

# **N\*Cast Product Specification**

## **N-Way Reference Manual**

Revision 1.2

October 15th, 2007

Software Release 1.0



Copyright © N\*Cast Corporation, 2007

## Table of Contents

<a href="#">1. Introduction.....</a>	<a href="#">4</a>
<a href="#">1.1. Purpose.....</a>	<a href="#">4</a>
<a href="#">1.2. Document Overview.....</a>	<a href="#">4</a>
<a href="#">1.3. Terms and Definitions.....</a>	<a href="#">4</a>
<a href="#">1.4. Telepresenter Units.....</a>	<a href="#">5</a>
<a href="#">1.5. N-Way Server Functionality and Modes of Operation.....</a>	<a href="#">5</a>
<a href="#">2. Server Administration.....</a>	<a href="#">10</a>
<a href="#">2.1. Defining an N-Way Account .....</a>	<a href="#">10</a>
<a href="#">2.2. Account Creation.....</a>	<a href="#">11</a>
<a href="#">2.3. Account Modification.....</a>	<a href="#">11</a>
<a href="#">2.4. Account Channels.....</a>	<a href="#">13</a>
<a href="#">2.5. Account Viewers.....</a>	<a href="#">13</a>
<a href="#">2.6. Archive Playback.....</a>	<a href="#">14</a>
<a href="#">2.7. Web Server Configuration.....</a>	<a href="#">14</a>
<a href="#">3. Telepresenter N-Way Access.....</a>	<a href="#">15</a>
<a href="#">3.1. N-Way Settings.....</a>	<a href="#">15</a>
<a href="#">3.2. Channel MTU Settings.....</a>	<a href="#">16</a>
<a href="#">3.3. Multicast Settings.....</a>	<a href="#">16</a>
<a href="#">3.4. Operating Restrictions.....</a>	<a href="#">16</a>
<a href="#">4. Information Pages Reference.....</a>	<a href="#">18</a>
<a href="#">4.1. Session Page.....</a>	<a href="#">18</a>
<a href="#">4.2. Viewers Page.....</a>	<a href="#">18</a>
<a href="#">4.3. Statistics Page.....</a>	<a href="#">19</a>
<a href="#">4.4. Logs Page.....</a>	<a href="#">20</a>
<a href="#">4.5. Configuration Page.....</a>	<a href="#">20</a>
<a href="#">5. Server Access.....</a>	<a href="#">22</a>
<a href="#">5.1. Web Interface.....</a>	<a href="#">22</a>
<a href="#">5.2. Streaming Server Interface.....</a>	<a href="#">22</a>
<a href="#">5.3. Secure Shell.....</a>	<a href="#">23</a>
<a href="#">5.4. Port Usage.....</a>	<a href="#">23</a>
<a href="#">6. N-Way System Operation – Detailed Examples.....</a>	<a href="#">24</a>
<a href="#">6.1. The N-Way Client.....</a>	<a href="#">24</a>
<a href="#">6.2. N-Way Connectivity - Sending.....</a>	<a href="#">25</a>
<a href="#">6.3. N-Way Connectivity - Receiving.....</a>	<a href="#">25</a>

- [6.4. N-Way Restriction – Server and Client on the Same LAN.....26](#)
- [6.5. N-Way Restriction – Two Tunnels on the Same LAN.....26](#)
- [6.6. N-Way Restriction – Multiple Hops from the LAN.....27](#)
- [7. Client Web Page Linkage.....28](#)
  - [7.1. Media Player Links.....28](#)
  - [7.2. RTSP Links.....28](#)
  - [7.3. Multicast Links.....28](#)
  - [7.4. RTSP Movies.....29](#)
  - [7.5. Launching Quicktime Player – QTL Files.....29](#)
  - [7.6. Launching Windows Media Player – ASX Files.....29](#)
  - [7.7. Embedding Quicktime Player in a Web Page.....29](#)
- [8. References.....31](#)
  - [8.1. MPEG Compression.....31](#)
  - [8.2. Packet Transmission.....31](#)
  - [8.3. Multicast.....31](#)
- [9. Revision History.....32](#)

## 1.Introduction

---

### 1.1.PURPOSE

The N:Cast N-Way Reference Manual is intended for the Network engineer who will be tasked with the job of installing and setting up an N-Way Server. This guide is designed to cover topics in depth and assumes the reader is familiar with network protocols such as multicast, topics such as webcasting and running of a Linux-based web server.

### 1.2.DOCUMENT OVERVIEW

This document is divided into three major sections: introduction to the operation and functionality of an N-Way Server, instructions on how to configure the server for customer accounts, and configuration of a Telepresenter for use with N-Way service.

### 1.3.TERMS AND DEFINITIONS

A complete discussion of network protocols, Internet streaming, webcasting and related topics is beyond the scope of this document. Other sources cover this material in great detail. The following are brief definitions of some of the terms used throughout this manual.

AAC – Advanced Audio Coding, a wideband audio encoding and compression algorithm.

IETF – Internet Engineering Task Force, the standards body for Internet protocols.

ISO – International Standards Organization

Latency – The end-to-end time delay between a change in the source image and the corresponding change in the remotely displayed image.

Lip-sync – The synchronization of independent audio and video streams at a receiving decoder so that the presentation is in the same time relationship as the source.

MPEG Compression – MPEG is an acronym for Motion Picture Experts Group, an industry-wide committee that has defined a series of standards for the compression of audio and video source material.

MTU – The maximum transmission unit is the maximum number of bytes permitted in a transmitted packet.

Multicast – A family of computer transmission protocols where multiple receivers access a single transmitted packet stream.

NCCP – N:Cast Conference Control Protocol provides coordination, control and identification of participants in a multi-way collaborative conference session.

N-Way – An N:Cast proprietary service for multicast bridging and webcasting.

RFC – Request for Comments, an Internet protocol standard.

RTSP – Real-Time Streaming Protocol is an IETF approved protocol for control of real-time streaming on the Internet.

Telnet – An IP network based protocol, which was originally used to connect remote consoles and terminals to mainframes, but is now used as a general, bi-directional, [byte oriented](#) communications facility. See RFC's 854 and 855.

Unicast – Refers to a point-to-point connection between two Internet host machines.

## 1.4. TELEPRESENTER UNITS

The Telepresenter is a stand-alone network communications appliance which captures RGB (VGA) signals from a desktop or laptop, compresses the image with an industry standard compression algorithm, packetizes and transmits the imagery as an internet media stream, receives a media stream from the internet, decompresses the imagery, and presents the received information to a viewing audience through use of a large-screen computer (VGA) monitor or via a room projector. Some Telepresenter models also archive the media stream in real-time, allowing for playback by the recipient at a later date.

The following Telepresenter models are capable of using N-Way services:

- Telepresenter S – A small stand-alone unit used primarily for webcasting.
- Telepresenter G2 – A rack mounted unit with streaming and archiving capabilities.
- Telepresenter M2 – A desktop unit with MPEG-2 video, PCM audio and JPEG graphics.
- Telepresenter M2P – A rack mounted unit with streaming, archiving, collaboration and PIP capabilities.
- Telepresenter M3 – A rack-mounted unit with streaming, archiving, collaboration, UXGA and PIP capabilities.
- Telepresenter M3 Series 2 – A rack-mounted unit with streaming, archiving, collaboration, WUXGA, HD and PIP capabilities.

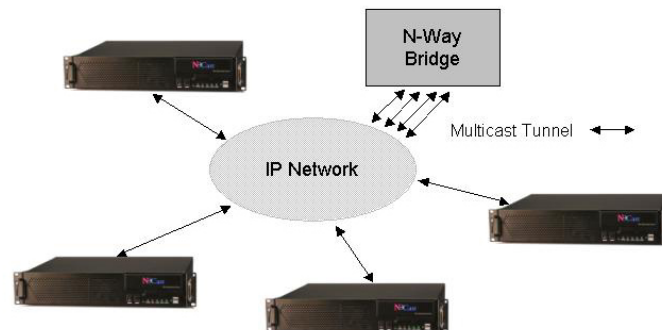
All Telepresenter models share a core operating system and base set of features.

## 1.5. N-WAY SERVER FUNCTIONALITY AND MODES OF OPERATION

The N-Way Server supports the following major services:

### 1.5.1. Multicast Bridging

Through the use of N-Way bridging and tunneling protocols, multiple Telepresenters, which are not situated on a native multicast network, can participate in a conference through the use of the server as a bridge. All the standard Telepresenter modes of operation (one-way streaming, full-duplex streaming and collaboration mode) are supported through use of the bridge. The N-Way Server must be located at a network point where multiple streams (one for each participating unit) can exist and flow without impacting or overloading the network. Multicast traffic at each end point is forwarded through the tunnel and emerges at the bridge where it is routed to all participating parties. The simplest conceptual model for this usage is a hub-and-spoke arrangement, where each remote Telepresenter is at the end of a spoke, and the N-Way Server is the hub located in a high-bandwidth network operations center.



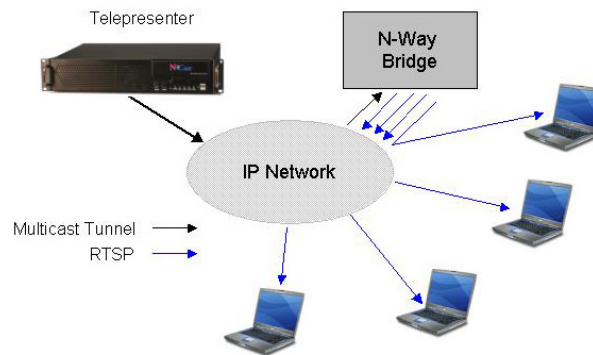
More complex architectures are possible for special applications (See Chapter 6). If the N-Way Server itself is located on a multicast network, traffic can flow from the multicast network through the bridge and its tunnels to the remote units (but the reverse of that flow is not supported). Also, multicast traffic from the local LAN of each

remote unit maybe forwarded to the bridge. Contact N-Cast for details on the uses and potential limitations of network architectures beyond a simple hub-and-spoke arrangement.

In each case, multicast traffic (the media streams) generated by the remote Telepresenter is encapsulated into a packet which is sent via unicast to the N-Way bridge, where it is unpacked and mixed with all other multicast streams present at the bridge. The server looks at all the multicast traffic in the mix, and forwards, via the reverse unicast connection, the media streams desired by a remote unit. Multicast group traffic not requested by a remote unit is discarded and not forwarded to any remote site.

### 1.5.2. One-to-Many Streaming using Multicast Bridging and RTSP

In this mode of operation one of the Telepresenter designated as the “Sender” is generating a media stream and forwarding this stream via a multicast tunnel to the N-Way Server. At the server the media stream packets are de-encapsulated and placed onto the local network as a multicast source. A streaming server process running in the N-Way Server can then accept RTSP protocol requests from remote desktops and forward media streams in the local multicast mix to the remote clients.



This mode of operation allows many hundreds of viewers (who have only unicast connections) to watch the encoded output of a single Telepresenter. The N-Way Server must be at a network point where the aggregation of many unicast streams will not impact functioning of the network.

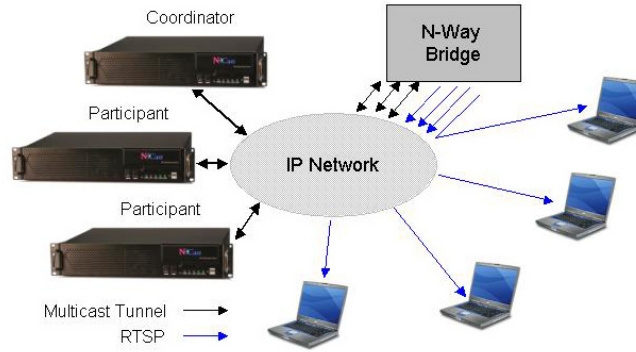
There is, within each Telepresenter, a similar one-to-many RTSP connection function, and for small groups and low bandwidth connections the use of an N-Way Server is not required. However, the number of viewers is limited and it is possible that the sending (encoding) Telepresenter is at a network location where the aggregation of multiple unicast streams will choke the network connection. In this case, the encoded stream should be tunneled to a central network point where mass distribution to a large number of clients is workable.

### 1.5.3. Collaboration Mode Streaming to the Desktop using RTSP

Telepresenter can be used in a special mode called “Collaboration Mode” where each Telepresenter in the conference can be given floor control in turn, and the other participating units will be viewing the graphics or video output of the unit, which currently “has the floor”. Thus, the conference coordinator can switch presentations from a central site to some remote site to allow a remote presenter (a student presenting a report, a foreign workgroup, a remote knowledge expert, etc.) to speak and be seen by all the participants in the conference. When the remote presenter is finished, the coordinator continues with his/her presentation from the central site and all the units are redirected to view the proceedings emanating from the central location.

If this collaborative event is to be viewed by remote desktops, two important technical issues must be resolved. First, as the source of the graphical or video presentation switches from Telepresenter to Telepresenter, the RTP stream-id changes with each switch, and most desktop client players are unable to re-sync onto a media stream with a new and different stream-id. They typically “lock-on” to the first stream-id they find, and ignore media with all other stream-id’s. The net result is that the viewer sees only media from one presenter, and the picture is frozen while other presenters have the floor.

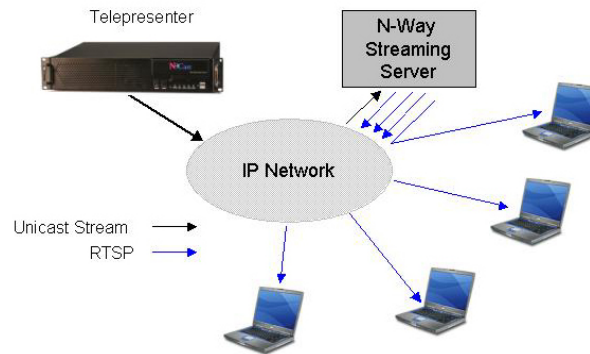
Also, in a collaborative conference, each Telepresenter is continuously generating an audio stream, and these multiple audio streams must be mixed into one sound source somewhere for playback. This function is normally handled by each Telepresenter's audio subsystem, but in the case of a desktop player there is no capability to do this. So, the server must decompress each incoming audio stream, mix all the streams together, and create a single outgoing audio stream for the desktops.



Collaboration mode to desktops is fully functional for the M2 series of Telepresenters, but the graphics and audio components are not currently available for the G2 and M3 units.

#### 1.5.4. One-to-Many Streaming using RTSP and the Auto Unicast (Announce) Feature

In this configuration a Telepresenter is given the IP address of the server and utilizes a unicast RTP stream to broadcast directly to the server. The server then "reflects" the streams to clients logged in via RTSP protocol.



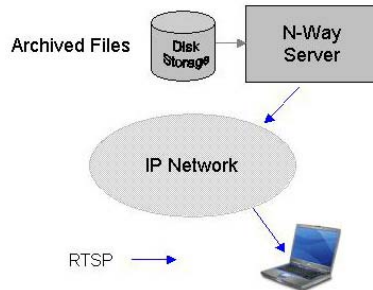
The "Auto Unicast (Announce)" facility is a mechanism within the RTSP protocol to automatically provide the server with the correct SDP media-file information. The server automatically installs an .SDP file for the Session and client players simply reference that .SDP to begin the connection and begin playing. The .SDP file is also automatically removed when the Session stops, thus disconnecting any connected clients. The Announce feature eliminates the need to manually configure and install .SDP files at the server.

#### 1.5.5. Archive Playback using RTSP

Several models of the Telepresenter allow recording of webcasts or conferences. These files are created as MPEG media files and stored locally until the file is downloaded and removed from the unit.

A Telepresenter is not designed to be a Video-on-Demand playback server. Continuous playback of captured files would interfere with the real-time capture and encoding activities of the unit. Nor is there any provision for backed-up storage of the files. These functions are best done elsewhere in the network.

An N-Way Server is capable of storing archived files and playing them back on demand from its hard-drive. Files may be uploaded to the server using the automatic FTP upload facilities within the Telepresenter.

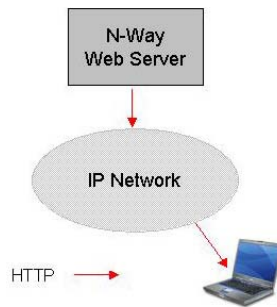


There is a configuration page within the Telepresenter to define the FTP server, account and password. The archived .mp4 file, along with its associated .xml file, can be uploaded immediately after a Session stops, or the upload can be programmed for later in the day or after business hours when the network will be less busy.

Once the file is residing in the content directory on the server, a simple RTSP link is all that's needed to play back the file on demand.

### 1.5.6. Web Server

Finally, an N-Way Server may be used as a web server. An industry-standard Apache web server is provided with the standard software installation, and this may be configured to run on any interface that is not used for streaming server access (no port-80 conflicts). The server operator must be familiar with the standard configuration files utilized by the Apache software.



### 1.5.7. Administrative Features

Access to N-Way services is organized by accounts, which are defined by the server administrator.

- Each account may be restricted by password and Telepresenter serial number.
- Each account defines a range of multicast addresses permitted for use.
- Each account defines a maximum number of concurrent sessions.
- An account may declare a variable number of access channels for desktop viewing.
- An account creates a list of viewers, each with a separate access password.

- For each account session time and traffic are recorded and may be used for customer billing.
- Real-time web access provides views of current sessions, viewers and traffic.
- System logs are stored in an SQL database for processing on a daily, weekly or monthly basis.
- Daily, weekly and monthly reports may be generated and emailed to clients.
- Directory based authentication for video-on-demand playback.

NCast welcomes customer feedback and input on these facilities, and will work with clients to add needed enhancements.

## 2. Server Administration

### 2.1. DEFINING AN N-WAY ACCOUNT

The design of the N-Way Server software was organized so that multiple independent companies, businesses or organizations would be able to use the same server without interference, conflict or lack of security. To facilitate this, an account structure was set up which provides the following features:

- Unique multicast addresses for each account, which prohibits accidental or deliberate diversion of media streams from one company or organization to another.
- Access to the server through password authentication and serial number verification.
- Lists of different program channels and viewers for different accounts.
- Usage and billing information for each account, Telepresenter unit and Viewer.

Consequently, an ISP or service provider may use one server at a central facility to handle the requirements of multiple customers, organizations, departments or individuals.

[logout]

N-Way  
 Status:  
RUNNING  
 Converter:  
RUNNING

### N-Way Account Summary

Accounts
Sessions
Viewers
Statistics
Logs
Configuration

Accounts [1 of 1]		
	Account Name	Full Name
1	christoph	Christopher Kozak
2	ncast-15	N*Cast Headquarters - Sunnyvale
3	ncast-pa	N*Cast Palo Alto
4	poland	poland
5	semek	Ziemowit Leszczynski
6	trecc	Technology Research, Education, and Commercialization Center

Thus the first step in setting up an N-Way Server is to define what accounts (company, organization, department or individual) will be required and then for each account prepare the following information:

- Account name and password
- Range of multicast addresses which will be utilized by the account
- Serial numbers of Telepresenters which will use the account
- The list of Viewers (desktop users) who will be able to access the server
- The list of Program Channels (live broadcasts) which Viewers will be able to access

Once this information is available the server administrator can proceed to the step of account creation.

## 2.2.ACCOUNT CREATION

A new account is created by logging in to the administrative screens of the server, going to the Accounts page, and clicking on “Add Account”:



Once all basic information has been entered (see the image below for a completed example) click on the “Add” button to add the account. The account will be available immediately for use.

## 2.3.ACCOUNT MODIFICATION

If information about the account needs to be modified in any way, click on the “More” button. All account contents may be modified from this screen.

### 2.3.1.Serial Numbers

The “Serial Numbers” field is a comma-separated list of Telepresenter serial numbers. Only units listed will be privileged to sign into this account.

If the N-Way Server is being run as a service, this allows the service provider to charge for each additional Telepresenter added to the account.

It also is a method for verifying that a Telepresenter is a valid member of a given account, even if the Telepresenter forwards the correct account name and password.

### 2.3.2.Multicast Addresses

This is a comma-separated list of multicast addresses or multicast address ranges to be used by the account. If a Telepresenter attempts to use a multicast address not in this list the traffic will not be forwarded. Use of the entry keyword “all” will allow all multicast addresses to be used.

Since the N-Way service may be used by any number of commercial businesses or organizations, it is important to keep the addresses in use unique to each account. If there is overlap, parties from one organization will be able to eavesdrop on the conversations and media streams of another organization.

If the address ranges for two organizations overlap, then those two accounts will be able to communicate with each other on the overlapping addresses.

The preferred address ranges to use are administratively scoped multicast addresses with the most locally scoped range available. See the discussion on multicast addresses in the Telepresenter Reference Manual.

### 2.3.3. Maximum Session Count

The Maximum Session Count limits the maximum number of Telepresenters which may be connected simultaneously using this account. For a service provider this allows limits on units in use and gives the provider an opportunity to charge higher fees for larger accounts.

Also, since this limits the number of concurrent sessions, it may be used as a method to restrict the total bandwidth consumption of the account. Bandwidth usage over the desired level may not be appropriate for the facilities of the network connection providing the N-Way service.

[logout]

N-Way  
 Status: RUNNING  
 Converter: RUNNING

## N-Way Account Detail

Accounts
Sessions
Viewers
Statistics
Logs
Configuration

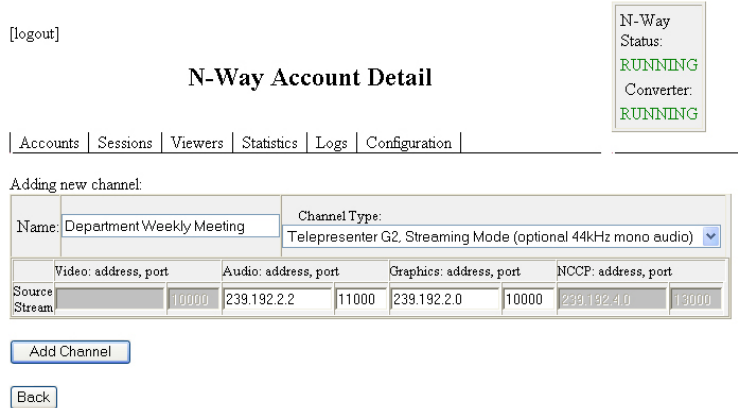
**Account: Technology Research, Education, and Commercialization Center**

Login:	<input type="text" value="trecc"/>
Full Name:	<input type="text" value="Technology Research, Education, and Comm"/>
Serial Numbers:	<input style="width: 100%; height: 40px;" type="text" value="01-29111-01040, 01-52311-02062, 01-52311-02085"/>
Multicast Addresses:	<input style="width: 100%; height: 40px;" type="text" value="233.2.171.161, 239.1.2.168 - 239.1.2.207, 239.1.3.32 - 239.1.3.71"/>
Maximum Session Count:	<input type="text" value="unlimited"/>
<input type="button" value="Modify Data"/>	
Password:	<input type="text" value="chicago"/>
<input type="button" value="Modify Password"/>	
<input type="button" value="Delete Account"/>	
<input type="button" value="Edit Account Channel Information -&gt;"/>	
<input type="button" value="Edit Viewer Information -&gt;"/>	

For simple multicast bridging, no further server entries are required. The account names, serial numbers and multicast addresses are all that's needed to connect multiple Telepresenters for streaming or collaboration work.

## 2.4. ACCOUNT CHANNELS

If part of the N-Way Service requirement is live streaming to desktops, then Account Channels must be created. An Account Channel defines the multicast addresses to be viewed by the desktop Viewer.



From the Account Setup page click on the “Edit Account Channel Information” button. Enter a name for the Channel. This can be the same name as the Channel in use by the transmitting Telepresenter, or be some other name meaningful to the Viewer, such as “Weekly Meeting” or “Corporate Training 1” or the like.

The Video, Audio, Graphics and NCCP (Conference) multicast addresses listed here must be valid addresses listed in the account setup page, and must exactly correspond to the multicast addresses in use by the Telepresenter originating the webcast.

When the Viewer logs into the N-Way Server to view the webcast, they will see “Weekly Meeting” (or whatever the channel name is) as the hot link to click on to launch their client media player.

## 2.5. ACCOUNT VIEWERS

Finally, the administrator must enter names and passwords for all the Viewers authorized to view the webcast. This allows the service provider to register Viewers for pay-per-view events, allows the administrator to delete Viewing accounts for employees that may have left the company, or allows the content providers to add or cancel viewing subscriptions to their list of authorized Viewers.

One or more of the Viewers may be designated as an “Administrator” in which case the list of authorized Viewers and their passwords may be administered by an account representative without the involvement of the server administrator. It is anticipated that lists of authorized viewers will change frequently, and the server administrator should not be burdened with these changes.

Viewer account names must be unique, not only within an account, but across all accounts for the server.

Statistics are kept on each Viewer, so time spent on the system can be logged and recorded for billing purposes or for simply tracking the time each Viewer was engaged with the system.

[logout]

N-Way  
 Status:  
**RUNNING**  
 Converter:  
**RUNNING**

## N-Way Account Detail

[Accounts](#) | [Sessions](#) | [Viewers](#) | [Statistics](#) | [Logs](#) | [Configuration](#)

Viewers for User NWay Technical Demo [1 of 1]

Username	Password	Administrator	
Tarzen	Ayeeeeoooo	<input checked="" type="checkbox"/>	<input type="button" value="Delete"/>

Create New Viewer:

Username:  Password:  Administrator:

Any number of Viewers may be registered to an Account, and there are no restrictions on the amount of viewing time permitted.

## 2.6. ARCHIVE PLAYBACK

Files that were recorded and archived on a Telepresenter may be uploaded to the server and played back on demand. The media content directory on the server is located in this directory:

`/usr/local/movies`

Files placed there (or in sub-directories of this directory) will be available for playback through use of a URL formatted for RTSP. The following is an example of a properly formatted RTSP link:

`rtsp://nway.server.com/m3-archived-file.mp4`

Complete details on how to setup client players for RTSP usage is beyond the scope of this manual. See Chapter 7 on "Client Web Page Linkage" for some examples of common methods to solve this problem.

## 2.7. WEB SERVER CONFIGURATION

The N-Way Server runs an industry standard Apache Web Server to receive requests for administrative functions and to present Viewers with their logon and Channel screens. Information and documentation on the Apache Server may be found at this website:

<http://www.apache.org>

As is usually the case for this server, the configuration information will be located in this file:

`/etc/httpd/conf/httpd.conf`

Port 80 on this system is reserved for HTTP media streaming, so standard web requests must be directed to an alternate port. Another alternative is to configure the server with a secondary IP address, which will be used exclusively for web requests.

Contact N\*Cast for additional help on configuring web server functionality.

## 3. Telepresenter N-Way Access

### 3.1. N-WAY SETTINGS

The use of N-Way services requires that the Telepresenter be enabled for an N-Way connection. This setting is located on the N-Way menu under the Configuration tab. By default this tab is not shown on the menu system, and an internal software setting must be activated to allow a Telepresenter to join an N-Way session. Contact N\*Cast to upgrade a Telepresenter for N-Way use.

The following is an example of the N-Way setup screen:



The Username and Password fields must match the N-Way Server account setup for your organization. The Primary server field is the domain name or IP address of the N-Way Server to be used. The port setting must match the port setting configured in the server. A TCP connection to this port on the server must be allowed to pass any firewalls in use.

The Secondary server field is the domain name or IP address and port of a backup or rollover server, which will be contacted if the connection to the Primary server fails. All units in a session must be connected to the same server for communications to function.

After filling in all the required fields the state should be set to “Enabled” and an update done. The web page will reflect connection status or connection attempts in the “Connection state” line of the page.

If a session is not using the N-Way Server for communication, the state should be “Disabled” as all traffic generated by the unit will be forwarded to the server whenever a connection is present. This could unnecessarily clog up the local network connections for the organization.

## 3.2.CHANNEL MTU SETTINGS

Packets transported through the multicast tunnel are limited to a size that is less than the MTU available for the network link supporting the tunnel. If the media packet length is kept to the usual MTU size of 1500, packet fragmentation will occur causing severe performance degradation.

The reduced packet length MTU must be set to 1476 or less for the Channel(s) used in an N-Way supported session. A good policy is to reserve a set of Channels specifically for N-Way use. The MTU will then be correct for the tunnel, and the other channels for other sessions will not need to utilize a non-standard MTU size.

Change the MTU fields as shown and update the Channel settings.

## 3.3.MULTICAST SETTINGS

The multicast addresses entered into the address fields must be within the range of the multicast addresses authorized for the N-Way account. If they are out of range, communication will be blocked in both directions by the server.

The use of administratively-scoped multicast address ranges is a good policy for this service. The TTL setting may be set low, but must be at least 1 or greater.

## 3.4.OPERATING RESTRICTIONS

There are some restrictions on use of Telepresenters with an N-Way Server:

- Only one Telepresenter may be connected to an N-Way Server from a local LAN segment. Only one multicast tunnel can originate or terminate on a LAN segment.
- If a Telepresenter is on the same LAN segment as an N-Way Server, it need not use tunneling to join an N-Way session, and the N-Way connection should be “Disabled”. The Telepresenter and Server will

communicate with each other using normal multicast broadcasts. The MTU restrictions must be adhered to in this case as its outbound traffic will be encapsulated by the server.

- Firewalls in the path of an N-Way Server and its clients must allow TCP and UDP traffic on these ports:
  - An initial TCP connection is made from the client to the server on the configured N-Way port, which is “10201” in the examples of this manual.
  - Once the connection is established, UDP traffic between client and server can be expected on ports in the range 32000:32999

## 4. Information Pages Reference

### 4.1. SESSION PAGE

The Session Page summarizes the current sessions active on the server and reports the history of Sessions completed.

[logout]

### N-Way Session Information

Accounts | **Sessions** | Viewers | Statistics | Logs | Configuration

N-Way Status:  
**RUNNING**

Converter:  
**RUNNING**

**Current Sessions** [ 1 of 1 ]

Account	IP Address	Serial Number	Unit ID	Start Time	From Server to Client (bytes)	From Client to Server (bytes)
Empty						

**Session History** [ 1 of 5 ] [ 1, 2, 3, 4... ] [ Last ]

	Account	IP Address	Serial Number	Unit ID	Start Time	Duration	From Server to Client (bytes)	From Client to Server (bytes)
1	semek	192.168.10.127/24	00-00000-00000	Poland	2005-09-21 02:13:24	1:10:09	0	0
2	semek	192.168.10.127/24	00-00000-00000	Poland	2005-09-20 09:39:40	0:36:41	0	439,719
3	semek	192.168.10.127/24	00-00000-00000	Poland	2005-09-20 09:35:36	0:04:02	0	0
4	ncast-pa	204.89.223.77/26	G2-10054-00007	G2S_PA	2005-09-20 09:04:14	0:55:40	51,628,998	24,395,898
5	poland	204.89.223.36/26	G2R-09045-0233	G2R_2U_36	2005-09-20 08:47:46	0:44:54	44,688,240	46,381,083
6	semek	192.168.10.127/24	00-00000-00000	G2	2005-09-20 08:32:34	1:02:53	70,776,901	34,641,910

The server administrator may check this page to verify what units are currently on-line and active.

Contact N\*Cast for information on how to obtain these statistics in machine-readable form. All Session statistics are kept by the server in an SQL database that may be accessed in a variety of ways depending on customer requirements.

### 4.2. VIEWERS PAGE

The Viewers Page lists which Viewers are currently active and provides a history of Viewers that have been active. Included is information on the Channel viewed, the time period, and amount of traffic sent to the Viewer.

[logout]

N-Way  
Status:  
RUNNING  
Converter:  
RUNNING

## N-Way Viewers Sessions Information

| Accounts | Sessions | **Viewers** | Statistics | Logs | Configuration |

Current Sessions [1 of 1]							
Account	Viewer	IP Address	Channel	Start Time	From Server to Desktop (bytes)		
Empty							

Session History [1 of 2] [ 1, 2 ]							
	Account	Viewer	IP Address	Channel	Start Time	Duration	From Server to Desktop (bytes)
1	ncast-15	demo15	141.158.244.253	N*Cast Channel 5	2005-02-24 10:43:00	0:16:40	14,567,682
2	ncast-15	paulo	67.180.15.250	N*Cast Channel 5	2005-02-24 10:40:50	0:16:48	17,024,594
3	ncast-15	paulo	67.180.15.250	N*Cast Channel 5	2005-02-24 10:37:47	0:02:25	2,037,906
4	ncast-15	paulo	67.180.15.250	N*Cast Channel 5	2005-02-24 10:36:50	0:00:51	770,305
5	ncast-15	paulo	67.180.15.250	N*Cast Channel 5	2005-02-24 10:25:14	0:11:29	12,622,056
6	ncast-15	demo15	141.158.244.253	N*Cast Channel 5	2005-02-24 10:23:56	0:19:05	18,596,746
7	ncast-15	paulo	67.180.15.250	N*Cast Channel 5	2005-02-24 10:20:39	0:05:27	7,720,618

Contact N\*Cast for information on how to obtain these statistics in machine-readable form.

### 4.3. STATISTICS PAGE

The Statistics Page gives an overview of all accounts and their transmission activity.

[logout]

N-Way  
Status:  
RUNNING  
Converter:  
RUNNING

## N-Way Account Statistics

| Accounts | Sessions | Viewers | **Statistics** | Logs | Configuration |

Totals Monthly Daily

Totals for Accounts [1 of 1]						
Account	Total duration	From Server to Clients (bytes)	From Clients to Server (bytes)	From Server to Desktops (bytes)	No of Session	
christoph	0:00:00	0	0	0	0	
ncast-15	9:53:46	442,095,743	1,116,830,480	236,554,208	9	
ncast-pa	21:29:04	421,344,931	127,573,080	0	28	
NWay Demo	0:00:00	0	0	0	0	
poland	138:43:22	4,102,046,563	8,239,985,446	0	101	
semek	38:41:50	2,817,424,573	2,642,516,957	36,880,568	72	
trecc	0:00:00	0	0	0	0	
Total	0:00:00	0	0	0	210	

Monthly customer billings may be generated from the statistics provided.

## 4.4. LOGS PAGE

The Logs Page reflects Login-Logout activity on the Server.

[logout]

N-Way  
 Status:  
RUNNING  
 Converter:  
RUNNING

### N-Way Log File

[Accounts](#) | [Sessions](#) | [Viewers](#) | [Statistics](#) | **Logs** | [Configuration](#)

Log Entries [1 of 21] [ 1, 2, 3, 4... ] [ Last ]				
Account	IP Address	Action	Date/Time	
420 semek	192.168.10.127/24	logout	2005-09-21 03:23:33	
419 semek	192.168.10.127/24	login	2005-09-21 02:13:24	
418 semek	192.168.10.127/24	logout	2005-09-20 10:16:21	
417 ncast-pa	204.89.223.77/26	logout	2005-09-20 09:59:54	
416 semek	192.168.10.127/24	login	2005-09-20 09:39:40	

Contact N-Cast for information on how to obtain this report in machine-readable form.

## 4.5. CONFIGURATION PAGE

The Configuration Page sets up various parameters related to the server end of the multicast tunnel, and a few other settings needed for internal operations of the server.

[logout]

N-Way  
 Status:  
RUNNING  
 Converter:  
RUNNING

### N-Way Configuration

[Accounts](#) | [Sessions](#) | [Viewers](#) | [Statistics](#) | **Logs** | **Configuration**

Interface:

N-Way Server Port:

Statistics Update Interval:  
 ▼

Log level:  
 Info  
 Warning  
 Debug

N-Way Server

Converter

The tunnel interface must be specified, particularly if there is more than one Ethernet connection to the server. All tunnel traffic will be routed via this interface.

The tunnel port is the port on which the server listens for incoming connection requests from remote Telepresenters. This need only be changed if there is a conflict with some other port used by the system.

The Statistics Update specifies how frequently current operating statistics are logged to the database.

The Log Level controls the level of detail recorded for each connection and for ongoing traffic. A change in this value is only required for diagnostic work.

The N-Way Server Start/Stop button controls the activity of the server's tunneling process. If stopped, all tunnel connections are broken, and no new sessions may be initiated.

The Converter Start/Stop button controls the activity of the server's process which creates a unified media stream in collaboration mode. If this process is not active, streams to desktops from collaboration sessions will not be available (Note: This functionality is currently available only for the M2 series of Telepresenters).

A small status box in the upper right corner of each web page reports the current status of these two processes.

## 5. Server Access

---

### 5.1. WEB INTERFACE

Access to the administrative and viewer web pages on the server must use a non-standard HTTP port, typically “8008” or similar. Standard HTTP port 80 access is used for media streaming and is not available for web service. Thus, a typical URL for administrative access would look like this:

<http://nway.ncast.com:8008/>

For viewer access the URL would be this:

<http://nway.ncast.com:8008/viewer>

To assist viewers and administrators easier access to the server, redirect commands may be installed in the configuration file of the organization’s main web server to eliminate the need for use of a non-standard HTTP port. The following are example Apache commands for a typical redirection:

```
Redirect permanent /nway http://nway.ncast.com:8008
```

The above command redirects administrative access from

<http://www.ncast.com/nway>

to

<http://nway.ncast.com:8008>

Similarly, for viewer access this redirect command might be used:

```
Redirect permanent /viewer http://nway.ncast.com:8008/viewer
```

The above command redirects administrative access from

<http://www.ncast.com/viewer>

to

<http://nway.ncast.com:8008/viewer>

### 5.2. STREAMING SERVER INTERFACE

Access to the administrative web pages for the streaming server use a non-standard HTTP port, “1220”. This port provides administration of process that controls RTSP streaming, and presents a live update of clients currently connected to the streaming server. For access, use this URL:

<http://nway.ncast.com:1220>

### 5.3.SECURE SHELL

Normal access to the server will be via secure shell (ssh) or secure file transfer protocol (sftp). Contact N\*Cast for account names and passwords to access the server.

### 5.4.PORT USAGE

The following ports are used for RTSP streaming:

- 80 - HTTP (TCP)
- 554 - RTSP (TCP)
- 6970-6999 - used for dynamic UDP broadcast
- 7070 - RTSP (TCP)

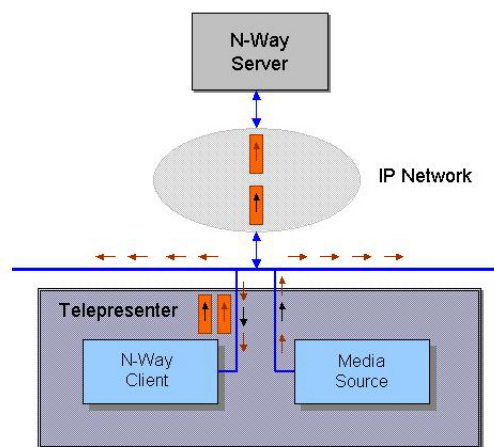
Firewall administrators must open these ports for successful RTSP connections.

## 6.N-Way System Operation – Detailed Examples

### 6.1.THE N-WAY CLIENT

If the simple multicast bridging arrangement described in Section 1.5 is not used, then a more in-depth understanding of how the N-Way system works is required, and this chapter provides greater detail on how the multicast bridge operates and how packet tunnels are created and used.

Within each Telepresenter multiple system processes are running, and when N-Way activity is enabled a new process called the “N-Way Client” is launched and activated. The figure below shows the activity and packet flow through the N-Way Client:



When a multicast session is started, the media stream sources (graphics and audio encoding processes) generate two types of multicast packets. The first type, RTP (UDP) packets contain encoded graphics or audio material and are shown as brown arrows in the diagram. The second type, IGMP control packets, are requests sent to routers to “join” a multicast group, and are depicted as black arrows. Since these are multicast packets, they are routed to all clients on the LAN (shown as a blue horizontal line).

When the N-Way Client launches it sets up a socket (connection to the internet), which allows it to eavesdrop on all the packet activity into and out of the Telepresenter. The diagram above shows two separate connections to the Ethernet LAN, even though there is only one physical connection. This is because two separate and independent sockets are in use, one for the Media Source and one for the N-Way Client.

When the Client sees an IGMP packet with a source address of its own machine, it encapsulates this request and forwards it to the server with the intention of telling the server “I have Media Source processes here that are interested in any traffic on the multicast address group contained in this IGMP packet”. The N-Way Server notes this request and passes the IGMP request to the LAN on which the server resides. An encapsulated IGMP request is shown in the diagram as a black arrow encased in an orange box.

If the Client sees an RTP (UDP) packet it checks first if the multicast address in the packet is current (an IGMP join request has been issued for this multicast group) and then it checks if the source address of the RTP packet is the same as the source address of its own machine. If so, the RTP packet is encapsulated and sent to the server. An encapsulated RTP packet is shown in the diagram as a brown arrow encased in an orange box.

When the N-Way Client receives an encapsulated packet from the server, it unpacks it and broadcasts it on the local LAN connection. Only RTP type packets will be received. The packet which is broadcast will be a multicast

packet with the source address of the originating machine and the TTL value will be set to 1. The media decoding processes in the Telepresenter (or PCs connected to the local LAN) will receive this packet and determine what appropriate processing steps are needed.

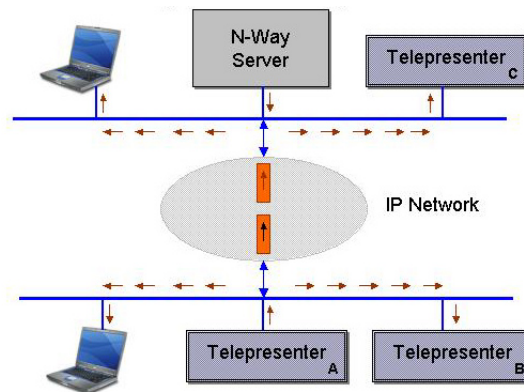
If the N-Way Client option “Send Local Only” is off, then RTP packets from the LAN with the correct multicast group address (a “join” is active) will be forwarded as well. This allows media streams from other Telepresenters on the same LAN to use the tunnel established by this N-Way Client.

If the N-Way Client option “Receive Local Only” is off, then IGMP requests from other Telepresenters on the LAN will be forwarded to the server. This allows the N-Way Client tunnel to be used to receive multicast traffic on behalf of other machines on the LAN.

### 6.2.N-WAY CONNECTIVITY - SENDING

In the diagram below Telepresenter “A” is set to broadcast graphics and audio on some multicast group address. Telepresenter B and the PC on that LAN will receive these broadcasts directly through multicast packets placed on the LAN by Telepresenter “A”. If the N-Way Client is enabled, this multicast traffic is encapsulated and sent to the server as a unicast stream. When the N-Way Server receives these encapsulated messages it processes each packet in two ways. First, it un-encapsulates the packet and places it on the server’s local LAN as a multicast packet from Telepresenter A (source address of “A”) with a TTL (time-to-live) value of 1. It also checks to see what other N-Way connections are active, and if one of them has requested multicast traffic with this packet’s multicast address, it forward this multicast packet through the tunnel to the requesting Telepresenter.

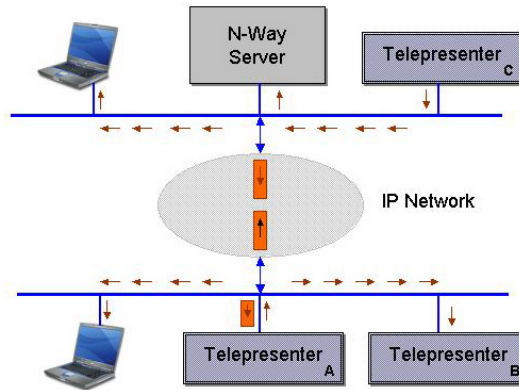
So Telepresenter “C” receives a copy of the multicast traffic from the server, as does any PC attached to the LAN. Remote Telepresenters connected to the server will also get the traffic if they previously requested it.



### 6.3.N-WAY CONNECTIVITY - RECEIVING

In the case where Telepresenter “A” wants to receive traffic from a particular multicast group, it uses the N-Way Client to forward an IGMP request for that group to the server, which then makes its own request for any multicast traffic on that group. If there is multicast traffic on the LAN for the group (shown in the diagram as originating from Telepresenter “C”) then the server picks it up and forwards it as encapsulated packets through the unicast tunnel to the N-Way Client on Telepresenter “A” which will unpack the RTP messages and place them as multicast traffic on the LAN of Telepresenter “A” (the TTL is set to 1 and the source address is from Telepresenter “C”).

With this arrangement, all machines on the LAN may receive the multicast traffic from Telepresenter “C”.

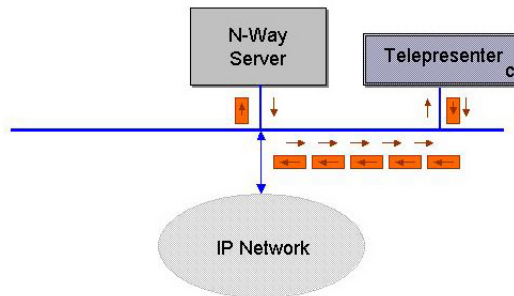


**6.4.N-WAY RESTRICTION – SERVER AND CLIENT ON THE SAME LAN**

As an example of what might go wrong when these rules are followed, consider the case where a Telepresenter and the Server are located on the same LAN.

An RTP packet generated by Telepresenter “C” is encapsulated and sent via the unicast tunnel to the Server. The Server then unpacks this packet and places it on its local LAN (same LAN as Telepresenter “C”). Here’s where a packet storm begins.

The N-Way Client on Telepresenter “C” sees a multicast packet with a validly joined multicast group, and with a source address of its own machine. Passing these two tests permits the Client to encapsulate the packet again and forward it once more to the Server. An endless feedback loop has been created and a packet storm on the LAN begins, taking down all other traffic on the LAN.



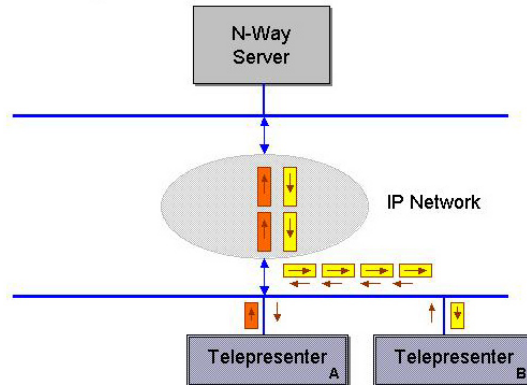
**6.5.N-WAY RESTRICTION – TWO TUNNELS ON THE SAME LAN**

A second configuration situation, which is automatically prohibited by the server is the case where two Telepresenters on the same LAN try to establish individual tunnels to the server.

In the diagram below we assume that Telepresenter “A” has established a tunnel (shown as orange encapsulation packets) and Telepresenter “B” has established a tunnel (shown as yellow encapsulation packets). Why can this cause a problem?

Let Telepresenter “A” create a media packet which is encapsulated and sent via the unicast tunnel to the server. This packet is also multicast on the LAN so Telepresenter “B” gets a copy directly from “A” via the LAN. The Server receives the packet, places it on its local LAN, and notes that Telepresenter “B” has asked for traffic from this particular multicast address. It encapsulates it for transmission to “B” (the yellow packets) and shortly thereafter it arrives at “B”. The fact that now a duplicate packet has arrived at “B” is not a serious problem (other than causing double the traffic on the LAN. The media processing procedures will discard the packet because the sequence number has already been used.

But, and here is the difficulty, the N-Way Client at “B” will place the packet onto the LAN with the source address of Telepresenter “A” and send it out with a TTL of 1. At this point Telepresenter “A” receives the packet, and the N-Way Client inside “A” determines that a multicast packet with a current group address and a source address of the local machine has arrived, and therefore should be forwarded up the tunnel to the server. We have now created a cyclic feedback loop from “A” to the Server to “B” and back to “A”, and the only thing limiting packet flow will be the maximum bandwidth in the links connecting the Server to the LAN of the Telepresenters.



**6.6.N-WAY RESTRICTION – MULTIPLE HOPS FROM THE LAN**

A final comment concerns limitations of traffic flow outside the local LAN. Packets arriving at the Server are multicast on the local LAN with the source address of the originating machine. Because of rules determining how multicast distribution networks are set up, this implementation does not allow these packets to flow to a native multicast network if the Server is situated on one. Only machines connected to the Server’s local LAN will be able to receive these broadcasts. Consequently, to reinforce this point, the Server sets the TTL of the packet to 1 to make sure that no forwarding of any type will happen.

The same situation applies to multicast packets arriving at the N-Way Client. These packets cannot be natively multicast beyond the local LAN, and therefore the TTL is set to 1 as a reinforcement of this condition.

## 7. Client Web Page Linkage

---

### 7.1. MEDIA PLAYER LINKS

There are three common methods through which a desktop media player receives media streams:

- RTSP – A player makes an RTSP request to connect to the server and receives the media stream under control of the RTSP protocol.
- Multicast – A player joins a media-stream multicast group and thus receives the media playback.
- HTTP – The player makes an HTTP request to the server and receives the media stream via TCP protocol.

The mechanisms by which players receive this linkage information varies by the type of protocol used and by the type of player.

### 7.2. RTSP LINKS

A media player which supports the RTSP protocol will require a link of the following form to play a media file:

```
rtsp://nway-server.ncast.com/my-archive-directory/my-archive-file.mp4
```

or

```
rtsp://nway-server.ncast.com:554/my-archive-directory/my-archive-file.mp4
```

In the case of a live media stream, the link would most likely reference an .sdp file:

```
rtsp://nway-server.ncast.com/my-stream.sdp
```

or

```
rtsp://nway-server.ncast.com:554/my-stream.sdp
```

If the client is using the N\*Cast Windows Media Player plug-in, this is the required link:

```
ncrtsp://nway-server.ncast.com/my-stream.sdp
```

or

```
ncrtsp://nway-server.ncast.com:554/my-stream.sdp
```

### 7.3. MULTICAST LINKS

A media player which will be using a multicast network for delivery of media streams needs to join the appropriate multicast group for audio and video. The multicast group information is delivered via download of an .sdp file:

```
http://www.ncast.com/sdp-files/my-multicast-stream.sdp
```

If the client is using the NCast Windows Media Player plug-in, this is the required link:

```
nchttp://www.ncast.com/sdp-files/my-multicast-stream.sdp
```

## 7.4. RTSP MOVIES

One simple method to deliver RTSP linkage information to a Quicktime player is through construction of a special type of movie called an "RTSP Movie". With a simple ASCII text editor, create a file "my-rtsp-movie.mov" with the following single line of information:

```
rtspstext rtsp://nway-server.ncast.com/my-movies/my-archive.mp4
```

Then simply create a link to this movie on the web page:

```
http://www.ncast.com/movies/my-rtsp-movie.mov
```

The web browser will create a blank page and then will play the movie.

## 7.5. LAUNCHING QUICKTIME PLAYER – QTL FILES

To launch a Quicktime Player as an independent entity apart from the web page, the web page must reference a ".qtl" file containing the following text:

```
<?xml version="1.0"?>
<?quicktime type="application/x-quicktime-media-link"?>
<embed src="rtsp://nway-server.ncast.com:554/my-stream.sdp"
  autoplay="true" quitwhendone="true" />
```

The Player will use the RTSP link information embedded in this file.

## 7.6. LAUNCHING WINDOWS MEDIA PLAYER – ASX FILES

To launch Windows Media Player as an independent entity apart from the web page, the web page must reference a ".asx" file containing the following text:

```
<ASX version = "3.0">
  <Entry>
    <Ref href="ncrtsp://nway-server.ncast.com:554/my-stream.sdp" />
  </Entry>
</ASX>
```

The Player will use the RTSP link information embedded in this file.

## 7.7. EMBEDDING QUICKTIME PLAYER IN A WEB PAGE

The following HTML code is used to embed a Quicktime movie in a web-page window:

```
<OBJECT CLASSID="clsid:02BF25D5-8C17-4B23-BC80-D3488ABDDC6B" WIDTH="99%"
HEIGHT="99%" ALIGN="center" CODEBASE="http://www.apple.com/qtactivex/qtplugin.cab">
<PARAM name="SRC" VALUE="http://www.ncast.com/movies/my-archive.mov">
<PARAM name="AUTOPLAY" VALUE="true">
```

```
<PARAM name="CONTROLLER" VALUE="true">
<PARAM name="SCALE" VALUE="aspect">
<EMBED SRC="http://www.ncast.com/movies/my-archive.mov" WIDTH="99%" HEIGHT="99%"
TYPE="video/quicktime"
ALIGN="center"
AUTOPLAY="true"
CONTROLLER="true"
SCALE="aspect"
PLUGINSOURCE="http://www.apple.com/quicktime/download/">
</EMBED></OBJECT>
```

The .mov file referenced above will typically be an rtsptext movie as discussed earlier.

Consult the Quicktime documentation on the Apple website for additional information about the parameters used and other features available.

## 8.References

---

### 8.1.MPEG COMPRESSION

ISO 14496-12 - ISO base media file format

ISO 14496-14 - MP4 file format

### 8.2.PACKET TRANSMISSION

IETF RFC 3550 "*RTP: A Transport Protocol for Real-Time Applications*", H. Schulzrinne, et. al., July 2003

IETF RFC 3551 "*RTP Profile for Audio and Video Conferences with Minimal Control*", H. Schulzrinne, et. al., July 2003

IETF RFC 3016 "*RTP Payload Format for MPEG-4 Audio/Visual Streams*", Y. Kikuchi, et. al., November 2000

IETF RFC 3640 "*RTP Payload Format for Transport of MPEG-4 Elementary Streams*", J. van der Meer, et. al., November 2003

IETF RFC 2326 "*Real Time Streaming Protocol (RTSP)*", H. Schulzrinne, et. al., April 1998

IETF RFC 2327 "*SDP: Session Description Protocol*", M. Handley, et. al., April 1998

### 8.3.MULTICAST

IETF RFC 1112 "*Host Extensions for IP Multicasting*", S. Deering, August 1989

IETF RFC 3171 "*IANA Guidelines for IPv4 Multicast Address Assignments*", Z. Albanna, et. al., August 2001

IETF RFC 3180 "*GLOP Addressing in 233/8*", D. Meyer, et. al., September 2001

IETF RFC 3138 "*Extended Assignments in 233/8*", D. Meyer, June 2001

IETF RFC 2365 "*Administratively Scoped IP Multicast*", D. Meyer, July 1998

IETF RFC 2327 "*SDP: Session Description Protocol*", M. Handley, et. al., April 1998

## 9.Revision History

---

Revision 1.2 – Information on FTP services and Automatic Unicast (Announce feature). Details on creating client web pages and RTSP links.

Revision 1.1 – Additional detailed information on operation of the N-Way system in Chapter 6.

Revision 1.0 – Initial revision based on software Release 1.0.