



**Operational Concept Description (OCD)
For
Media Routing Algorithm**

for

**World Streaming Network
WSN-PRGM-0003-0.8
Version 0.8 Release 1
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1 Scope

1.1 Identification

This document discusses the Media Routing Algorithm being built for the World Streaming Network (WSN) infrastructure.

Identification Number:	WSN-PGRM-0003
Title:	Operational Concept Description for Media Routing Algorithm
Abbreviations:	
Version Number:	0.3
Release Number:	1.0

1.2 System Overview

The Media Routing Algorithm (MRA) is a unique method of resolving how a consumer will receive the best quality of service from a streaming media server in a distributed Managed Media Switches (MMS). The MRA is designed to advance the art of streaming media out of a Content Delivery Network (CDN) style architecture and move it toward an interactive television architecture.

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The Media Routing Algorithm functions within the WSN stream signaling control system. The Figure 1: High Level Architecture on the next page is a high level overview of the WSN systems:

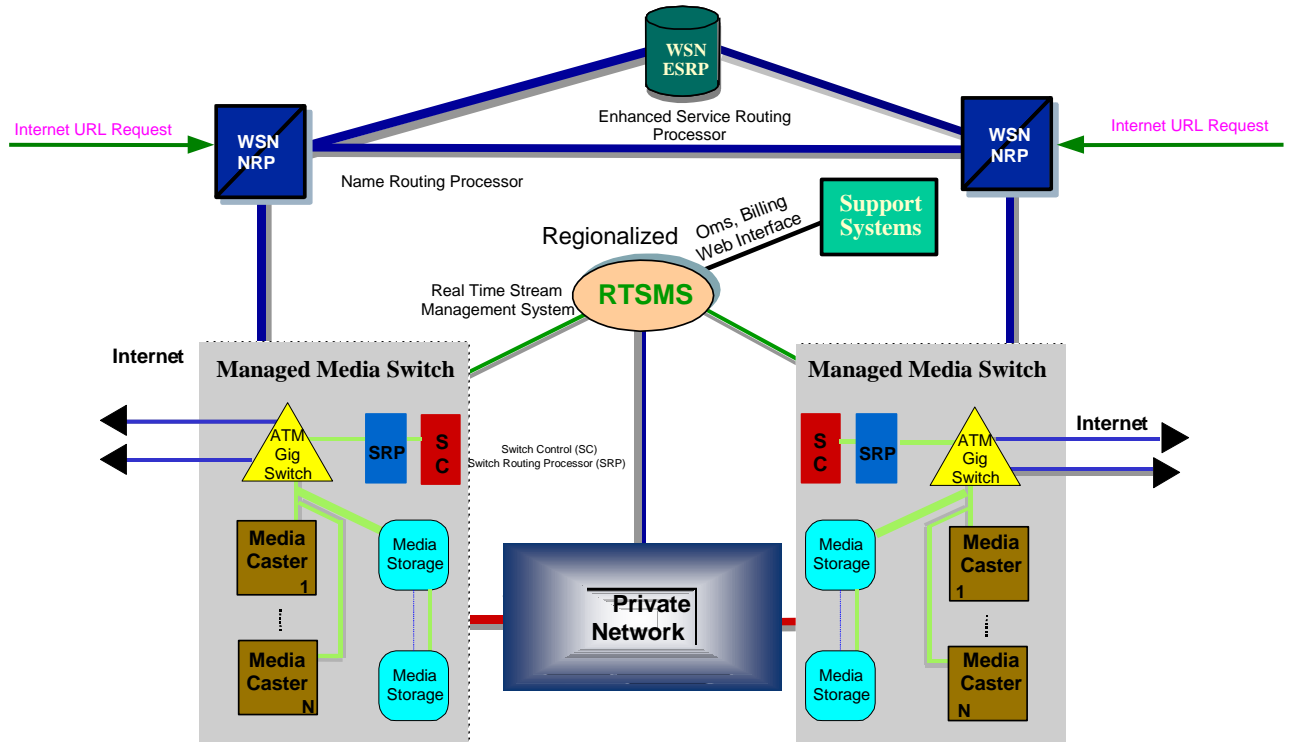


Figure 1: High Level Architecture

The MRA interacts with all of the systems shown in Figure 1: High Level Architecture. The MRA divides each consumer request into three components:

1. Access Point of Consumer
2. Content Management of Consumer's request
3. Delivery of multi-media to Consumer

Each of these functions is discussed in sections that follow.

1.3 Document Overview

This document describes the high-level architecture approach for developing an industry leading Domain Name System (DNS) replacement for the streaming media market. The underlying goal is to develop a carrier grade customer signaling system similar to ones utilized by long distance providers. Service management concepts are drawn from the International Telecommunications Union (ITU) voice service management. Other standards bodies are consulted for the broadband delivery such as the Internet Engineering Task Force (IETF), the ATM Forum, and the ADSL Forum.

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2 Referenced Documents

1. Log Data Storage and Transport Subsystem, Interface Requirements Specification, Version 1.0, Document Number: WSN-REQ-0002, November 20, 2000
2. Operational Concept Description (OCD) Streaming Signaling System for World Streaming Networks, WSN-PRGM-0002-1.3, Version 1.3 Release 1 Prototype 2, November 13, 2000
3. Signaling Project Release 1.0, RTP Signal Wrapper Subsystem, Interface Requirements Specification, Version 0.3, Document Number: WSN-REQ-0004, September 13, 2000
4. RFC for DNS

3 Current Situation

In the quest to deliver content to audiences, we have seen the development of many types of ‘venues’: Print, Radio, Broadcast Television, Cable Television and Home Video. Recently, a new venue, “Streaming,” has gained commercial attention. Content owners recognize that Streaming (Live and On Demand) provides the optimal environment for experiencing content by establishing an actual, one-to-one connection between the content and the audience. This enables a rich media, interactive experience: the future of media delivery.

The streaming industry has been commercialized over the last 4 years beginning with Broadcast.com (now Yahoo/Broadcast). This first phase was technology driven utilizing centralized network architecture over the public Internet. New entrants took the Broadcast.com model and scaled it into a distributed network: phase two. INTERVU (now Akamai/INTERVU) was the first to implement a distributed network over the public Internet on a large commercial scale. This new type of service architecture is called a ‘Content Delivery Network’ (CDN).

CDN streaming services today are very poor due to a lack of reliable service delivery infrastructure. Consequently, advertisers receive delayed and inconsistent reporting data, and audiences suffer from poor picture quality.

The current approach to streaming service architecture lacks the integrated service and delivery management discipline required to achieve any realistic quality of service. Service can only be assured if it is monitored and measured in a controlled synchronous environment. The current CDN architectures are not quality-based networks and rely on an uncontrollable environment, the Internet. In fact, they are not networks in the traditional sense at all. They are instead a series of servers located in POPs interconnected and controlled over the public Internet. Even iBeam, using satellite to broadcast content, does not maintain a synchronous state between broadcast elements: thus, no control. The only proven way to establish command and control architecture is to deploy a private, synchronous service.

The industry will not see the large revenue streams typically associated with broadcast and cable television until content providers are provided with the high levels of guaranteed service and audience experience they are used to with traditional broadcast delivery. In order for the streaming industry to move to the next phase (phase three - WSN), broadcast quality digital encoding, reliable delivery, and telecommunications style service management must exist.

3.1 Scope of OCD

This OCD is the User's view of the Media Routing Algorithm. The document will logically describe the routing services throughout the WSN network and what capabilities the Operations staff of WSN will have in routing the media streams in the WSN network.

3.2 Operational Policies and Constraints

WSN is guided by delivering the best quality of service possible for the streaming media industry. This requires an MRA that is capable of handling public Internet Consumers in a traditional CDN model of service and a "closed" circuit consumer in an interactive television model. The closed circuit model uses TCP/IP routing, but on any high bandwidth connection. (E.g., ADSL, VDSL, or cable modem.)

WSN achieves its goal by implementing a three stage routing algorithm that is cable of processing public Internet Requests and delivering broadband television to the home via a set top box. The following diagram shows the routing phases:

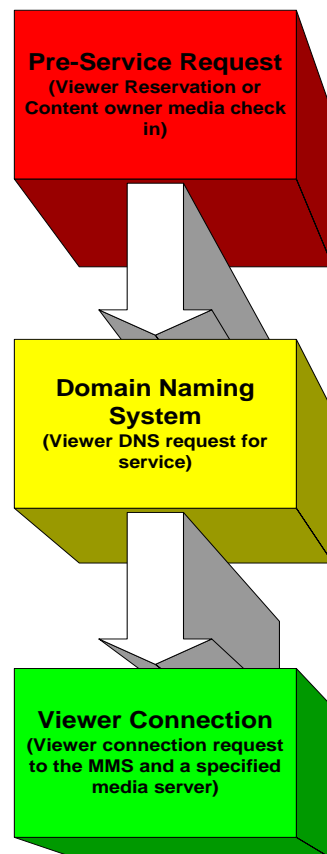


Figure 2: WSN Routing Layers Possible

WSN competitors normally utilize one or perhaps two stages of routing. WSN is unique in that three different levels occur. The following sections describe in detail how the Media Routing Algorithm (MRA) functions.

3.2.1 Pre-Service Request

The Pre-Service Request Routing is collected via the WSN Web Site and the Real Time Stream Management System. The viewer must reserve the media they intend to view via a reservation process. The WSN reservation process collects information about the viewer, content the viewer desires to see, and the network resources required for providing a quality viewing experience to the viewer. The following illustrates the message flow:

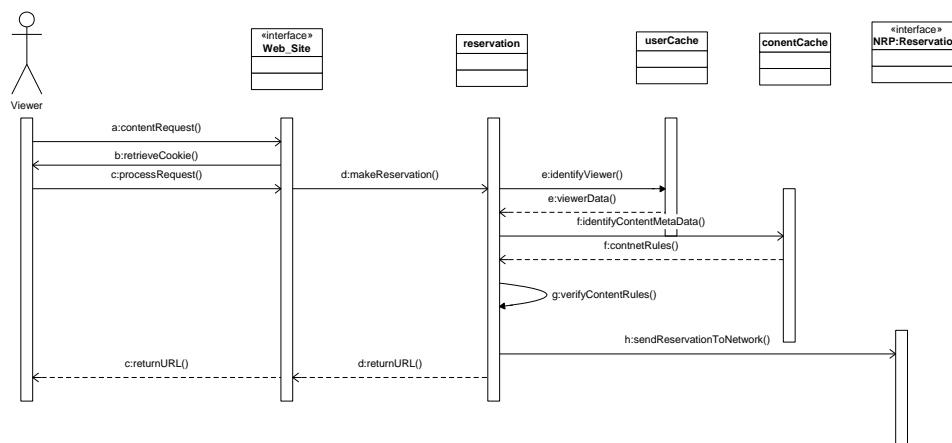


Figure 3: Pre-Service Routing

3.2.1.1 Viewer Identification

Most Content Distribution Networks (CDN) fail to utilize the concept of a reservation when content is freely distributed via a static link Universal Resource Locator (URL). If the content requires payment the CDN will collect credit card processing information.

As shown in Figure 3: Pre-Service Routing, the viewer request is passed to the WSN website to obtain a playscript. Current industry standards have the URL directly located on the referring website. The viewer's request may simply pass through the WSN website

if the viewer is identified and all content owners' rights can be protected per their instructions.

The key WSN concept is that the DRM metadata and the viewer need to be connected to determine if any of the content owner's rights need to be protected. An example would be if the content owner has given instructions to distribute the content freely to anyone requesting the content, then the viewer's request will pass through the WSN reservation system without pausing or even knowing they were routed through reservations. The WSN pre-service registration process has the following capabilities:

1. Identification that the content owner requests restricted (black out) content for certain geographic areas of the country/world.
2. Language preferences of the viewer if the content is multi-lingual.
3. Viewer profiling for statistical type reporting
4. Viewer anonymity if requested. WSN requires only broad statistical categories that do not specifically identify a home/user. For example, geographic black outs are achieved by NPA-NXX and Zip code. Specific consumer addresses and phone numbers are not required for viewing.
5. Viewer profiles allow individuals to permissively grant WSN use of certain personal information. For example, in a household utilizing a subscriptions based cable like service, the parents may establish users for every household member. Each member would have an age profile, viewing restriction profile, and even an advertising restriction profile is possible. The parents would receive automatic enforcement of their established viewing guidelines if this data was provided to WSN.
6. Credit Card processing for Pay Per View and subscription services.

In Figure 3: Pre-Service Routing steps identified as "a through e" are where these items are captured and performed. WSN will utilize a variety of viewer identification techniques depending on the product being sold. Common examples of viewer identification are:

- Internet products such as "Content Owner Paid" would utilize the web based COOKIE identification technique and caching the Media Player Identification in a database from the viewers first connection.
- Subscription products such as broadband cable would utilize an encrypted application within the set top box located in the subscriber's household.
- Custom products such as Pay Per View would utilize a combination of the Internet and the subscription model.

The unique feature of the WSN MRA is that product routing can be established based upon the information available at the time the viewer connects to the Domain Name System (DNS). Different routing rules can be established and changed for when the viewer is uniquely identified, statistically identified (i.e. age group, sex, income, etc.), or an anonymous viewer exists.

3.2.1.2 Content Distribution and Management (CDM)

WSN's Media Routing Algorithm (MRA) contains within it a Content Distribution and Management approach. It works in conjunction with a Content Digital Rights Management (DRM) system. The DRMs of today allow the content owner to place metadata about the content, how it is to be utilized, and who the actual owner is into electronic form. WSN has advanced this concept to allow for automatic enforcement of the DRM rules in a real time and efficient manner. The MRA is an enforcement vehicle for the content owner's desires since approximately six of the routing tables focus upon the content metadata.

In Figure 3: Pre-Service Routing steps "f through g" identify where the content metadata items are captured and enforced. Common examples of content metadata are:

- Geographic black out of live events such non sold-out sporting events
- Viewing time restrictions such as TV series that cannot be broadcast on-demand during the scheduled weekly broadcast TV time slot.
- Viewer age restrictions for rated movies in a pay per view or premium subscription service.
- Identifying which Managed Media Switches have the entire list of content the viewer wishes to see.

The WSN reservation system will match available data about the viewer with the content metadata provided by the content owner. If the viewer is not allowed to see the content, a form of video busy treatment can be played.

3.2.1.3 Reservation Distribution

Once the reservation has been approved, information about the content play list and the individual viewer are sent to the Name Resolution Processor (NRP) shown in Figure 6: Overview of Signaling Network on the next page. When the Real Time Stream Management System (RTSMS) knows the NRP has the reservation data, a play script is returned to the viewer. The play script allows the viewer to locate the exact media content and activates the second stage of routing as shown in Figure 2: WSN Routing Layers Possible.

3.3 Domain Name System (DNS)

The public Internet is managed via a process known as the Domain Name System (DNS), which is an adopted Internet Engineer Task Force (IETF) standard. DNS resolves alphanumeric names to IP addresses, which effectively separates the viewer from any physical network topology. WSN uses the NRP to replace the standard DNS with an

intelligent, two tiered, real time routing approach. The NRP accepts standard DNS messages and replies to all DNS messages per the IETF standard, except DNS reverse resolution. However, the WSN NRP executes a complex routing algorithm that utilizes the reservation data obtained from the Pre-Service Routing phase, information about the network load capacity, and the normal DNS data received from the request.

Normal DNS resolution is shown in the following figure:

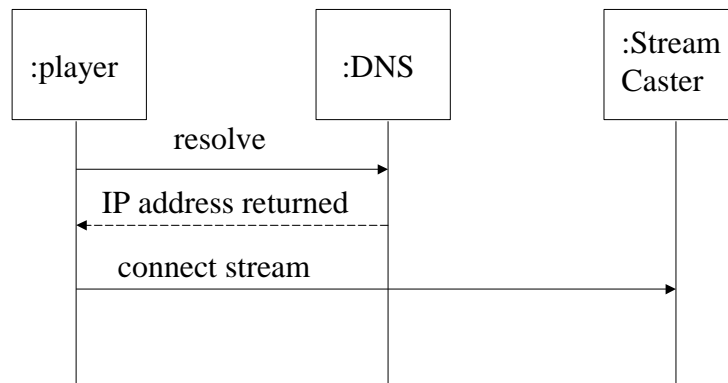


Figure 4: Normal DNS Functions for Streaming

In this figure the player is the viewer's software/hardware that knows how to receive the stream that is served up by the stream caster into the appropriate visual/audio rendering. The player is generally located on the viewer's computer or set top box. The viewer is an individual who will be seeing or hearing the stream.

The WSN NRP which runs the MRA performs a translation from an alphanumeric name to the destination IP address as shown in the following figure:

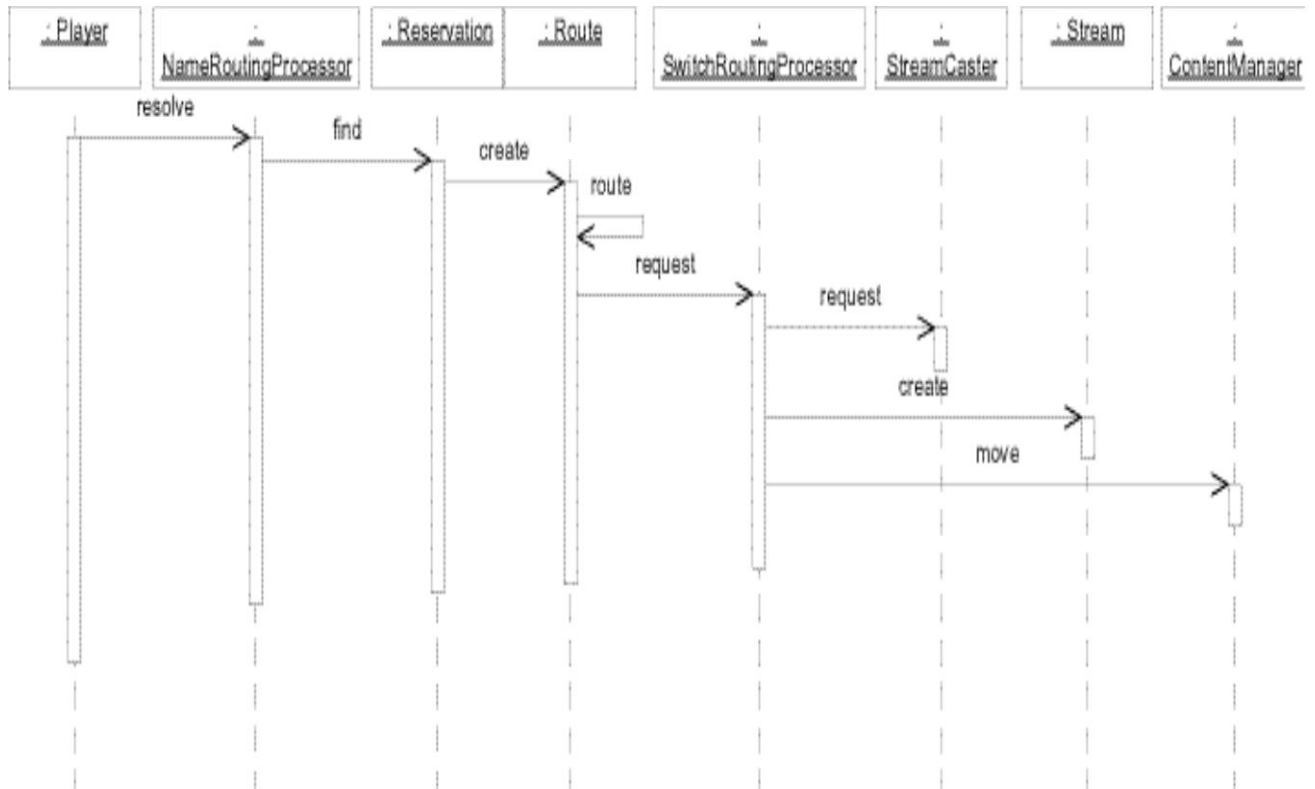


Figure 5: WSN MRA DNS Process

The second stage of the Media Routing Algorithm incorporates a real time process for resolving DNS requests based upon the MRA meta data, viewer identification, and the load status of the network.

The object shown in Figure 5: WSN MRA DNS Process identified as “player” is the Viewer’s media player such as Real Network’s Real Player, Apple’s Quick Time, Microsoft’s Media Player, or a set top box.

At the time that a reservation is made by the viewer a play script is generated and transferred to the viewer’s player. This play script contains the URLs of the media for the requested presentation along with some instructions about how the player should present the media to the viewer. While there are many possible ways of formatting the URLs one example for illustration purposes would be:

rtpc://servertype.reservationid.nrpname.net/orderid/presentationid/mediaid

where servertype would be a string representing the type of server that the media requires, reservationid is the unique identifier for the reservation assigned at reservation time, nrpname is the domain name of the NRP that was determined during pre-route by the reservation system, orderid represents the unique identifier for the order that tells the RTSMS how to account for the viewing of the presentation, presentationid represents the unique identifier for the presentation against which the original reservation request was made, and mediaid represents the unique identifier for an individual piece of content that is a part of the presentation. The portion of the URL between the double slash (//) and the first single slash (/) is referred to as the hostname by the Internet standard DNS definition. It is used on the Internet to find an IP address of a particular host so that a connection can be formed. WSN has replaced the standard implementation of DNS with one that performs the MRA to select a server.

When the player receives the play script it attempts to resolve the URLs that are in the play script it will request that the DNS resolve the host name in the URL and return an IP address for that host name. Play scripts that were generated by the WSN reservations system will have the resolve request sent to the NRP. The NRP will find the reservation information in the reservation table by using the reservation number that was embedded in the hostname by the reservation system. The combined set of data will be used for routing of the request. The NRP calls a routing process which is the NRP's portion of the MRA that returns a sorted list of MMSs capable of handling this request. The NRP then signals to the Switch Routing Processor (SRP) of the first MMS in the list. The NRP provides the reservation and network data to the SRP, which determines which Stream Caster should receive the request. The SRP then looks at the current load and status of each Stream Caster within the MMS to determine a candidate Stream Caster. The SRP contacts the candidate Stream Caster to verify that it can process the request. The SRP will check with every Stream Caster in the switch that is capable of processing the request, if necessary. Once one Stream Caster accepts the request, the SRP notifies the NRP that this MMS accepts the reservation and passes back the IP address of the Stream Caster. The NRP returns the IP address of the Stream Caster to the Player which the Player will then use to establish a session with the Stream Caster.

The SRP establishes a Viewing Session State Model upon acceptance of the reservation. The Viewing Session State Model is used to keep track of the status on the viewing of all the media within the Presentation for that particular reservation. This provides us with several capabilities: we know when all the media have been watched and the reservation has been fulfilled, if a Viewer terminates one of the streams we can terminate the others (this prevents the viewer from killing all the ads and just watching the main feature), etc. of the All resources are shown as unavailable to new reservation requests until the viewer in the initial reservation has completed or timed out his/her session.

Figure 5: WSN MRA DNS Process shows a two part DNS process executed on the NRP. In the first part, the NRP uses the MRA to create a list of possible MMSs that can handle the request. Then, in the second part, the NRP talks to each SRP on the switches to determine in real time if the reservation request can be handled. This process should be

completed within 200 milliseconds. Once the MMS has accepted the reservation this moves the routing process into the third stage.

3.4 Player Connection Routing

The third phase shown in Figure 2: WSN Routing Layers Possible is the Player Connection to the MMS. This phase of routing is when the Viewer's media player is connecting or connected to the MMS.

Within the Player Connection Phase of routing there are two major sub-stages that exist: 1) Media Description and 2) Connected. In each of these stages, the MRA may be invoked by devices within the MMS for re-routing purposes.

3.4.1 Media Description Stage

The Player will connect to the MMS Stream Caster device represented by the IP address returned by the NRP for the DNS request as discussed in Section 3.3. Once the Viewer's media player establishes the connection it will request the Stream Caster's Media Server to describe the content to be played and inform the Media Server what functions it supports. During this time period the Viewer's player is in conversation with the media server software, but the media is not playing.

During this phase, player incompatibilities with the content can arise. The incompatibility may be how the viewer has set up options within the player or the player's detection of copying devices within the viewer's PC. This may require the Stream Caster and SRP to re-route the request. The SRP would notify the NRP that it cannot process the request and may provide information that allows the NRP to select another MMS which is better suited to servicing the request. An example is when the player connects to the MMS and the Stream Caster determines that this is a real old version that this particular Stream Caster and MMS do not support. The SRP would notify the NRP that this reservation cannot be fulfilled at this MMS. The SRP would provide the reservation number and the reason why the NRP is being contacted. The NRP can then re-route the request and instruct the SRP to redirect the viewer to a new location.

3.4.2 Connected Stage

The connected stage exists once the player is receiving a video stream. However, the Stream Caster code might detect a degradation of service and require the video stream to be re-routed to another Stream Caster within the same MMS or another MMS altogether. This type of routing change is invoked by the Stream Caster and the Signal Wrapper Subsystem that WSN places upon the device to monitor and control the streams.

If the Signal Wrapper system detects any sort of quality issues or imminent failure, it will inquire of the SRP where it should relocate the existing streams. The SRP will normally return the IP address of another Stream Caster within the same MMS, but the SRP may contact the NRP and physically relocate the viewer's session to another MMS.

3.5 Description of WSN Signaling System

3.5.1 Major System Components and Interfaces

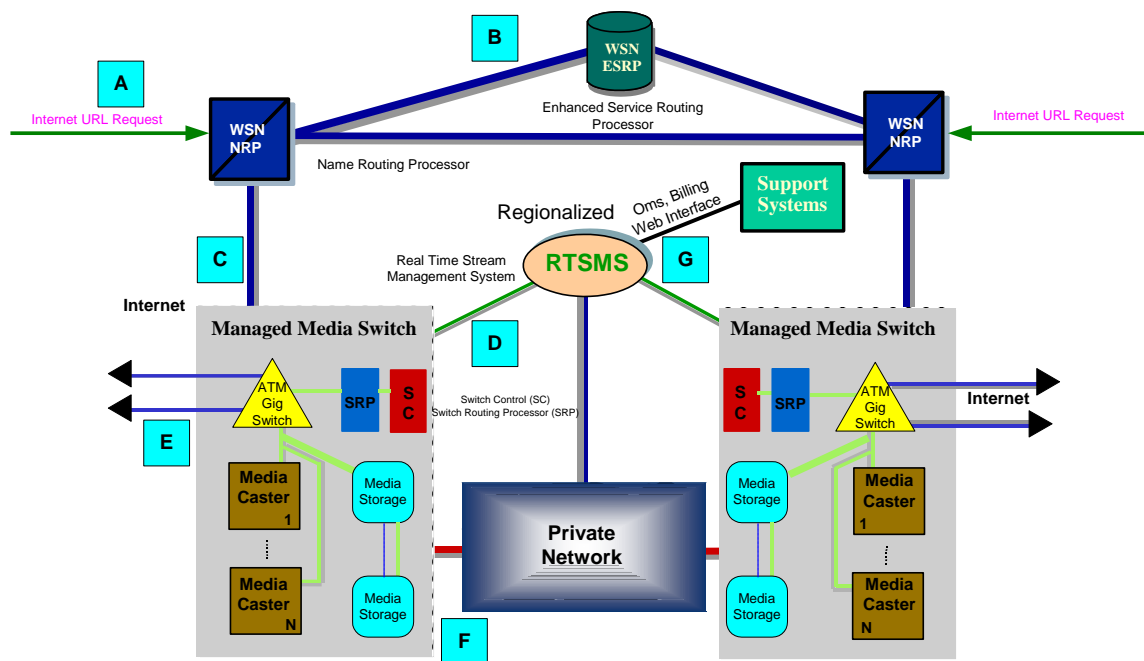


Figure 6: Overview of Signaling Network

A full description of each interface can be found in Signaling Project Release 1.0, RTP Signal Wrapper Subsystem, Interface Requirements Specification, Version 0.3, Document Number: WSN-REQ-0004, September 13, 2000.

Different parts of the Media Routing Algorithm are executed on the Real Time Stream Management System (RTSMS), the Name Routing Processor (NRP), and the Signal Routing Processor (SRP) within the Managed Media Switch (MMS). Unlike switch voice routing, which utilizes connections and is routed at the voice switch, the MRA utilizes

logical references versus physical ports. This means the routing algorithm can be moved “up network” and out of the Managed Media Switch. This is a strategic difference from voice enabled switches. It provides WSN with a faster routing algorithm than traditional voice switches and significantly reduces the cost of the broadband switch.

3.5.2 Planned Capabilities

The MRA works in conjunction with the WSN three-tiered architecture. A WSN unique feature is called the “reservation” which is used so network resource utilization can be determined and an individual state model established to monitor the viewer’s session. When the reservation is established, a play script that contains the URLs for all the media in the presentation is returned to the player which uses the play script to connect to and control the viewing of the media in the presentation. These URLs have a unique reservation id in the host name which is used as a key to the MRA. Unique benefits of the reservation concept are:

- The impacts of the viewer’s selection upon the overall streaming media network are known.
- Allows for identification of the viewer
- Allows for geographic location of the viewer if the viewer utilizes high-speed (300K- 1.5 Mbits per second) or broadband access (> 1.5 Mbits per second).
- Provides the means to tie together the viewer, the content, and the viewing experience for reporting and billing purposes.
- Provides security and fraud detection capabilities by using unique, one use only reservation ids and checking against orders and presentations that are not visible to the hostile internet.

The host names that are generated by the reservation request look to be individual subdomains of the NRP so that when the NRP receives the DNS request it can use the reservation id to find the information about the reservation. The MRA in the reservation system has already verified and appended certain information to the reservation and has forwarded this information to the appropriate NRP. The NRP looks up this reservation information and uses this information as input to the NRP’s portion of the MRA. The NRP’s MRA portion performs a routing algorithm using a series of tables built by the Network Operators to determine a sorted list of Managed Media Switches (MMS) that are capable of processing the request. The Name Routing Processor (NRP) will then check the first MMS listed to determine in real time if that MMS is capable of processing the consumer’s request. If the MMS responds in a negative fashion, the NRP moves on to the next MMS until one acknowledges the ability to process the request or the list is exhausted.

This methodology is strategically different than the URL based routing of today’s Content Distribution Networks (CDN). CDNs, e.g., Akamai, rely on the Domain Name System or hardware based load balancing process to resolve and locate the content on their networks. CDNs that use DNS have all the information about the media in the URL itself where it can be changed by parties wishing to bypass their system. Also, their DNS

tables (the hostname to IP address mapping tables) have to be manually changed in order to respond to network issues. WSN's reservation system prevents the altering of a URL from affecting the system. Since reservation ids are embedded in the hostname and are unique, one use only numbers, URLs that contain reservation ids that are not currently active will be immediately rejected and reported. Also, URLs that do not contain the proper configuration of reservation ids, order ids, presentation ids, and media ids will be automatically rejected and reported. The MRA also dynamically adjusts to network conditions. Hardware based load balancing solutions are expensive and can only be applied to servers that are collocated with the hardware. WSN will replace DNS with the NRP's MRA part. Public Internet customers will not know there is an intelligent DNS. The MRA will return a DNS standard conformant reply. This allows for inexpensive, network wide balancing.

The MRA will also handle xDSL and Cable Modem connections. These are connection oriented services across Ethernet. The MRA will attach information obtained from a WSN access partner to aid in streaming media service delivery. Access partners are used to provide access to the WSN when direct connection (last mile) to the consumer is not available. The information provided is usually viewer identification information as well as identification about which access partner is providing access.

The access data gathered will be paired with information about the content the consumer selected. The WSN Content Management System will provide a series of tables that allow the algorithm to gather information about the media chosen to be viewed by the consumer. For example, if the user chose a live sporting event that is blacked out in his/her area the content tables could be used to restrict the user from viewing the live event. This kind of screening occurs in the RTSMS's part of the MRA. The Content Management System is used by the publishers' agents to describe media, put together presentations, apply restrictions, attach ordering/billing agreements, and publish the presentations on the WSN network.

The last series of tables provide information about the status of the WSN MMS switching network. These tables are used to build a media routing list, which can be used to service the consumer's request based upon the real time status of the WSN MMS network.

In the routing tables below there is a general concept of a next process / next partition for making decisions about what to do next. The next process field of an entry determines which process and its associated table should be processed next. The next partition field indicates what part of the table should be used for the next process. Since the MRA is mostly data driven, the next partition field indicates essentially indicates a different set of data to drive the algorithm.

3.5.3 Media Routing Algorithm Table Flow

The diagram below provides the reader with the primary tables and the normal routing pathway through those tables:

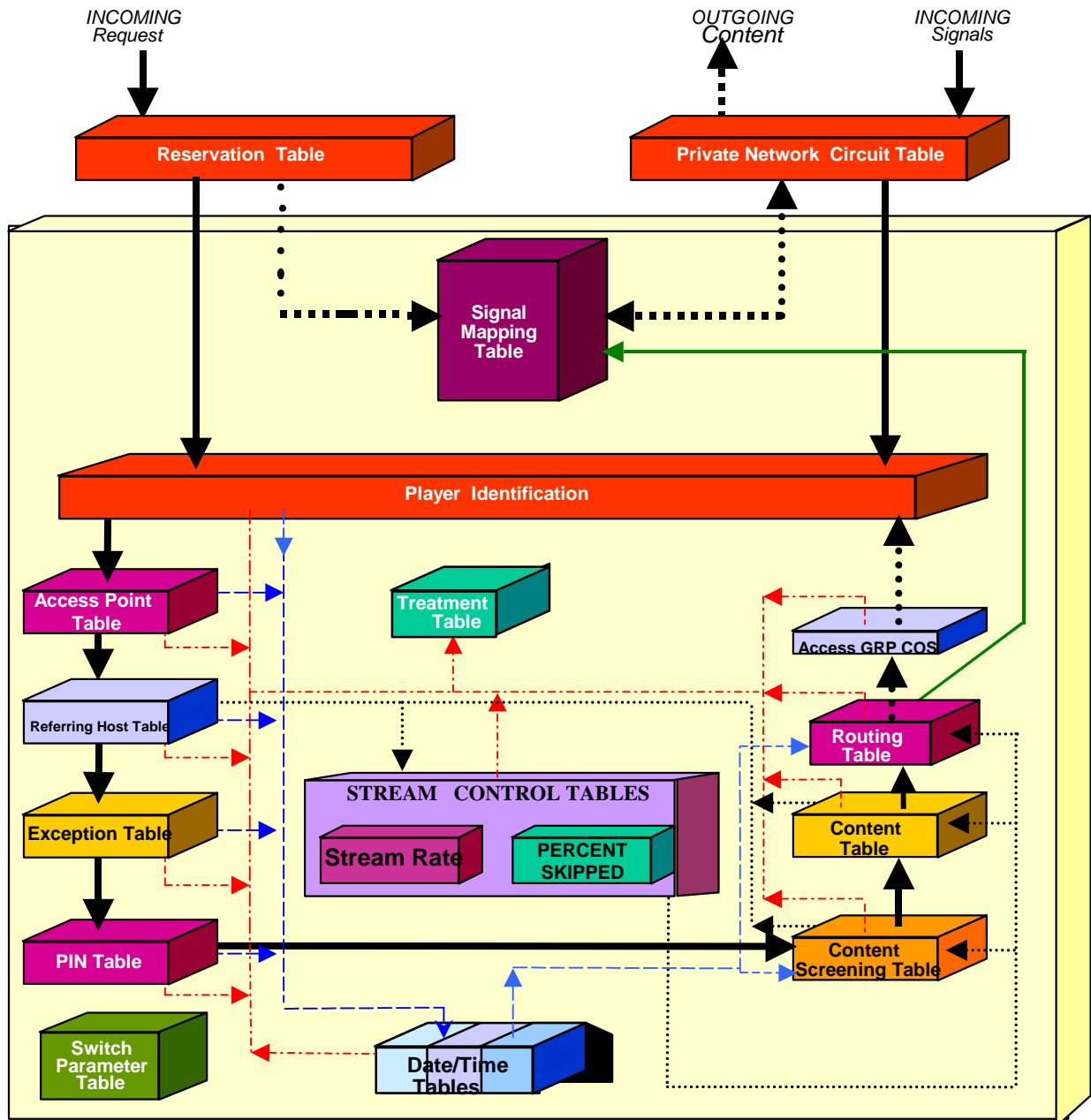


Figure 7: MRA Table Flow

The Media Routing Algorithm (MRA) consists of the tables shown above. These will be utilized to append information to the routing record that is then used during the routing processes. This document does not provide the routing algorithm. The routing algorithm will be presented via Structure Development Language (SDLs) models following the International Telecommunications Union (ITU) standards.

The MRA will progress the consumer's request through various tables. The routing algorithm will provide a list of possible MMS sites that can handle the request. The following sections describe the attributes of the tables and the user capabilities of each table for the MRA.

4 Reservation Time Tables

These tables are accessed at reservation time to provide an early screening out or customization of reservations for presentations. It's important to do this as early in the process as possible to prevent improper reservations from tying up resources or excessive charges for canceling credit card charges.

4.1 Player Compatibility

The Player Compatibility table is used to make sure that the media and the consumer's player are compatible. This table is maintained by the IT staff. If the content format type along with the viewer's player type is not found, then the reservation should be rejected. The resource usage fields are factors to be applied to the nominal resources for the media in calculating the resources to be applied to the presentation script.

Content Format Type – The unique vendor code returned from the presentation about the type of media encodings that are in the presentation.

Field Content	Field Description	Default	Value
Real	Content encoded to Real Networks Standards		Real
Apple	Content encoded to Apple's Quick Time standards		Apple
Microsoft	Content encoded to Microsoft's media standards		Mov
MPEG4	Content encoded to MPEG4 standards		MPG4

Viewer Player Type – The version and type of player

Field Content	Field Description	Default	Value
Media Client	Media viewer not identified	Y	9999
	Real Networks – Version		RPvXX
	Real Networks - Version		RPvXX
	Real Networks – Version < YYY (Denotes all player prior to this version)		RPOLD
	Quick Time Player - Version		QTvXX
	Quick Time Player - Version		QTvXX
	Quick Time Player – Custom		QTCST
	Quick Time Player – Version < YYY (Denotes all players prior to this version)		QTOLD
	Windows Media – Version		MSvXX
	Windows Media – Version		MSvXX
	Windows Media – Custom		MSCST
	Windows Media – Version < YY (Denotes all players prior to this version)		MSOLD

Bandwidth Resource Factor – The factor to apply to the bandwidth resource

Field Content	Field Description	Default	Value
Bandwidth	Factor to multiply bandwidth usage by	Y	1.0

Disk Space Resource Factor – The factor to apply to the disk space resource

Field Content	Field Description	Default	Value
Disk Space	Factor to multiply disk space usage by	Y	1.0

CPU Resource Factor – The factor to apply to the CPU resource

Field Content	Field Description	Default	Value
CPU	Factor to multiply CPU usage by	Y	1.0

4.2 Age Screening Table

The Age Screening table is used by the Content Management System (CMS), in particular the Presentation, to make sure that the appropriate content is only streamed to those eligible to watch it. Note that these are only the defaults and can be overridden by the Viewer's profile (e.g., a parent may establish that their child can't see violent movies even though the child is old enough). This table is maintained by the IT staff.

Content Rating – defines the rating level of the content that can be viewed by this viewer. Everything below the highest level established is viewable. These are used to further expand or restrict the defaults based on the age of the viewer.

Field Content	Field Description	Default	Value
Default	Unrated, non-adult oriented material	Y	null
G	Movie classification of G rating – General Audience		G
PG	Movie classification of PG rating – Parental Guidance		PG
PG-13	Movie classification of PG-13 - Parental Guidance must be 13 years old		PG13
R	Movie classification of R - Parental Guidance must be 16 years old		R
NC-17	Movie classification of NC-17 - Parental Guidance must be 17 years old		NC17
	Gaming Classifications to add		
	TV Ratings to add		

Minimum Age – The minimum age in years that a Viewer is allowed to see the content.

Field Content	Field Description	Default	Value
Age	The minimum age for the content type		

5 Access Tables

Access tables are used to find the information about the reservation, append information about the network access point, and start the routing based on how much we know about the identity of the Viewer.

WSN uses two forms of reservations to create the initial request. The first reservation type is where the viewer is directly interacting with a WSN web site. The second type is a WSN web portal partner that generally is paying for the bandwidth and storage of their content and does not want the MMS to know who the viewer is. These portals manage their viewers and enforce privacy policies so the viewer has anonymity.

These systems provide the initial access point into WSN. A record is established and sent to a Name Resolution Processor. The initial table accesses this record for the additional information and processes it via the routing tables. Once the routing tables have been traversed, the WSN routing algorithm is executed to determine the final switch/stream caster combination that will be used.

5.1 Reservation Cache

The reservation cache contains all the reservation information that has been assigned to this NRP that has not yet completed viewing or has not yet started. The MRA starts out by using the reservation identifier in the hostname from the DNS request to find the reservation in the reservation cache. If the reservation is not found then a network operator configurable treatment is returned. If the reservation is found then the reservation information forms the initial information in the routing record and the MRA starts to run through its other tables appending information and ultimately deciding where to send the request. Note that since the information was pushed down via out-of-band signaling there is no opportunity for tampering with the info by someone outside the private network.

The reservation contains the following information:

- The reservation identifier – a unique number that is generated on the RTSMS and corresponds to exactly one viewing experience. Different players playing the same presentation will have different reservation identifiers.
- The order identifier – a unique number that references the order under which this reservation was placed. This is used for billing and reporting purposes. An order indicates on what basis and how and to whom the viewing of the reservation should be billed.
- The buyer identifier – the unique number used to identify the person who placed the reservation. We don't always have this identifier.
- The buyer's IP address – the IP address of the buyer. If we have this information we can validate on the Stream Caster that it actually is the buyer trying to watch the presentation and not someone else.

- The media content player type – the type and version of the player that the viewer wishes to use. Note that we don't necessarily know this.
- The portal identifier – the unique number used to identify through which portal/host this reservation was requested.
- The start time – the reservation can't be viewed any earlier than this time.
- Is this a test – an indicator on whether this is a test reservation or not. Only test reservations can be viewed on Stream Casters that are in test mode. This allows testing of Stream Casters in the network without having normal traffic routed to it.
- The presentation script – the presentation script contains information about the media to be served, the overall rating of the presentation script, the resources required, how the media is to be served, and instructions about how to dynamically change the content (e.g., ads based on demographics) and interstitial content insertion (aka, interstitial ad insertion). Since a presentation can involve more than one type of server, this information is broken up by server type.

5.2 Network Access Point Identification

The Network Access Point Identification table provides a way to possibly determine the access point based on the IP address of the DNS server that is trying to resolve the hostname for the Player. This is not a foolproof method but should get us close most of the time.

IP Address – The IP Address that is the key to this table.

Field Content	Field Description	Default	Value
IP Address	The address of the DNS server		

Access Point – This WSN identifier for the closest managed access point to the consumer. In set top box solutions this would be the set top box identifier and in public Internet it would be the access provider id of the closest WSN Managed Media Switch.

Field Content	Field Description	Default	Value
Access Customer Id	WSN customer id for the access provider's point of presence where the consumer request is being served.		Num 9

Network Type – This is the type of last mile solution being offered by the access provider at this point of presence. These map to the maximum speeds allowed at the access point.

Field Content	Field Description	Default	Value
Public	Public Internet	Y	IN
Wireless – Analog	Public Internet cell/PDA wireless devices		AW
ADSL	Asymmetric Digital Subscriber Line (ADSL)		AD
HDSL	High Bit Rate Digital Subscriber Line (HDSL)		HD
HDSL2	High Bit Rate Digital Subscriber Line 2 (HDSL2)		HD2

IDSL	ISDN Digital Subscriber Line (IDSL)		ID
MDSL	Medium Bit Rate Digital Subscriber Line (MDSL)		MD
RADSL	Rate Adaptive Asymmetric Digital Subscriber Line (RADSL)		RDA
SDSL	Symmetric Digital Subscriber Line (SDSL)		SD
VDSL	Very High Speed Digital Subscriber Line (VDSL)		VD
GsHDSL	Gs High Bit Rate Digital Subscriber Line (GsHDSL)		GD
MMDS	Multi-Channel Multi-Bit Rate Distribution Service Wireless broadband service		MM

Max Transport Rate to Destination – This is the maximum allowable transport bit rate to the point of presence

Field Content	Field Description	Default	Value
56K	Analog 56K bits per second	Y	A5
64K	Analog 64K bits per second		A6
128K	128 K bits per second		A12
256K	256 K bits per second		A25
300K	300 K bits per second		B3
1000K	1 Mega bits per second		B1

Max Transport Rate from Destination – This is the maximum allowable transport bit rate from the point of presence

Field Content	Field Description	Default	Value
56K	Analog 56K bits per second	Y	A5
64K	Analog 64K bits per second		A6
128K	128 K bits per second		A12
256K	256 K bits per second		A25
300K	300 K bits per second		B3
1000K	1 Mega bits per second		B1

WSN Last Mile– This is a flag indicating if WSN can access the last mile on this access provider for collecting information on and controlling the stream.

Field Content	Field Description	Default	Value
No	WSN does not have control of the last mile	Y	N
Yes	Send request to the user defined partition of next process		Y

6 Initial Routing Tables

The Initial Routing Tables allow routing decisions to be made by the Network Operators based upon who's requesting and where the request is coming from.

6.1 Identity Table

The Identity table starts off the actual routing algorithm on the NRP. It is used by the Network Operators to identify specific Players, Audiences, and Access Points for specific handling. There is a hierarchy here in that if a specific Player is in the table then that is used even if there is an entry for the Access Point or Audience. Similarly, if the Player isn't there, but there is a matching Audience, then the Audience row will be used if even if there is an entry for the Access Point. The Access Point is used if it matches and the first two rules don't apply. Finally, there is one Unknown entry that is the default.

The Consumer Relations Service is the repository of all the demographic information that the system has about the Buyers, Audiences, and Viewers.

Identity Type – The type of identifier in the table.

Field Content	Field Description	Default	Value
Unknown	Default row is that origination information is masked or not currently in our tables	Y	UNK
Access Point Id	Indicates that the identifier is a WSN customer id for the access provider's point of presence where the consumer request is being served.		AP
Audience Id	Indicates that the identifier is an WSN Consumer Audience identifier from the WSN Consumer Relations Service		AUD
Player Id	Indicates that the identifier is a Player Id		PLAY

Identifier – This is the identifier value.

Field Content	Field Description	Default	Value
Identifier	The identifier associated with the above type.		

Next Process – This is the next routing process that will receive this request.

Field Content	Field Description	Default	Value
Referring Host	Send request to the Referring Host Table		RH
Day Of Week	Send request to Day of Week Table		DW
Day Of Year	Send request to Day of Year Table		DY
Time Of Day	Send request to Time of Day Table		TD
Content	Send request to Content Table		CN
Switch	Send request to Switch Table		SW

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	Default
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

6.2 Referring Host Table

This table contains information about the website that referred the consumer to the WSN service. This table will also handle cable Point Of Presence (POP) boxes and their references. *(Note: At this time the research on the naming conventions is underway on cable.)*

Referring Site – The home page reference of the referring site.

Field Content	Field Description	Default	Value
Unknown	Default row is that origination information is masked or not currently in our tables. The not found table look up will resolve to this row.	Y	99999
Site Name	The .com reference of the web site referring the consumer to WSN (i.e. CNN.com).		VCHAR256

Order Identifier – The publisher's order identifier from the CMS on the referring site that is forwarding the consumer request to WSN. This is placed in the reservation at the time the reservation is made

Field Content	Field Description	Default	Value
Unknown	Default row is that origination page reference is not currently in our tables. The not found table lookup resolves to this row.	Y	99999
Order ID	The Publisher's Order Identifier		VCHAR256

Next Process – This is the next routing process that will receive this request.

Field Content	Field Description	Default	Value
Day Of Week	Send request to Day of Week Table		DW
Day Of Year	Send request to Day of Year Table		DY
Time Of Day	Send request to Time of Day Table		TD
Content	Send request to Content Table		CN
Switch	Send request to Switch Table		SW

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

7 Date and Time Routing Tables

These tables are usually supplied by the content owner and/or publishing agent. They allow customization of the MRA based upon the Greenwich Mean Time of Viewer's request. These are generally applied after the content has been identified when used by the publishing agent. However, the network operators can also use these to control flow for network management purposes. In the later case, they will usually appear before the content tables.

7.1 Day of Week

This table allows for customized routing based upon the day of year.

DOW Partition – This field is the partition that will be used in access this table from the Next Partition fields of other tables.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	Default
User Defined Name	User created partition which groups like routing requests		VCHAR 15

From Day – This field will indicate the day of week that the action to be taken by this line entry is applicable.

Field Content	Field Description	Default	Value
DD	The day of the week that this is suppose to begin.	None	1=Sunday 2=Monday 3=Tuesday 4=Wednesday 5=Thursday 6=Friday 7=Saturday

To Day – This field will indicate the day of week that the action to be taken by this line entry is to stop effective at Midnight.

Field Content	Field Description	Default	Value
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DD	The day of the week that this is suppose to end. This may be the same as the From Day.	None	1=Sunday 2=Monday 3=Tuesday 4=Wednesday 5=Thursday 6=Friday 7=Saturday
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Next Process – This is the next routing process that will receive this request.

Field Content	Field Description	Default	Value
Referring Host	Send request to the Referring Host Table		RH
Day Of Year	Send request to Day of Year Table		DY
Time Of Day	Send request to Time of Day Table		TD
Content	Send request to Content Table		CN
Switch	Send request to Switch Table		SW

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

7.2 Day of Year

This table allows for customized routing based upon the day of year.

DOY Partition – This field is the partition that will be used in access this table from the Next Partition fields of other tables.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	Default
User Defined Name	User created partition which groups like routing requests		VCHAR 15

From Date – This field will indicate the local date that the action to be taken by this line entry starts to be applicable.

Field Content	Field Description	Default	Value
YYYY-MM-DD	Year, Month, and Day of Month	None	Valid future date

To Date – This field will indicate the last local date that the action to be taken by this line entry is applicable.

Field Content	Field Description	Default	Value
YYYY-MM-DD	Year, Month, and Day of Month	None	Valid future date

Next Process – This is the next routing process that will receive this request.

Field Content	Field Description	Default	Value
Referring Host	Send request to the Referring Host Table		RH
Day Of Week	Send request to Day of Week Table		DW
Time Of Day	Send request to Time of Day Table		TD
Content	Send request to Content Table		CN
Switch	Send request to Switch Table		SW

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

7.3 Time of Day

This table allows for customized routing based upon the day of year.

TOD Partition – This field is the partition that will be used in access this table from the Next Partition fields of other tables.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	Default
User Defined Name	User created partition which groups like routing requests		VCHAR 15

From Time – This field will indicate the start time that the action to be taken by this line entry is applicable.

Field Content	Field Description	Default	Value
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Military Time	This field indicates the local time that the action to be taken by this line entry is to start. It is in whole minutes. .	None	00:00-23:59
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To Time – This field will indicate the end time that the action to be taken by this line entry is applicable.

Field Content	Field Description	Default	Value
Military Time	This field indicates the local time that the action to be taken by this line entry is to complete. It is in whole minutes. .	None	00:00-23:59

Next Process – This is the next routing process that will receive this request.

Field Content	Field Description	Default	Value
Referring Host	Send request to the Referring Host Table		RH
Day Of Week	Send request to Day of Week Table		DW
Day Of Year	Send request to Day of Year Table		DY
Content	Send request to Content Table		CN
Switch	Send request to Switch Table		SW

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

8 Content Distribution Tables

These tables contain information of individual media clips and the WSN presentation. A presentation is one or more media clips in a play list and their associated impacts on the Network. The tables are used by Network Operators to control the routing of specific publisher or presentation level content.

8.1 Content Table

This table allows the Network Operators to control the routing on a Publisher and Presentation basis

CT Partition – This field is the partition that will be used in access this table from the Next Partition fields of other tables.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	Default
User Defined Name	User created partition which groups like routing requests		VCHAR 15

Publisher Id – This field will contain the Publisher id within the Content Management System. The number is unique.

Field Content	Field Description	Default	Value
Default	No Publisher ID match	Y	All zeros
Publisher_ID	A unique number that identifies a Publisher within the WSN network		numeric

Presentation Id – This field will uniquely identify a presentation within the WSN Enhanced Service Routing Processor (ESRP).

Field Content	Field Description	Default	Value
Default	All presentations for the Publisher	Y	All zeros
Publisher_ID	A unique number that identifies a presentation within the WSN network		numeric

Next Process – This is the next routing process that will receive this request.

Field Content	Field Description	Default	Value
Referring Host	Send request to the Referring Host Table		RH
Day Of Week	Send request to Day of Week Table		DW

Day Of Year	Send request to Day of Year Table		DY
Time Of Day	Send request to Time of Day Table		TD
Switch	Send request to Switch Table		SW

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

8.2 Presentation Cache

This table contains data on the media clips being viewed and the physical location of the media. The ESRP provides this data to the NRP and it is updated for Content Distribution caching on a real time basis.

This table doesn't have partitions and has no next process / next partition fields because it is simply an informational table on where the content is located so that the selected switches can be reordered based on whether or not they have the content already.

Presentation Id – This field will uniquely identify a presentation within the WSN Enhanced Service Routing Processor (ESRP).

Field Content	Field Description	Default	Value
Presentation_ID	A unique number that identifies a presentation within the WSN network		numeric

Storage Boundary-This field will identify where a presentation and/or media actually resides within the Network.

Field Content	Field Description	Default	Value
Default	All MMS Switches	Y	all
Tape	Utilized when the media is stored a digital tape which is robotically loaded at the Network Operation Center or Root Switch Site		tape
Root	Identifies the content at Root Switches only		root
MMS	Identifies the content is stored at selected MMS switches		MMS

MMS Listing -This field will contain the full listing of the MMS locations that media and presentations can be seen. This listing can have up to 100 possible locations.

9 Network Control Tables

9.1 Switch Table

This table is used as the generally final step in selecting a list of eligible switches to be used in finding the ultimate SRP to handle the reservation.

Switch Partition – This tells the NRP which Partition was chosen by the process calling the Switch Table.

Field Content	Field Description	Default	Value
default	No route list – send to treatment	Y	treatment
User Defined Name	User created partition which groups like routing requests		VCHAR 15

Switch Number – This field orders the switches within a switch list. The MRA processing will process the switch choices for a given Switch Partition in the order indicated by the Switch Numbers.

Field Content	Field Description	Default	Value
Switch Number	Switch number designating the priority in which the switches are to be utilized		1-20
final	When the list is fully verified and no switch choice can process the viewer request the viewer session is routed to video busy via treatment		Treatment Number

Switch Identifier – This field is the unique identifier of the switch.

Field Content	Field Description	Default	Value
Switch ID	The identifier of the switch		String

9.2 Alternate Switch Table

This table is used for creating an alternate pathway for servicing the viewer's request if none of the switches from the Switch Table can service the reservation request.

Switch Partition – This tells the NRP which Partition was chosen by the process calling the Switch Table.

Field Content	Field Description	Default	Value
default	No route list – send to treatment	Y	treatment
User Defined Name	User created partition which groups like routing requests		VCHAR 15

Switch Number – This field orders the switches within a switch list. The MRA processing will process the switch choices for a given Switch Partition in the order indicated by the Switch Numbers.

Field Content	Field Description	Default	Value
Switch Number	Switch number designating the priority in which the switches are to be utilized		1-20
final	When the list is fully verified and no switch choice can process the viewer request the viewer session is routed to video busy via treatment		Treatment Number

Switch Identifier – This field is the unique identifier of the switch.

Field Content	Field Description	Default	Value
Switch ID	The identifier of the switch		String

9.3 Class of Service Table

The Class of Service table allows viewers originating on specified access trunks and terminating on specified access trunks to behave differently. The access trunk is rated for its reliability and distance accuracy. This is common for xDSL delivery of streaming media. The distance from the DSLAM creates quality of service issues. This table is utilized for broadband subscription television service.

MMS Switch Number – This is the MMS switch identifier

Field Content	Field Description	Default	Value
Switch Id	A unique six digit number that identifies the WSN MMS switch		999999

Access Group Number – This field identifies the access group trunk number that is directly attached to the MMS. This is the internal identification number

Field Content	Field Description	Default	Value
Access Id	Identifies the Virtual Path of the broadband circuit for directly connected access groups		999999999

Access Mapping Number – This field identifies the access group trunk number that is directly attached to the MMS. If the MMS is purchased by an ISP, ASP, or CDN, this number represents the carrier's circuit number in their system

Field Content	Field Description	Default	Value
Access Map id	Identifies the Virtual Path of the broadband circuit for directly connected access groups		999999999

Next Process – This is the next routing process that will receive this request. **Selections Not Valid at this time *****

Field Content	Field Description	Default	Value

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

9.4 Stream Treatment Table

This table allows the Network Operation's personnel the ability to customize how a request for service will be denied. Utilization of pre-record media messages and event customer specific messages is possible.

Treatment Partition – This tells the NRP which Partition was chosen by the process calling the Stream Treatment Table.

Field Content	Field Description	Default	Value
Network Defined Name	Design time created names that specify which device is calling for the treatment.		VCHAR 15

Treatment Type – This field establishes the rate of control which will be applied to incoming viewer request for service.

Field Content	Field Description	Default	Value
User Defined Name	User created partition which groups like treatment requests		

Message Presentation – This is the WSN presentation id of the video treatment message to be played.

Field Content	Field Description	Default	Value
None	Utilize RTSP error messaging only	Y	Per RTSP error Standards
Presentation Id	Valid WSN presentation id which contains a media clip which provides a video explaining why the viewer was not connected		

Message Switch – This is MMS Switch Id that is to be called which contains the error presentation.

Field Content	Field Description	Default	Value
MMS Switch Id	MMS id which are the network recordings		999999

Passed Next Process – This is the next routing process that will be taken assuming the incoming request fell out of the boundaries of applying a stream rate control.

Field Content	Field Description	Default	Value

Passed Partition – This is the next partition of the Passed Next Process table that will be taken assuming the incoming request fell outside the boundaries of applying a stream rate control.

Field Content	Field Description	Default	Value

9.5 Private Network Circuit Table

This table contains information about the logical circuit created to support the WSN service. This table will differentiate between narrowband and broadband service requests and the optimized routing decision.

This table is populated from the Network Control Tables to provide optimized network routing information and logical circuit identification. Key components of the MRA are relayed to this table for stream initiation processes. Due to this fact, attributes in this table may change as the MRA is fully defined.

Logical Circuit Id – The id assigned to the logical circuit for the stream.

Field Content	Field Description	Default	Value
Circuit Id	Unique identifier that for the circuit supporting the routed stream.		Number

Circuit Type – This tells the NRP which Partition was chosen by the process calling the Private Network Circuit Table

Field Content	Field Description	Default	Value
NB	Value stating that the stream is from a narrowband stream caster.		NB
BB	Value stating that the stream is from a broadband stream caster		BB

Circuit State – Indicator showing whether the supported stream is content, control, or guide. This row is intended to support broadband transport.

Field Content	Field Description	Default	Value
STRMNG	Default stating that the current state of the circuit is streaming	Y	STRMNG
GUIDE	Indication that the supported stream is a channel guide		CHANNEL
CONTROL	Indication that the supported stream is an index (for VCR like control)		CONTROL

Secured Transport – Indicator if the supported stream is encrypted or not.

Field Content	Field Description	Default	Value
None	Default row is that the supported stream is unencrypted	Y	No
Yes	Flag indication that the supported stream is encrypted		Yes

Layered Transport – Indicator if the supported stream is layered. As broadband transport technologies emerge, some solutions may be layered to degrade gracefully in the face of network congestion.

Field Content	Field Description	Default	Value
None	Default row is that the supported stream is not layered	Y	No
Yes	Flag indication that the supported stream is layered		Yes

Next Process – This is the next routing process that will receive this request. **Selections Not Valid at this time *****

Field Content	Field Description	Default	Value
Proxy	Send request to the access signal wrapper table	Y	SW

Next Partition – This is the table partition (i.e. high order key) that should be looked up in the Next Process table.

Field Content	Field Description	Default	Value
Default	Send request to the default partition of next process	Y	
User Defined Name	Send request to the user defined partition of next process		VCHAR 15

10 SRP Tables

The SRP Tables are used to guide the SRP on selecting a Stream Caster for a presentation.

10.1 Player Type

The Player Type table is used to direct a type of presentation to a list of Stream Casters that are capable of streaming the presentation.

Content Format Type – The unique vendor code returned from the content management system about the type of media client software that will be utilized.

Field Content	Field Description	Default	Value
Unkown	Not provided on referring play script or reservation	Y	999
Real	Content encoded to Real Networks Standards		Real
Apple	Content encoded to Apple's Quick Time standards		Apple
Microsoft	Content encoded to Microsoft's media standards		Mov
MPEG4	Content encoded to MPEG4 standards		MPG4

Viewer Player Type – The type of view client that is being used in this presentation. Two special cases exist within this attribute. The “old” case allows all versions prior to this designation to be routed the same. This will reduce Operation’s order entry time for routing. The second case is the “custom”. The Windows and Quick Time are open source players that can be modified. This allows for special routing of these cases.

Field Content	Field Description	Default	Value
Media Client	Media viewer not identified	Y	9999
	Real Networks – Version		RPvXX
	Real Networks - Version		RPvXX
	Real Networks – Version < YYY (Denotes all player prior to this version)		RPOLD
	Quick Time Player - Version		QTvXX
	Quick Time Player - Version		QTvXX
	Quick Time Player – Custom		QTCST
	Quick Time Player – Version < YYY (Denotes all players prior to this version)		QTOLD
	Windows Media – Version		MSvXX
	Windows Media – Version		MSvXX
	Windows Media – Custom		MSCST
	Windows Media – Version < YY (Denotes all players prior to this version)		MSOLD