comprehensive web server and web-publishing system designed especially for use with Microsoft Windows NT Server. It is also allows security feature to be implemented on specific virtual directories to control access.

3.3.4 Web Publish Technology

Active Server Page (ASP) is chosen as main web publishing technology. ASP is able to generated normal HTML file to return to user on-demand, which will increase system performance. Any changes to ASP files do not required those files to be compiled. This feature makes the development work easier. The ease with ASP files can be edit is also one of the major factors, which ASP considers as the main publishing technology.

One of the advantages ASP has over CGI is improved performance. When the browser requests for a CGI application file, the server loads the file and executes it. The application itself creates an HTML file which is then assembled into a temporary page on the server, packaged up for HTTP transmission and sent to the browser. With ASP, the browser actually references the pages it wants and the page is read into memory. However, before the page is transmitted back to the browser, the server examines the page for any scripts. The server will execute any scripts that are found only. The script can change the HTML page itself by inserting values or adding extra text or HTML codes. Once the page is ready, the server will package it up in the HTTP wrapper and sends it off to the browser.

Another drawback of CGI is the difficulty of changing program's code. Whenever a CGI program written in C or C++, for example had been changed, the program has to be recompiled for the changes to take effect. In ASP, the changes would be made in the scripting language directly in the web pages itself. Therefore, no recompilation is required.

3.3.5 Streaming Technology

Microsoft Windows Media Services 4.1 (MWMS) will be used for the streaming part. There are several driving factors encourage the usage of this technology. MWMS provided live encoding and capturing of live analog stream up to 3.5 Mbps, which is suitable for live TV programs broadcasting through LAN. It support both multicast and unicast broadcasting were also make this technology to be deployed in

this project. Another factor, which brings to its use in WebTV, is the fact that it is freeware downloadable from Microsoft web site.

3.3.6 Development Tools

Development tools can be divided into web pages development tool and Windows Media tools. For web pages development tools Microsoft Visual Interdev 6.0 was chosen for as an editor tool for the development of ASP pages because it provide more features that are helpful for ASP coding. The graphical design can be drawn easily by using Visual Interdev 6.0. It also provides the script outline as well as the toolbox and server object that minimizes the burden to build a web-application.

While Windows Media tools, which include content creation tools and content management tools are delivers along with MWMS for the development of streaming application for WebTV.

Chapter 4

System Design

4.1 WebTV System Architecture Design

The WebTV overall application infrastructure will be based on a three-tier architecture as show in figure 4.1. System architecture design for WebTV can be divided into two portions, live broadcasting TV programs and music/video on-demand.

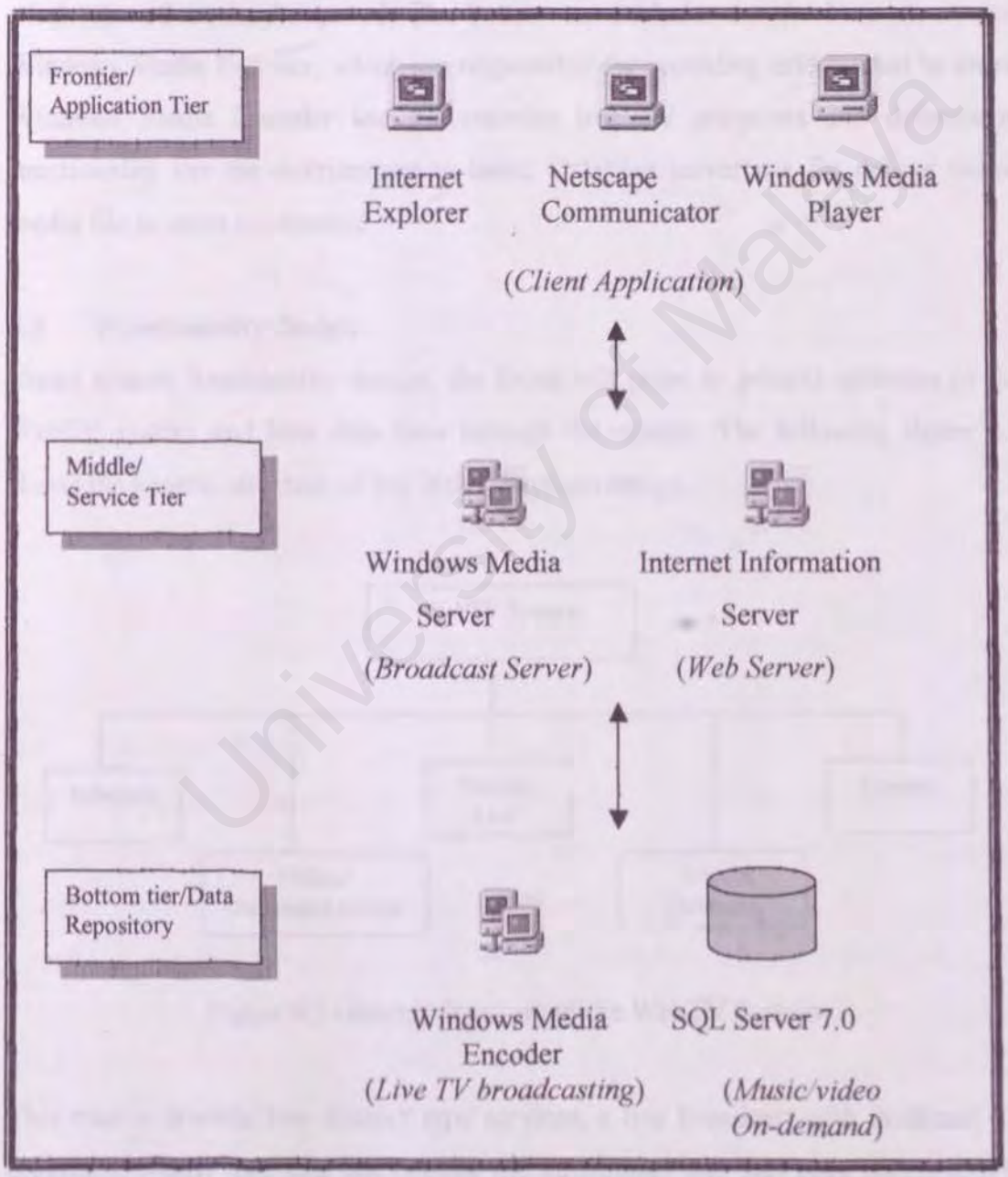

Figure 4.1 WebTV System's Architecture.

The application tier is comprised of web publishing application and Windows Media Player that will be responsible for presenting information to the users. For the WebTV system, client-side application will require a web browser (Internet Explorer or Netscape) and windows media player installed. The functionality tier will use IIS to manage web services as well as provide authentication of WebTV users. Windows Media Services use for broadcasting using unicast and multicast, which depends on what type of services required. The bottom tier includes the database server and Windows Media Encoder, which are responsible for providing information to users. Windows Media Encoder use for encodes live TV programs and delivers to functionality tier for multicasting to users. Database server use for deliver stored media file to users on-demand.

4.2 Functionality Design

Under system functionality design, the focus will point to general structure of the WebTV system and how data flow through the system. The following figure 4.2 shows the general structure of the WebTV system design.

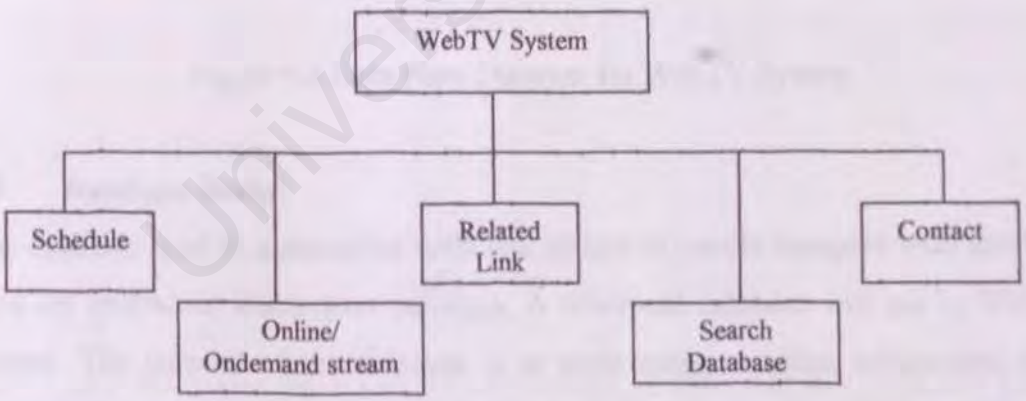

Figure 4.2 General Structure of the WebTV System.

This system provide two distinct type services, a live broadcast with multicast TV programs, which user can not control the streaming, user can only watch it. The second is user can search and play an asf file or video file from database on-demand using unicast, which user can control the stream of asf file. In other world, user can

forward, backward, pause, stop, and play an asf file using unicasting. But the disadvantage is it will consume a lot of bandwidth.

Others functionality includes a linking for user to other services provider, which similar to this system for example CNN Online. A mailing facility also provided for user to contact TV station and WebTV administrator.

Figure 4.3 show how data and information flow through WebTV system.

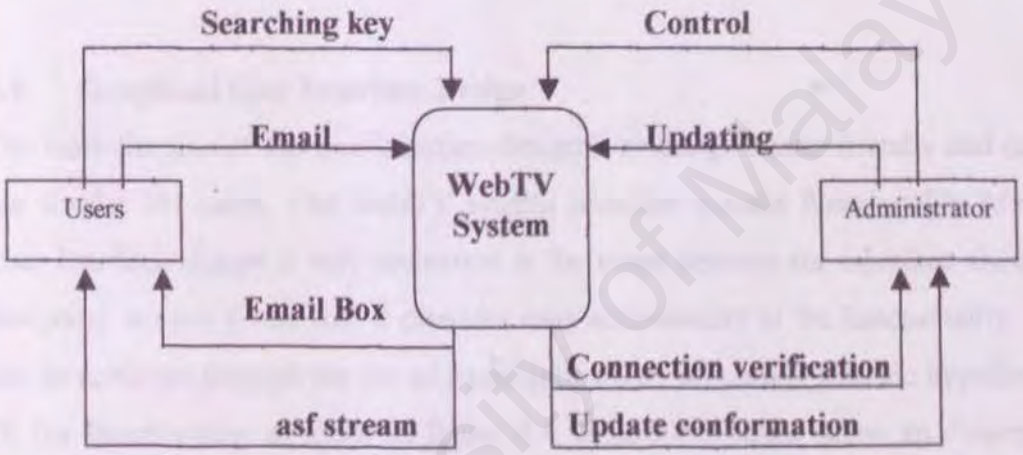

Figure 4.3 Data Flow Diagram for WebTV System

4.3 Database Design

The database used in connection with this system is simple compare with database used for trading or transaction purposes. A relational database will use in WebTV system. The purpose of the database is to store songs or video information only, which will stream to users on-demand. Database requirement was show in figure 4.2 below before transforming into relational database design. One table will be open for storing data for each entity. Table 4.1 shows the columns and equivalent data type for each column in the table.

Field	Data Type	Description
Song_ID	Char(3)	Primary key; Index key
Song_Name	VarChar(50)	Name of the song
Artiste_Name	VarChar(50)	Name of the artiste
Album	VarChar(50)	Song's album
Time_lapse	Num(3)	total time of the song

Table 4.1 Song Relation Table

4.4 Graphical User Interface Design

The main purpose of the user-interface design is to design a user-friendly and easy to use display for users. The WebTV system provides 5 main functionality to users. User Interface design is very important in the sense because the interface should be designing in such a way that it provides easy accessibility to the functionality. This can be achieved through the use of a navigation bar, which will provide hyperlinks to all the functionality as show in figure 4.4. Figure 4.5 below show an example of screen design for WebTV system interface. This design is subject to change depend on users new and useful input through process in module development, which using incremental prototyping.

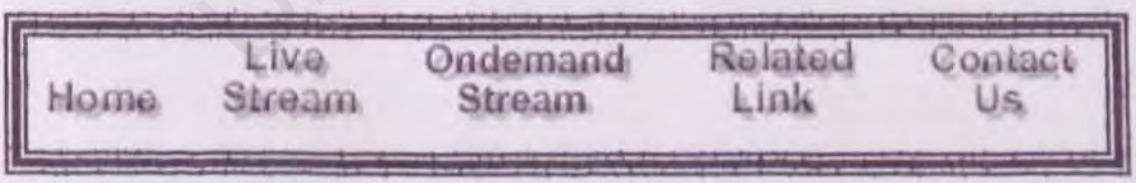

Figure 4.4 WebTV navigation bar

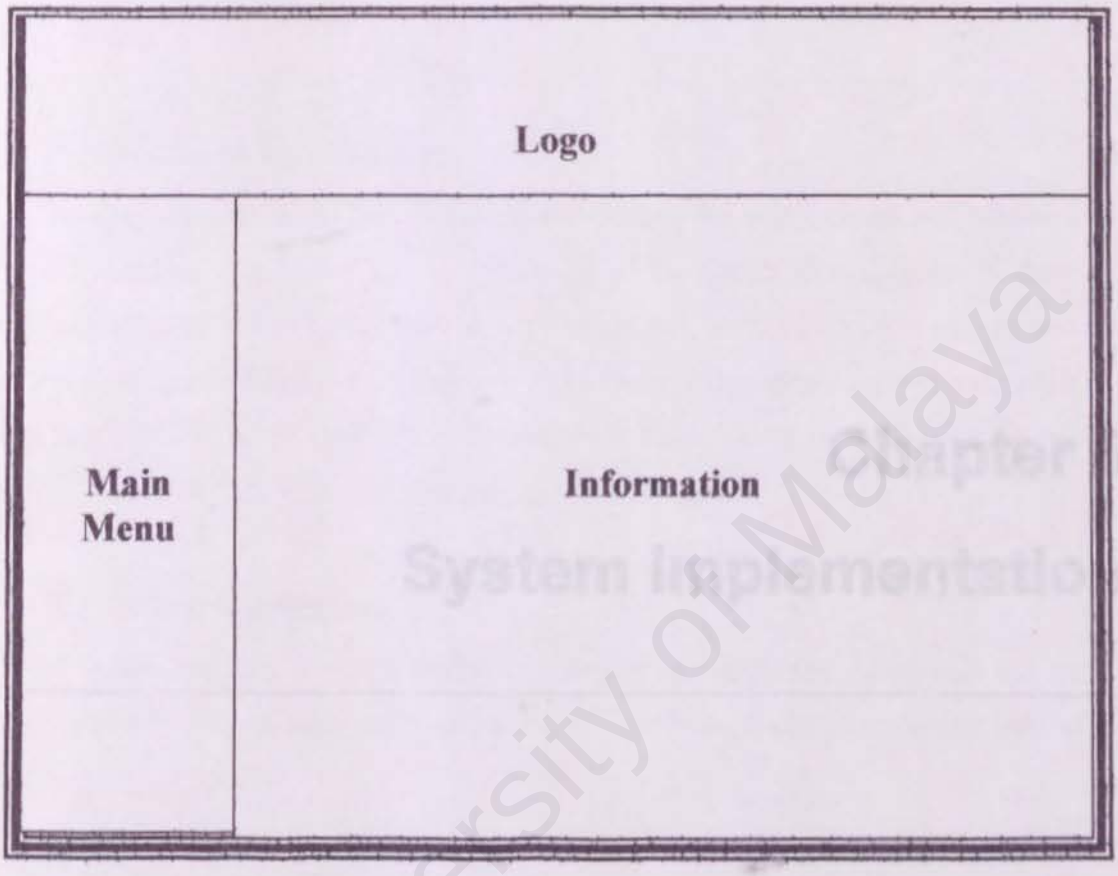

Figure 4.5 Example of WebTV screen Design

Chapter 5

System Implementation

5.0 System Implementation

Implementation is the process of developing WebTV system based on the requirements planned in the early stage and it is matched with the design architecture discussed in the previous chapter.

5.1 Development Environment

Before the development of the whole system can begins, the environment and platform for development have to be set up. As the design of the system shows, basically there were three parts that had to be implement, application tier, services tier, and bottom tier. These three components had to be set up in a way to ensure they could support each other without any conflict. Setting up of the development environment was time consuming and difficult because lack of knowledge about the installation.

5.1.1 Hardware Installation

Hardware installation was the most initial step before any development process can be proceeds. Preparation and installation of hardware requirement was an important step to make this system a success.

WebTV is a hardware dependent system because this system required encoding live television programmes broadcast from local television station, converting media files, provided multiple multicast streams to clients, and supported multiple requests of unicast streams from clients.

5.1.1.1 LOD1

Two machines are used for the development and implementation this system. The first machine named LOD1, which was configured as Primary Domain Controller is single process base machine. LOD1 was an Intel base machine running on Pentium II 233Mhz with 10.2 GB of hard disk and 192MB of SRAM. This machine was setup for the installation of Windows Media Services broadcast server, SQL Database server, IIS web server, and others development tools such as Microsoft Visual InterDev.

5.1.1.2 LOD2

LOD2 was configured as the Backup Domain Controller for LOD domain. This machine was also Intel base machine running on two unit of Pentium III Xeon 800Mhz processor with 18.2 GB ultra SCSI hard disk and 256 MB of SRAM. A powerful machine was required for encoding and converting of media file or live event to active streaming format. LOD2 was setup for the installation of converters, Windows Media Encoder, and for storing media files. This machine was used to provide services for LOD1 such as encode live television programmes and convert all media files for the LOD1.

5.1.1.3 Capture Card

Capture card was required in implementing this project. It was used to capture live television programmes broadcast from local television station. For this project, Winnov video capture card was chosen because of it provide high quality of video capture and interoperate with existing system equipments. This card was installed in LOD2 because encoding of live event such as television programmes required powerful processor to maintain server performance.

5.1.2 Software Installation

After the installation of hardware, software installation was started to build up a complete platform for the development WebTV system.

5.1.2.1 Operating System

The first phrase to set up the developing was to install and setup the Windows NT Operating System. This process began with formatting the hard disk of the computers to NT File System (NTFS) to provide more security feature supported in Windows NT 4.0. The Windows NT Server 4.0 was then installed using CD ROM. After the installation completed, the hardware specification was configured in Windows NT. After that, the network setting and info was setup in Windows NT. This included Domain Name (LOD), computer name (LOD1), IP address, gateway, DNS etc. Next the service pack 6.0 (SP 6) was installed after the installation of service pack 3.0 (SP 3). Finally the Server Option

Pack 4.0 was installed into the computers. After numerous restarts, the server was up and ready.

5.1.2.2 Web Server

As WebTV is a web-based application, a web server is needed. Internet Information Server (IIS) is used as the web server for the system. IIS 4.0 was installed during the installation of NT Server Option Pack 4.0. After that a web site is created using the Management Console of the IIS. This web site would be used for accessing Inventory Control System application. The application was set to use the port number 80. The proper security, user rights and operators were set up. By using the Windows NT's User Management, one user account was created to provide access rights to the WebTV files.

5.1.2.3 Broadcast Server and Supporting Tools

After the installation of Windows NT server 4.0 and the service pack 6.0, this has provided a suitable platform for installing Windows Media Services 4.1 (WMS). WMS is the core of this system. Windows Media Tools, which include Windows Media Encoder, Windows Media Author, and Windows Media Indexer, are supporting tools to WMS also installed into the server after the installation of WMS.

Windows Media Services provide the ability to stream multimedia content in .asf or .wma format over networks that range from low-bandwidth, dial-up Internet connections to high-bandwidth, local area networks. WMS do provided the ability to create an IP multicast station and unicast publishing point using multicast station and unicast publishing point function in the Windows Media Administrator in the main menu.

5.1.2.4 Database Server

MS SQL Server 7.0 is the main database for the WebTV system and the only database for song information for the WebTV system. MS SQL Server was then installed on the Windows NT Server, which previous created. After that, all the storage required was created in the server using MS SQL Console Manager. One table named song would be needed by the application according to the design mentioned in the design section.

5.1.2.5 Development Tools

Finally stage in building up the development environment was setup all necessary development tools in the development server. Development tools such as Microsoft Visual InterDev was installed for the requirements of create dynamic ASP and normal HTML web pages. On the other hand, converters like VCDGear and Sonic Foundry Stream Anywhere were installed for the converting of movie files in VCD format into .asf format in order to stream through network using WMS. TMPGEnc and Nero Burn Rom were installed for the creation of VCD.

5.2 WebTV System Implementation

The development of WebTV System was implemented module by module. Each module was developed and tested separately. After that all modules were combined and integrated to form the system. The following lists the implementation of each module in detail.

5.2.1 Coding and Programming Module

The methodology used in the development of the WebTV system is the incremental prototyping methodology. For the coding module, a prototype was created and tested. This prototype only had basic functions of the module. After that, testing and improving on prototype process is repeated until a functional and precise prototype is created. Finally all the prototypes were combined and integrated to form the final application.

5.2.1.1 Active Server Pages Script

ASP is the only database programming language use to create dynamic web pages for this system. By default, VBScript is the chosen language for scripting ASP. But it is still perfectly legal to mix languages, as long as they are properly specified for each section of code in the application's page (web page).

There are three unique ways to indicate that blocks of script are to be executed on the server (that is the server-side code). One method is to surround the scripts with the <%

and %> tags. In this case, any text between these tags is treated as server-side scripting commands, based on the language defined at the beginning of the Active Server Page. In addition to specifying scripts to execute on the server, one can clearly indicate variables that are to be replaced by actual values by using the <%= *variable* %> syntax. Finally, because it is possible to create subroutines within the Active Server Pages just like with client scripts (JavaScript), ASP programmer can specify blocks of code using the <SCRIPT> tag, as long as the tag contains the **RUNAT=SERVER** attribute. Otherwise, that block of code will be run at client-side.

5.2.1.2 Interface

Interface is very important in presenting information to users. An attractive and user-friendly interface can reduce the time for users to understanding the system functionality provided. To ensure the appearance of each page is consistent and coherence, each page is following the same structure of interface base on the template created. Table was using in developing the template for this system. Figure 5.1 below shows the interface template code for this system. Figure 5.2 shows output of the interface template.

```
<HTML>
<HEAD>
<TITLE>WebTV</TITLE>
//JavaScript put here
</HEAD>
<BODY>
<div align=center><img style="width: 600px; heigh: 75px" src="logo.gif" ></div>
<table width="100%" border="0" height="403">
  <tr>
    <td width="8%" valign=top align=middle>
    <!—Home→
    <!—Live stream→
    <!—On-demand stream→
    <!—Related link→
    <!—Schedule→
    <!—Contact us→
    </td>
    <td width="82%" valign=top>
    Other information
    </td>
  </tr>
</table>
</BODY>
</HTML>
```

Figure 5.1 Interface templates for WebTV.

Figure 5.2 Output of interface template

5.2.1.3 Embed Windows Media Player

Windows Media Player (WMP) is used to receive any unicast or multicast stream from the system. WMP can be insert into a web page as an object using the template coding in figure 5.3:

```
<BODY>
...
<OBJECT id= mediaPlayer
codebase="http://activex.microsoft.com/activex/controls/mplayer/en/nsmp2inf.cab#Version=6,
4,5,715"
classid=CLSID:22D6f312-B0F6-11D0-94AB-0080C74C7E95 high=... width=...
type=application/x-oleobject STANDBY="Loading Microsoft® Windows Media&#8482;
 Player components...">
<PARAM NAME="FileName" VALUE="source file name">
<PARAM NAME="ShowControls" VALUE="1">
<PARAM ...>
...
<EMBED TYPE="application/x-mplayer2"
pluginspage="http://www.microsoft.com/Windows/Downloads/Contents/Products/MediaPlayer
/"
src="Source file name"
Name=MediaPlayer
showcontrols=1
...
High=...
Width=...>
</EMBDE>
</OBJECT>
...
</BODY>
```

Figure 5.3 Template for embed W.M. Player into a web page

5.2.1.4 Database Connection

The coding for making connection to SQL server database is simple because DSN was using to create an ODBC connection to database. The template coding used for making connection to database is stored in DataStore.asp file. Figure 5.4 below was the template coding for connecting to database.

```
<%
strConnect = "DSN=Data source name; uid=User ID; pwd=User password"
%>
```

Figure 5.4 Template for making database connection

5.2.1.5 Query String

This template was coded to enable user to make a query to the database with the users' input criteria. This template provided two options for user to search for any songs available in the song table from the WebTV database, the first one is search by song name and second is search by artist name. Figure 5.5 below was the template for creating selection criteria base on users' input.

```
// searchItem and searchKey was retrieve from user input

DIM searchItem, searchKey, strSearchstring, objCommand, objRS, strOutput
searchItem=Request.QueryString(User input)
searchKey= Request.QueryString(User input)

If searchItem="Condition" then
    strSearchstring="WHERE Table Field=" & "'" & searchKey & "'"
else
    strSearchstring="WHERE Table Field =" & "'" & searchKey & "'"
end If
```

Figure 5.5 Template for create selection criteria

Figure 5.6 shows the template for creating SQL statement from the selection criteria created from Figure 5.5.

```
set objCommand=server.createobject("ADODB.Command")
objCommand.ActiveConnection = strConnect          //Database connection string

objCommand.CommandText = "SELECT Item " & _
                         "FROM Table name " &_
                          Selection criteria

objCommand.CommandType = adCmdText
set objRS = objCommand.Execute
```

Figure 5.6 Template for create SQL statement

5.2.1.6 Output String

Table was use to present data retrieve from the database after the execution of SQL statement. Table is chosen because it has the ability to make the appearance of the pages look more attractive. Figure 5.7 was the template code for creates a dynamic table.

```
<%
strOutput = "<TABLE BORDER=0 cellspacing=10 cellpadding=5>" &_
        "<TR bgcolor=#0e8bff WIDTH=""100%"">" &_
        "<TD WIDTH=""50%""><B>Field name</B></TD>" &_
        "<TD WIDTH=""50%""><B> Field name</B></TD>" &_
        ...
        "<TD WIDTH=""50%""><B> Field name</B></TD></TR>"

 While Not objRS.EOF
  strOutput = stroutput & "<TR bgcolor=lightskyblue>" &_
  "<TD> " &objRS("Field name") &"</TD>" &_
  "<TD> " &objRS("Field name") &"</TD>" &_
  ...
  "<TD> " &objRS("Field name") &"</TD></TR>"
  objRS.MoveNext
 Wend

 strOutput= strOutput & "</TABLE>"
 Response.Write strOutput
 objRS.Close
 set objRS = Nothing
%>
```

Figure 5.7 Template for create dynamic table

5.2.1.7 ASX Metafile

An ASX metafile is an .asx file that provides information that Microsoft Windows Media Player uses to receive unicast streams, multicast streams, and other supported media from an intranet or the Internet. Some of the ASX metafiles was created automatically after the multicast station was created. In order to provide on-demand stream to client, ASX metafiles were created base on the template code show in figure 5.8 below.

```
<ASX version = "3.0">
    <Title>Title</Title>
    <Entry>
    <Ref href = "mms://server name/sub folder/title_1.asf" />
    </Entry>
    <Entry>
    <Ref href = "mms://server name/sub folder/title_2.asf" />
    </Entry>
    ...
    <Entry>
    <Ref href = "mms://server name/sub folder/title_n.asf" />
    </Entry>
</ASX>
```

Figure 5.8 Template for create ASX metafile

5.2.2 Media Files Module

This was a very challenging module because it required a lot of research and understanding in MPEG standard. It required 5 main converters such as Windows Media Encoder, VCDGear, Sonic Foundry Stream Anywhere, TMPGEnc, and Xing MPEG encoder to convert media file to the active streaming format.

5.2.2.1 Converting .dat (VCD) to .asf

VCDGear and Sonic Foundry Stream Anywhere required in converting VCD file format (MPEG 1) to active streaming format (MPEG 4). First, VCDGear was used to convert .dat (MPEG 1) file format from VCD into .mpg (MPEG 1) file format and store into hard disk. Steps to convert .dat file format from VCD into .mpg file format are listed follow.

1. First insert VCD into CD ROM and activate VCDGear program.
2. Select converting type to **.dat to .mpg.**

3. Click **load button**, to chose the source file from mpegv folder in VCD. After that set the destination for store the file.
4. Click the **start button** to start the process. Finally, after about 10 minutes .mpg file was created from the VCD and can be found in the destination path.

After that, Sonic Foundry Stream Anywhere was used to convert .mpg file format into .asf file format. Steps to converting .mpg file format to .asf file format were:

1. Go to **File** menu and click on **Add/Open.**
2. After that chose the source file, which created previously using the VCDGear and wait for a few seconds for the program loading the media file.
3. Next go to **File** menu again and click on **Save media file as...** in the **File** menu.
4. A **dialog box** will pop out. Select the **Windows Media Format** check box and insert the path and source files name into the **Source** box. After that, insert the destination path for storing the .asf file.
5. Select the desired **bandwidth** for the .asf file from the list provided. For high quality streaming, 250 kbps and above are suitable. For conserving network resources, 56 kbps and below should be selected.
6. Then click **OK button** to close the **Dialog box.** Converting process was started after closing the **Dialog box.** Wait about 25 minutes for completing the process
7. Finally, desired .asf file format was created from the .mpg file format.

The Converting process can simplify in figure 5.9.

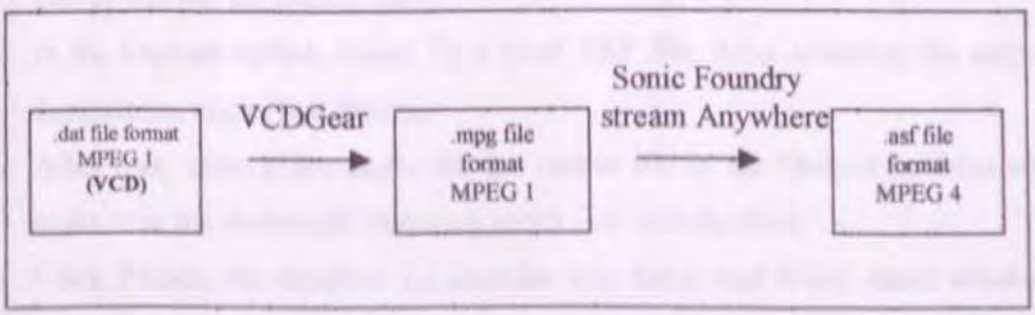

Figure 5.9 MPEG 1 to MPEG 4 converting process

5.2.2.2 Converting .mp3 to .asf

This converting process was relatively simple because it involve audio file only. One converter only required in this process. Windows Media Encoder (WME) was use in converting .mp3 file format to .asf file format. This encoder can also provided the ability to convert .avi and .wav file format to .asf file format. WME must be configured to create and stream Advanced Streaming Format (ASF) information. WME provided three type of configuration method:

1. **QuickStart** to create a new .asd file from a live source.
2. **Templates** to create a new .asd file from either a live source or a stored content file.
3. An option to **customize** a new .asd file to custom specifications.

The template method was used in configure WME. Steps to configure WME using the template.

1. On the **File** menu, click **New**.
2. In the Welcome window, select **Template with Input/Output** Options, and click **OK**.
3. In the **Compression and Formats** screen, choose **56 ISDN Audio** as the template stream format for this session, and then click **Next**.
4. In the **Input Settings**, Input Source screen, select **AVI/WAV File**, and then click **Next**.
5. After **AVI/WAV File** was selected, A **Dialog box** will ask for the source file. Click **Next** to ignore this massage to the **Output option dialog** because source file can be specify later.
6. In the **Output option,** select **To a local ASF file.** After selecting the output destination, click **Next** Button.
7. After that, enter a **file name** for the output file in the **Output settings** and make sure the Automatic Indexing check box was checked.
8. Click **Finish,** the template for encoder was finish and WME **Start window** appears again.
9. On **start menu**, click on **Input File** for enter source file to the encoder
10. On the **Encode** menu, click **Start**. WME starts encoding the ASF stream.

11. On the **File** menu, click **Save** or **Save as**, and type in a file name for example "song". After that click **Save** to save the configuration to an .asd file.

* **For more information about how to edit, join, and cut media files, please refer to Appendix B. Appendix C shows how to create a Video CD.**

5.2.3 Broadcasting Module

This module was required to build up three multicast stations and three unicast stations for WebTV to broadcasting services to the client using WMS.

5.2.3.1 Creation of Virtual Directory

Before any broadcasting station created user must be able to this system from their PC attach to the LAN, a virtual directory named webtv had been created in the IIS web server using Internet service manager. The virtual directory is corresponds to the actual directory where all the system pages are found. This directory has read and executes rights only. Another virtual named ASXRoot had also created to store all .asx files, which use for redirect the connection to a particular stream. The creation of this virtual directory enables users to receive unicast streams, multicast streams, and other supported media from the system.

5.2.3.2 Multicast Station and Unicast Publish Point

After complete the installation of all related server, three multicast stations were created to provide multicast streams on live television programmes, movie files, and audio files over the network. Following was the general procedure to create new multicast station using multicast station QuickStart wizard:

1. In the Windows Media Administrator menu frame, click **Multicast Stations**. The Multicast Stations page appears. After that select the **Use wizard to create new station** check box
2. Click **Stations**, and then click **New**. Configure and Publish Multicast Broadcast Streams QuickStart wizard appears.

3. On the **Select a station** screen, select **Create a new station**.
4. On the **Create a new station** screen, type a name and a description for the station, then select **Multicast mode**.
5. On the **Specify a program and stream name** screen, type a name for the program in **Program Name** and a name for the stream in **Stream Name**. Two program options were provided:
   - Select **Start program once wizard is finished** to make the program immediately available for viewing after the station is created.
   - Select **Replay stream objects once finished (loop)** to play the program repeatedly after it is started.
6. Select and configure a stream source for the multicast station.
   - On the **Specify a source for the stream object** screen, select a source for the stream.
   - On the **Specify a source URL for the stream object** screen, type the URL to the stream source.
   - On the **Specify stream format information** screen (or screens), specify the path to the stream source so its stream format information is added to the station definition.
7. Store the multicast station information file (**.nsc file**) in virtual directory, webtv. Created using Management Console of IIS that can be accessed by Microsoft Windows Media Player.
   - On the **Export path for the station information file** screen, type the path to the .nsc file storage location.
   - On the **Station information file URL** screen, specify the URL or **UNC** path that Windows Media Player will use to access the stored .nsc file.
8. On the **Select publishing method** screen, select the methods for publishing the stream. After that, select **create an .htm file containing <OBJECT> and <EMBED> tag for the Microsoft Media Player**.
9. On the **Ready to publish** screen, review the list of options you have selected. To edit any of these, click **Back** once or more to return to the appropriate station information. If every thing all right, this station was created successfully.

Three Unicast publishing points were also created to provide on-demand and interactive stream to the client. Unicast publish point QuickStart wizard also provided by WMS. Following was the general procedure to create a new unicast publishing point:

1. In the Windows Media Administrator menu frame, click **Unicast Publishing Points**. After that select the **Use wizard to create new broadcast unicast publishing point** check box
2. Click **Broadcast**, and then click **New**. Configure and Publish Unicast Broadcast Streams QuickStart Wizard appears.
3. On the **Select a publishing point** screen, select **Create a broadcast publishing point**.
4. On the **Specify source** screen, select the source content. On the **New broadcast publishing point to a (the source for the broadcast content that previous selected)** screen, type an alias for the new broadcast unicast publishing point in the **Alias** box. Then type the path in the **Path** box. If Windows Media Encoder is the source for the broadcast, verify the value in the **Port** box is correct.
5. On the **Select publishing method** screen, select the desired publishing protocol. In this project, UDP protocol was selected. Then, select the publishing options that Microsoft Windows Media Player uses to access the live content from your broadcast unicast publishing point.
6. On the **Ready to publish screen**, review the list of options that you have selected. To edit any of these, click **Back** once or more to return to the appropriate on-demand unicast publishing point information. If every step is correct, a new unicast publish point was successfully created

5.2.3.3 Television Broadcasting

WebTV, as implies by the title, live television broadcasting was the main service for this system. Two machines were required for the implementation of live television broadcasting. LOD2 was used for capture and encode live television programme into active stream format. LOD1 was used to retrieve the unicast stream from LOD2 and then multicast the stream out through the network.

First, to capture the live television programme, Winnov capture card must be configured. Configuration for capture card was simple. First, start the Winnov capture program. On the File menu, click Winnov configuration. After that, specify the audio and video input for the event, which wanted to capture. For WebTV system setting, video input was set to Composite input and audio input was set to Aux input.

There are two phases in setup live television broadcast. The first phase was configured Windows Media Encoder (WME) to capture and encode live event. As discuss in previous section, template method configuration was chosen in configuring WME.

1. On the **File** menu, click **New**
2. In the Welcome window, select **Template with Input/Output** Options, and click **OK**.
3. In the **Compression and Formats** screen, select **512 video** as the template stream format for this session, and then click **Next**.
4. In the **Input Settings**, **Input Source** screen, select **Live source**, and then click **Next**.
5. **Capture Source** screen will ask for capture device to use. Chose **default** capture device because one capture card only installed in LOD2.
6. In the **Output Settings**, **Output Options** screen, select To **Windows Media Server over network**, click **Next**.
7. In the **Transmission** screen, select **Allow Remote Server(s) Connection** and initial **MSBD Port** to 1111. Default port was 7007.
8. Click **Finish**. The Windows Media Encoder **Start window** appears. On the **Encode** menu, click **Start**. Windows Media Encoder starts encoding the ASF stream.
9. On the **File** menu, click **Save** or **Save as**, and type in a file name for example "television". After that click **Save** to save the configuration to an .asd file.

The second phase was required to create a multicast station using Windows Media Services. This station was used to retrieve unicast stream, which was the live television

programme stream created in LOD2. Following steps show how to create a live television multicast station using Windows Media Services.

1. In the Windows Media Administrator menu frame, click **Multicast Stations**. The Multicast Stations page appears. After that select the **Use wizard to create new station** check box
2. Click **Stations**, and then click **New**. Configure and Publish Multicast Broadcast Streams QuickStart wizard appears.
3. On the **Select a station** screen, select **Create a new station**.
4. On the **Create a new station** screen, type a name and a description for the station, then select **Multicast mode**.
5. On the **Specify a program and stream name** screen, type **Television** in **Program Name** and **Television Multicast Stream** in **Stream Name.** After that, select **Start program once wizard is finished** to make the program immediately available for viewing after the station is created.
6. On the **Specify a source for the stream object** screen, select **Windows Media Encoder** as the source. Click **Next.**
7. On the **Specify a source URL for the stream object** screen, type **mdbd://LOD2: 1111** as the URL to the stream source.
8. On the **Specify stream format information** screen, select **standard configuration in the Windows Media Encoder**.
9. On the **Export path for the station information file** screen, type **C:\InetPub\wwwroot\Station1.nsc** for the as the path to the .nsc file storage location.
10. Next, on the **Station information file URL** screen, type **http://LOD1/Station1.nsc** for Windows Media Player will use to access the stored .nsc file.
11. On the **Select publishing method** screen, select **create an .htm file containing <OBJECT> and <EMBED> tag for the Microsoft Media Player**.
12. On the **Ready to publish** screen, review the list of options that have selected. Click **Finish** to end up this session.

Figure 5.10 below shows the simplify procedure for creating live television multicast station using Windows Media Encoder and Windows Media Services.

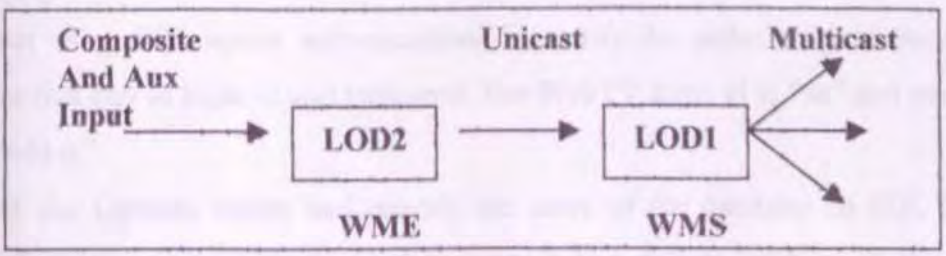

Figure 5.10 Live television multicast station setup process.

5.2.4 Database Module

One database named webtv was created using Ms SQL server. Before connecting to data source like Ms SQL server, a DSN is needed in order to open connection to the database server. DSN is a method of standardizing database connectivity. There are two types of DSN: System DSN and User DSN. A System DSN tends to be more convenient but less secure than a User DSN. If multiple users are using the same client computer and there is a need to hide the existence of the data source from some of the users, User DSN will do the trick.

Step to create a webtv DSN

1. On the **Start** menu, click **Settings**, and then click **Control Panel**. (In earlier versions of Windows, select **Control Panel** from the Main program group.)
2. Double-click ODBC to open the driver manager's user interface, the ODBC Data Source Administrator.
3. Click the **System DSN/User DSN** tab. After that click **Add**.
4. From the installed ODBC drivers list, select **SQL Server** and click **Finish** to bring up the **ODBC SQL Server Setup** dialog box.
5. Insert the data source a name, for webtv system the data source named webtv was using.

6. Next enter the name of the SQL Server in the **Server** box, which is LOD1. The SQL Server should have the same name as the Windows NT-based computer on which it is running.
7. Select using SQL server authentications for verify the authenticity of the logon id. After that key in login id and password. For WebTV login id is "sa" and password is "good4us"
8. Click the **Options** button and provide the name of the database on SQL Server to which database administrator want to connect as a default database, in this case the default database is **webtv** and database file name is webtvdb.mdf.
9. At the bottom of the dialog box is a check box called **Convert OEM to ANSI Characters**. Click **OK** to return to the **ODBC Data Source Administrator** dialog box, and click **OK** again. Finally the Data Source Name called webtv had created.

Chapter 6
System Testing

6.0 System Testing

Testing provides a method to uncover logical error and to test the system reliability. The main objective of testing is to examine the system for correctness, accuracy, completeness, and reliability. The procedures for testing this system are carried out in stages. The stages involve can be categorized into unit testing, module testing, and integration testing.

6.1 Unit Testing

Unit testing concentrates on the smallest component of the system for testing. Every individual components developed in a system are tested independently, without other system components, to ensure that they operate correctly. These components might be performing tasks such as checking the ability of multicast stream to route other network, check the quality and performance of the stream, checking the connection of database server, etc.

6.1.1 Multicast and Unicast Streaming Testing

The purpose of streaming testing was wanted to determine either all multicast and unicast stream could reach to other network. This testing was required to carry out in the network other than 202.185.109.*, such as 202.185.107.*, 202.185.107.*, and 10.100.1.*. In order to implement this testing, every lad in Faculty of Computer Science and Information Technology, such as Makmal Micro I, Makmal Micro I, Makmal Boolean, and etc were chosen as the testing platform.

Windows Media Player (WMP) is the testing tool in implement this testing. WMP was used to receive any multicast and unicast streaming, which available from WebTV system. There are two types of testing needed to carry out.

1. To test multicast stream.

   Type in the URL such as **mms://202.185.109.170(or lod1)/*station_name*.nsc** in the **Open Windows**

2. To test Unicast stream.
   Type in the URL such as **mms://202.185.109.170(or lod1)/*file_name*.asf** or **msbd://202.185.109.168(or lod2):*port number*** in the **Open Windows**

The quality of the stream was also evaluated during this testing. In addition, the performance, which was the time need to receive and start playing the stream was also include in this testing process.

6.1.2 Database Connection Testing

The purpose of database testing was to make sure data could retrieve from data store in LOD1. Performance and correctness for the database to make a connection and retrieve data was the key feature in this testing. Same as streaming testing, database connection testing was carried out in other network. Web browser was the testing tool for testing database connection.

To test the accuracy of the data retrieve from the database, song name was type in the box provided in the web page. After that, the data return from the query was check for the correctness and the linking provided could be function. Performance of the database connection base on the time needed for retrieves data.

6.1.3 Interface Testing

In the WebTV system, the interface plays an important role in ensuring that the users are able to navigate and interact with the system. The interface is tested for user-friendliness. This is accomplished by asking some users to test out the interface.

The testing performed by observing users reaction while users navigate and using the system. Later evaluation was made to determine the level of user friendliness base on user feedback and total time consume for users to understand the function provided. This will also enlighten the problems associated with the interface.

6.2 Module Testing

A module is a collection of dependent components, for example, the query form in HTML and the SQL statement generator which the latter unit must receives data from the former unit in order generate the SQL statement. A module encapsulates related components so that they can be tested without other system modules.

Module testing involves integrating all the interfaces in the WebTV system into a main interface to ensure that all components can be functional and interacts with each other correctly. This testing was carried out by checking all hyperlinks on each page is functional properly to ensure that the path provided is legitimate. Interactions between one page and another are also tested to ensure that the information provided is display correctly to client.

At this time, an isolated performance test was also carried out on the broadcasting module in WebTV system. This test was to ensure that the Windows Media Player, which embedded in the web page could provide to services for client to receive multicast and unicast stream. For example, when a user click on the television, songs, or movie button. The Windows Media Player embedded in the web page should be able to connect to broadcast server to retrieve the stream that user had selected. The performance test was base on the time taken for buffering and play the stream. The time taken should be in a reasonable range, which was in between 15 to 25 seconds.

6.3 Integration Testing

When all modules were tested and satisfied the requirements, they were integrated into the whole system. During the integration, integration testing was carried out in order to ensure the components of the system would support each other. The objective of integration testing were as following:

- Compare the whole system with the functional and non-functional requirement.
- Detect any fault or bugs in the integrated system.

- Exam the correct flow of the integrated system.

The development of the WebTV System is divided into modules and then all the modules are integrated as one main system. Therefore the bottom up approach is the most suitable integration testing method.

At the beginning of the WebTV system integration testing, all the modules are added to the main interface. After that, try to access each module from the main interface. If there were no errors occur, this testing proceeds by switching from one module to another module. This is done by using the as Hoc technique.

During integration testing, if errors appear, then the module that goes wrong is identified. The input and output values that cause the errors are used in module testing after the particular module is amend.

6.4 System Testing

After the integration testing, a final overall system testing is carried out. This test covers the performance, reliability, accuracy, and other criteria. A testing team, which consist the developer and 4 users are required to carry out the system testing.

First, the team member will access the system from different network at the same time. This will determine its ability of the system to support concurrent users to access the resources of the system. Next, the 4 users were asked to test the system without any instruction or guideline from the developer to determine the level of user-friendliness of the system. Any errors occur during the testing process will jotted down and the developer will try to solve the errors.

Chapter 7
System Evaluation

7.0 System Evaluation

7.1 WebTV Achievement

This section will discuss about the successful achievement of the project. The success of the achievement was base on the requirement of this system.

7.1.1 Multicast and Unicast Services

This system had the ability to provide multicast streaming service for live television broadcasting and pre-recorded media files to computer users through LAN. A part from that, value added services such as, Video On-demand (VOD) and Music On-demand (MOD) also provided as extra services to the users. In conserving network resources, the maximum bandwidth for on-demand streams was set to maximum 56 kbps.

7.1.2 Informative Services

As an informative system, this system does provide extra linking to other web site such as, CNN online, Dvrplayer, etc. Brief description about those extra linking was also provided for the user to make a better choice, which can fit their needs. In addition, extra linking to local television schedule such as, TV3 and NTV7 was also provided. With this addition service, users could know when will their favourite television program on air.

7.1.3 Interactive Services

Mailing service was provided to the users as a consideration for caters users, who need to interact with the system. Mailing address and email address for contact WebTV administrator and local television station such as TV3 and NTV7 were provided. Users can post their comments or advice to WebTV system administrator, TV3, or NTV7 via email or traditional mail. This service had makes become an interactive system.

7.1.4 User-friendly Services

As a consideration of system requirement, the interface for this system was designed as simple as possible to achieve the user-friendly requirement, but still maintain the interactive elements from the users point of view. To achieve this requirement animated graphic was used in the design and development of the web page. However, to maintain the performance for loading the pages, all graphics was store in .gif file format and the file size were less than 2.0k.

7.2 System Evaluation

Evaluation is an important phase in development of any project as it allows one to review the overall system in many aspects. This will provide the opportunity for improving the skill and knowledge for the future development of the project. The evaluation of the WebTV system is stated in the following section.

7.2.1 Strength

This system although does not have powerful features to some extent, still has some strength of its own.

7.2.1.1 High Scalability

The WebTV system is highly scalable. The system has scalability in which it is possible to add more hardware and software easily to the WebTV in future. The Windows Media Services broadcast server, IIS web server, SQL server, and Windows Media Encoder does not have to be place in the same machine, makes it possible to split and implement this system using dedicated machine.

7.2.1.2 Wide-accessibility

The WebTV is deployable on the LAN of University of Malaya. This has provided wide-accessibility to users in that users can access the WebTV virtually from anywhere

in the Campus. Client side software only required the installation of web browser and Windows Media Player 6.4 or later to access the stream.

7.2.1.3 Loosely Coupled

The WebTV is loosely coupled due to its three-tier architecture. It is not dependent on the implementation of any one of the tiers. For example, the existing SQL server on the bottom tier is replaced with an Oracle server, this will not require any changes on the presentation tier and only minor changes have to be implemented in the coding to reflect the changes made in the middle tier. This has provided flexibility in implementing future application or business solutions.

7.2.1.4 Simple and User-friendly Interface

This system is design to be simple and user-friendly from the very first beginning. Windows, icon, menu, and pointer techniques are used extensively during the design of this WebTV system. User should be able to navigate through the web pages by simply pointing and clicking to the icon from the list in the menu provided.

7.2.1.5 IP Multicast Enable

The ability of the broadcast server, Windows Media Services to provide multicast function is the fey factor to making the success of the WebTV project. With this technology, live television, movie files, or any pre-record media files can be stream over multicast enable network with minimum bandwidth consumption.

7.2.1.6 Interactive System

The ability of Windows Media Services to provide unicast function has made the system become an interactive entertainment system. With unicast stream, users have the right to control the stream. Users can pause, fast forward, backward, jump to next or previous track of that stream. Interactive also provided in the sense of this system allow

users to contact with either television station such as TV3 and NTV7 or WebTV administrator.

7.2.2 Limitation

Despite some of the system strengths mentioned previously, there are limitations, which cannot be handle and researched.

7.2.2.1 Limited Selection of WebTV programme

The selection of television channel is only limited to local television programmes only for example TV3 and NTV 7 only. The movies and songs provided also limited to few movies only because this system to build is to show ability of the streaming pre recorded movie files (VCD) and audio files (MP3) over IP network using streaming technology only. Copyright issue is also one of the boundaries of this system.

7.2.2.2 Version of Windows Media Player Dependent

The version of Windows Media Player in the client side will affect the performance of WebTV in streaming media files to client. If the version is not compatible, client will required to download codec from Microsoft web sites before receive the stream. This will delay users from receive the stream directly from the broadcast server on time. The appropriate version requires for watching or listening media files was 6.4 or later.

7.2.2.3 Requirement For Broadband Connection

For the live television streaming and live pre-record media files streaming required broadband connection from the client side, which require about 250 kbps in order to access the live streaming. This range of bandwidth is necessary in order to provide a good quality of motion picture for client. As a result, the live stream is unable to receive by Internet users because this range of bandwidth does not provided by local Internet Service Provided (ISP) for normal Internet users.

7.3 Problems Encountered

Along the process of completing this project, a lot of problems surfaced from time to time. These problems usually involved the using of new technologies and new products such as ASP, VB Script, Windows 2000 Server, IIS, Windows Media Services, and MS SQL Server.

7.3.1 Setting Up Server

Many problems are faced in setting up the relevant server in the WebTV such as SQL Server, Windows Media Services Broadcast server and Windows NT/2000 server. This problem is due to lack of experience in dealing with the server. Many problems also faced with the Compaq ML 530, which require a different set of installation procedures using their custom installation software.

7.3.2 Unfamiliarity With New Technology

Streaming technology is still new to the computing world. Problem is faced in understanding the concept and implementing the new technology to develop the system such as system architecture design to enhance the performance and usability of the system. In addition, the requirement to convert media file to Active Streaming Format was also one of the problem encountered. The suitable converter for was difficult to determine.

7.3.3 Incompatible Encoder

This problem arises from the use of Windows Media Encoder 7.0 (WME 7.0). This encoder is not compatible with Windows Media Services (WMS). The stream file format generated from WME 7.0 was in .wma, but WMS only recognize .asf file format.

7.4 Solutions

The first two problems discuss above, was solved after reading products documentation, which provided along the product. The third problem encounter during system implementation due to the file format generated from the newer version of Windows Media Encoder did not recognized by the Windows Media Services. To solution for handle this problem was also simple. From the experience gain during literature review, the earlier version of Windows Media Encoder was compatible with Windows Media Services. So to solve this problem, the earlier version of Windows Media Encoder was chosen instead of Windows Media Encoder 7.0.

7.5 Future Enhancements

In order to improve upon the current developed system, a few enhancement or new features could be added.

7.5.1 Integrated With Extra Information

The current WebTV system did not display any information about the current and next stream of media files. It will be more informative if the stream information is built into the database. The client who wants to know more detail about the stream provided can browse from that particular stream information and has a better understanding of what will be display about the current and next streaming provided to client.

7.5.2 Synchronize Song With Lyrics

To make the system become more attractive, songs' lyrics can be added into the system and synchronise with the song. This will enable users not only limited to listen to the song; their can also read the lyrics provided from the system while the song is playing.

7.6 Knowledge Gained

There is a lot of knowledge gained after the completion this project. This type of knowledge was very useful in build up our career in the future time.

7.6.1 A Better Comprehension of Networking Technology

One has to have sufficient knowledge on network systems when developing a solution for the WebTV. Issues such as shared resources, distributed systems, three tier architecture, type of network, broadcasting, and MPEG standard has to be understood completely. Security is also the major concern in network system.

7.6.2 Ability To Set Up NT/2000 Server

The WebTV uses Windows NY/2000 server as it operating system at the administrator side. This has provided the opportunity of learning how to set up a domain for the project such as create a primary domain controller (PDC) and backup domain controller (BDC). Some of the important knowledge gained includes learning how to create new users account. In addition, skill also gained on how to set up resources for sharing among domain using trust relationship and also how to grant access rights to users.

7.6.3 Understanding of Streaming Technology

Streaming technology is some thing new in computer world. Windows Media Services has provided a good platform in understanding the streaming technology. With the excellent documentation provided, the concept of the streaming technology was gained. In addition to that, it also provided better understanding in multicast stream and unicast stream. Although streaming technology is still new, the potential of technology is very strong. An understanding in this technology was an additional competitive advantage.

7.6.4 Using SQL Server

Microsoft SQL server is designed for the use over the any network. As such, the Microsoft SQL server will be an interesting business solution to distributed organizations. In the sense, knowledge on the features and functionality of the SQL server is of great value.

7.6.5 Improve Debugging Skill

ASP does not provide debugging function. Without the reliance on automated debugging tools, other debugging methods have to be used such as displaying message boxes and printing values of variables onto the page. This has provided an opportunity to improve debugging skill.

7.6.6 Active Server Pages

ASP technology, though new, has captured the attention of many software and web developers. It provided very powerful features enabling one to create highly interactive and dynamic web pages. The very core of ASP technology lies in the implementation of object-oriented concept. Knowledge in ASP has propelled one to the forefront of web base technology.

7.7 Review of Goals

In overall, the initial objectives set by the project have been archived. This project has successfully created an informative, innovative, interactive, and user-friendly web base entertainment system for Faculty of Computer Science and Information Technology. In addition, the system has the ability of implement live encoding and streaming of television program or media file using multicast technology through LAN. The successful of the creation of low bandwidth media files, enable the on-demand services provided would not consume much network bandwidth.

Chapter 8
Conclusion

Conclusion

Overall, this project has successfully delivered the system on time and fulfilled the objectives and requirements as determined during system analysis phase. This system not only allows users to watch online television programs using their personal computer, it also provides the online movies and songs to the users.

In addition, to make this system more attractive, on-demand services also provided to users. Users can select the movie or song from the database on demand. As an informative and interactive system, this system does provide some useful link to other web sites and also provides mailing services for users to contact the administrator.

This project has provided the golden opportunity to learn the fundamental of database programming while at the same time, gain knowledge of Microsoft technology such as Windows Media Services, SQL server, Windows NT/2000, IIS, and Visual InterDev. In addition, it also provides the opportunity to expose to hardware technology throughout this project. Thus, the knowledge gained during this project is priceless.

WebTV is an innovative and groundbreaking concept, which deploys the multimedia and streaming technology in a web base system to provide an information and entertainment to computer users. The success of this project will introduce a new way to watch television program to Internet users.

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Glossary

Glossary

Active Streaming format (ASF)

A low-overhead data format for multimedia streams, encapsulating images, audio, AVI, and so forth, as well as URLs, and allowing for the synchronization of these objects within the stream. A NetShow server can stream ASF formatted content and can store ASF streams as .asf files.

Advanced Streaming Format (.asf) file

An audio or video file that is formatted in ASF.

ActiveX

Microsoft ActiveX™ technologies are an open technology platform that extends the Windows architecture to include Internet and corporate Intranet features and capabilities. ActiveX embraces both Java and Microsoft's Component Object Model (COM) technologies.

ASFChop

A command-line utility for trimming the beginning or end of an ASF stream that has been stored by the Real-Time Encoder.

ASF Editor

A graphical tool that allows you to author, test, and generate an ASF file. The tool is designed to handle most of the issues of encoding and timing of low to mid bit-rate content. It allows the author to place objects—sounds, images, and URLs—so that they appear at the correct time during playback. It does not produce video files.

ASF Real-Time Encoder

An encoder used to author live ASF multimedia streams. It allows control of dynamic mixing of input media, and it outputs an ASF stream for distribution.

ASF Stream Descriptor (.asd) file

A configuration file created and read by Windows Media Encoder. The file contains Encoder settings that describe the characteristics of a multimedia stream. The file also is read by the Windows Media Station service to define the stream format supported by a given station.

ASF Stream Redirector (.asx) file

An ASX metafile that provides information that Microsoft Windows Media Player uses to receive unicast streams, multicast streams, and other supported media from an Intranet or the Internet.

Bandwidth

In communications, the difference between the highest and lowest frequencies in a given range. For example, a telephone line accommodates a bandwidth of 3000 Hz, the difference between the lowest (300 Hz) and highest (3300 Hz) frequencies it can carry. In computer networks, greater bandwidth networks indicate faster data-transfer capability. Bandwidth is expressed in bits per second (bps). In the NetShow environment, the NetShow Administrator can specify bandwidth constraints for a variety of functions, including maximum aggregate unicast bandwidth from the server, maximum bandwidth for a single unicast stream from the server, and the continuous bandwidth used by a multicast file transfer.

Bit rate

The speed at which binary content can be streamed across a network. It usually is measured in kilobits per second (Kbps)—for example, 28.8 Kbps. Windows Media Encoder and Windows Media Administrator have settings for the bit rate of ASF content.

Broadcast multicast

Delivery of one stream by a Windows Media server to many clients, which *listen* to it by monitoring the IP address over which the stream is multicast. From the client perspective, a broadcast multicast is a connectionless experience because the client never connects to a Windows Media server.

Broadcast unicast

A point-to-point connection that a client initiates to a publishing point on a Windows Media server.

Buffer

An area of memory reserved for use as an intermediate repository in which data is temporarily held while waiting to be transferred between two locations. A buffer ensures that there is an uninterrupted flow of data between computers.

Client

Typically, the software that makes requests in client/server communications. Client software requests connections and communicates with servers.

Codec

Short for compressor/decompressor. An algorithm or scheme used when recording digital video or audio. A codec is used, for example, when video is transmitted over the Internet; the video is compressed on the sending end and decompressed on the receiving end. Windows Media Tools provides a choice of codecs for ASF content. Users can select a codec based on the audio or image quality, and image size preferred.

Distribution mode

A setting of Windows Media server components that indicates whether Windows Media server components are going to multicast the ASF stream, distribute the ASF stream (via unicast), or do both. If the distribution mode is set to multicast only, then

the server broadcasts the ASF stream via multicast and unicast. If the distribution mode is set to distribution only, then the server delivers the ASF stream if requested by another server that is going to broadcast the ASF stream. If the distribution mode is set to both, then the multicast mode and the distribution mode are functional.

Encoder

A tool that can convert both live and stored audio and video content to an ASF stream, which then can be streamed over a network by a Windows Media server. To provide added depth to your content stream, you can add script commands. These script commands can be used to go to a specific Web site, initiate page flips, provide rating information, or create an e-mail message. Once a content stream is created, it can be written to an .asf file for playback later.

Home publishing point

The root directory for publishing ASF content. Microsoft Windows Media Player can stream any .asf files placed in this directory or its subdirectories. A home publishing point is also an on-demand publishing point. Unlike other publishing points, a home publishing point does not have an alias. Instead, the computer name is used in a URL for access to the home publishing point. Also called the ASF root directory.

Internet Protocol address (IP address)

A 32-bit number that is the unique IP address of each computer or device on the Internet. This number specifies a physical location, or node, on the network.

Internet Server API (ISAPI)

A framework for creating a dynamic link library (DLL) to provide Internet server-side functionality. Windows Media Services uses ISAPI to provide one of the options for security.

Intranet

A network belonging to an organization. Only members of that organization have access to it. An intranet that is connected to the Internet usually is protected by a firewall or other device.

Media Stream Broadcast Distribution protocol (MSBD protocol)

A protocol used to reference a Windows Media Encoder, which is the source of a stream, such as **msbd://***server_name*. It also is used when streaming from the Windows Media Station service to a content-storage server. In addition it is used for server-to-server distribution.

Metafile

In a Windows Media Technologies system, a text file that contains information, for media content. Windows Media Services use three kinds of metafiles: .asd file metafiles, .asx file metafiles, and .nsc file metafiles.

Microsoft Media Server protocol (MMS protocol)

A protocol used to reference and stream .asf files from a Windows Media server.

Microsoft Windows Media Player

A client program or control that receives streaming media from a Windows Media server. This control either can run as a stand-alone client executable program or can be embedded in a Web page, C++ program, or a Microsoft Visual Basic program that uses the client ActiveX control. Microsoft Windows Media Player is the first version that is a universal player.

Multicast

A one-to-many connection in which multiple clients can receive the same stream from a server. To receive a multicast, a client must have access to a multicast-enabled network. In contrast, a unicast is a one-to-one connection in which one client receives a distinct stream from a server.

Multicast-enabled network

A network that has routers that can interpret Class D IP addresses.

On-demand

Describes stored media content that is available for streaming on a Windows Media Services system. Windows Media Services can stream either stored content from a publishing point, or live content using Windows Media Encoder.

On-demand unicast

A point-to-point connection that a client initiates to a publishing point. In an on-demand unicast, the server streams stored content to the user.

Port

A location on a server from which content streams to a client. A port is represented by a number that is part of a URL. Windows Media server components, when in use, bind to ports. By default, the Windows Media Unicast service binds to port 1755 and the Windows Media Station service binds to port 7007. If HTTP streaming is enabled for a service, then that service switches to use port 80, which is the preferred port for any HTTP streaming. You can change the ports that any of the Windows Media server components use by editing the registry.

Protocol

A set of formats and procedures that enable computers to exchange information. Protocols that Windows Media Services use include HTTP, MMS, and MSBD.

Publishing point

A virtual directory used for storing content that is available to clients, or for accessing a live stream. Clients reach a publishing point through its URL.

Station

A defined location from which a player can receive streams. In effect, it is an IP address and a port. Windows Media server components use stations with ASF streams only, and save station information as a file with an .nsc extension.

Stream

Data transmitted across a network and any properties associated with the data. Streaming data allows the player to begin rendering the data immediately instead of waiting for the entire file to be downloaded.

Unicast

A client/server connection in which a client receives an on-demand stream of stored content from a server, or receives a broadcast of live content. No other client has access to this stream. In contrast, a single multicast stream is available to multiple clients.

User Datagram Protocol (UDP)

A connectionless transport protocol in the TCP/IP protocol stack that, like TCP, runs on top of IP networks.

Video capture card

An add-on board for providing digitized images on a computer. With a video capture card, you can provide live camera or VCR input to Windows Media Encoder

VidToASF

A command-line utility that quickly converts an edited .avi or .mov file to an .asf file so that it can be stored on a Windows Media server and streamed to clients.

WavToASF

A command-line utility that quickly converts an edited .wav audio file to an .asf file so that it can be stored on a Windows Media server and streamed to clients.

Windows Media Encoder

A feature of Windows Media Technologies used to create live ASF streams. Windows Media Encoder turns live audio and video content into an ASF stream and distributes that stream through a port. Windows Media Encoder also can save an ASF stream as an .asf file. Windows Media Encoder can distribute an ASF stream via MSBD protocol or HTTP.

Windows Media Station (.nsc) file

A file that describes a station to the player. The player accesses the station file indirectly by way of an .asx file that directs the client to a specific .nsc file.

Appendix A

Figure A.1 CNN Online

Figure A.2 AdventureTV.com

Figure A.3 DvrPlayer.com

Figure A.4 ESPN Sport

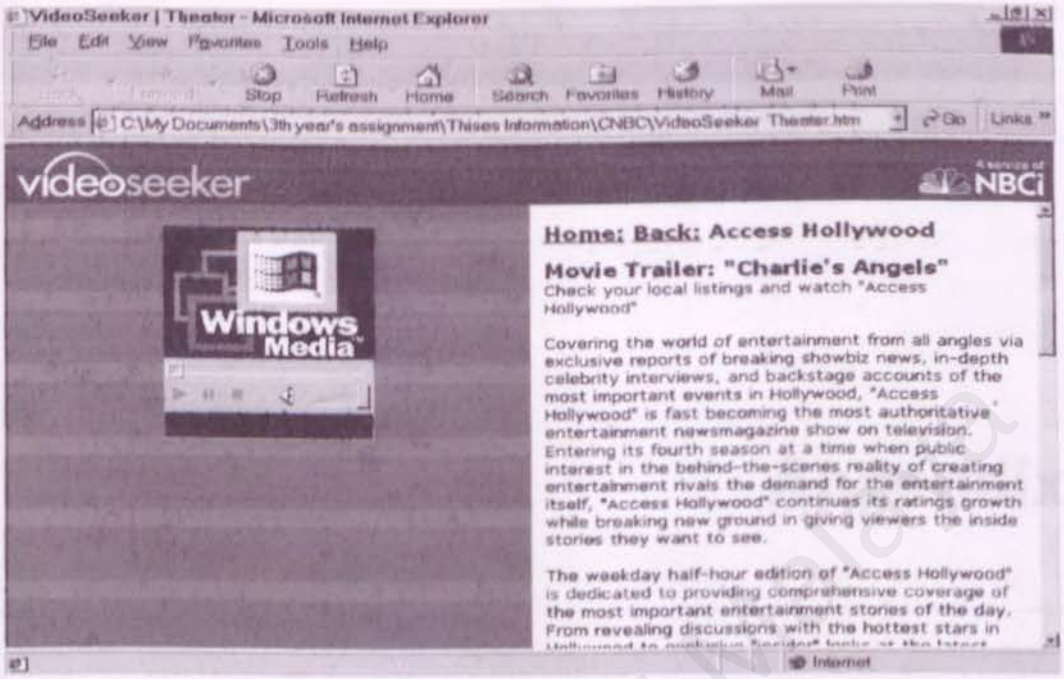


Figure A.5 NBCi (VideoSeeker)

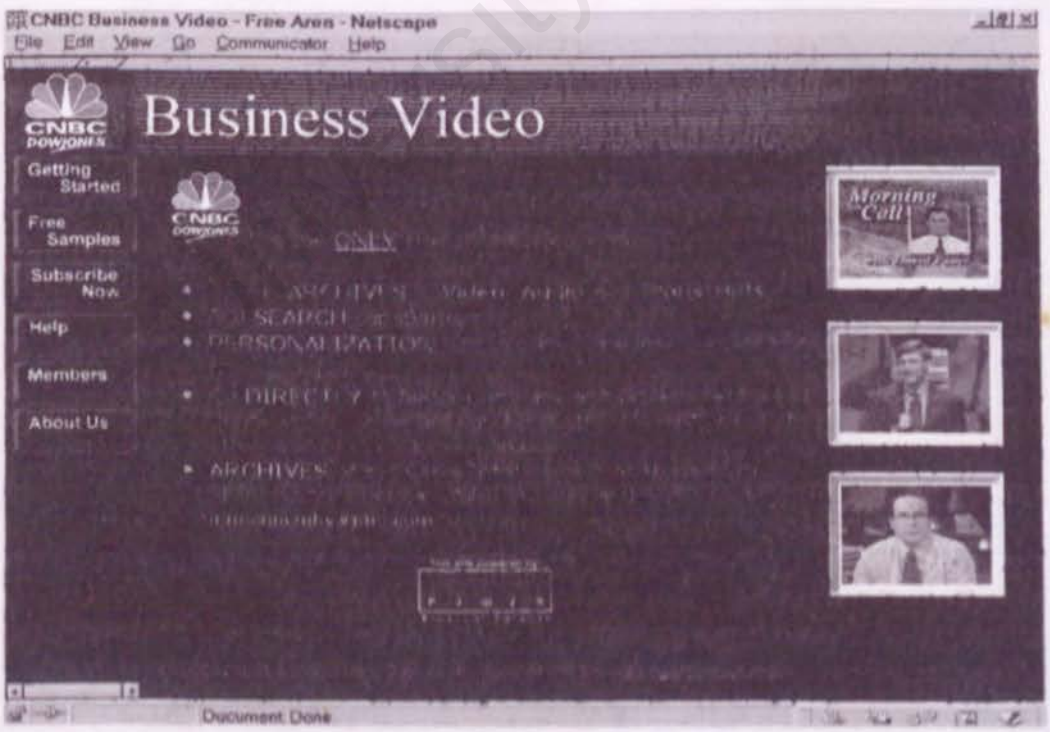


Figure A.6 CNBC Dow Jones Business Video

Appendix B

B1 How To Join/Cut .mpg Files

TMPGEnc was use in joining any .mpg file during this project. Below shows how to join two or more .mpg files into single file.

1.) First activate the **TMPGEnc** program. Following figure B.1 shows the TMPGEnc windows

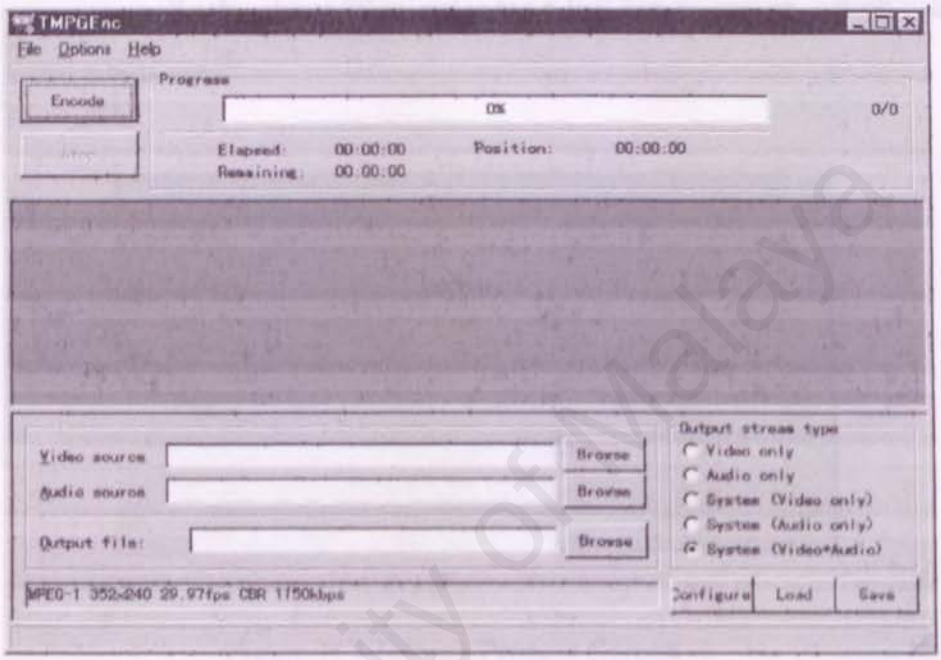


Figure B.1 TMPGEnc

2.) On the **File** Menu, Click on **MPEG tools.** In the **MPEG tools** screen select **Cut/Join** section as show in figure B.2 below.

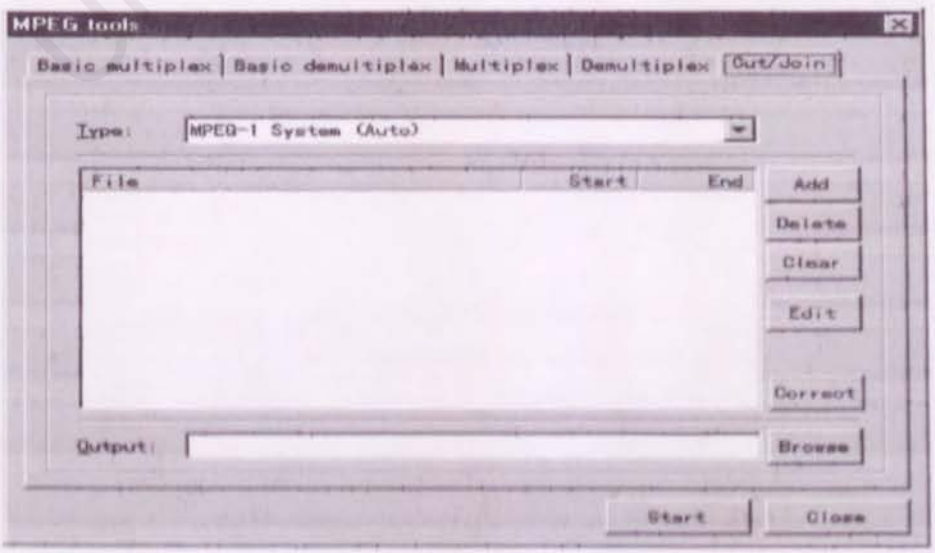


Figure B.2 MPEG Tools Screen

3.) After that, click on **Add button** to add any mpg files, which need to combine as a single file.

4.) Next, key in **output file name** and **directory** for storing the file in **Output** box.

5.) Finally, click on **Start button** to activate the joining process. The process will take about 30 minutes for a full-length movie, which was one and a half hour.

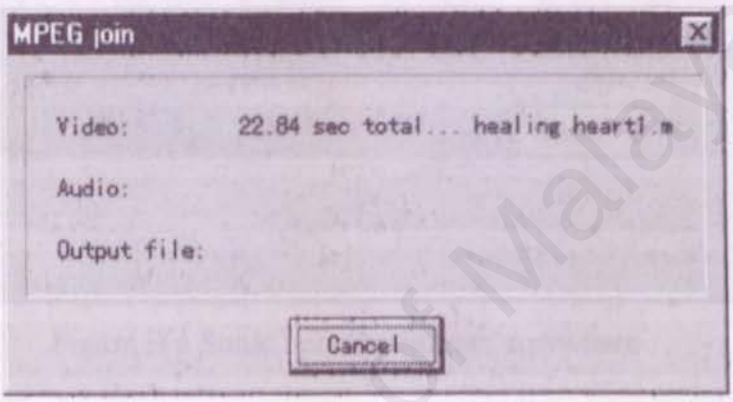


Figure B.3 Joining Process Screen

B2 How To Split/Cut .asf Files

Sonic Foundry Stream Anywhere was use in sprit or cut any .asf files in this project. Follow steps shows how to cut an asf file into smaller pieces.

1.) Activate the Sonic Foundry Stream Anywhere as show in figure B.4 below.

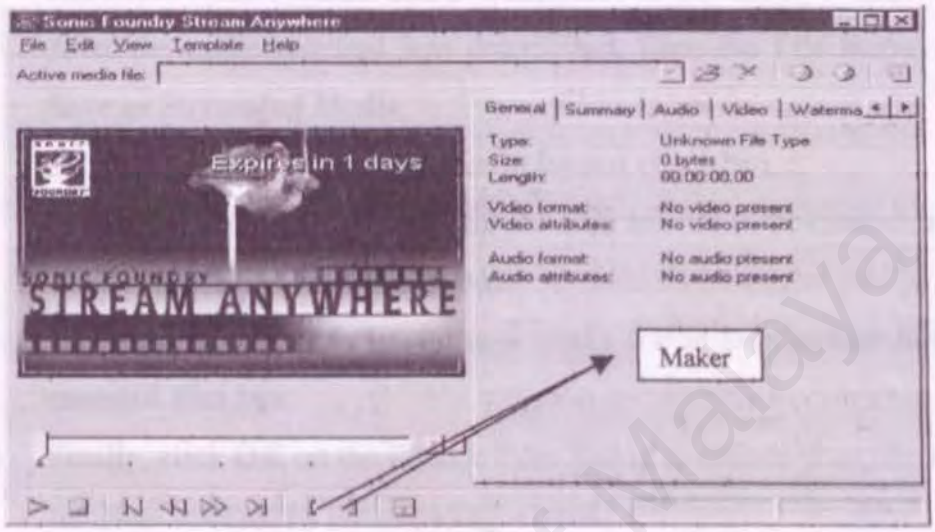


Figure B.4 Sonic Foundry Stream Anywhere

2.) From the File menu, choose **Open/Add**, or click the **Open/Add** button on the toolbar to add the media, which required being sprit.

3.) Browse to the file's location in the Open/Add Files dialog, or type the path and file name in the **File name** box. Next, click **Open** as shows in figure B.5 below.

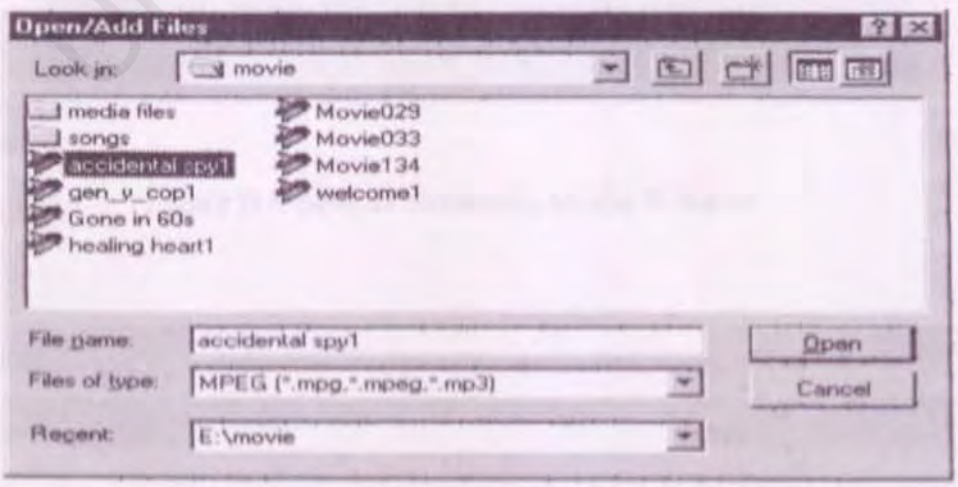


Figure B.5 Open/Add Dialog Window

4.) After that, move the cursor to the new starting point required in the track provided and click on the **Maker in button,** [.

5.) Next, point the cursor to the finish point required in the track provided and clicks on the **Maker Out button,**] .

6.) After the range required was determined, from the File menu, choose **Save as Streaming Media**.

7.) Select the **Encode Windows Media format** check box.

8.) Select the required bandwidth for the new asf file to be created from the Windows Media Template list box.

9.) Key in the destination for the new media file in **Destination folder for encoded files box**.

10.) Finally, click **OK** on the Encode Files dialog to encode your file with the template selected by the encoding wizard.

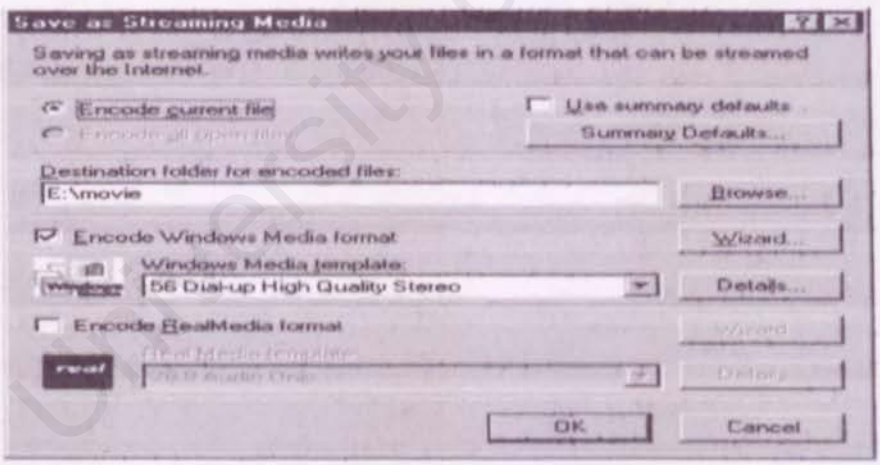


Figure B.6 Save as Streaming Media Window

Appendix C

How To Create a VCD From Pre-record Media Files

Four phases involve in create a VCD from a pre-record media files such as videotape (analog format) or live event capture. TMPGEnc, Xing MPEG Encoder, and VCDGear were required for converting media file to appropriate VCD format. Nero Burn Rom was used in burning the media file into a blank compact disk.

C1 Phase One (Create ASF File From Pre-recorded File)

The first phase required converting pre-record media file, which store in analog format to MPEG 4 format such as Active Streaming Format. ASF format was chosen instead of .avi because it enables to minimize the storage space requirement. Winnov capture was needed in this phase for capture and convert analog file format to digital format.

1. First, **Winnov capture card** must be configuring properly. Make sure video input was in **composite input** and audio input was in **Aux input**. After that, set composite input and Aux input active.
2. **Brightness**, **contrast**, **saturation**, and **hue** needed to adjust to produce a good quality media file.
3. After all configurations were done, play the videotape using **VCR** or **camera**.
4. To start record a **video clip**, click on the **Record Video Button** or choose **Record Video** from the **capture menu**. During the capture the elapsed time is display below the image in the **Videum Capture window**.
5. To stop recording, click the **Record Video button** again. An icon is displayed on the upper left side of the Videum Capture image, indicating that the video clip is ready.
6. To save the video clip to asf format, choose **Save As** from the **File Menu**. Next, name the captured file and specify the location for store the file and also select **Custom ASF Format** from the list box.

7. Then click the **OK button**. (A dialog box will pop up for input **Film Per second** and **resolution** for the ASF video clip). The compression process will start. Wait about 30 minutes a 90 minutes video clip in ASF format was created. This ASF video created will converted into .mpg format in second phase.

C2 Phase Two (Create MPEG File From ASF File)

Second phase required converting asf file created in phase one into mpeg file. TMPGEnc was used to perform this task. This phase is more complex compare with other phases because it involves two encoders for create an appropriate file format. Following step shows how to convert asf file into mpeg file using TMPGEnc.

1. First activate the **TMPGEnc** program. Following figure B.1 shows the TMPGEnc windows.

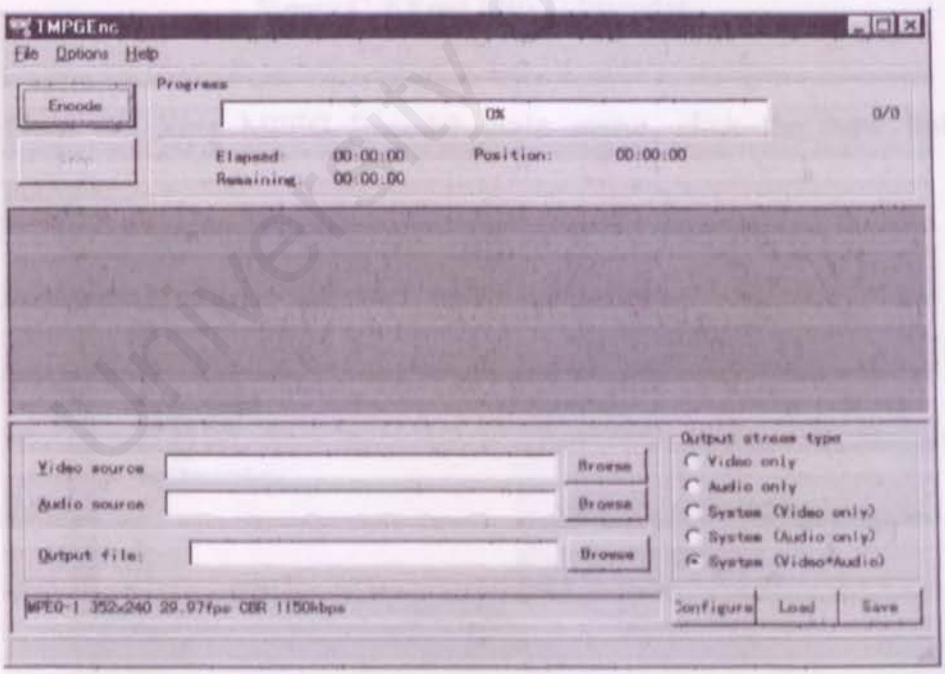


Figure C.1 TMPGEnc

2. Select **System (Video + Audio)** in the **Output stream type**.
3. Specify the location of the video and audio sources in the **Video source** and **Audio source** boxes. After that, specify the output location of the output file created from ASF file.

4. Finally, click on **Encode button** to start encoding process.

The MPEG format created from TMPGEnc was not the appropriate format for create a VCD. To Achieve the VCD MPEG format Xing MPEG Encoder was used in convert it to VCD MPEG format.

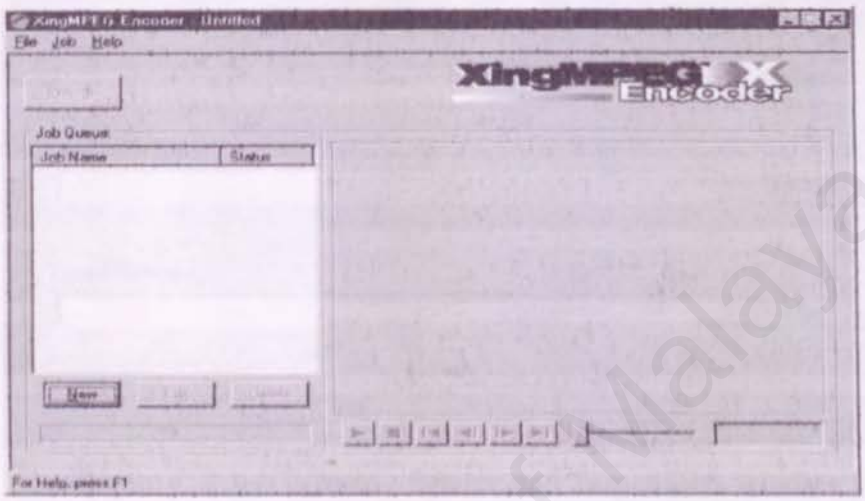
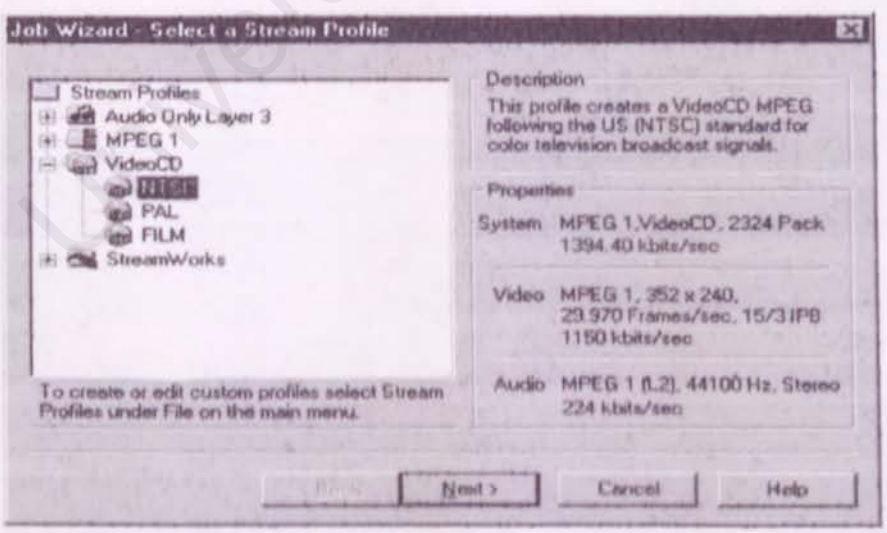


Figure C.2 Xing MPEG Encoder

1. From the Xing MPEG Encoder **main menu**, click the **New button** to activate.



C.3 Job Wizard - Select a Stream Profile window

2. Select a **VideoCD - NTSC** from the **Job Wizard - Select a Stream Profile** window. After that click the **Next button**.

3. To input the .mpg file, click the **Browse button** and select an .mpg file from the **Job Wizard - Source and Target Files window**.

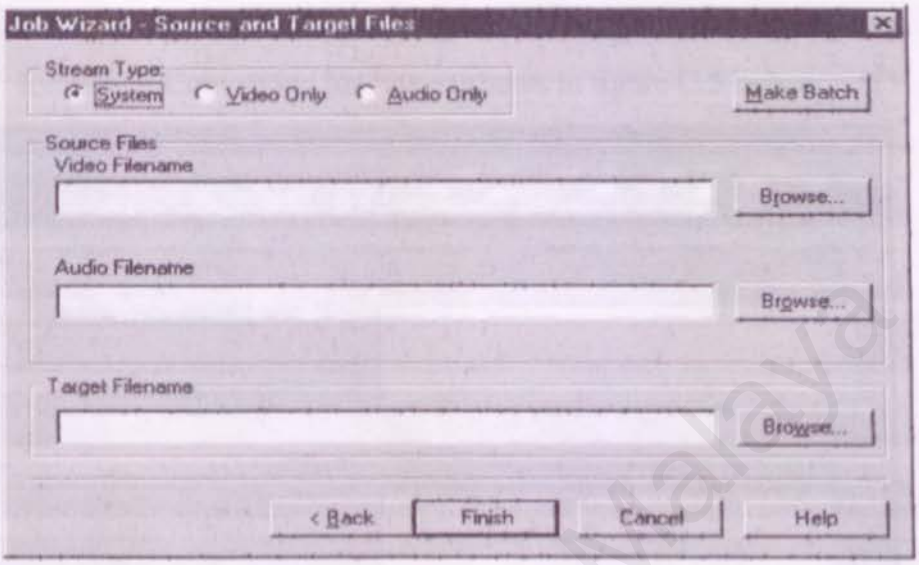


Figure C.4 Job Wizard – Source and Target Files window

4. Click the **Finish Button** to start the encoding process. The appropriate MPEG format for creating VCD was created.

C3 Phase Three (Create Dat File From MPEG File)

VCDGear was used in converting MPEG file created to VCD format, which was DAT format. This phase is simple compare with other phases.

1. First, activate VCDGear program and select **mpeg -> dat** from Extraction/Conversion list box as shows in figure C.5 below.

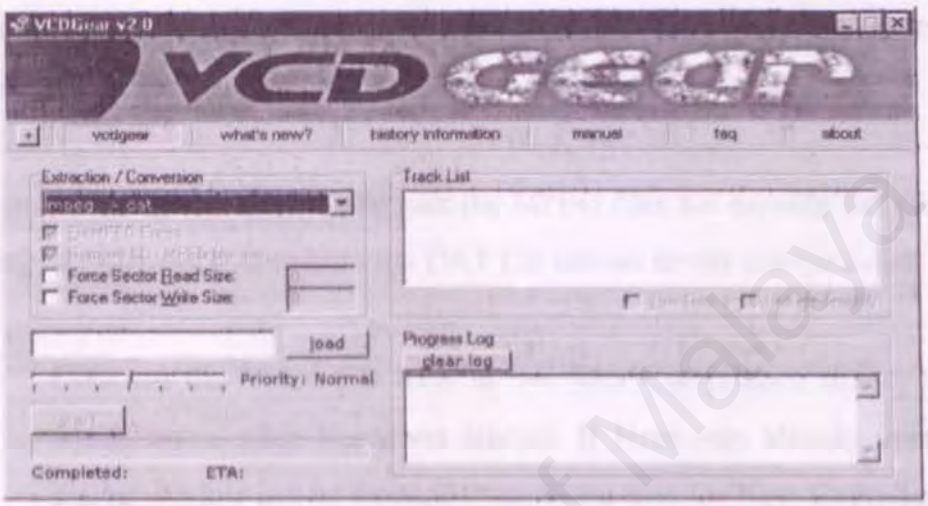


Figure C.5 VCDGear

2. After that, click on load button to specify the source file in .mpg format, which was required to convert into .dat format.
3. Next, name and specify the destination of the output file.
4. Finally, click start button to start the encoding process. Wait about 20 minutes for a 90 minutes media file to complete.

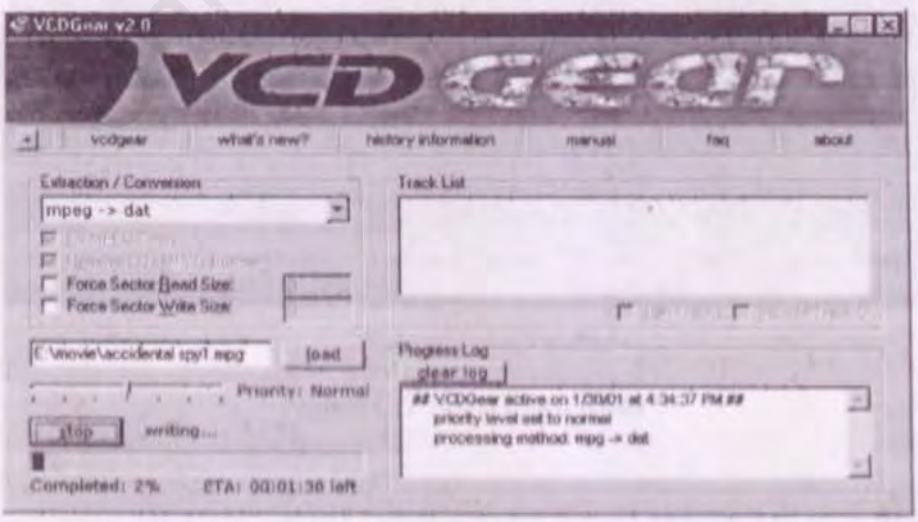


Figure C.6 MPEG To DAT Encoding Process

C4 Phase Four (Create VCD From DAT File)

After the DAT file was successfully created. It can be burn into an empty compact disk using Nero Burn Rom. This special software was need because it automatically creates some necessary folder for a VCD such as CDI folder, EXT folder, MPEGAV folder, SEGMENT folder, and VCD folder. Those folders contain file or information for the use of VCD player. VCD player will not be able to play the VCD if one of the folders does not exist.

Before start burning the VCD, make sure the MPEG files are suitable for Video-CD. Following steps shows how to burn the DAT file into an empty compact disk.

1. Click on the **Video-CD icon** in the New Compilation dialog window, which opens after Nero was started. If Nero was already opened, the dialog window can be reached through the icon for **New Compilation**.

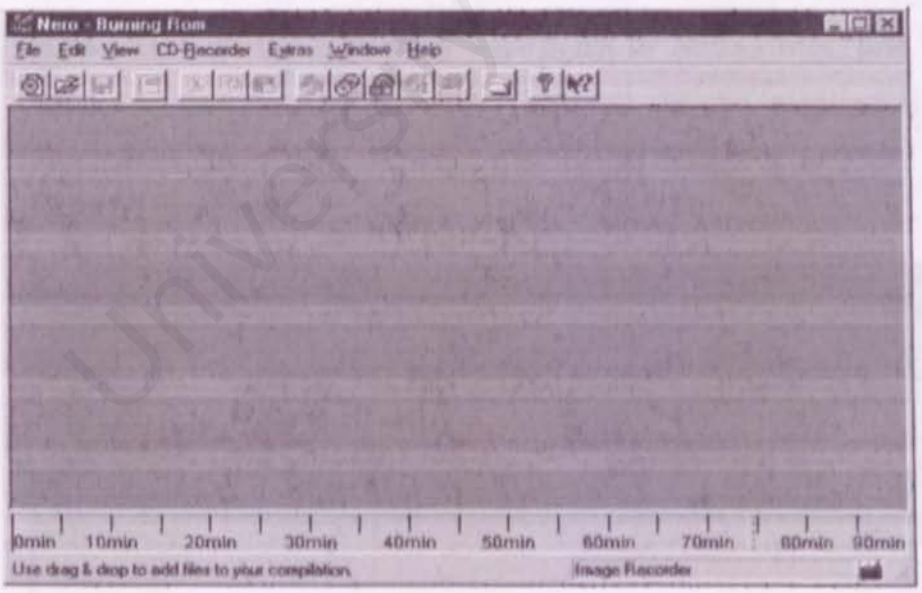


Figure C.7 Nero Burn Rom

2. Select **Video-CD** from the list and click on the **New button** at the right of the **New Compilation** window.

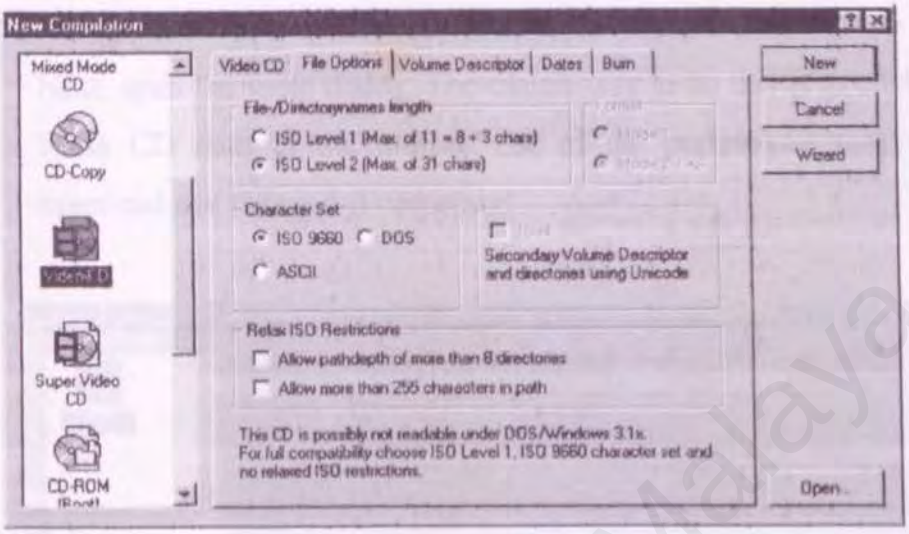


Figure C.8 New Compilation Window

3. The corresponding blank compilation window for Video-CD will open. This CD-ROM (ISO) window with a list of MPEG files, just like the Mixed-Mode compilation, which contains all the required files and directories. Those directories and files cannot delete.

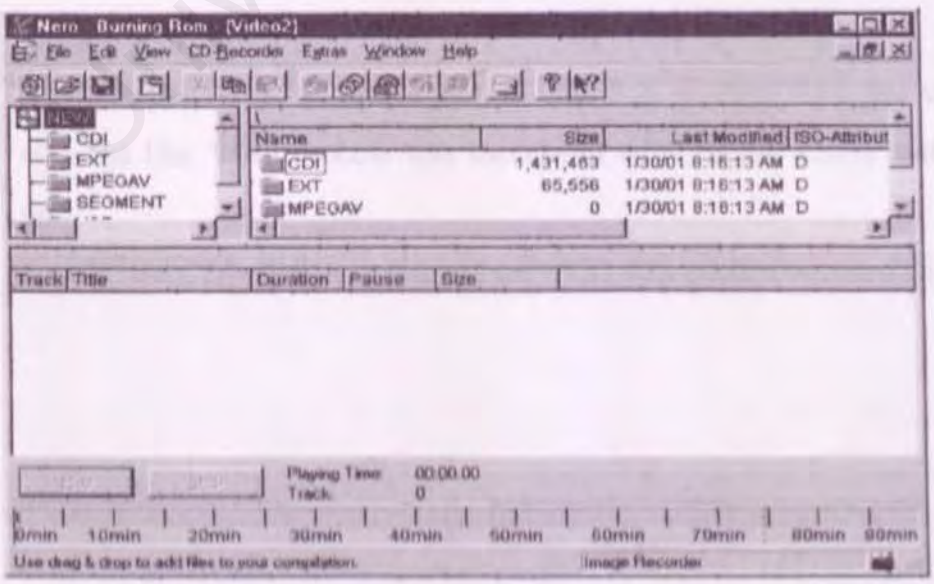


Figure C.9 Blank Compilation Window

4. To add desired media file, go to the **VIEW > New File Browser** command or by clicking on the **File Browser icon**. After that, click on the desired MPEG files in the **File Browser** with the mouse and then drag them into **the MPEG list** in the bottom part of the window.
5. Next, open the write dialog. The easiest way to do this is to click on the Write CD icon in the toolbar. All of the preferences may now be examined and changed if necessary.

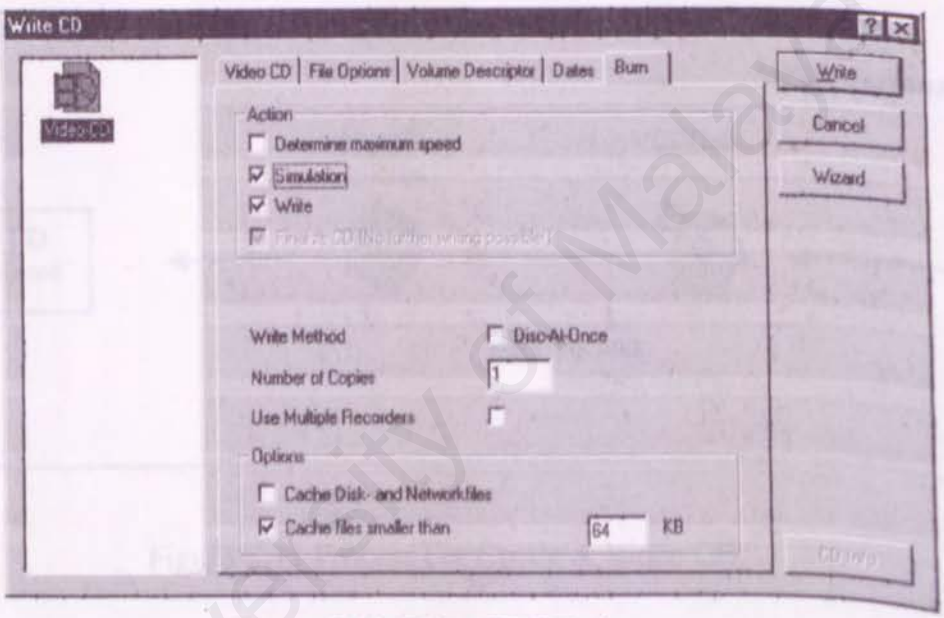


Figure C.10 Write CD Window

6. Click on the Write button for start the burning process. As a last step, a message like "burn process was successful with 2x(300 KB/s)" will pop up.
7. Finally, the CD will be ejected and the VCD was created successfully.

The process of create a video CD can be summarize as follow:

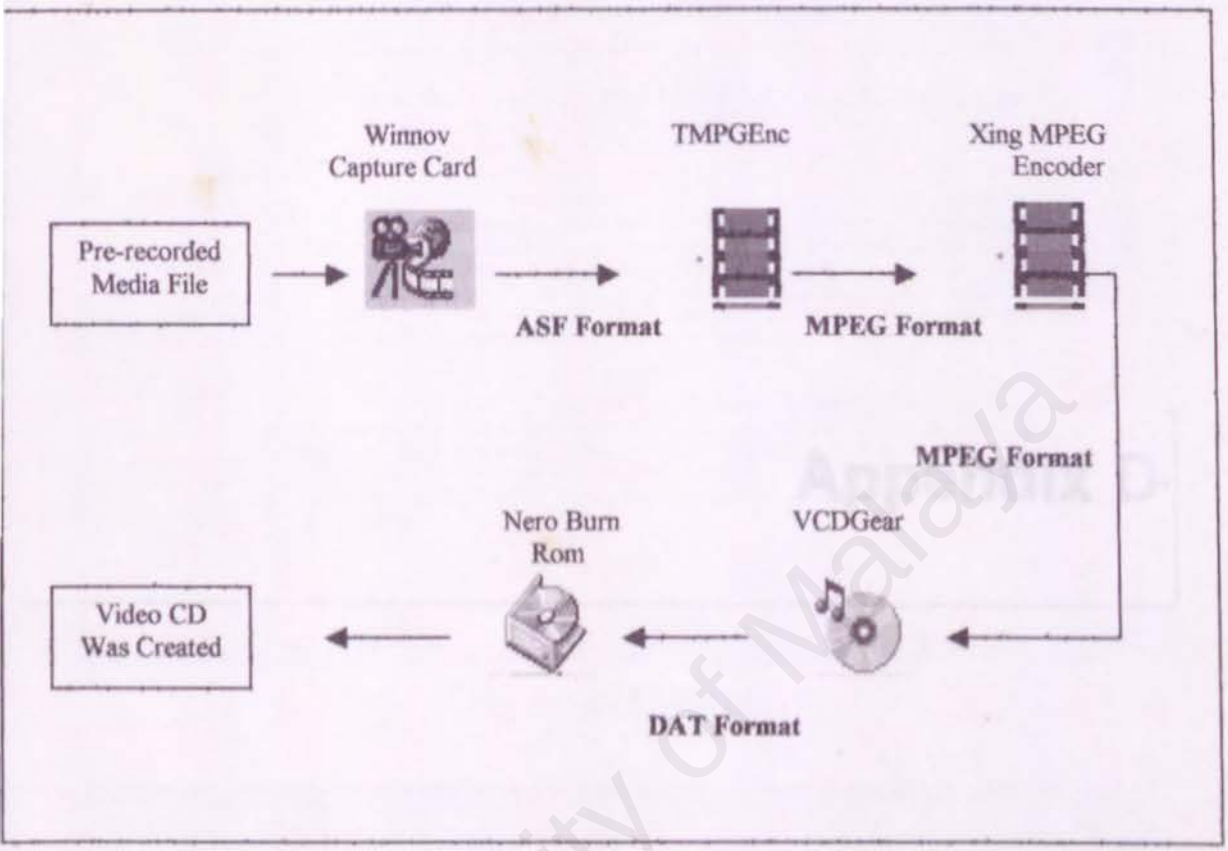


Figure C.11 Process For Create A Video CD

Appendix D

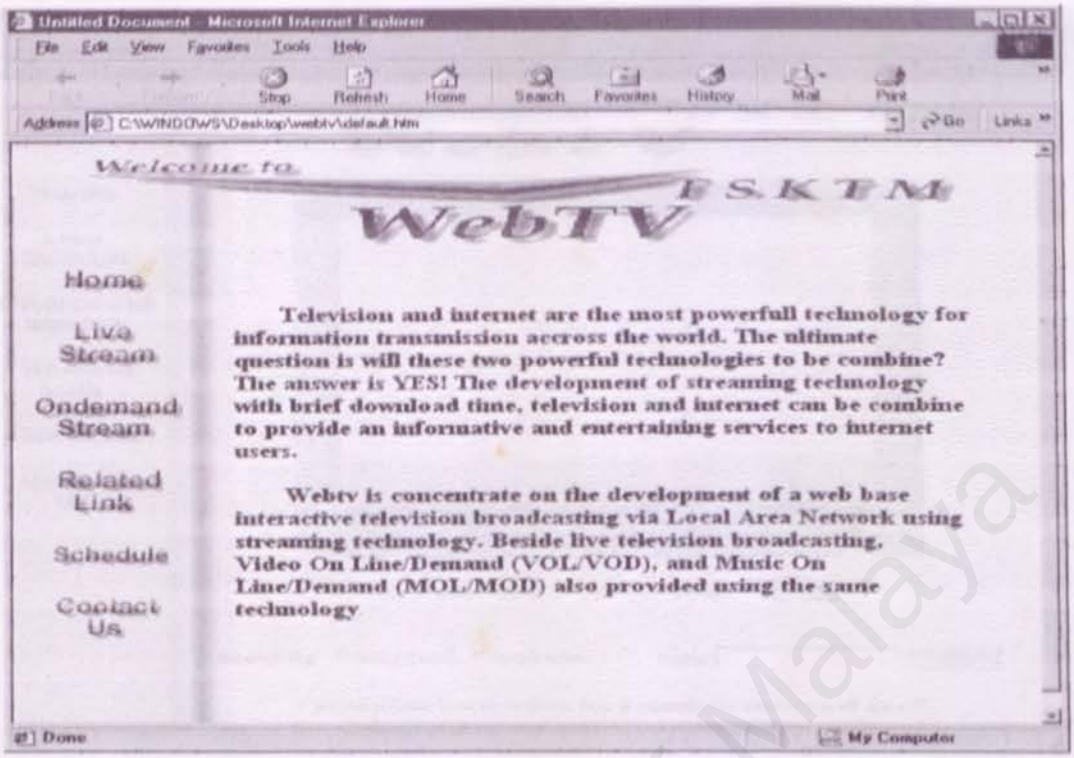


Figure D.1 Home

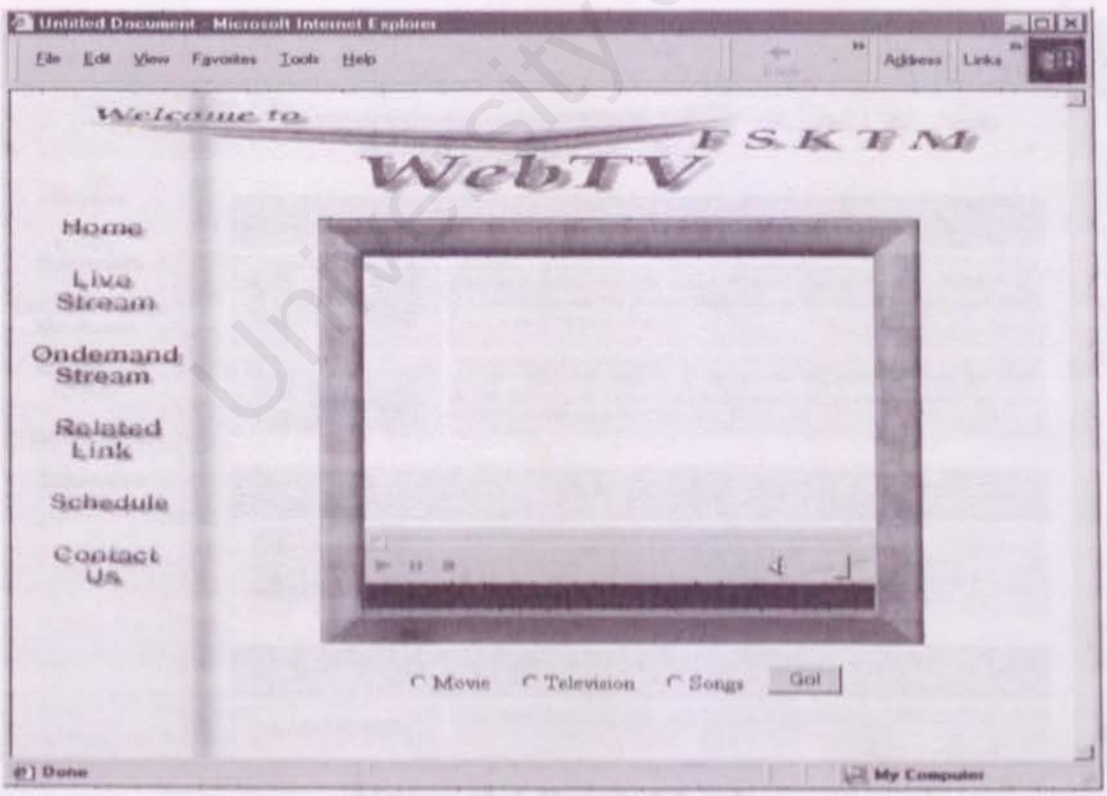


Figure D.2 Live Stream

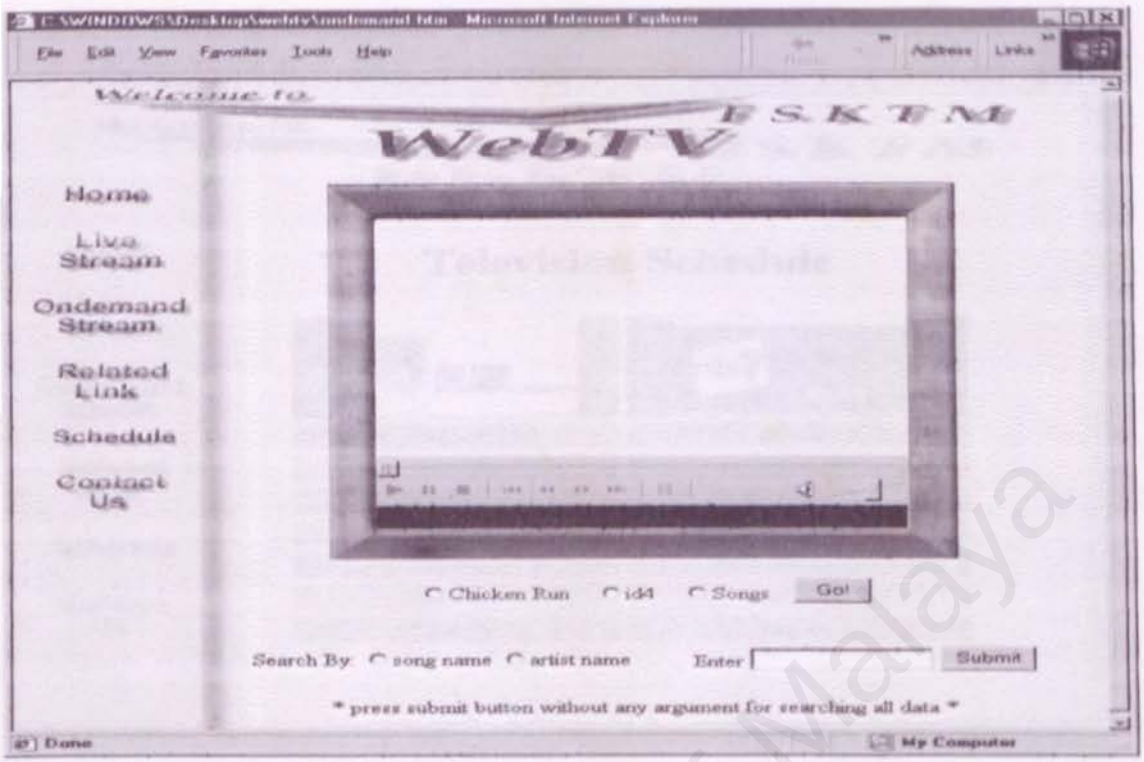


Figure D.3 On-demand Stream

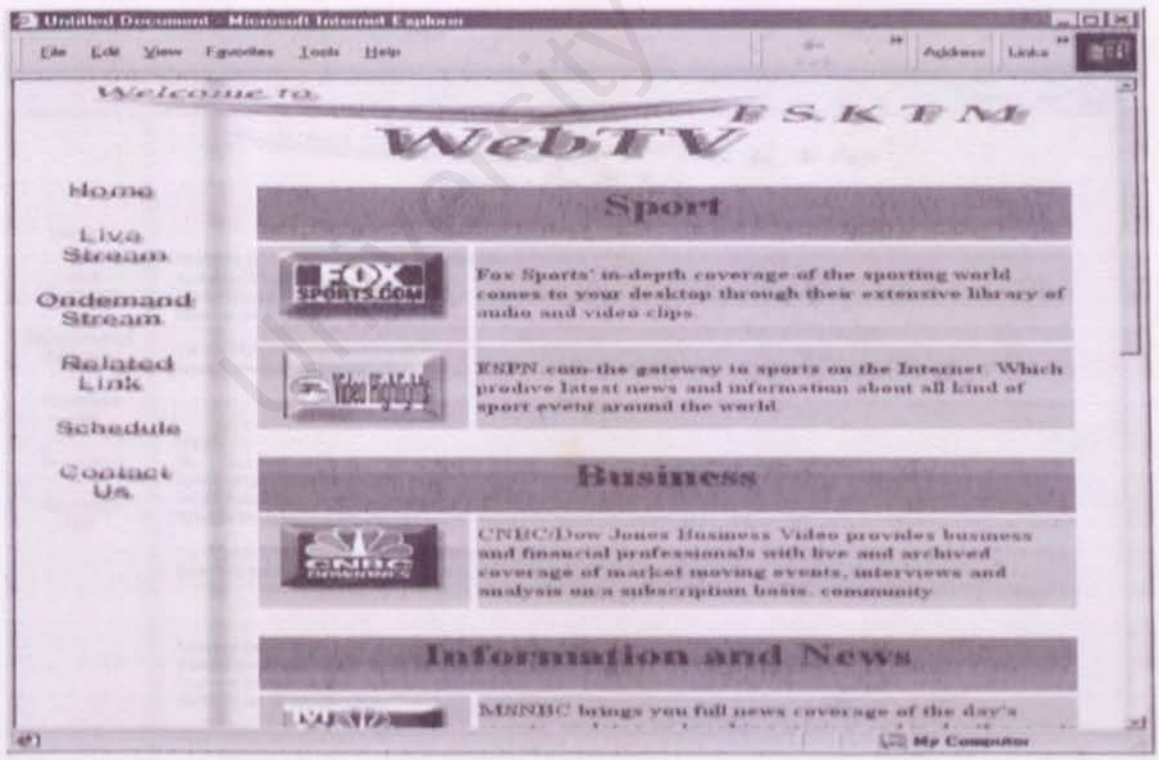


Figure D.4 Related Link

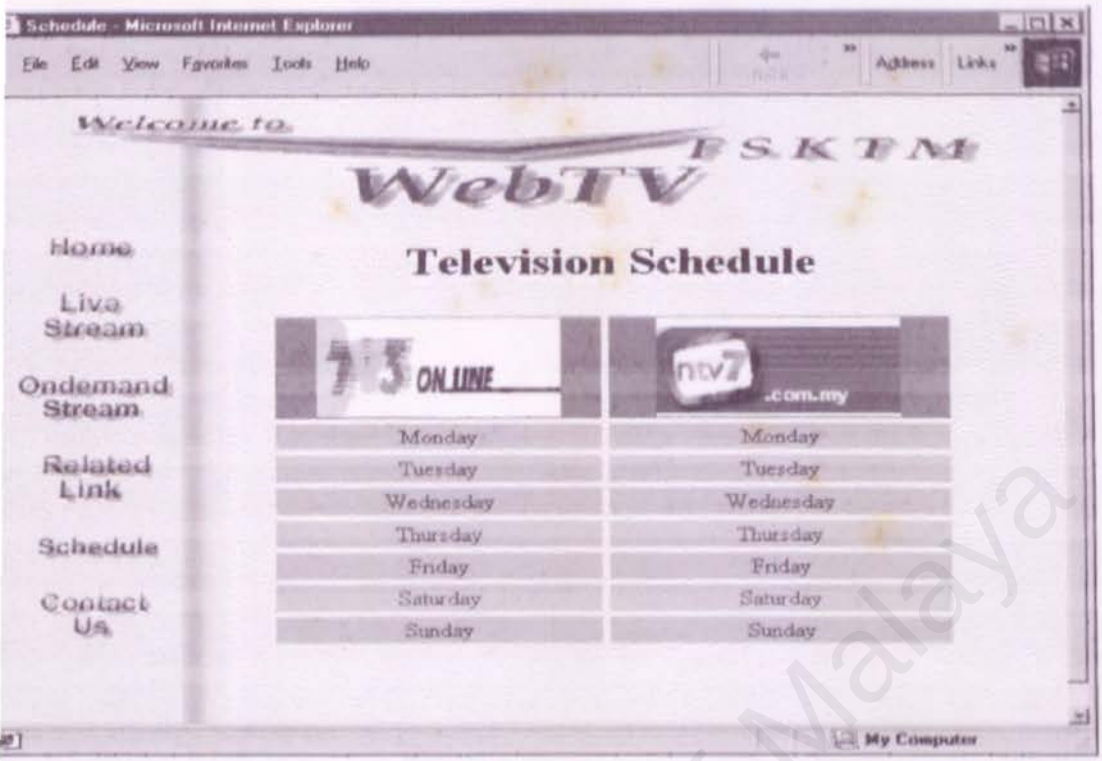


Figure D.5 Schedule

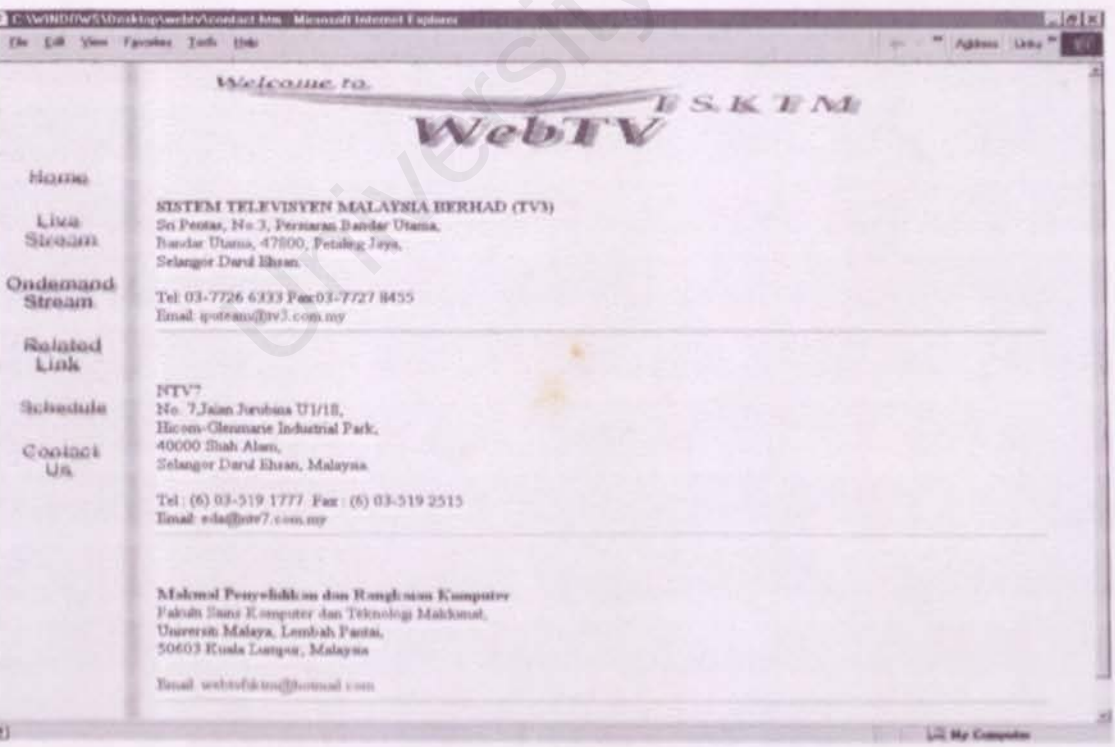


Figure D.6 Contact Us