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1.0 Introduction

With today’s Internet and Intranet technologies, personal and corporate communication is becoming faster and more cost effective. Conventional means of communication like telephones are increasingly losing out to new technologies such as desktop and boardroom video conferencing. MCS ASP is a cutting-edge product offering for service providers (ISPs/ASPs) that employs MCS v6 technology to provide a professional business-class video teleconferencing and document sharing solution for the communication needs of different organizations and customers.

Conventional video conferencing systems are **POINT-TO-POINT** systems as shown in Figure 1.1 below, where both parties (PC/Boardroom) will use ISDN WAN links to communicate with each other. Major setbacks of this system include:

- Point to point communication only
- The communication protocol is propriety, thus the expensive WAN link has to be dedicated for video conferencing only.

![Conventional video conferencing systems](image1)

**Figure 1.1: Conventional video conferencing systems**

The current **POINT-TO-MULTIPOINT** systems have addressed the prior constraint of point-to-point systems and made it possible for more than two parties to communicate simultaneously. However the following disadvantages still exist:

![Current point-to-multipoint systems](image2)

**Figure 1.2: Current point-to-multipoint systems**
MCS Version 6.0 Technical White Paper

- Such conferencing systems require dedicated ISDN lines to the desktop and boardrooms. This means additional cabling must be laid to each point.
- An expensive MCU is required for mixing and re-transmitting video.
- The expensive WAN link is still proprietary and only dedicated for video conferencing. Additional WAN links are necessary if the company wishes to send data and email as well. This substantially increases your cost.
- The expensive WAN Bandwidth needed increases proportionally with the number of joining sites.

MCS version 6.0 presents a revolutionary **MULTIPOINT-TO-MULTIPOINT** system that is ahead of current technology. It allows conferencing with as many people as desired from anywhere around the world. MCS overcomes the disadvantages of current conferencing systems through the following unique features (See page 6 for the full list):

- MCS allows multipoint desktop and boardroom conferencing using your existing LAN infrastructure, without affecting your current applications. Hence, no ISDN lines or additional cabling is needed. This considerably saves both cost and set-up time.
- No expensive MCU is required.
- MCS uses the non-proprietary IP protocol and runs over your existing network lines and even over the Internet. Also, your same expensive data WAN link can now be used for all your data as well as your video conferencing needs, without any additional cost.
- Most importantly, the required bandwidth remains constant no matter how many sites join the conference. MCS uses a revolutionary Server-2-Server technique to keep the consumed bandwidth constant at a minimum. This optimizes and saves the high WAN or Internet bandwidth cost.

*Figure 1.3: Multipoint-to-multipoint systems*
2.0 MCS Description

Desktop Conferencing Systems have become immensely popular in substituting real meetings and conferences, as time cannot be compromised in today’s world. However, replacing these vital meetings is not an easy task. Thus a commendable, reliable and efficient system is required. That’s where MLABS Multimedia Conferencing System version 6.0 - or more popularly known as MCSv6 - comes in.

MCS is a full-fledged versatile multipoint video conferencing system that can seamlessly integrate into an organization’s network’s architecture. MCS is designed to flexibly fit into any existing LAN and WAN environment. The key point that has always been stressed throughout MCS development is flexibility. Realizing the amount of money invested in setting up a networking environment, changing the whole or part of the architecture for a certain kind of product is not acceptable let alone economical. Another major advantage of MCS is that it is software based and uses non-proprietary hardware. This means that your existing multimedia PC can probably become an MCS client, as long as it meets the basic requirements needed to run MCS.

MCS uses multicast technology within the LAN and unicast technology within the WAN. This enables MCS to keep the conference bandwidth constant no matter how many users are connected to that conference. In order for the multicast packets to traverse the WAN, the Multiple LAN IP Converter (MLIC) entity converts the LAN-based multicast packets to unicast packets to enable them to pass through the WAN routers. On the receiving end another MLIC reconverts these unicast packets and retransmits them as multicast packets onto the other LAN.

MCS uses the RSW Control Criteria which was developed with a real meeting room in mind. This helps create a realistic virtual meeting room that provides an intuitive, smooth and enjoyable conferencing experience. Furthermore, the RSW control criteria effectively optimizes bandwidth usage.

MCS is a client-server based system which supports distributed network entities. MCS allows up to 1000 users per server and the number of servers is scaleable. Thus a conference can have an UNLIMITED number of participants per conference by simply increasing the number of servers.

Figure 2.1: MCS in action
MCS Unique Features – Thinking outside the box

With its innovative RSW Control Criteria, NAT Traversal, MLIC, Server2Server and multipoint-to-multipoint solutions, MCS was offers new technologies that breaks multimedia conferencing into new grounds rather than following the norm. This has resulted in a conferencing system that genuinely offers a unique solution with superb performance.

Complete Solution
MCS provides a comprehensive conferencing solution that goes beyond meeting the basic conferencing requirements to offer a smooth professional conferencing experience. It includes video conferencing, document sharing and chat client software, server solution and powerful utilities such as MCS Recorder, MCS Web Admin, and MCS Accounting. MCS offers this great package at a very competitive price.

ASP Package
By offering a cutting-edge package that is targeted towards service providers, MCS takes a big leap towards the future of communication and business models. Combined with the innovative multipoint-to-multipoint MCS technology, features such as Server-2-Server, MLIC and powerful accounting and administration tools help MCS ASP Edition usher video conferencing and document sharing into an exciting new era.

Real Time Conference Updates
This feature enables the chairman and all participants to be automatically updated about the latest status of the conference. Any new request, cancellation of a request, a participant just joining etc will be automatically indicated to the rest of the participants. These updates are provided by MCS server to all the participants in real-time.

Open Hardware compliant
MCS is fully software-based and can be used with different capture cards and cameras. MCS can also be seamlessly integrated into any IP based network infrastructure including Ethernet, Fast Ethernet, Gigabit Ethernet, Token Ring, FDDI, ATM, satellite and wireless networks.

Live Update
MCS offers live updates that ensure your system has the latest up-to-date components. Furthermore, being a software-based solution, MCS can be easily upgraded. Other hardware-based solutions are very expensive to upgrade and maintain.

Global Roaming and NAT Traversal Solution
With its support for dynamic IP configuration and its new NAT solution MCSv6 ensures complete customer connectivity and satisfaction all around the clock from the ASP subscribers. The solution frees the user from the IP constraint and allows him to use MCS anywhere around the world. Whether you want to use MCS inside the company network, from the comfort of your home, or when you’re attending a conference abroad; MCS can go with you anywhere on your portable laptop. MCSv6 now allows users behind NAT to receive audio and video, so even the annoying hotel room NATed addresses will not interrupt your MCS experience. All you need is your username and password.

Server2Server: Unlimited Participants at a Constant Bandwidth
MCS utilizes a new revolutionary Server-2-Server (S2S) mechanism that allows an unlimited number of participants in a single conference. An icing on the cake is that MCS offers this at a constant low bandwidth.

Security
MCS provides a secure conferencing solution where only invited and approved users can join a conference. Other systems on the other hand have to use an MCU which allows any user to call in its IP address and join the conference where he can stealthily monitor the meeting. In today’s competitive corporate world, where an idea or a deadline is worth millions, this is simply not acceptable. MCS provides this security by implementing an innovative multipoint-to-multipoint technology that does not require the expensive yet insecure MCUs.
**Interactive Document Conferencing**
MCS’s newly integrated document conferencing and chat goes a step further than the typical document conferencing offered by current systems. Not only can you share your document (slide, word document, PDF, excel sheet, web pages etc...); MCSv6 allows interactive editing by all active participants (MCS allows 3 active + chairman). The changes to the document will be seen by all observer participants in real time. This makes collaborative decision making and brainstorming a simple task.

**Multicast Enabled.**
MCS uses Dynamic UDP multicasting for efficient transmission of real-time multimedia data. Multicasting removes interference caused to the other systems and servers by broadcast type traffic.

**Chairman Continuous Presence.**
MCS employs a very useful conference control criteria called **Chairman Continuous Presence** (C2P) which ensures that the chairman will always be present and active during a conference. Besides the chairman, MCSv6 now allows three active participants. The rest of the participants are observers. Observers can take turns to become active. This creates an organized and professional meeting room environment.

**Distributed Network Technology**
Distributed network entities continue to be a vital part of MCS version 6.0. By distributing specific functions to different entities, MCS optimizes throughput by having these different but related processes executed by different systems, creating parallel environments for information and data processing.

**Internet Real Time Streaming Standards Compliant**
MCSv6 is designed to meet the Internet Real Time Streaming Standards. This includes the capability to stream multimedia data using the Real-time Transfer Protocol as defined in RFC 1889.

**24 bit True Color Transmission**
This allows each user’s client to transmit real life colors as it is captured, providing a realistic color scenario of the transmission site. As a result, the picture quality is sharp with vibrant colors.

**RSW Control Criteria**
MCS uses the RSW Control Criteria, an advanced conference control method that replicates a meeting room to create the perfect conferencing environment. RSW control criteria also helps optimize bandwidth usage.

**UDLR Support**
MCS supports UniDirectional Link Routing (UDLR). UDLR is very important in networks that use satellite broadcast links which are unidirectional. It is designed to enable the operation of routing protocols over unidirectional links (UDLs) without changing the routing protocols themselves. UDLR enables a router to emulate the behavior of a bidirectional link for IP operations over a UDL.
**MCS ASP Server**

As opposed to MCS Enterprise Server which is developed for big enterprises, corporations and organizations that are scattered in various locations; MCS ASP Server is targeted towards service providers (ISPs/ASPs) who are interested in a hosting model. The ASP Server is meant to be hosted and connected to the backbone of a telecommunication or ISP’s network or data farm. Subscribers, in turn, use remote client to log into the server to access video and document conferencing services.

MCS ASP Server supports the full features of MCS Enterprise Server and comes in three configurations: ASP 250, ASP 500 and ASP 1000 with 250, 500 and 1000 user licenses, respectively per server. For more than 1000 users, multiple servers can be purchased. The service providers can in turn sell this conferencing service to a diverse array of customers including homes, offices, small and big companies, hospitals (Telemedicine) and schools (Distance Learning). We offer an optional customer support option for these accounts.

MCS ASP Server comes with an optional accounting module that can be used for billing purposes. It provides detailed information about the usage of the server including user ID, login and logout times.

MCS ASP Server offers tremendous scalability to accommodate a large number of users without having to buy extra expensive hardware such as the Multipoint Control Units (MCU) required by other competing products. MCS ASP Server includes a Multiple LAN IP Converter (MLIC) which enables multiple LANs interconnected by WANs to join in a conference. Combined with MCS’s Server2Server technology, MLIC provides superb connectivity with excellent bandwidth management.

MCS ASP Server features a new NAT traversal and firewall solution that greatly simplifies connecting from virtually anywhere. No more frustrated users who are NATed or behind a firewall. MCS transiently detects the user’s settings and connects to the server, ensuring a smooth trouble-free user experience.

![Figure 2.2: MCS Server](image-url)
MCS Client Packages

MCS clients come in three incarnations: MCS Desktop Client, MCS Boardroom Client and MCS Mini-Boardroom Client.

MCS Desktop Client

MCS Desktop client solution is the efficient way to communicate face to face, delivering business quality desktop videoconferencing from the convenience of your office, home or even when you are on the move. MCS Desktop client is very unique compared to other H.323 based videoconferencing solutions as it supports dynamic IP configuration (DHCP). This means that users can be invited to a conference by name rather than dialing their numbers or IP addresses. Users using this system can thus be mobile and still be connected/invited to a conference anywhere in the world even when their IP address changes. MCS Client software is free and easily downloadable. A valid MCS user license must be used to connect to the server. The user license can be purchased via service providers hosting an MCS ASP Server or as part of the MCS Enterprise Server Edition. The Client software seamlessly integrates onto any existing or available infrastructure and can be effectively used for meetings, trainings and collaboration on active projects in real time. MCS Desktop Client includes the MCS Document Conferencing and Chat feature, where multiple file formats can be shared and edited in real-time.

Figure 2.3: MCS Desktop Client on your office PC or you portable computer when you're on the move

MCS Boardroom Client

MCS Boardroom Client delivers top-quality video, state-of-the-art audio which is user-friendly and easy to manage. It is equipped with a 34” high resolution monitor, high resolution Pan Tilt Zoom camera and advanced audio echo cancellation. MCS Boardroom Client is suitable for large conference rooms, trainings and collaboration on projects and designs where more than 15 people are involved real-time.

MCS Boardroom Client also supports the MCS Document Conferencing feature and can be used with all MCS solutions and any other H.323 compatible video conferencing system. MCS Boardroom Client offers unbeatable value for a high-end boardroom solution at a very competitive price compared to any of its competitors.
MCS Mini-Boardroom Client

MCS Mini Boardroom Client is developed based on the MCS Boardroom Model. It is designed to meet the needs and budget of small boardrooms and offices where 6 to 8 participants can conference in real time. Versatile and compact, the system can be moved to different locations where required and simply plugged-in to their existing network point to videoconference. One unique feature of MCS Mini Boardroom is the attractive twin screens dedicated separately for video and document conferencing from a single compact codec unit.
MCS System Description

MCS is divided into several components, making it very modular and flexible. Each of these components is a network entity, operating almost independently of each other. By just adding or taking out these components, MCS can cater for different needs and requirements. This will be illustrated in detail later.

MCS version 6.0 features include:-

Features:-

- NAT Traversal Solution: Now MCSv6 allows multiple clients behind NAT to flexibly send and receive audio and video.
- Global Roaming: MCSv6 client, with its support for dynamic IP configuration and its new NAT solution, frees the user from the IP constraint and allows him to use MCS anywhere around the world using his user name and password. No MLIC is needed.
- Simplified Server License Activation Process: The old tedious process is now replaced in version 6 with a simple process where you can activate the server from the host itself. Just invoke the program and it will connect to the license server and automatically upload and download the necessary information.
- Echo Cancellation: MCSv6 now offers cutting-edge hardware acoustic echo cancellation microphones that effectively remove all echo and background noise ensuring a clear and pleasant conferencing experience. These elegant and stylish echo cancellers will fit perfectly into your conferencing or meeting room.
- Three Active Support: Instead of two active participants only MCSv6 now allows three participants to be active simultaneously, in addition to the chairman who is always active. Thus, four duplex videos can be displayed simultaneously.
- Profile Customization: Users can easily save their customized settings into a profile, enabling multiple users with multiple configurations. Each profile maintains its own settings and options.
- Last Dialed: MCS stores the last 5 server IP addresses entered by the user.
- Users can set their status (Available, Away or Busy) before or during a conference.
- Users can flexibly change their password directly from MCSv6 client.
- Messages from the server are displayed at the client. Information of multiple servers can be saved.
- Integrated Options Page. All MCSv6 settings and options are provided in one easily accessed area.
- Buddy Alert: create a buddy list of users you wish to get notified when they login.
- Quick Conference (beta)
  - Auto Save: Quickly recreate the last conference
  - Can manually save any conference
  - Can quickly recreate saved conferences
- Client indicator (Show client version, for example executive or enterprise version).

User Interface:-

- Improved user friendly GUI with Window XP’s looks and feel.
- Customizable Skin: Users can change MCS skin to reflect their individuality.
- Other users’ audio and video information is provided.
- Alternative ways for the user to access the features/controls.
- Dual View ➔ Normal View: For maximum information;
  ➔ Compact View: More screen space for other work, see Figure 2.6.
- MCS can be set to be always on top, where it will not be hidden by other windows.
- Integrated Chat and Document Conference, less dialogs and controls on the desktop.
- Users can select left, right, top, bottom or center alignment for the video window.
- Quick Control Button: Show Available, Hide Offline when creating conference.
- MCSv6 utilizes the system tray icon, with less clutter on the taskbar.
Startup Options:

- Auto login – MCS can be set to automatically log into the server after 5 seconds of its startup.
- Option to minimize MCS to the system tray.
- Option to enable/disable the splash screen that is displayed at MCS startup.

Utilities:

- MCS Accounting: MCSv6 ASP Edition introduces a web-based accounting utility to be used by administrators to process MCS usage and generate reports and payment bills.
- MCS Web Admin: A new remote server administration utility with a web interface. Now an administrator can easily configure MCS anywhere. Features include remotely creating new users and groups, reconfiguring the ASP Server, etc...
- MCS Recorder: A new stand-alone utility that records the ongoing conference. With MCS Recorder you can easily archive an important meeting for future reference.
- Debug Utilities: Built-in debug utilities provide advanced Audio/Video statistics (incoming packets/s, packets dropped/s, etc...). These statistics enable the user to evaluate the status of the network during a conference. For more details see the Audio/Video module section.

Extra Options:

- Built in support for both MCS and ITU H.323 standard.
- More control for the chairman over the conference (remove/drop/invite/change).
- Integrated Document Conferencing and Chat modules provide more options and functions.
- Multiple conference invitations notification.
- Multiple chat conferences and chat log for future reference.
- Intelligent installation and un-installation.
- Port customization
- Dll version information is provided.
- UDLR support

The entities of MCS are:

- **MCS Client**
  - MCS Main Control
  - MCS Conference Monitor
  - MCS Audio & Video
    - Audio
    - Video
    - Compression
    - Echo Cancellation
  - MCS H.323
  - MCS Document Conferencing and Chat Client
  - MCS NAT Traversal and Firewall Solution

- **MCS Server**
  - MCS Communication Server
  - MCS Document Conferencing and Chat Server
  - Multiple LAN IP Converter (MLIC)
  - MCS Accounting
  - MCS Web-Admin

- **MCS Live Update**

- **MCS Recorder**
MCS is not just a client-server based application, but one that supports distributed network entities. The client entity is the user based GUI application that works on the end user’s PC.

Client Configuration:

### Table 2.1: Client Configuration

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum</strong></td>
<td></td>
</tr>
<tr>
<td>Processor</td>
<td>PIII 966Mhz</td>
</tr>
<tr>
<td>RAM</td>
<td>256MB</td>
</tr>
<tr>
<td>Hard Disk</td>
<td>50 MB</td>
</tr>
<tr>
<td></td>
<td>Win 2000</td>
</tr>
<tr>
<td></td>
<td>Win XP</td>
</tr>
<tr>
<td></td>
<td>Win 2003</td>
</tr>
<tr>
<td><strong>Recommended</strong></td>
<td></td>
</tr>
<tr>
<td>Processor</td>
<td>PIII 1.2 Ghz</td>
</tr>
<tr>
<td>RAM</td>
<td>Min 256MB</td>
</tr>
<tr>
<td>Hard Disk</td>
<td>200 MB</td>
</tr>
<tr>
<td></td>
<td>Win 2000</td>
</tr>
<tr>
<td></td>
<td>Win XP</td>
</tr>
<tr>
<td></td>
<td>Win 2003</td>
</tr>
<tr>
<td></td>
<td>PIII 1Ghz</td>
</tr>
<tr>
<td></td>
<td>256MB</td>
</tr>
<tr>
<td></td>
<td>50 MB</td>
</tr>
<tr>
<td></td>
<td>P4 1.4Ghz</td>
</tr>
<tr>
<td></td>
<td>384MB</td>
</tr>
<tr>
<td></td>
<td>50 MB</td>
</tr>
</tbody>
</table>

PC with above specification must have:-
- Multimedia (full duplex sound card, microphone, speakers).
- Network Interface Card.
- USB web camera or Video Capture Card with Supported Video Camera.

**Software provided**  
MCS-Client Application

The main modules of the client entity are MCS Main Control and Conference Monitor, which do all the coordination and synchronization for the client entity, MCS Audio & Video, Compression, Audio Echo Cancellation, MCS H.323 Conference, MCS Document Conferencing and Chat Client and MCS NAT Traversal and Firewall solution.
MCS Main Control & MCS Conference Monitor

- Functions of MCS Main Control:
  - Provides controls for login/logout chat.
  - Provides controls to create conference and join conference for MCS mode.
  - Provides controls to call and hang up for H.323 mode.
  - Provides controls to switch status (Available, Busy, or Away).
  - Provides controls to switch between H.323 mode and normal MCS mode, prior to login.
  - Provides communication interface with MCS servers.
  - Provides user lists for the Chat and Document Conferencing module.
  - Provides feedback of client and server messages to users.
  - Loads and handles synchronization of chat, MCS conference monitor and H323 module.

Figure 2.6: MCS Main Control

- Functions of MCS Conference Monitor:
  - Loads and handles synchronization of audio, video and Document Conferencing modules.
  - Provides controls to access audio/video/Document Conferencing features.
  - Provides controls to Start/Stop transmission for the chairman and active users.
  - Aligns video window relative to the screen.
  - Provides controls for muting the speaker/microphone.
  - Shows Mic In Peakmeter/Indicator.
  - Set Video Resolution/Frame Rate/Property.
  - Provides controls for conference control.
  - Provides user status information (e.g., participant/observer/joined active)

- Users: Request, Release, Unqueue, Leave
- Chairman: Change Status, Invite, Remove, Drop, End
- New features:
  - Auto join conference -> if status is available
  - Quick Conference : Save last conference -> Allows the user to quickly recreate last conference

Figure 2.7 below depicts what a client would see whenever a conference is started. Each conference is given an ID in the form of a name. The default conference server is the server within your LAN. Other conference servers which are to be involved in the conference are also selected. All the users registered with the conference server will be displayed. The chairman (person who starts the conference) will select the users s/he wishes to invite for the conference. Users may also request to join the conference and the chairman can approve or deny their request. The chairman can define users as either participants or observers. Participants can request and actively transmit audio and video. Observers can only passively listen and watch the conference.
Once the conference has started, the chairman may still invite more users by selecting the user on-the-fly without restarting the conference.

Figure 2.7: Different types of participants

Figure 2.8: Choosing conferencing server and users for conferencing
MCS Audio & Video

MCS audio and video use the UDP (Multicast) protocol for transmission. This is due to the lossy nature of audio and video. MCS also implements a customized RTP (Real-Time Transport Protocol) with some modification to ensure the proper sequencing of packets, and support for other signaling and QoS information.

MCSv6 video module utilizes a new capture and playback architecture that is based on Microsoft DirectX. The new architecture significantly enhances the video quality, especially for the 640x480 resolution. It also lowers the CPU utilization and uses low bandwidth.

Figure 2.9: Two MCS users making a video conference call with chatting
For the video module, the video packets that are transmitted fulfill the following specification:

**Table 2.2: Video module’s specification**

<table>
<thead>
<tr>
<th>Resolution available</th>
<th>128 x 96, 160 x 120, 176 x 144, 320 x 240, 640 x 480</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment available</td>
<td>Left, Right, Top, Bottom, center, Boardroom(size of 320 x 240), 640 x 480 for P2P conference (fix mode)</td>
</tr>
<tr>
<td>Image type</td>
<td>24 Bit True Color</td>
</tr>
<tr>
<td>Protocol</td>
<td>UDP (Unicast and Multicast Packets)</td>
</tr>
</tbody>
</table>

Additional user friendly video features include:-

- The position of the video windows can be easily adjusted.
- Stop and start video transmission on-the-fly during conference.
- Auto-size the video window according to the sending parties’ resolution.
- Video frame rate can be adjusted to achieve the desired quality.
- Set video property and video source on-the-fly.
- WDM camera support

MCSv6 audio module uses a new capture and playback architecture that is based on Microsoft’s DirectX. The new architecture improves the audio quality, optimizes CPU usage and uses low bandwidth.

The audio module includes the following features:-

- Adjust and mute microphone/ audio capture.
- Adjust and mute audio playback.
- Mic In peakmeter/indicator (only available in system that supports multiple sound capture from the sound card).
- Auto adjust Mic volume (based on Mic In Peakmeter, this feature will be disabled if Mic in peakmeter is disabled).
- Recalibration: re-initialize DirectX filter and sound buffer on the fly with new sound buffer size. This is important to enhance the audio quality in congested network.

The audio module supports GSM 6.10 and Microsoft ADPCM codecs. The audio packets that are transmitted fulfill the specification below:

**Table 2.3: Audio module’s specification**

<table>
<thead>
<tr>
<th>Data type</th>
<th>Wave Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>UDP (Unicast and Multicast Packets)</td>
</tr>
</tbody>
</table>

Both video and audio modules include debug utilities that generate advanced user statistics at the playback side to monitor the audio and video streams. The statistics include incoming packets/s, bytes/s, packets dropped/s, incorrect sequence packets/s, total bytes received and total packets received. These utilities enable MCS users to understand the status of the network and the multimedia streams conditions during a conference. At the capture side, debug information are written into a file containing IP address, port number and data size captured.
Compression

Compression is used to further enhance the distributed aspect of the multimedia conferencing system. The data compression module is needed for enhancing the performance of transmission over the LAN, MAN and WAN connections, especially when the bandwidth is limited.

Within the data compression module, any chosen compression algorithm (or multiple algorithms) can be implemented. Examples include:

- VDO Wave
- MJPEG
- H.323
- YUV411
- MPEG4
- Intel Indeo 5.0

MCS uses the VDOnet VDOWave Video Codec compression and decompression standard. This codec provides scalability with the best balance of quality at very low bandwidth.

The functions of the data compression module include:

- Take the Audio/Video frames passed in raw format from the client entity.
- Compress this Audio/Video data and pass it back to the client entity.
- Receive compressed Audio/Video frames from the client entity.
- Uncompress Audio/Video data and pass it back to the client entity.

Audio Echo Cancellation

MCSv6 now offers high-end hardware acoustic echo cancellation microphones. A stylish and attractive addition to your meeting room, MCS echo canceller effectively removes all echo and noise ensuring a clear and pleasant listening experience.

![Figure 2.10: MCS Acoustic Echo Cancellation Microphone](image)

MCSv6 Echo Canceller Microphone boosts the following features:

- Distributed Echo Cancellation effectively eliminates echo
- Noise cancellation removes background noises (fans, air cons etc…)
- Wideband digital audio (50 Hz-7 kHz) enhances audio quality
- MCS echo canceller microphone provide 360° audio pickup
- Mute button and LED glow indicates when “power-on”
- Simply link an additional MCS echo canceller microphone for expanded coverage in larger rooms
- Small, stylish and portable design that fits perfectly into conference and meeting rooms
- Full-duplex sound enables participants to speak and listen at the same time without cutting in and out.
**MCS H.323**

In addition to MCS video conferencing, MCS includes the ability to use H.323 ITU standard for video conferencing. You can use H.323 mode to communicate with any client that supports H.323 (MCS, Microsoft NetMeeting, GnomeMeeting...) This gives MCS users the absolute freedom to communicate not only with other MCS users, but with any H.323 user. Just dial in the IP address of the user you want to communicate with and you’re good to go. See the figure below.

- Enable p2p video conferencing with other non-MCS clients that support the ITU H.323 standard.
- Able to both dial and receive calls.
- Able to connect to an H.323 MCU for multipoint conferencing.
- Able to connect through an H.323 Gatekeeper.
- Able to send and receive CIF and QCIF videos.
- Able to go full screen (Boardroom mode only).
- Advanced settings: Network bandwidth selection, Audio/Video Codec selection, Audio Buffer/jitter options can be adjusted as shown in Figure 2.5.

![Figure 2.11 LEFT: choosing H.323 module, RIGHT: make an IP call](image)

![Figure 2.12 LEFT: the call is connected, RIGHT: H.323 option](image)
Figure 2.13 TOP LEFT: general settings, TOP RIGHT: Gatekeeper settings,
BOTTOM LEFT: video settings, BOTTOM RIGHT: audio settings
MCS Document Conferencing and Chat Client

MCSv6 now boasts a newly integrated document conferencing and chat client that ensures a robust and smooth performance. It is perfect for remote presentations, document collaborations, distance learning, remote medical consultations, decision support systems and file sharing. The chat feature is a full-featured chatting program that provides text-based conferencing functionality. The document conferencing feature allows the client to transfer files and perform Document Conferencing (share and edit files, web pages, etc...) MCS Chat can be used by itself from the client or within MCS document conferencing.

Chat features:-

- Multipoint-to-multipoint chat conference.
- Supports simultaneous multiple chat conferences.
- Ability to invite users on-the-fly.
- Fully integrated within MCSv6.
- Log file to automate minutes taking.
- Real time participant status update to show the status of the participants joining the conference.

File transfer features:-

- Users can transfer any type of files to a specific online user or to all the online users.
- Option to automatically receive files from a specific user or all users.
- Can transfer files during conferencing or when not in conference.

Document Conferencing features:-

- Only during conference
- Supports most popular file types, such as
  - Power point presentations
  - Microsoft Excel sheets
  - Word documents
  - Web pages
  - All picture files
  - All text
  - Email files
  - Macromedia flash
  - All audio and video
  - Adobe PDF file
  - AutoCAD files
- Anyone can be presenter, the token can be delegated to other joined participants in the conference when the chairman passes the token to a specific participant, or when a user requests delegation and is granted by the chairman.
- Chairman has the right to withdraw the delegation from presenter.
- Control of slides by presenter, slides can be synchronized in participants’ DC window.
- Quick update in DC window itself for MS word and Excel Document by presenter, and updated document can be updated in participants’ site.
- Advance feature: show downloading status for all the users when sharing files.
- Pop up dialog for users to save presented files at the end of conference.
- Feedback (for file transfer in general)
- Modified date synchronization, for files received using DC. Each transferred file carries its original modification date in coordinated universal time (UTC) format, to overcome the problem faced with different regions; this will keep all the receivers up-to-date with the original file (for file transfer in general).
- Opening media files inside the DC browser.
Figure 2.14: Integrated MCS DC and Chat: docked view on left, undocked view on right

Figure 2.15: A website shared using MCS DCH
Figure 2.16: A Microsoft PowerPoint Slide shared using MCS DCH

Figure 2.17: A Microsoft Excel sheet shared using MCS DCH
Figure 2.18: A Microsoft Word document shared using MCS DCH

Figure 2.19: A PDF document shared using MCS DCH
Figure 2.20: A JPG picture shared using MCS DCH

Figure 2.21: A Flash file shared using MCS DCH
Figure 2.22: An MP3 song shared using MCS DCH

Figure 2.23: A Quick Time movie shared using MCS DCH
MCS NAT Traversal Solution

MCSv6 introduces a new NAT traversal solution that allows multiple clients behind NAT to flexibly send and receive audio and video. The solution transiently and automatically detects the user’s settings and allows the user to successfully send and receive data.

MCS NAT Traversal Steps

- The client sends an initialization packet
- NAT captures the packet and replaces the client’s private IP address with its own public IP address.
- The server receives the initialization packet and replies with the same packet to the NAT
- When the NAT receives the packet it establishes a NAT session and sends the response packet to the client.
- Now that the NAT session has been established, the client and the server can exchange data
- The session is maintained until no data is exchanged. After a timeout the NAT closes the session.

Since UDP does not guarantee packet delivery, the solution must ensure that the initialization packet which establishes the NAT session is received by the server and that its response is received by the client. This can is achieved by using internal acknowledgement.

- The server sends an acknowledgement when it receives the initialization packet.
- The client sends an acknowledgement when it receives the NAT session response packet.

If an acknowledgement is not received, the packet is sent again.

UDP is a connectionless protocol; hence the NAT does not know when the session is finished. NAT terminates the session if the server and the client do not exchange any data for a specific timeout period. The timeout period is typically between 30 seconds to 1 minute. However, the NAT administrator may change the timeout period.

MCS NAT traversal solution solves the timeout problem by sending a “keepalive” packet from the client to the server to keep the session alive. When no data packets are being exchanged, the client sends an empty “keepalive” packet to the server. Since the packet is empty, it will keep the session from being terminated without overloading the network.

MLIC maintains a table for the ports opened in NAT for each conference and for each NATed client. This is done during the NAT session initialization of each port.

For each conference, MLIC records the following:
- An ID corresponding to the index in the table
- The state: Active/ Inactive
- The multicast address used by the clients to identify a conference
- A list of NATed clients

For each client, MLIC records the following:
- The public IP address of the NAT that the client uses
- The local address of the client
- The number of open ports on the NAT (sending and receiving ports)
MCS Firewall Configuration

Most firewalls use packet filtering approach to control the incoming and outgoing packets, usually by using information like port numbers or IP addresses. They either block the packet or allow it to go through the network if it matches the listed rules. Firewall users usually need to set up security rules based on this information, to make the firewall work according to their needs.

As MCSv6 is a server-client and IP-based video conferencing system that uses the internet or any other network to exchange data, it is extremely important for MCSv6 users who use firewalls in their network to configure their firewall security rules properly, in order to run MCSv6 smoothly. This is because MCSv6 uses a range of port numbers in the program itself for the client-server, server-server and client-client communication.

By default, MCSv6 uses port numbers ranging from 13250 TO 13270. Ports 13250-13259 uses TCP connection while ports 13260-13270 uses UDP connection. Users simply need to make sure that packets with these port numbers are not blocked (i.e., open these ports). Also, in the case of firewalls that block packets based on IP addresses, users must ensure that IP addresses held by any MCSv6’s clients and servers they wish to communicate with are not blocked.

MCS’s well-defined port usage maintains the firewall’s security provision. Furthermore, MCS supports port customization which allows a user to change the ports he wants MCS to use to any desired range.

The figure below shows one example of the above mentioned scenario:

*Figure 2.24: MCS in networks with Firewalls*
MCS Server Entity

MCS Server entity includes the following: MCS Server, Document Conferencing and Chat (DCH) Server, Multiple LAN IP Converter (MLIC).

MCS Server

MCS server employs the **RSW control criteria**, which is a set of rules that uses the client-server style of communications. The RSW control criteria was created to optimize the high bandwidth requirement of multimedia conferences as well as to create an intuitive system of order for these conferences. The main purpose of MCS server is to maintain and control the conference according to the RSW control criteria used.

The functions of MCS server include:

- Controlling the conference using the chosen RSW control criteria.
- Allowing users to login into the system.
- Allowing users to change their passwords after they login.
- Establishing inter-server links (during multi-server conferences).

In a multi-server conference, there will be communications between the servers from each LAN. The server within the LAN in which the conference is started will communicate all information regarding the conference to the other servers. This information includes the chairman, the control criteria used, the participants invited from each LAN, and the undated queue information in real-time.

![Figure 2.25: MCS in a Multi-LAN environment Inter-Server communication](image-url)
MCS Document Conferencing and Chat (DCH) Server

The MCS DCH Server is a server side program that is used to receive/send message from/to MCS clients and to coordinate document conferencing sessions between the clients. It is started by MCS Server and the first packet is generated by MCS server. If MCS server is never started, MCS DCH Server can not be activated. MCS DCH Server will be restarted when it receives a restart signal from the MCS server.

MCS DCH Functions:-
- It receives messages in packets from client
- It reflects the packets to other clients in conference excluding the original sender
- Acts as a central unit for authentication and exchange of data and controls

MCS DCH Features:-
- A user can initiate multiple chats at the same time.
- Once a user is invited to a chat, the user will be automatically added in when the user logs into the server.
- It allows for multiple sessions or conferences to be held concurrently.

Multiple LAN IP Converter (MLIC)

MLIC enables multiple LANs interconnected by WANs to join in a conference. Since MCS transmits multicast packets, these packets are generally dropped by the WAN routers (See the dotted line in figure 2.26). MLIC converts these multicast packets into unicast packets to enable them to pass through these WAN routers to reach the other LANs. On the receiving end another MLIC converts these unicast packets and retransmits them as multicast packets onto the LAN.

When the MLIC entities are added to the above architecture, now the solid line represents video and audio multicast data that are successfully transmitted between these two LANs via the WAN Router. Now both LANs can join in each other’s conferences. The MLIC is indicated as a separate hardware unit in the diagram, but in reality, it is a software component that sits in the same hardware unit as the server.
MLIC functions:
- Audio/Video packets are transmitted by the client (active site) in LAN 1. MLIC in LAN 1 will
  - Listen to specified port for Audio/Video UDP multicast packets.
  - Change these packets into Audio/Video UDP unicast packets and transmit them.
- The converted packets then go through the WAN router to LAN 2. The MLIC in LAN 2 will then
  - Receive Audio/Video UDP Unicast packets from the MLIC in LAN 1.
  - Change Audio/Video UDP Unicast packets to Audio/Video Multicast packets and retransmit within LAN 2.

**MCS Accounting**

MCSv6 ASP Edition introduces a powerful web-based accounting utility that can be used by administrators to process ASP Server usage and generate reports and payment bills. It provides information such as user ID, login time and logout time.

You must have administrator privileges to use MCS Accounting. Once you login you can:
- View ASP Server usage reports.
- You can view daily reports, monthly reports, or customize your request by specifying start and end dates.
- You can view a report for certain users or for all users.
- You can set the user’s charging rate
- Add a new currency, delete and existing currency or edit it (change exchange rate)
MCS Web Admin

MCS Web Admin is a new remote server administration utility with a web interface. With MCS Web Admin an administrator can easily configure MCS anywhere. Features include remotely creating new users and groups, reconfiguring the ASP Server, etc...

You must have administrator privileges to use MCS Web Admin.
You can use MCS Web Admin to remotely change a user’s password (See Figure 2.19), change server configurations (See Figure 2.30), add/delete users and add/delete groups (See Figure 2.31).
MCS Live Update Entity

MCS Live Update is a software update system that downloads and updates MCS Client with the latest version of the files from MCS Server anytime, anywhere. It consists of server and client applications.

MCS live update functions include:

- Update and delivery of versioned and un-versioned files.
- Encrypted server pack update.
- Client pack update.
- Auto components registration.
- Logging off Servers.

Figure 2.32: MCS Live Update under MCS Options.
# 3.0 MCS Standard

**Table 3.1: MCS Standard**

| Transmission Standard          | IPv4 for IP  
|                               | IP multicasting standard  
|                               | Working on native IPv6 support for IP  
| **Video & Audio Packet Framing Standards** | Internet’s Real Time Protocol (RFC1889) for real time data - RTP  
|                               | Audio standard: GSM, ADPCM  
|                               | Video standard: VDOnet VDOWave  
| **Control Standard**          | RSW control criteria standards  
| **Software Architecture Standards** | Microsoft’s COM architecture  
|                               | the latest cutting edge standards in components  
| **User Interface**            | User friendly GUI  
|                               | Integrated chat and Document Conferencing capabilities  
| **Video Resolution**          | Changeable according to client preference  
|                               | 640 X 480  
|                               | 320 x 240  
|                               | 176 x 144  
|                               | 160 x 120  
|                               | 128 x 96  
| **Frame Rate**                | Default 30  
|                               | Changeable according to client preference 1-40  
| **Full-Duplex Digital Audio** | Instant adaptation echo cancellation  
|                               | Automatic gain control  
|                               | Automatic noise suppression  
| **Ethernet/Internet/Intranet Connectivity** | Supports TCP/IP, DNS, WINS, SNMP, DHCP, ARP, WWW, ftp, Telnet, 10/100 Mbps Ethernet Hub  
| **Utility**                   | Web-based administrative tool  
|                               | User can set status (Available, Away, Busy)  
|                               | User password changeable on client  
|                               | Built-in support for MCS and H.323  
| **Startup**                   | Auto-login to the server  