



Next Generation On Demand (NGOD)

Client Session Interface - S1/C1 (RTSP) 1.1

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Key to Document Status Codes:

Work in Progress (W)	An incomplete document, designed to guide discussion and generate feedback that may include several alternative requirements for consideration.
Draft (D)	A document in specification format considered largely complete, but lacking review by other VE and PE vendors. Drafts are susceptible to substantial change during the review process.
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1 SCOPE

1.1 Introduction and Overview

As part of the Comcast NextGen VoD Architecture initiative, the Client Session Setup Interface (S1) and the Client Stream Control Interface (C1) define interaction between VOD clients and the Session Manager component.

1.2 Purpose of document

The purpose of this document is to define the syntax and semantics for the S1 and C1 interfaces.

1.3 Scope

The following information will be included in this document:

- Interface overview including protocol options and design considerations
- Overview of messages and purpose of each message
- Detail for each message request/response – sequence diagrams, message parameter details, and syntax definitions.

The following items are out of the scope of this document:

- How the client determines the Session Manager IP address and port.

1.4 Requirements (Conformance Notation)

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

“MUST”	This word or the adjective “REQUIRED” means that the item is an absolute requirement of this specification. The word “MANDATORY” may be used in lieu of “MUST” in certain circumstances.
“MUST NOT”	This phrase means that the item is an absolute prohibition of this specification.
“SHOULD”	This word or the adjective “RECOMMENDED” means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
“SHOULD NOT”	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood

and the case carefully weighed before implementing any behavior described with this label.

“MAY”

This word or the adjective “OPTIONAL” means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

2 REFERENCES

2.1 Normative References

The following documents may be of use in understanding this interface.

[N-1] NGOD RTSP Usage Specification

[N-2] H. Schulzrinne; et al, Real Time Streaming Protocol (RTSP), RFC 2326, April 1998

[N-3] R. Fielding; et al, Hypertext Transfer Protocol -- HTTP/1.1, RFC 2068, January 1997

[N-4] Berners-Lee, T., and D. Connolly, "HyperText Markup Language Specification - 2.0", RFC 1866, November 1995

[N-5] M. Handley; et al, SDP: Session Description Protocol, RFC 2327, April 1998

[N-6] H. Schulzrinne; et al, Real Time Streaming Protocol (RTSP), RFC 2326bis-07, July 19, 2004

2.2 Informative References

N/A

3 TERMS AND DEFINITIONS

This specification defines the following terms:

N/A

4 ABBREVIATIONS AND ACRONYMS

This specification uses the following abbreviations and acronyms:

Table 1 - Abbreviations and Acronyms

MPEG	Motion Picture Experts Group
NGOD	Next Generation On Demand
NPT	Normal Play Time – format as defined in the RTSP RFC 2326
RTSP	Real-time Streaming Protocol
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
UDP	Universal Datagram Protocol

5 S1 AND C1 - INTERFACE SPECIFICATION

5.1 Key Decision Drivers, Scope, and Constraints

The following key decisions and constraints bound the architecture and associated interfaces.

5.2 Interface Requirements Phasing

This document describes the establishment of sessions and interaction with sessions that utilize a single set of resources determined at the time of session setup.

Future requirements:

- The ability for a client to request additional or different resources after the establishment of the initial session. For example, perhaps a client would like to play a different MPEG file in the course of the session. The S1 specification would need to be extended to change/add the asset being requested.
- The ability for a session to start up multiple streams. For example a football game play-out could start up multiple streams and the client could choose between different camera angles (streams). The session setup request interface would need to be able to convey the desired play-out. The session setup response would need to encompass the tuning parameters for multiple streams.
- The ability for the client to send messages in a more secure manner. For example, one could implement an SSL socket layer on top of which RTSP messages would be sent. Note that SSL may not be possible for legacy set tops that do not support TCP sockets. Another option is to add on additional authentication mechanisms on top of the standard RTSP protocol.
- The ability for the client to setup a session for a real-time feed. The RTSP Play Request will need to have an option of specifying a start position of “now.”

5.3 Overall Architecture

The overall architecture of the S1 and C1 interactions as specified in this document is characterized by the following.

- Sessions are established and torn down via interactions over S1 between the On Demand Client and the Session Manager.
- In the course of establishment of the session the Session Manager communicates location information of a Streaming Server to be used by the On Demand Client for stream control of the established session.
- The client interacts with the Streaming Server over interface C1 to control the streaming of that session, e.g. pause, rewind, and fast-forward.

5.4 Description of Functional Components

The components that are involved with interfaces S1 and C1 are as follows.

- **On Demand Client** – Enables the end-user application and interfaces with head end components. This typically runs on a digital set top box, but is not limited to solely that implementation.
- **Session Manager** – Manages life cycle of sessions for on demand video services as requested by On Demand Clients.
- **Streaming Server** – Outputs video streams and manages stream control.

5.5 Protocol Interfaces

The protocol chosen for S1 and C1 for this specification is based on the Real-time Streaming Protocol (RTSP). The RTSP protocol has various options that, if not implemented uniformly, could lead to a lack of interoperability. This specification, along with the NGOD RTSP Usage Specification, defines a minimal subset of RTSP messaging in order to be compliant with the Comcast NextGen Architecture S1 and C1 interface.

The architecture shall support both UDP and TCP transport for interfaces S1 and C1.

5.5.1 RTSP Headers

The following chapters will define the syntax for each message. Unless otherwise noted the RTSP headers required for a given message are defined in RFC 2326 and the NGOD RTSP Usage Specification.

5.6 Future Considerations

Protocol extensions. When defining the syntax of the RTSP messages included in S1 and C1, we will define a paradigm of extensibility for use in the future when adding new messages and fields to the protocol.

Future functionality. Please see “Interface Requirements Phasing” for a discussion of future functionality.

6 RELATIONSHIP BETWEEN S1 AND C1

6.1 Introduction

The S1 and C1 interfaces are related in that the client-side of the interface is implemented by the On Demand Client component. The On Demand client uses S1 for session setup/teardown and uses C1 for stream control.

6.2 Flow Overview

The On Demand Client uses the S1 SETUP message to establish a session with the Session Manager component. Within the S1 SETUP response message is information defining the location that the On Demand Client will use to establish interface C1. Please see the “

S1 – Session setup messages” section for details. This information includes the IP and port of the RTSP server with which the On Demand Client will interact for interface C1, as well as needed session identification information. The On Demand Client connects to the RTSP server on the Streaming Server and sends PLAY and PAUSE commands. There is no need for the On Demand Client to send an additional SETUP message over C1.

By way of illustration a session may involve the following.

1. The On Demand Client sends a SETUP request to the Session Manager to establish a new session.
2. The Session Manager sends a SETUP response which includes the Streaming Server stream control IP & port, and session ID information.
3. The On Demand Client to the Streaming Servers RTSP server sends a PLAY message. The Streaming Server responds.
4. The On Demand Client sends stream control commands (PLAY and PAUSE) to the Streaming Server RTSP server. The Streaming Server responds each time.
5. The On Demand Client releases the session by sending a TEARDOWN message to the Session Manager.

7 S1 – SESSION SETUP MESSAGES

7.1 Introduction

The On Demand Clients interact with the Session Manager with the RTSP Setup Request and Response messages to establish new sessions.

7.2 Interaction Diagram

The below diagram depicts the interaction between the On Demand Client and the Session Manager to set up a session.

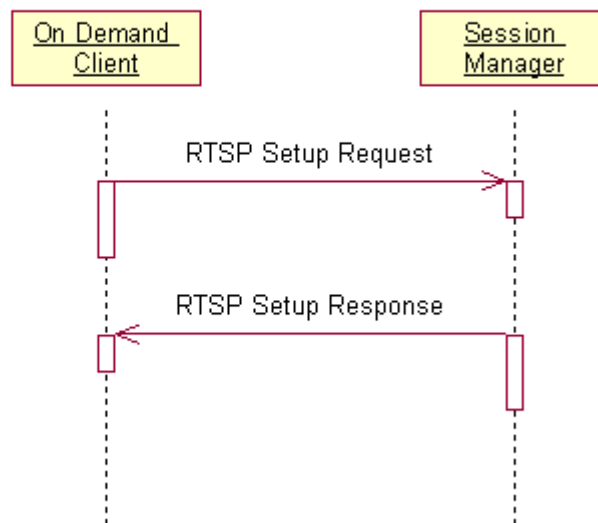


Figure 1 Session Setup Interaction between Session Manager and On Demand Client

7.3 RTSP Setup Request

7.3.1 RTSP URL

The RTSP URL shall have the following syntax.

`Rtsp://<session-manager-path>:<session-manager-port>/;purchaseToken=<purchase-token>;serverId=<server-id>`

Where

- <session-manager-path> is the DNS name or IP address of the session manager

- <session-manager-port> is the port for the session manager
- <purchase-token> is the token negotiated between the Purchase Server and the On Demand Client. This is a string representation of a 128-bit value (UUID).
- <server-id> is the server ID negotiated between the Purchase Server and the On Demand Client. This identifier represents the IP address of the application server. E.g. Purchase Server.

Note that all of the above variables are mandatory for a valid RTSP URL for an NGOD S1 SETUP message.

7.3.2 RTSP Headers

The RTSP Transport header will have the following additional syntax definition.

```
Transport:
MP2T/DVBC/QAM;
unicast;
client=<client-id>;qam_name=<qam_name>

[ ,
MP2T/DVBC/QAM;unicast;
client=<client-id>;
qam_name=<qam_name>
]*
```

where

- <client-id> is a unique identifier of the client, usually a MAC address or Unit address
- <qam_name> is a string representation of a QAM name discovered by the client

Note that it is possible to represent multiple qam-name values in a single Transport header. Please see the below example.

7.3.3 Example

```
SETUP rtsp://sessionmanager2.comcast.com:554/;
purchaseToken=c0c2d8b0-cc82-11d9-8cd50-800200c9a66;
serverID=1.1.1.1 RTSP/1.0
CSeq: 123
Require: com.comcast.ngod.s1
Transport:
MP2T/DVBC/QAM;unicast;client=00AF123456DE;
qam_name=Chicago.Southbend.5,
MP2T/DVBC/QAM;unicast;client=00AF123456DE;
qam_name=Chicago.Southbend.10
ClientSessionId: 00AF123456DE00000001
```

7.4 RTSP Setup Response

7.4.1 RTSP Headers

The RTSP Transport header will have the following additional syntax definition.

The syntax of the Transport header is as follows.

```
Transport:
MP2T/DVBC/QAM;
unicast;
[destination=<destination>;]
[qam_name=<qam_name>;]
```

where

- <destination> describes the “<frequency>.<program-number>” where <frequency> describes the frequency in Hertz with which to tune to the request stream and <program-number> is the program number of the requested stream.
- <qam_name> is a string describing the assigned qam-name for the transport stream that the STB needs to tune to, this can be compared with the qam-name list from client auto-discovery.

7.4.2 Example

Following is an example RTSP SETUP response. For detailed descriptions of each individual field, please see the “SDP” section of the NGOD RTSP Specification.

```
RTSP/1.0 200 OK
CSeq: 123
Session: 716195834
Transport: MP2T/DVBC/QAM;unicast;
destination=24000000.23
OnDemandSessionId: be074250-cc5a-11d9-8cd5-0800200c9a66
ClientSessionId: 00AF123456DE00000001
Content-type: application/sdp
Content-length: 149

v=0
o=- 777 2890842817 IN IP4 1.2.3.4
s=
t=0 0
a=control:rtsp://videoserver234.comcast.com:554/9876
c=IN IP4 0.0.0.0
m=video 0 udp MP2T
```


8 S1 – SESSION TEARDOWN MESSAGES

8.1 Introduction

On Demand Clients interact with the Session Manager with the RTSP Teardown Request and Response messages to teardown existing sessions.

8.2 Interaction Diagram

The below diagram depicts the interaction between the On Demand Client and the Session Manager to tear down a session.

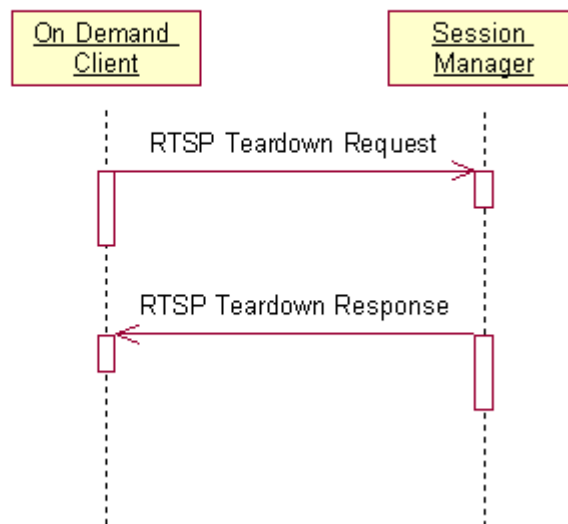


Figure 2 Session Teardown Interaction between Session Manager and On Demand Client

8.3 Teardown Request

8.3.1 RTSP URL

The RTSP URL shall have the following syntax.

`rtsp://<session-manager-path>:<session-manager-port>/`
where

- <session-manager-path> is the DNS name or IP address of the session manager
- <session-manager-port> is the port for the session manager

8.3.2 Example

```
TEARDOWN rtsp://sessionmanager2.comcast.com:554
RTSP/1.0
CSeq: 789
Require: com.comcast.ngod.s1
Reason: 200 "user pressed stop"
Session: 98765
OnDemandSessionId: be074250-cc5a-11d9-8cd5-0800200c9a66
ClientSessionId: 00AF123456DE00000001
```

8.4 Teardown Response

8.4.1 Example

```
RTSP/1.0 200 OK
CSeq: 789
Session: 98765
OnDemandSessionId: be074250-cc5a-11d9-8cd5-0800200c9a66
ClientSessionId: 00AF123456DE00000001
```

9 S1 – ANNOUNCE MESSAGES

9.1 Introduction

On some occasions the Session Manager will send unsolicited messages to the On Demand Clients that have active sessions running. These messages shall be sent via RTSP Announce Request and Response messages as detailed below.

9.2 Interaction Diagram

The below diagram depicts the interaction between the On Demand Client and the Session Manager to notify the client of information relating to the session.

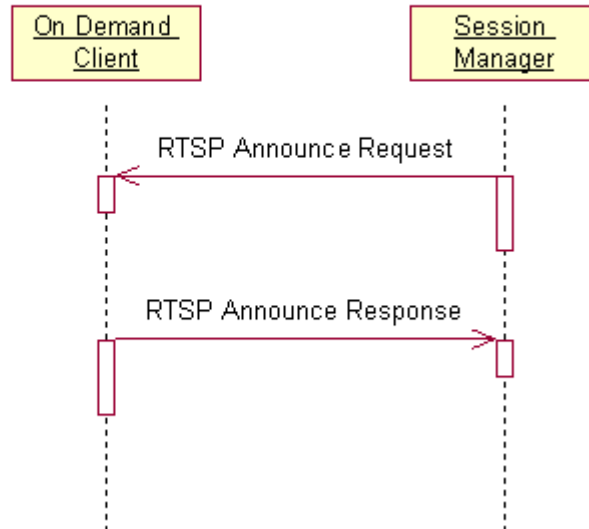


Figure 3 Session Information Interaction between Session Manager and On Demand Client

9.3 Announce Request

9.3.1 RTSP URL

The RTSP URL shall have the following syntax.

`rtsp://<server-path>:<server-port>/`

where

- <server-path> is the DNS name or IP address of the Session Manager
- <server-port> is the port of the Session Manager

9.3.2 Example

```
ANNOUNCE rtsp://sessionmanager2.comcast.com:554
RTSP/1.0
CSeq: 3
Require: com.comcast.ngod.s1
Session: 94155497
Notice: 5402 "Client Session Terminated" event-
date=19930310T023735.013Z npt=342554
OnDemandSessionId: be074250-cc5a-11d9-8cd5-0800200c9a66
```

9.4 Announce Response

9.4.1 Example

```
RTSP/1.0 200 OK
CSeq: 3
Session: 94155497
OnDemandSessionId: be074250-cc5a-11d9-8cd5-0800200c9a66
```

10 S1 – HEARTBEAT (PING) MESSAGES

10.1 Introduction

The On Demand Clients interact with the Session Manager to send “heartbeat” messages to convey to the Session Manager that the client is still alive. This is accomplished by the client by periodically sending a RTSP PING Request to the Session Manager.

10.2 Interaction Diagram

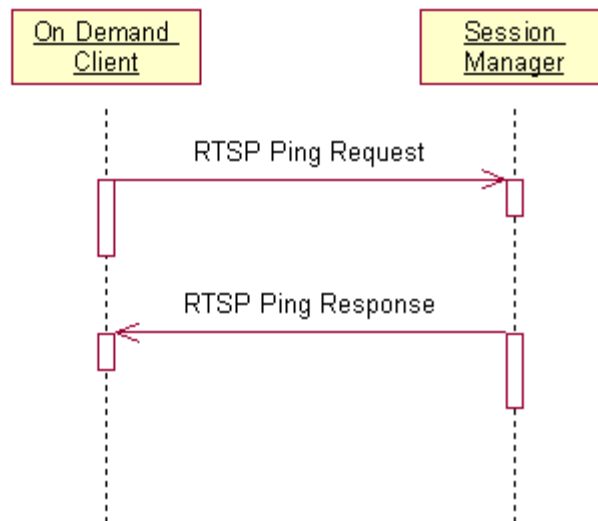


Figure 4 Heartbeat (PING) Message Interaction between Session Manager and On Demand Client

10.3 Ping Request

10.3.1 Example

```
PING rtsp://sessionmanager2.comcast.com:554 RTSP/1.0
CSeq: 123
Require: com.comcast.ngod.s1
Session:12345678
OnDemandSessionId: be074250-cc5a-11d9-8cd5-0800200c9a66
```

10.4 Ping Response

10.4.1 Example

```
RTSP/1.0 200 OK
CSeq: 123
Session:12345678
OnDemandSessionId: be074250-cc5a-11d9-8cd5-0800200c9a66
```

How often the Ping messages should be sent by On Demand Client to Session Manager is subject to further definition. A default value for the interval between the Ping messages may be defined for both On Demand Client and Session Manager. It is up to each specific implementation on how Session Manager should handle the missing of the Ping messages from On Demand Client.

11 C1 – PLAY MESSAGES

11.1 Introduction

The On Demand Clients interact with the Streaming Server with the RTSP Play Request and Response messages to play—including playing at normal (1x) rate, rewinding, and fast-forwarding the stream.

11.2 Interaction Diagram

The below diagram depicts the interaction between the On Demand Client and the Streaming Server to exact a play.

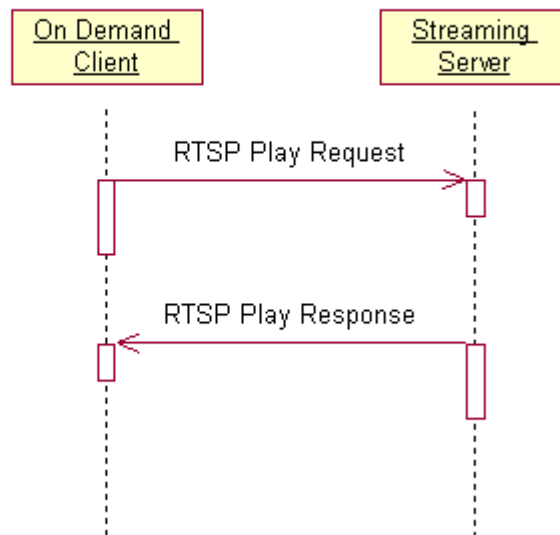


Figure 5 Play Interaction between Streaming Server and On Demand Client

11.3 Play Request

11.3.1 RTSP URL

The RTSP URL shall have the following syntax.

`rtsp://<streaming-server-path>:<streaming-server-port>/`
where

- <streaming-server-path> is the DNS name or IP address of the streaming server
- <streaming-server-port> is the port for the streaming server

11.3.2 Headers

Please refer to the RTSP RFC2326 for definition of the Scale and Range headers. Normal Play Time (NPT) must be used as mandatory representations of time format for NGOD. For a server generated play list, the On Demand Client should not be aware of the element and time interval within the play list. Therefore, the NPT is relative to the beginning of the play list.

11.3.3 Examples

An example of a normal play follows.

```
PLAY rtsp://videosever234.comcast.com:554/98765
RTSP/1.0
CSeq: 456
Require: com.comcast.ngod.cl
Session: 77
Range: npt=0-
```

An example of a rewind -5x play follows.

```
PLAY rtsp://videosever234.comcast.com:554/98765
RTSP/1.0
CSeq: 456
Require: com.comcast.ngod.cl
Session: 77
Scale: -5.0
```

An example of a fast-forward at 5x play follows.

```
PLAY rtsp://videosever234.comcast.com:554/98765
RTSP/1.0
CSeq: 456
Require: com.comcast.ngod.cl
Session: 77
Scale: 5.0
```

11.4 Play Response

11.4.1 Example

```
RTSP/1.0 200 OK
CSeq: 456
Session: 77
Range: npt=0-
```


12 C1 – PAUSE MESSAGES

12.1 Introduction

The On Demand Clients interact with the Streaming Server with the RTSP Pause Request and Response messages to pause the video play-out.

12.2 Interaction Diagram

The below diagram depicts the interaction between the On Demand Client and the Streaming Server to exact a pause.

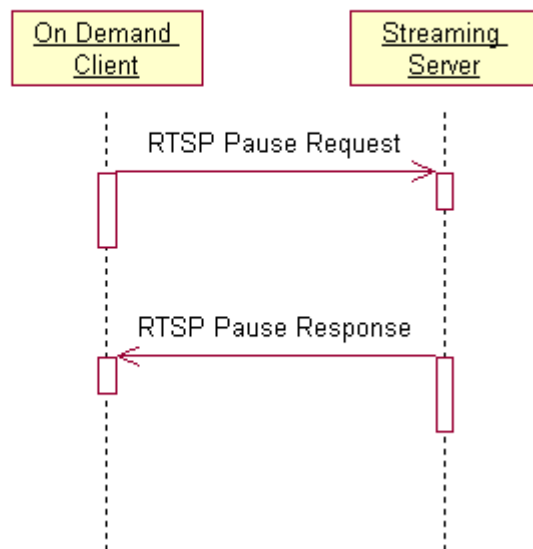


Figure 6 Pause Interaction between Streaming Server and On Demand Client

12.3 Pause Request

12.3.1 RTSP URL

The RTSP URL shall have the following syntax.

`rtsp://<streaming-server-path>:<streaming-server-port>/`
where

- <streaming-server-path> is the DNS name or IP address of the streaming server
- <streaming-server-port> is the port for the streaming server

12.3.2 Example

```
PAUSE rtsp://videosever234.comcast.com:554/98765
RTSP/1.0
CSeq: 836
Require: com.comcast.ngod.cl
Session: 77
```

12.4 Pause Response

12.4.1 Example

```
RTSP/1.0 200 OK
CSeq: 836
Session: 77
Range: npt=1742-
```

13 C1 – ANNOUNCE MESSAGES

13.1 Introduction

On some occasions the Streaming Server will send unsolicited messages to the On Demand Clients that have active sessions running. These messages shall be sent via RTSP Announce Request and Response messages as detailed below.

13.2 Interaction Diagram

The below diagram depicts the interaction between the On Demand Client and the Streaming Server to notify the client of information relating to the session.

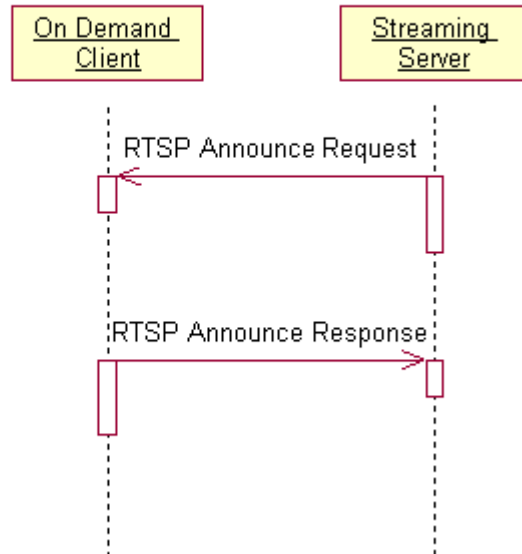


Figure 7 Announce Message Interaction between Streaming Server and On Demand Client

13.3 Announce Request

The RTSP URL shall have the following syntax.

`rtsp://<server-path>:<server-port>/`

where

- <server-path> is the DNS name or IP address of the Streaming Server
- <server-port> is the port of the Streaming Server

13.3.1 Example

```
ANNOUNCE rtsp://videosever234.comcast.com:554 RTSP/1.0
CSeq: 1
Require: com.comcast.ngod.cl
Session: 8537781583503421373
Notice: 2101 "End-of-Stream Reached" event-
date=19930316T064707.735Z npt=2314223
```

13.4 Announce Response

13.4.1 Example

```
RTSP/1.0 200 OK
CSeq: 1
Session: 8537781583503421373
```

14 C1 – GET_PARAMETER MESSAGES

14.1 Introduction

The On Demand Clients interact with the Streaming Server with the RTSP Get_Parameter Request and Response messages to retrieve information about the state of the stream.

14.2 Interaction Diagram

The below diagram depicts the interaction between the On Demand Client and the Streaming Server for a Get_Parameter interaction.

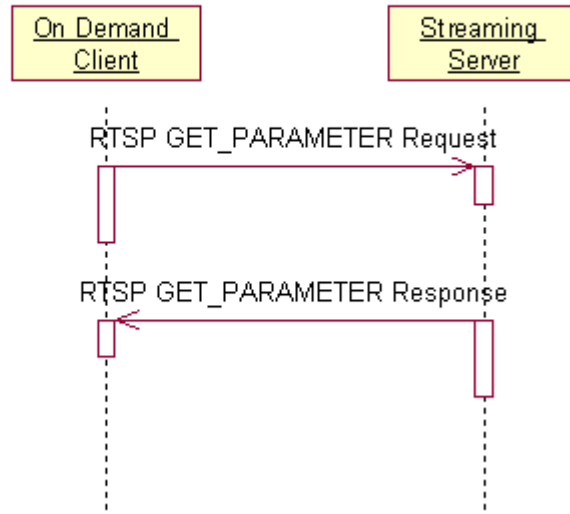


Figure 8 Get_Parameter Interaction between Streaming Server and On Demand Client

14.3 Get_Parameter Request

14.3.1 RTSP URL

The RTSP URL shall have the following syntax.

`rtsp://<streaming-server-path>:<streaming-server-port>/`
where

- <streaming-server-path> is the DNS name or IP address of the streaming server
- <streaming-server-port> is the port for the streaming server

14.3.2 Example

```
GET_PARAMETER
rtsp://streamingserver32.comcast.com:554/98765 RTSP/1.0
CSeq: 36393
Require: com.comcast.ngod.cl
Content-Type: text/parameters
Session: 1231796058
Content-Length: 16

presentation_state
```

14.4 Get_Parameter Response

14.4.1 Example

```
RTSP/1.0 200 OK
CSeq: 36393
Session: 1231796058
Content-Type: text/parameters
Content-Length: 23

presentation_state: play
```

The valid parameter options are defined in the NGOD RTSP Usage specification.