

[MS-RDPEAI]: Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension

Intellectual Property Rights Notice for Open Specifications Documentation

- **Technical Documentation.** Microsoft publishes Open Specifications documentation for protocols, file formats, languages, standards as well as overviews of the interaction among each of these technologies.
- **Copyrights.** This documentation is covered by Microsoft copyrights. Regardless of any other terms that are contained in the terms of use for the Microsoft website that hosts this documentation, you may make copies of it in order to develop implementations of the technologies described in the Open Specifications and may distribute portions of it in your implementations using these technologies or your documentation as necessary to properly document the implementation. You may also distribute in your implementation, with or without modification, any schema, IDL's, or code samples that are included in the documentation. This permission also applies to any documents that are referenced in the Open Specifications.
- **No Trade Secrets.** Microsoft does not claim any trade secret rights in this documentation.
- **Patents.** Microsoft has patents that may cover your implementations of the technologies described in the Open Specifications. Neither this notice nor Microsoft's delivery of the documentation grants any licenses under those or any other Microsoft patents. However, a given Open Specification may be covered by Microsoft [Open Specification Promise](#) or the [Community Promise](#). If you would prefer a written license, or if the technologies described in the Open Specifications are not covered by the Open Specifications Promise or Community Promise, as applicable, patent licenses are available by contacting iplg@microsoft.com.
- **Trademarks.** The names of companies and products contained in this documentation may be covered by trademarks or similar intellectual property rights. This notice does not grant any licenses under those rights.
- **Fictitious Names.** The example companies, organizations, products, domain names, e-mail addresses, logos, people, places, and events depicted in this documentation are fictitious. No association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred.

Reservation of Rights. All other rights are reserved, and this notice does not grant any rights other than specifically described above, whether by implication, estoppel, or otherwise.

Tools. The Open Specifications do not require the use of Microsoft programming tools or programming environments in order for you to develop an implementation. If you have access to Microsoft programming tools and environments you are free to take advantage of them. Certain Open Specifications are intended for use in conjunction with publicly available standard specifications and network programming art, and assumes that the reader either is familiar with the aforementioned material or has immediate access to it.

Revision Summary

Date	Revision History	Revision Class	Comments
12/05/2008	0.1	Major	Initial Availability
01/16/2009	0.1.1	Editorial	Revised and edited the technical content.
02/27/2009	0.1.2	Editorial	Revised and edited the technical content.
04/10/2009	0.1.3	Editorial	Revised and edited the technical content.
05/22/2009	0.2	Minor	Updated the technical content.
07/02/2009	0.2.1	Editorial	Revised and edited the technical content.
08/14/2009	0.2.2	Editorial	Revised and edited the technical content.
09/25/2009	1.0	Major	Updated and revised the technical content.
11/06/2009	2.0	Major	Updated and revised the technical content.
12/18/2009	2.0.1	Editorial	Revised and edited the technical content.
01/29/2010	3.0	Major	Updated and revised the technical content.
03/12/2010	4.0	Major	Updated and revised the technical content.
04/23/2010	4.0.1	Editorial	Revised and edited the technical content.
06/04/2010	4.1	Minor	Updated the technical content.
07/16/2010	4.1	No change	No changes to the meaning, language, or formatting of the technical content.
08/27/2010	4.1	No change	No changes to the meaning, language, or formatting of the technical content.
10/08/2010	4.1	No change	No changes to the meaning, language, or formatting of the technical content.
11/19/2010	4.1	No change	No changes to the meaning, language, or formatting of the technical content.
01/07/2011	4.1	No change	No changes to the meaning, language, or formatting of the technical content.
02/11/2011	5.0	Major	Significantly changed the technical content.
03/25/2011	5.0	No change	No changes to the meaning, language, or formatting of the technical content.
05/06/2011	5.0	No change	No changes to the meaning, language, or formatting of the technical content.
06/17/2011	5.1	Minor	Clarified the meaning of the technical content.

[MS-RDPEAI] — v20110610

Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension

Copyright © 2011 Microsoft Corporation.

Release: Friday, June 10, 2011

Contents

1	Introduction	7
1.1	Glossary	7
1.2	References.....	7
1.2.1	Normative References.....	7
1.2.2	Informative References	8
1.3	Overview	8
1.3.1	Initialization Sequence	8
1.3.2	Data Transfer Sequence	9
1.3.3	Format Change Sequence.....	10
1.4	Relationship to Other Protocols.....	10
1.5	Prerequisites/Preconditions	10
1.6	Applicability Statement.....	11
1.7	Versioning and Capability Negotiation.....	11
1.8	Vendor-Extensible Fields.....	11
1.9	Standards Assignments	11
2	Messages.....	12
2.1	Transport.....	12
2.2	Message Syntax	12
2.2.1	SNDIN_PDU Header.....	12
2.2.2	Initialization Messages	12
2.2.2.1	Version PDU (MSG_SNDIN_VERSION)	13
2.2.2.2	Sound Formats PDU (MSG_SNDIN_FORMATS).....	13
2.2.2.3	Open PDU (MSG_SNDIN_OPEN)	14
2.2.2.3.1	Extended Wave Format Structure (WAVEFORMAT_EXTENSIBLE)	16
2.2.2.4	Open Reply PDU (MSG_SNDIN_OPEN_REPLY)	17
2.2.3	Data Transfer Messages	17
2.2.3.1	Incoming Data PDU (MSG_SNDIN_DATA_INCOMING)	17
2.2.3.2	Data PDU (MSG_SNDIN_DATA)	18
2.2.4	Format Change Messages.....	18
2.2.4.1	Format Change PDU (MSG_SNDIN_FORMATCHANGE)	18
3	Protocol Details.....	20
3.1	Common Details	20
3.1.1	Abstract Data Model	20
3.1.2	Timers	20
3.1.3	Initialization	20
3.1.4	Higher-Layer Triggered Events.....	21
3.1.4.1	Recording Audio	21
3.1.5	Message Processing Events and Sequencing Rules.....	21
3.1.5.1	Protocol Initialization.....	22
3.1.5.2	Protocol Termination	22
3.1.6	Timer Events	23
3.1.7	Other Local Events	23
3.2	Client Details.....	23
3.2.1	Abstract Data Model	23
3.2.2	Timers	23
3.2.3	Initialization	23
3.2.4	Higher-Layer Triggered Events.....	23
3.2.5	Message Processing Events and Sequencing Rules.....	23

3.2.5.1	Initialization Sequence	23
3.2.5.1.1	Processing a Version PDU	23
3.2.5.1.2	Sending a Version PDU	23
3.2.5.1.3	Processing a Sound Formats PDU	23
3.2.5.1.4	Sending an Incoming Data PDU	23
3.2.5.1.5	Sending a Sound Formats PDU	24
3.2.5.1.6	Processing an Open PDU	24
3.2.5.1.7	Sending a Format Change PDU	24
3.2.5.1.8	Sending an Open Reply PDU	24
3.2.5.2	Data Transfer Sequence	25
3.2.5.2.1	Sending an Incoming Data PDU	25
3.2.5.2.2	Sending a Data PDU	25
3.2.5.3	Format Change Sequence	25
3.2.5.3.1	Processing a Format Change PDU	25
3.2.5.3.2	Sending a Format Change PDU	25
3.2.6	Timer Events	25
3.2.7	Other Local Events	25
3.3	Server Details	25
3.3.1	Abstract Data Model	25
3.3.2	Timers	26
3.3.3	Initialization	26
3.3.4	Higher-Layer Triggered Events	26
3.3.5	Message Processing Events and Sequencing Rules	26
3.3.5.1	Initialization Sequence	26
3.3.5.1.1	Sending a Version PDU	26
3.3.5.1.2	Processing a Version PDU	26
3.3.5.1.3	Sending a Sound Formats PDU	26
3.3.5.1.4	Processing an Incoming Data PDU	26
3.3.5.1.5	Processing a Sound Formats PDU	26
3.3.5.1.6	Sending an Open PDU	27
3.3.5.1.7	Processing a Format Change PDU	27
3.3.5.1.8	Processing an Open Reply PDU	27
3.3.5.2	Data Transfer Sequence	27
3.3.5.2.1	Processing an Incoming Data PDU	27
3.3.5.2.2	Processing a Data PDU	27
3.3.5.3	Format Change Sequence	27
3.3.5.3.1	Sending a Format Change PDU	27
3.3.5.3.2	Processing a Format Change PDU	28
3.3.6	Termination	28
3.3.7	Timer Events	28
3.3.8	Other Local Events	28
4	Protocol Examples	29
4.1	Annotated Initialization Sequence	29
4.1.1	Server Version PDU	29
4.1.2	Client Version PDU	29
4.1.3	Server Sound Formats PDU	29
4.1.4	Incoming Data PDU	34
4.1.5	Client Sound Formats PDU	34
4.1.6	Open PDU	39
4.1.7	Format Change PDU	39
4.1.8	Open Reply PDU	40
4.2	Annotated Data Transfer Sequence	40

4.2.1	Incoming Data PDU	40
4.2.2	Data PDU	40
4.3	Annotated Format Change Sequence	41
4.3.1	Server Format Change PDU	41
4.3.2	Client Format Change PDU	41
5	Security	42
5.1	Security Considerations for Implementers	42
5.2	Index of Security Parameters	42
6	Appendix A: Product Behavior	43
7	Change Tracking	45
8	Index	47

1 Introduction

The Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension seamlessly transfers audio data from a Remote Desktop Protocol client to a Remote Desktop Protocol server.

1.1 Glossary

The following terms are defined in [\[MS-GLOS\]](#):

HRESULT
little-endian
protocol data unit (PDU)
Unicode

The following terms are defined in [\[MS-RDPEDYC\]](#):

Dynamic Virtual Channel (DVC) Listener (or Listener)

The following terms are specific to this document:

audio format: A data structure used to define waveform-audio data. The actual structure of individual formats is opaque to this protocol. For more information, see [\[MSDN-AUDIOFORMAT\]](#).

dynamic virtual channel: A transport used for lossless communication between a client and a server component over a main data connection as specified in [\[MS-RDPEDYC\]](#).

Remote Desktop Protocol (RDP) client: The client which initiated the remote desktop connection.

Remote Desktop Protocol (RDP) server: The server to which the client initiated the remote desktop connection.

Wave Capture Device: A device that captures audio to the computer.

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as specified in [\[RFC2119\]](#). All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

References to Microsoft Open Specification documents do not include a publishing year because links are to the latest version of the documents, which are updated frequently. References to other documents include a publishing year when one is available.

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information. Please check the archive site, <http://msdn2.microsoft.com/en-us/library/E4BD6494-06AD-4aed-9823-445E921C9624>, as an additional source.

[MS-ERREF] Microsoft Corporation, "[Windows Error Codes](#)".

[MS-RDPBCGR] Microsoft Corporation, "[Remote Desktop Protocol: Basic Connectivity and Graphics Remoting Specification](#)".

[MS-RDPEA] Microsoft Corporation, "[Remote Desktop Protocol: Audio Output Virtual Channel Extension](#)".

[MS-RDPEDYC] Microsoft Corporation, "[Remote Desktop Protocol: Dynamic Channel Virtual Channel Extension](#)".

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, <http://www.rfc-editor.org/rfc/rfc2119.txt>

[RFC2361] Fleischman, E., "WAVE and AVI Codec Registries", RFC 2361, June 1998, <http://www.ietf.org/rfc/rfc2361.txt>

1.2.2 Informative References

[ETSI-GSM] European Telecommunications Standards Organization, "GSM UMTS 3GPP Numbering Cross Reference", March 2008, <http://webapp.etsi.org/key/key.asp?GSMSpecPart1=06&GSMSpecPart2=10&Search=search>

[MS-GLOS] Microsoft Corporation, "[Windows Protocols Master Glossary](#)".

[MSDN-AUDIOFORMAT] Microsoft Corporation, "WAVEFORMAT", <http://msdn.microsoft.com/en-us/library/ms713497.aspx>

[MSDN-WAVEFMTEXT] Microsoft Corporation, "WAVEFORMATTEXTENSIBLE", <http://msdn.microsoft.com/en-us/library/ms713496.aspx>

1.3 Overview

This section provides a high-level overview of the operation of the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension. The purpose of this protocol is to transfer audio data from a **Remote Desktop Protocol (RDP) client** to a **Remote Desktop Protocol (RDP) server**, hereinafter referred to as client and server, respectively. For example, an application running on a server may request to record audio data. This data will be transferred from the client to the server, allowing a server application to record from an audio device installed on the client.

The protocol is divided into three main sequences:

Initialization sequence: The server and client exchange versions and audio formats, and begin recording.

Data transfer sequence: The client sends audio data to the server.

Format change sequence: The server requests a new **audio format**, and the client confirms this request.

1.3.1 Initialization Sequence

The initialization sequence has the following goals:

1. To establish the client and server protocol versions and capabilities.
2. To establish a list of audio formats supported by both the client and the server.
3. To begin recording audio data.

Initially, the server sends a [Version PDU](#) to the client within the already established **dynamic virtual channel**. The client will respond with its own Version PDU. Next, the server will send a [Sound Formats PDU](#), which contains a list of the audio formats the server supports. The client sends its own Sound Formats PDU to the server, establishing the common list of audio formats. All audio data will be encoded using one of the formats in this list.

Once the audio formats have been exchanged, the server will indicate that it has requested to begin recording, by sending an [Open PDU](#). The client will attempt to start recording from an attached audio capture device and return the result to the server in an [Open Reply PDU](#). At this point, the client will begin sending audio data.

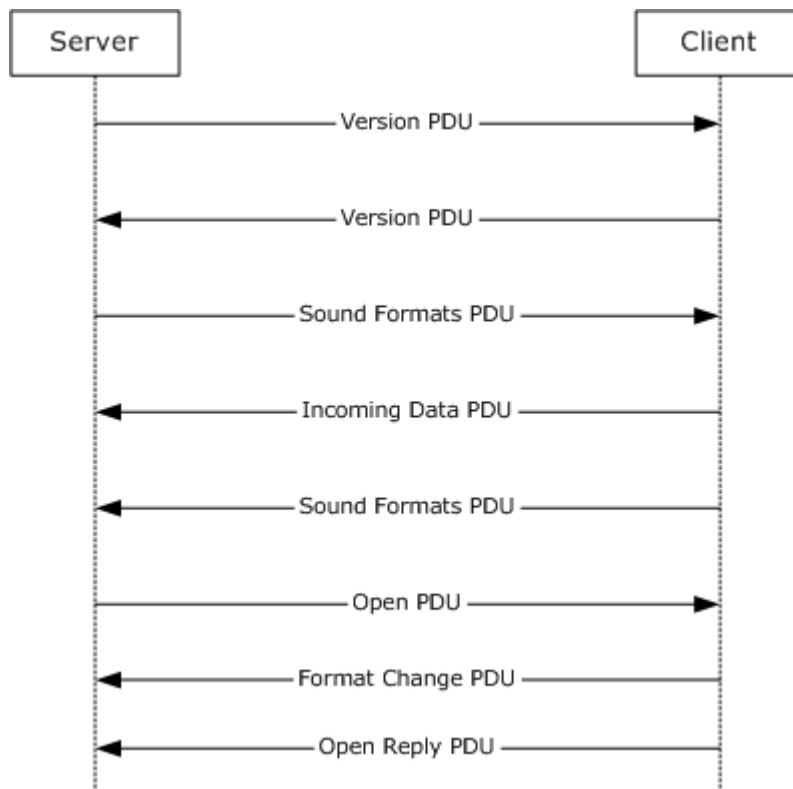


Figure 1: Initialization sequence

1.3.2 Data Transfer Sequence

The data transfer sequence simply transfers audio data from the client to the server. The client will encode captured audio data using the current audio format agreed on during either the initialization sequence or the format change sequence and send it to the server. The client first sends an [Incoming Data PDU](#), which informs the server that the next packet will contain audio data. The client will then send the audio data in a [Data PDU](#).

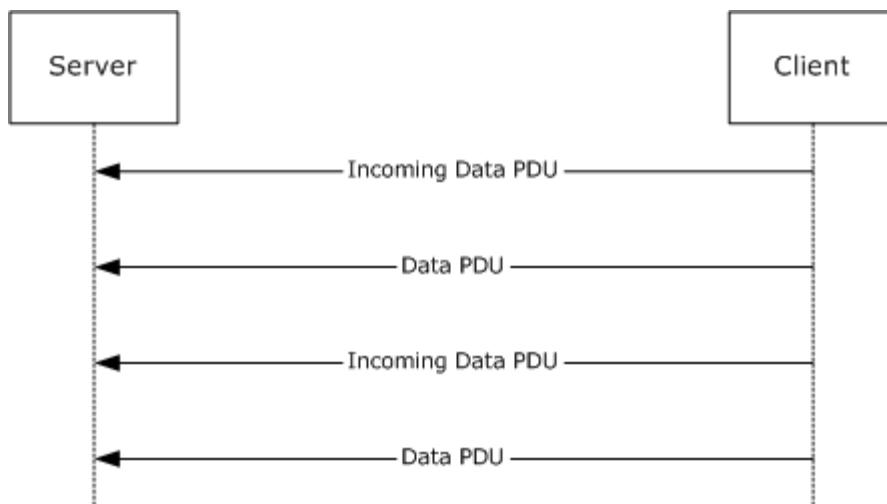


Figure 2: Data transfer sequence

1.3.3 Format Change Sequence

The format change sequence provides a mechanism for the server to request that the client use a different format for encoding the audio data. The server initiates the sequence by sending a [Format Change PDU](#), identifying the server's desired format out of the list that was agreed on during the initialization sequence. The client will then confirm this change of format by sending a Format Change PDU specifying the same format. From this point, the client will encode audio data using the new format.

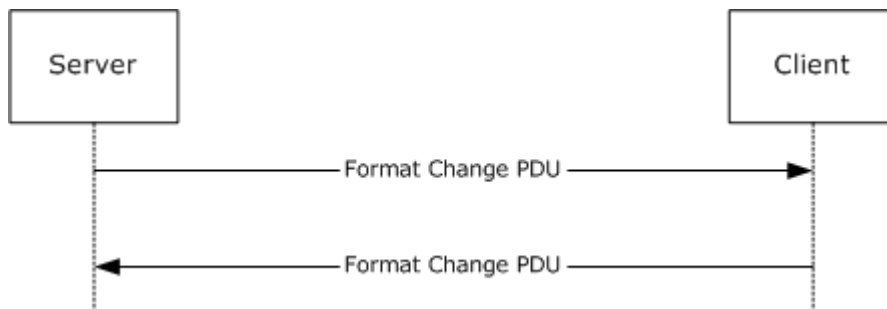


Figure 3: Format change sequence

1.4 Relationship to Other Protocols

The Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension is embedded in a dynamic virtual channel transport, as specified in [\[MS-RDPEDYC\]](#).

1.5 Prerequisites/Preconditions

The Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension operates only after the dynamic virtual channel transport, as specified in [\[MS-RDPEDYC\]](#), is fully established. If the dynamic virtual channel transport is terminated, no other communication occurs over the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension.

All multiple-byte fields within a message are assumed to contain data in **little-endian** byte ordering, unless otherwise specified.

1.6 Applicability Statement

The Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension is designed to run within the context of a Remote Desktop Protocol (RDP) dynamic virtual channel established between an RDP client and RDP server. The protocol is applicable when the client is required to record audio and transfer the recorded audio to the server.

1.7 Versioning and Capability Negotiation

The Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension is capability-based. The client and the server exchange capabilities during the protocol initialization sequence (as specified in section [3.2.5.1](#), and section [3.3.5.1](#)). After the capabilities have been exchanged, the client and server do not send **PDUs** or data formats that cannot be processed by the other.

1.8 Vendor-Extensible Fields

This protocol uses **HRESULT** values as defined in [\[MS-ERREF\]](#) section 2.1.1. Vendors can define their own **HRESULT** values, provided that they set the C bit (0x20000000) for each vendor-defined value, indicating that the value is a customer code.

1.9 Standards Assignments

None.

2 Messages

2.1 Transport

This protocol is designed to operate over a dynamic virtual channel, as specified in [\[MS-RDPEDYC\]](#) section 1.1. The dynamic virtual channel name is the null-terminated ANSI encoded character string "AUDIO_INPUT", which is the name of the **Listener** on the client side. The usage of a channel name when opening a dynamic virtual channel is specified in [\[MS-RDPEDYC\]](#) section 2.2.2.1. The RDP layer manages the creation, setup, and transmission of data over the dynamic virtual channel.

2.2 Message Syntax

The following sections define the syntax for the various PDUs in each protocol sequence. The listing is not exclusive; some PDUs can appear in other sequences.

2.2.1 SNDIN_PDU Header

The SNDIN_PDU header MUST be included in all audio capture PDUs. It identifies the type of the PDU.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MessageId																															

MessageId (1 byte): An 8-bit unsigned integer that specifies the type of audio PDU.

Value	Meaning
MSG_SNDIN_VERSION 0x01	Version PDU
MSG_SNDIN_FORMATS 0x02	Sound Formats PDU
MSG_SNDIN_OPEN 0x03	Open PDU
MSG_SNDIN_OPEN_REPLY 0x04	Open Reply PDU
MSG_SNDIN_DATA_INCOMING 0x05	Incoming Data PDU
MSG_SNDIN_DATA 0x06	Data PDU
MSG_SNDIN_FORMATCHANGE 0x07	Format Change PDU

2.2.2 Initialization Messages

The following sections contain the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension message syntax for exchanging versions and capabilities, establishing a list of audio

formats supported by both the client and the server, and starting audio data recording. For more information, see section [3.1.3](#).

2.2.2.1 Version PDU (MSG_SNDIN_VERSION)

The Version PDU is sent by the server and the client to negotiate which version of the protocol MUST be used.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1					
Header									Version																											
...																																				

Header (1 byte): A [SNDIN_PDU](#) header (section [2.2.1](#)). The **MessageId** field of the SNDIN_PDU header MUST be set to MSG_SNDIN_VERSION (0x01).

Version (4 bytes): A 32-bit unsigned integer. This field specifies the protocol version used by the client or server that sent this PDU. This field MUST be set to 0x00000001.

2.2.2.2 Sound Formats PDU (MSG_SNDIN_FORMATS)

The Sound Formats PDU is sent by the server and the client to negotiate a common list of supported audio formats.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1					
Header									NumFormats																											
...									cbSizeFormatsPacket																											
...									SoundFormats																											
...																																				
...																																				
...																																				
...									ExtraData (variable)																											
...																																				
...																																				
...																																				

...

Header (1 byte): An [SNDIN_PDU](#) header (section [2.2.1](#)). The **MessageId** field of the SNDIN_PDU header MUST be set to MSG_SNDIN_FORMATS (0x02).

NumFormats (4 bytes): A 32-bit unsigned integer. This field specifies the number of formats in the **SoundFormats** array.

cbSizeFormatsPacket (4 bytes): A 32-bit unsigned integer. This field is reserved in the Sound Formats PDU that is sent from server to client. The value is arbitrary in the PDU sent from server to client, and MUST be ignored upon receipt on the client side. In the PDU sent from client to server, this field MUST be set to the size, in bytes, of the entire PDU minus the size, in bytes, of the **ExtraData** field.

SoundFormats (16 bytes): A variable-sized array of audio formats supported by the client or server. The number of formats is **NumFormats**. Each element in the array conforms to the [AUDIO_FORMAT](#), [\[MS-RDPEA\]](#) section 2.2.2.1.1. Any of the audio codecs defined in [\[RFC2361\]](#) are allowed by this protocol. Implementations MUST, at a minimum, support WAVE_FORMAT_PCM (0x0001). For more information about this codec, see [\[MS-RDPEA\]](#) section 2.2.2.1.1.[<1>](#)

ExtraData (variable): An optional field that contains additional data. This data MAY be appended to the end of a Sound Formats PDU. The data is arbitrary and MUST be ignored by the recipient. The recipient finds out where **ExtraData** starts by parsing the PDU. This will tell the total size of all the data fields in this PDU except **ExtraData**. The size of ExtraData can be calculated by subtracting the size of the useful data from the size of the PDU. The **MSG_SNDIN_FORMATS** structure is encapsulated in the Dynamic VC Data First PDU ([\[MS-RDPEDYC\]](#) section 2.2.3.1) and Dynamic VC Data PDU ([\[MS-RDPEDYC\]](#) section 2.2.3.2). The length of these PDUs is determined as described in [\[MS-RDPEDYC\]](#) sections [3.1.5.1](#) and [3.1.5.2](#).

2.2.2.3 Open PDU (MSG_SNDIN_OPEN)

The Open PDU is sent by the server and indicates that the server requests to start recording from the client device. The **wFormatTag**, **nChannels**, **nSamplesPerSec**, **nAvgBytesPerSec**, **nBlockAlign**, **wBitsPerSample**, **cbSize**, and **ExtraFormatData** fields specify the audio format that the client SHOULD use to record from the audio input device. The **initialFormat** field contains an index into the list of audio formats agreed to by the client and the server. The **initialFormat** field specifies the format in which audio data MUST be encoded.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31										
Header								FramesPerPacket																																	
...								initialFormat																																	
...								wFormatTag														nChannels																			
...								nSamplesPerSec																																	
...								nAvgBytesPerSec																																	

...	nBlockAlign	wBitsPerSample
...	cbSize	ExtraFormatData (variable)
...		
...		
...		
...		

Header (1 byte): A [SNDIN_PDU](#) header (section [2.2.1](#)). The **MessageId** field of the SNDIN_PDU header MUST be set to MSG_SNDIN_OPEN (0x03).

FramesPerPacket (4 bytes): A 32-bit unsigned integer. This field specifies the number of audio frames that the client MUST send in each [Data PDU](#). The product of nChannels, wBitsPerSample, and FramesPerPacket is the size of audio data that the client MUST put in a Data PDU. The audio data size is determined by the server application and is not determined by the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension.

initialFormat (4 bytes): A 32-bit unsigned integer. This field is an index into the list of audio formats agreed on by the client and server. This field specifies the initial audio format.

wFormatTag (2 bytes): A 16-bit unsigned integer identifying the compression codec of the audio format. For more information on compression formats, see [\[RFC2361\]](#). If this field is set to WAVE_FORMAT_EXTENSIBLE (0xFFFE), the **cbSize** field MUST be equal to 22.

nChannels (2 bytes): A 16-bit unsigned integer. This field specifies the number of channels in the audio format identified by **wFormatTag**. It is part of the audio format and is not determined by the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension.

nSamplesPerSec (4 bytes): A 32-bit unsigned integer. This field specifies the sampling rate, in hertz, for recording audio.

nAvgBytesPerSec (4 bytes): A 32-bit unsigned integer. This field specifies average data-transfer rate for the format, in bytes per second.

nBlockAlign (2 bytes): A 16-bit unsigned integer. This field specifies the block alignment, in bytes. The block alignment is the minimum atomic unit of data for this audio format.

wBitsPerSample (2 bytes): A 16-bit unsigned integer. This field specifies the size, in bits, for each audio sample.

cbSize (2 bytes): A 16-bit unsigned integer specifying the size of the **ExtraFormatData** field.

ExtraFormatData (variable): Extra data specific to the audio format. The size of **ExtraFormatData**, in bytes, is **cbSize**. If **cbSize** is 0, this field MUST NOT exist. If **wFormatTag** is set to WAVE_FORMAT_EXTENSIBLE (0xFFFE), this field MUST be a [WAVEFORMAT_EXTENSIBLE](#) structure.

2.2.2.3.1 Extended Wave Format Structure (WAVEFORMAT_EXTENSIBLE)

The Extended Wave Format Structure provides detailed audio format information. For more information, see [\[MSDN-WAVEFMTEXT\]](#).

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
wValidBitsPerSample/wSamplesPerBlock																dwChannelMask															
...																SubFormat															
...																															
...																															
...																															
...																															

wValidBitsPerSample/wSamplesPerBlock (2 bytes): Depending on the format used, the 16-bit field before **dwChannelMask** can be interpreted as either **wValidBitsPerSample** or **wSamplesPerBlock**. **wValidBitsPerSample** is a 16-bit unsigned integer specifying how many bits are valid for each sample. This value MUST be less than or equal to the value of the **wBitsPerSample** field of the containing [Open PDU](#). **wSamplesPerBlock** is a 16-bit unsigned integer specifying the number of samples contained in one compressed block of audio data. This value is used with compressed formats that have a fixed number of samples within each block. This value can be set to 0 if a variable number of samples is contained in each block of compressed audio data.

dwChannelMask (4 bytes): A 32-bit unsigned integer specifying from which audio channels to record. This field MUST be a bitwise OR of the following values.

Speaker position	Flag bit
SPEAKER_FRONT_LEFT	0x00000001
SPEAKER_FRONT_RIGHT	0x00000002
SPEAKER_FRONT_CENTER	0x00000004
SPEAKER_LOW_FREQUENCY	0x00000008
SPEAKER_BACK_LEFT	0x00000010
SPEAKER_BACK_RIGHT	0x00000020
SPEAKER_FRONT_LEFT_OF_CENTER	0x00000040
SPEAKER_FRONT_RIGHT_OF_CENTER	0x00000080
SPEAKER_BACK_CENTER	0x00000100
SPEAKER_SIDE_LEFT	0x00000200

Speaker position	Flag bit
SPEAKER_SIDE_RIGHT	0x00000400
SPEAKER_TOP_CENTER	0x00000800
SPEAKER_TOP_FRONT_LEFT	0x00001000
SPEAKER_TOP_FRONT_CENTER	0x00002000
SPEAKER_TOP_FRONT_RIGHT	0x00004000
SPEAKER_TOP_BACK_LEFT	0x00008000
SPEAKER_TOP_BACK_CENTER	0x00010000
SPEAKER_TOP_BACK_RIGHT	0x00020000

SubFormat (16 bytes): A [GUID](#) that specifies the audio format to use for recording data. This field MUST be set to KSDATAFORMAT_SUBTYPE_PCM ({00000001-0000-0010-8000-00aa00389b71}).

2.2.2.4 Open Reply PDU (MSG_SNDIN_OPEN_REPLY)

The Open Reply PDU is sent by the client to convey the result of an attempt to open the audio capture device.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Header										Result																					
...																															

Header (1 byte): A [SNDIN_PDU](#) header (section [2.2.1](#)). The **MessageId** field of the SNDIN_PDU header MUST be set to MSG_SNDIN_OPEN_REPLY (0x04).

Result (4 bytes): An [HRESULT](#) containing the status of the attempt to open the client-side **Wave Capture Device**.

2.2.3 Data Transfer Messages

The following sections contain the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension message syntax for transferring audio data from client to server. For more information, see section [3.2.5.2](#).

2.2.3.1 Incoming Data PDU (MSG_SNDIN_DATA_INCOMING)

The Incoming Data PDU is sent by the client to indicate that the next packet sent MUST either be a [Data PDU](#) or a [Sound Formats PDU](#). This PDU is used for diagnostic purposes. The time used to transmit a Data PDU/Sound Formats PDU can be found out by comparing the time between receiving a Data PDU/Sound Formats PDU and receiving an Incoming Data PDU. The server MAY use this time and the data size of a Data PDU/Sound Formats PDU to calculate how fast the network is transmitting data. The result of this calculation MAY then be used to determine the audio format to use.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Header																															

Header (1 byte): An [SNDIN_PDU](#) header (section [2.2.1](#)). The **MessageId** field of the SNDIN_PDU header MUST be set to MSG_SNDIN_DATA_INCOMING (0x05).

2.2.3.2 Data PDU (MSG_SNDIN_DATA)

The Data PDU is sent by the client and contains a fragment of audio data.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Header								Data (variable)																							
...																															
...																															
...																															
...																															

Header (1 byte): A [SNDIN_PDU](#) header (section [2.2.1](#)). The **MessageId** field of the SNDIN_PDU header MUST be set to MSG_SNDIN_DATA (0x06).

Data (variable): A variable-length field that contains audio data. The recipient can determine the length of the **Data** field by subtracting the length of the **Header** field from the length of the Data PDU. The **MSG_SNDIN_DATA** structure is encapsulated in the Dynamic VC Data First PDU ([\[MS-RDPEDYC\]](#) section 2.2.3.1) and Dynamic VC Data PDU ([\[MS-RDPEDYC\]](#) section 2.2.3.2). The length of these PDUs is determined as described in [\[MS-RDPEDYC\]](#) sections [3.1.5.1](#) and [3.1.5.2](#).

2.2.4 Format Change Messages

The following section specifies the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension message syntax for changing audio data encoding format. For more information, see section [3.2.5.1.7](#) and section [3.3.5.1.7](#).

2.2.4.1 Format Change PDU (MSG_SNDIN_FORMATCHANGE)

The Format Change PDU is sent by the server to request that the client change audio formats and by the client to confirm a format change.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Header										NewFormat																					

...

Header (1 byte): An [SNDIN_PDU](#) header (section [2.2.1](#)). The **MessageId** field of the SNDIN_PDU header MUST be set to MSG_SNDIN_FORMATCHANGE (0x07).

NewFormat (4 bytes): A 32-bit unsigned integer that represents an index into the list of audio formats exchanged between the client and server during the initialization phase, as specified in section [3.1.1](#). For more information about changing audio formats, see sections [3.2.5.3](#) and [3.3.5.3](#).

3 Protocol Details

3.1 Common Details

3.1.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

Audio format list: The client and server maintain a list of audio formats that were agreed on during the initialization sequence throughout the duration of the protocol. The **NewFormat** field of the [Format Change PDU](#) and the **InitialFormat** field of the [Open PDU](#) are indices into this list. The index to the **audio format list** is zero-based, where the value zero refers to the first format in the list.

Current audio format: The client and server maintain the current audio formats. This is the format in which audio data MUST be encoded when transmitted from the client to the server. The **NewFormat** field of the Format Change PDU or the **InitialFormat** field of the Open PDU indicates the current audio format.

Audio capture device state: The audio capture device has two states: **opened** and **not opened**. Initially the state is **not opened**. The server sends an Open PDU to ask the client to open the audio capture device. The client sends an [Open Reply PDU](#) to tell the server the result of opening the capture device. If the capture device is opened successfully, the audio input device state becomes **opened**.

Audio data ready: The client sends an [Incoming Data PDU](#) to tell the server that it is ready to send data. The server maintains the **audio data ready** state to prepare to receive a [Data PDU](#).

Protocol version: The client and server store the protocol version negotiated during the initialization sequence.

3.1.2 Timers

None.

3.1.3 Initialization

Before this protocol begins, the dynamic virtual channel transport MUST be established as specified in section [2.1](#). The server and client also need to negotiate the protocol version and a common list of audio formats by exchanging [Version PDUs](#) and [Sound Formats PDUs](#). Once the protocol version and audio formats list have been exchanged, the server sends an [Open PDU](#) to the client to indicate that the server requests to start recording. The client attempts to start recording and returns the result to the server in an [Open Reply PDU](#) message.

3.1.4 Higher-Layer Triggered Events

3.1.4.1 Recording Audio

When the server attempts to start recording audio, for example the server runs Sound Recorder, the client **MUST** redirect the audio data. If the initialization sequence has not happened, the server **MUST** begin the initialization sequence.

3.1.5 Message Processing Events and Sequencing Rules

The state transition diagram in the following figure summarizes the message sequencing rules for the Remote Desktop Protocol: Audio Input Redirection Virtual Channel Extension. Further details on sending and processing the messages are included in sections [3.2.5](#) and [3.3.5](#). Malformed packets that do not meet the specifications outlined in section [2.2](#), unrecognized packets, and out-of-sequence packets **MUST** be ignored by the server and the client. There are no time-outs for receiving a reply for any request.

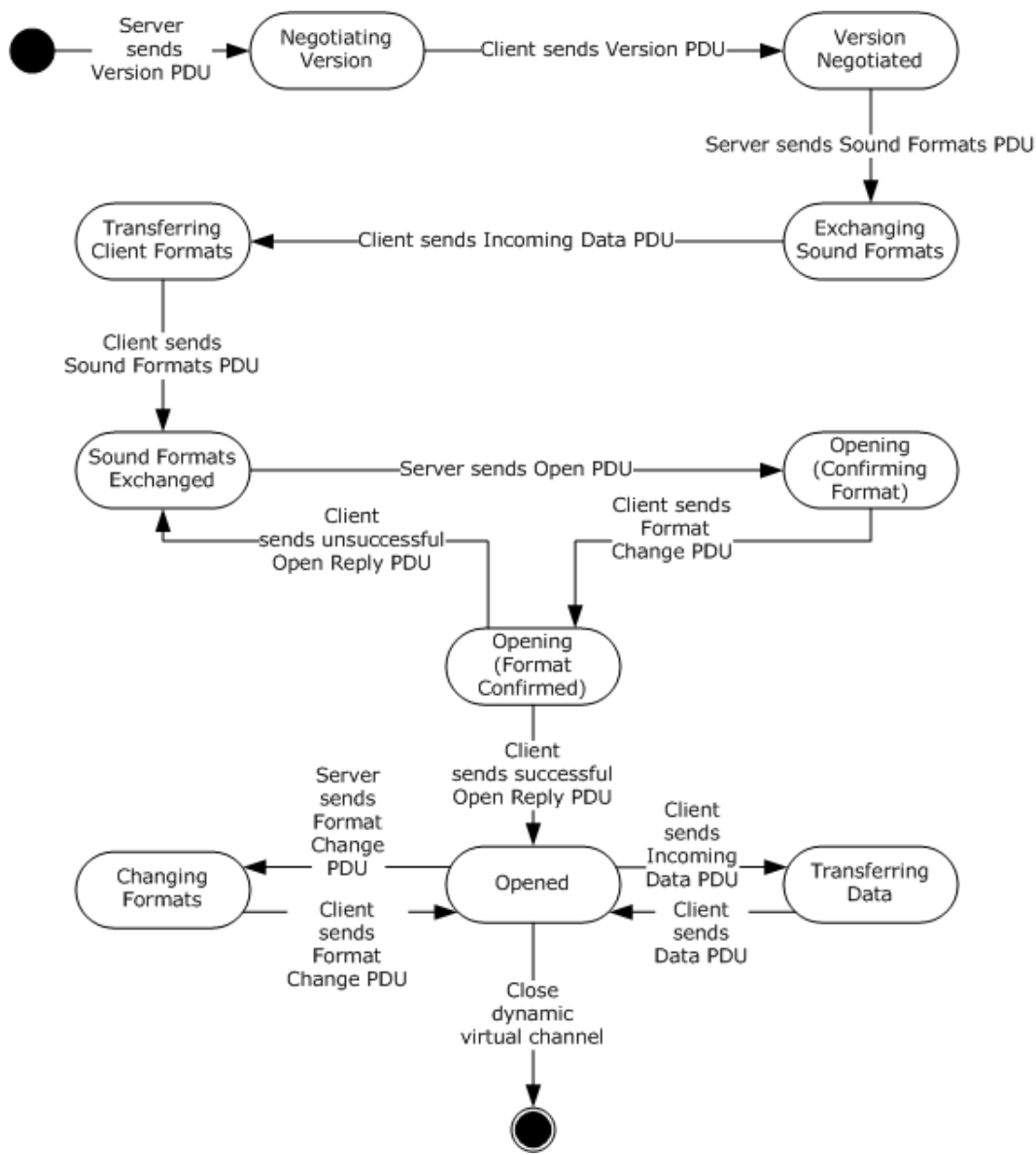


Figure 4: State transition diagram

3.1.5.1 Protocol Initialization

The protocol begins when the server opens the dynamic virtual channel. The first PDU sent is always the [Version PDU](#).

3.1.5.2 Protocol Termination

The protocol is terminated when the dynamic virtual channel is closed. This may occur at any time during the protocol sequence and not merely on the state transition labeled "Close dynamic virtual channel". The close can be initiated by either the RDP server or the RDP client, but it is normally initiated by the RDP client.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

None.

3.2 Client Details

3.2.1 Abstract Data Model

The abstract data model is specified in section [3.1.1](#).

3.2.2 Timers

None.

3.2.3 Initialization

Initialization is specified in section [3.1.3](#).

3.2.4 Higher-Layer Triggered Events

See section [3.1.4](#) for more information.

3.2.5 Message Processing Events and Sequencing Rules

3.2.5.1 Initialization Sequence

3.2.5.1.1 Processing a Version PDU

The structure and fields of the [Version PDU](#) are specified in section [2.2.2.1](#).

The Version PDU MUST be the first PDU received by the client. The client MUST store the protocol version and use this to determine which messages are supported by the server.

3.2.5.1.2 Sending a Version PDU

The structure and fields of the [Version PDU](#) are specified in section [2.2.2.1](#).

The client MUST acknowledge the Version PDU sent by the server by sending its own Version PDU to the server.

3.2.5.1.3 Processing a Sound Formats PDU

The structure and fields of the [Sound Formats PDU](#) are specified in section [2.2.2.2](#).

The client uses the audio formats sent by the server when selecting which formats will be used.

3.2.5.1.4 Sending an Incoming Data PDU

The structure and format of the [Incoming Data PDU](#) are specified in section [2.2.3.1](#).

The client MUST send an Incoming Data PDU before responding to the server with a [Sound Formats PDU](#).

3.2.5.1.5 Sending a Sound Formats PDU

The structure and fields of the [Sound Formats PDU](#) are specified in section [2.2.2.2](#).

The client MUST respond to the Sound Formats PDU sent by the server by replying with its own Sound Formats PDU. The list of audio formats that the client sends back to the server MUST be a subset of the list sent by the server. Formats that are not in the server's list MUST NOT be included in the client's audio format list.

The list sent by the client establishes the allowed audio formats for the current protocol session. These formats MUST be referenced by the **NewFormat** field of the [Format Change PDUs](#) and the **initialFormat** field of the [Open PDU](#). A value of *I* refers to the *I*th format of this list and means that audio data MUST be encoded in the *I*th format in the list.

3.2.5.1.6 Processing an Open PDU

The structure and fields of the [Open PDU](#) are specified in section [2.2.2.3](#).

The server sends the Open PDU to indicate that it is ready to start receiving audio data. The Open PDU specifies two audio formats. The first format is specified by the **InitialFormat** field and is an index into the negotiated audio formats list. This format is the audio format that the client MUST use to encode audio data and send to the server. The format is used to encode audio data that can be changed by a [Format Change PDU](#) later.

The second format is specified by the **wFormatTag**, **nChannels**, **nSamplesPerSec**, **nAvgBytesPerSec**, **nBlockAlign**, **nBitsPerSample**, **cbSize**, and **ExtraFormatData** fields. These fields specify the format that SHOULD be used to capture data from the actual audio input device.

3.2.5.1.7 Sending a Format Change PDU

The structure and format of the [Format Change PDU](#) are specified in section [2.2.4.1](#).

Client sends Format Change PDU after it receives a Format Change PDU from the server. The **NewFormat** field MUST be set to the same value as the **NewFormat** field in the server's Format Change PDU.

Client also sends Format Change PDU after it receives [Open PDU](#) from server. Client sends this Format Change PDU before sending [Open Reply PDU](#), and the **NewFormat** field MUST be set to the same value as the **initialFormat** field in the server's Open PDU.

3.2.5.1.8 Sending an Open Reply PDU

The structure and fields of the [Open Reply PDU](#) are specified in section [2.2.2.4](#).

After processing an [Open PDU](#), the client MUST attempt to begin recording from a local audio input device. The client MUST inform the server of the result by sending an appropriate [HRESULT](#) code in the **Result** field. An **HRESULT** code is an error code when its first bit is set to 1. See [\[MS-ERREF\]](#) section 2.1 for a description of **HRESULT**.

3.2.5.2 Data Transfer Sequence

3.2.5.2.1 Sending an Incoming Data PDU

The structure and format of the [Incoming Data PDU](#) are specified in section [2.2.3.1](#).

Once the client has captured a packet of audio data to send to the server, the client **MUST** send an Incoming Data PDU immediately before sending each [Data PDU](#).

3.2.5.2.2 Sending a Data PDU

The structure and format of the [Data PDU](#) are specified in section [2.2.3.2](#).

This message **MUST** be sent immediately after sending an [Incoming Data PDU](#). The client **MUST** fill the **Data** field with an audio packet encoded using the current audio format.

3.2.5.3 Format Change Sequence

3.2.5.3.1 Processing a Format Change PDU

The structure and format of the [Format Change PDU](#) are specified in section [2.2.4.1](#).

The Format Change PDU indicates that the server requires the client to use a different audio format to encode audio data. The client **MUST** change the current audio format to the value contained in the **NewFormat** field, which is an index into the negotiated audio formats list. The client **MUST** also confirm the format change by replying with a Format Change PDU. After sending a Format Change PDU, all audio data **MUST** be encoded using the new format until the server requests another format change.

3.2.5.3.2 Sending a Format Change PDU

The structure and format of the [Format Change PDU](#) are specified in section [2.2.4.1](#).

After processing a Format Change PDU, the client **MUST** confirm the format change by replying with its own Format Change PDU. The **NewFormat** field **MUST** be set to the new value of the current audio format. After sending a Format Change PDU, all audio data **MUST** be encoded using the new format, until the server requests another format change. The format change operation **MUST** always succeed.

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

3.3 Server Details

3.3.1 Abstract Data Model

The abstract data model is specified in section [3.1.1](#).

3.3.2 Timers

After sending [Version PDU](#), the server MAY use a time-out when waiting for the client's Version PDU.[<2>](#)

After sending [Sound Formats PDU](#), the server MAY use a time-out when waiting for the client's Sound Formats PDU.[<3>](#)

After sending [Open PDU](#), the server MAY use a time-out when waiting for the client's Open Reply PDU.[<4>](#)

3.3.3 Initialization

Initialization is specified in section [3.1.3](#).

3.3.4 Higher-Layer Triggered Events

See section [3.1.4](#) for more information.

3.3.5 Message Processing Events and Sequencing Rules

3.3.5.1 Initialization Sequence

3.3.5.1.1 Sending a Version PDU

The structure and fields of the [Version PDU](#) are specified in section [2.2.2.1](#).

The Version PDU MUST be the first PDU sent by the server.

3.3.5.1.2 Processing a Version PDU

The structure and fields of the [Version PDU](#) are specified in section [2.2.2.1](#).

The server MUST store the protocol version sent by the client.

3.3.5.1.3 Sending a Sound Formats PDU

The structure and fields of the [Sound Formats PDU](#) are specified in section [2.2.2.2](#).

The server MUST send a Sound Formats PDU after processing the client's [Version PDU](#). The Sound Formats PDU informs the client of the audio formats that are supported by the server.

3.3.5.1.4 Processing an Incoming Data PDU

The structure and format of the [Incoming Data PDU](#) are specified in section [2.2.3.1](#).

The client sends an Incoming Data PDU to inform the server that it is about to respond with its [Sound Formats PDU](#). This PDU is used for diagnostic purposes. An Incoming Data PDU also precedes a Data PDU (see section [3.3.5.2.1](#)).

3.3.5.1.5 Processing a Sound Formats PDU

The structure and fields of the [Sound Formats PDU](#) are specified in section [2.2.2.2](#).

The server MUST store the list of audio formats sent by the client. This list is the final list of formats that may be used during this protocol session.

3.3.5.1.6 Sending an Open PDU

The structure and fields of the [Open PDU](#) are specified in section [2.2.2.3](#).

The server sends an Open PDU after the audio format exchange is completed. The fields of the Open PDU MUST be set according to section [3.2.5.1.6](#).

3.3.5.1.7 Processing a Format Change PDU

The structure and format of the [Format Change PDU](#) are specified in section [2.2.4.1](#).

Before sending the [Open Reply PDU](#) and beginning the transmission of audio data, the client sends a Format Change PDU. This PDU confirms the initial format chosen by the server and informs the server that all audio data MUST initially be encoded in the format specified by the **NewFormat** field.

3.3.5.1.8 Processing an Open Reply PDU

The structure and fields of the [Open Reply PDU](#) are specified in section [2.2.2.4](#).

The Open Reply PDU contains the result of the client's attempt to open the audio capture device. If the **Result** field is a success code, the client will begin sending audio data. If the **Result** field is an error code, the client MUST not send audio data. If the **Result** field is an error code, then the server MAY send an additional [Open PDU](#).

3.3.5.2 Data Transfer Sequence

3.3.5.2.1 Processing an Incoming Data PDU

The structure and format of the [Incoming Data PDU](#) are specified in section [2.2.3.1](#).

The Incoming Data PDU indicates that the client is about to send a packet of audio data. The server uses this information for diagnostic purposes. An Incoming Data PDU also precedes a [Sound Formats PDU](#) (see section [3.3.5.1.4](#)).

3.3.5.2.2 Processing a Data PDU

The structure and format of the [Data PDU](#) are specified in section [2.2.3.2](#).

After receiving a Data PDU, the server decodes the audio data according to the current audio format. The decoded audio is then provided to server-side applications that are recording audio.

3.3.5.3 Format Change Sequence

3.3.5.3.1 Sending a Format Change PDU

The structure and format of the [Format Change PDU](#) are specified in section [2.2.4.1](#).

When the server determines that a new format is necessary, it MUST choose one from the list of audio formats negotiated in the initialization sequence. The server MUST set the **NewFormat** field of the Format Change PDU to the index into the list of the new audio formats.

The server MUST continue to decode any audio data that arrives using the old audio format until it receives the confirmation Format Change PDU from the client.

3.3.5.3.2 Processing a Format Change PDU

The structure and format of the [Format Change PDU](#) are specified in section [2.2.4.1](#).

The client sends a Format Change PDU to confirm the format change. After receiving acknowledgment, server MUST set **Current audio format** as **NewFormat**. From this point, all audio data sent by the client MUST be encoded using the new audio format. The server MUST decode all audio packets that arrive after this PDU according to the new audio format.

3.3.6 Termination

Termination is specified in section [3.1.5.2](#).

3.3.7 Timer Events

None.

3.3.8 Other Local Events

None.

4 Protocol Examples

4.1 Annotated Initialization Sequence

The following is an annotated dump of an initialization sequence, as described in section [1.3.1](#).

4.1.1 Server Version PDU

The following is an annotated dump of a [Version PDU](#).

```
00000000 01 01 00 00 00
01 -> MSG_SNDIN_PDU_HEADER::MessageId = MSG_SNDIN_VERSION (1)
01 00 00 00 -> MSG_SNDIN_VERSION::Version = 1
```

4.1.2 Client Version PDU

The following is an annotated dump of a [Version PDU](#).

```
00000000 01 01 00 00 00
01 -> MSG_SNDIN_PDU_HEADER::MessageId = MSG_SNDIN_VERSION (1)
01 00 00 00 -> MSG_SNDIN_VERSION::Version = 1
```

4.1.3 Server Sound Formats PDU

The following is an annotated dump of a [Sound Formats PDU](#).

```
00000000 02 15 00 00 00 00 00 00 80 01 00 02 00 44 ac 00
00000010 00 10 b1 02 00 04 00 10 00 00 00 02 00 02 00 44
00000020 ac 00 00 47 ad 00 00 00 08 04 00 20 00 f4 07 07
00000030 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40
00000040 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11 00 02
00000050 00 44 ac 00 00 db ac 00 00 00 08 04 00 02 00 f9
00000060 07 02 00 02 00 22 56 00 00 27 57 00 00 00 04 04
00000070 00 20 00 f4 03 07 00 00 01 00 00 00 02 00 ff 00
00000080 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88
00000090 01 18 ff 11 00 02 00 22 56 00 00 b9 56 00 00 00
000000a0 04 04 00 02 00 f9 03 02 00 01 00 44 ac 00 00 a3
000000b0 56 00 00 00 04 04 00 20 00 f4 07 07 00 00 01 00
000000c0 00 00 02 00 ff 00 00 00 c0 00 40 00 f0 00 00
000000d0 00 cc 01 30 ff 88 01 18 ff 11 00 01 00 44 ac 00
000000e0 00 6d 56 00 00 00 04 04 00 02 00 f9 07 02 00 02
000000f0 00 11 2b 00 00 19 2c 00 00 00 02 04 00 20 00 f4
00000100 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0
00000110 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11
00000120 00 02 00 11 2b 00 00 a9 2b 00 00 00 02 04 00 02
00000130 00 f9 01 02 00 01 00 22 56 00 00 93 2b 00 00 00
00000140 02 04 00 20 00 f4 03 07 00 00 01 00 00 00 02 00
00000150 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30
00000160 ff 88 01 18 ff 11 00 01 00 22 56 00 00 5c 2b 00
00000170 00 00 02 04 00 02 00 f9 03 31 00 01 00 44 ac 00
00000180 00 fd 22 00 00 41 00 00 00 02 00 40 01 02 00 02
00000190 00 40 1f 00 00 00 20 00 00 00 02 04 00 20 00 f4
```

```

000001a0 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0
000001b0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11
000001c0 00 02 00 40 1f 00 00 ae 1f 00 00 00 02 04 00 02
000001d0 00 f9 01 02 00 01 00 11 2b 00 00 0c 16 00 00 00
000001e0 01 04 00 20 00 f4 01 07 00 00 01 00 00 00 02 00
000001f0 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30
00000200 ff 88 01 18 ff 11 00 01 00 11 2b 00 00 d4 15 00
00000210 00 00 01 04 00 02 00 f9 01 31 00 01 00 22 56 00
00000220 00 7e 11 00 00 41 00 00 00 02 00 40 01 02 00 01
00000230 00 40 1f 00 00 00 10 00 00 00 01 04 00 20 00 f4
00000240 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0
00000250 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11
00000260 00 01 00 40 1f 00 00 d7 0f 00 00 00 01 04 00 02
00000270 00 f9 01 31 00 01 00 11 2b 00 00 bf 08 00 00 41
00000280 00 00 00 02 00 40 01 31 00 01 00 40 1f 00 00 59
00000290 06 00 00 41 00 00 00 02 00 40 01

02 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_FORMATS (2)

15 00 00 00 -> MSG_SNDIN_FORMATS::NumFormats = 0x15 = 21
00 00 00 80 -> MSG_SNDIN_FORMATS::cbSizeFormatsPacket = 0x80000000 = 2147483648 bytes
01 00 02 00 44 ac 00 00 10 b1 02 00 04 00 10 00 00 00 -> AUDIO_FORMAT
    01 00 -> AUDIO_FORMAT::wFormatTag = 0x1 = 1
    02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
    44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
    10 b1 02 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2b110 = 176400
    04 00 -> AUDIO_FORMAT::nBlockAlign = 0x4 = 4
    10 00 -> AUDIO_FORMAT::wBitsPerSample = 0x10 = 16
    00 00 -> AUDIO_FORMAT::cbSize = 0x0 = 0

02 00 02 00 44 ac 00 00 47 ad 00 00 00 08 04 00 20 00 f4 07 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
    02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
    02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
    44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
    47 ad 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0xad47 = 44359
    00 08 -> AUDIO_FORMAT::nBlockAlign = 0x800 = 2048
    04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
    20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
    f4 07 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 44 ac 00 00 db ac 00 00 00 08 04 00 02 00 f9 07 -> AUDIO_FORMAT
    11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
    02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
    44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
    db ac 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0xacdb = 44251
    00 08 -> AUDIO_FORMAT::nBlockAlign = 0x800 = 2048
    04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
    02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
    f9 07 -> data

02 00 02 00 22 56 00 00 27 57 00 00 00 04 04 00 20 00 f4 03 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
    02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
    02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
    22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050

```

```

27 57 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x5727 = 22311
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 03 07 00 00 01 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 22 56 00 00 b9 56 00 00 00 04 04 00 02 00 f9 03 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
b9 56 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x56b9 = 22201
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 03 -> data

02 00 01 00 44 ac 00 00 a3 56 00 00 00 04 04 00 20 00 f4 07 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
a3 56 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x56a3 = 22179
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 07 07 00 00 01 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 44 ac 00 00 6d 56 00 00 00 04 04 00 02 00 f9 07 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
6d 56 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x566d = 22125
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 07 -> data

02 00 02 00 11 2b 00 00 19 2c 00 00 00 02 04 00 20 00 f4 01 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
19 2c 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2c19 = 11289
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 11 2b 00 00 a9 2b 00 00 00 02 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
a9 2b 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2ba9 = 11177
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512

```

```

04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 01 -> data

02 00 01 00 22 56 00 00 93 2b 00 00 00 02 04 00 20 00 f4 03 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff -> AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
93 2b 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2b93 = 11155
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 03 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 22 56 00 00 5c 2b 00 00 00 02 04 00 02 00 f9 03 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
5c 2b 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2b5c = 11100
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 03 -> data

31 00 01 00 44 ac 00 00 fd 22 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT
31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
fd 22 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x22fd = 8957
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65
00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

02 00 02 00 40 1f 00 00 00 20 00 00 00 02 04 00 20 00 f4 01 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff -> AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
00 20 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2000 = 8192
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 40 1f 00 00 ae 1f 00 00 00 02 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
ae 1f 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x1fae = 8110
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 01 -> data

02 00 01 00 11 2b 00 00 0c 16 00 00 00 01 04 00 20 00 f4 01 07 00 00 01 00 00 00

```



```

02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff -> AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
0c 16 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x160c = 5644
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 11 2b 00 00 d4 15 00 00 00 01 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
d4 15 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x15d4 = 5588
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 01 -> data

31 00 01 00 22 56 00 00 7e 11 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT
31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
7e 11 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x117e = 4478
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65
00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

02 00 01 00 40 1f 00 00 00 10 00 00 00 01 04 00 20 00 f4 01 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff -> AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
00 10 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x1000 = 4096
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 40 1f 00 00 d7 0f 00 00 00 01 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
d7 0f 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0xfd7 = 4055
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 01 -> data

31 00 01 00 11 2b 00 00 bf 08 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT
31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
bf 08 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x8bf = 2239
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65

```

```

00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

31 00 01 00 40 1f 00 00 59 06 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT
31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
59 06 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x659 = 1625
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65
00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

```

4.1.4 Incoming Data PDU

The following is an annotated dump of an [Incoming Data PDU](#).

```

00000000 05
05 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_DATA_INCOMING (5)

```

4.1.5 Client Sound Formats PDU

The following is an annotated dump of a [Sound Formats PDU](#).

```

00000000 02 15 00 00 00 9b 02 00 00 01 00 02 00 44 ac 00
00000010 00 10 b1 02 00 04 00 10 00 00 00 02 00 02 00 44
00000020 ac 00 00 47 ad 00 00 00 08 04 00 20 00 f4 07 07
00000030 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40
00000040 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11 00 02
00000050 00 44 ac 00 00 db ac 00 00 00 08 04 00 02 00 f9
00000060 07 02 00 02 00 22 56 00 00 27 57 00 00 00 04 04
00000070 00 20 00 f4 03 07 00 00 01 00 00 00 02 00 ff 00
00000080 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88
00000090 01 18 ff 11 00 02 00 22 56 00 00 b9 56 00 00 00
000000a0 04 04 00 02 00 f9 03 02 00 01 00 44 ac 00 00 a3
000000b0 56 00 00 00 04 04 00 20 00 f4 07 07 00 00 01 00
000000c0 00 00 02 00 ff 00 00 00 c0 00 40 00 f0 00 00
000000d0 00 cc 01 30 ff 88 01 18 ff 11 00 01 00 44 ac 00
000000e0 00 6d 56 00 00 00 04 04 00 02 00 f9 07 02 00 02
000000f0 00 11 2b 00 00 19 2c 00 00 00 02 04 00 20 00 f4
00000100 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0
00000110 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11
00000120 00 02 00 11 2b 00 00 a9 2b 00 00 00 02 04 00 02
00000130 00 f9 01 02 00 01 00 22 56 00 00 93 2b 00 00 00
00000140 02 04 00 20 00 f4 03 07 00 00 01 00 00 00 02 00
00000150 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30
00000160 ff 88 01 18 ff 11 00 01 00 22 56 00 00 5c 2b 00
00000170 00 00 02 04 00 02 00 f9 03 31 00 01 00 44 ac 00
00000180 00 fd 22 00 00 41 00 00 00 02 00 40 01 02 00 02
00000190 00 40 1f 00 00 00 20 00 00 00 02 04 00 20 00 f4
000001a0 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0
000001b0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11

```

```

000001c0 00 02 00 40 1f 00 00 ae 1f 00 00 00 02 04 00 02
000001d0 00 f9 01 02 00 01 00 11 2b 00 00 0c 16 00 00 00
000001e0 01 04 00 20 00 f4 01 07 00 00 01 00 00 00 02 00
000001f0 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30
00000200 ff 88 01 18 ff 11 00 01 00 11 2b 00 00 d4 15 00
00000210 00 00 01 04 00 02 00 f9 01 31 00 01 00 22 56 00
00000220 00 7e 11 00 00 41 00 00 00 02 00 40 01 02 00 01
00000230 00 40 1f 00 00 00 10 00 00 00 01 04 00 20 00 f4
00000240 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0
00000250 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff 11
00000260 00 01 00 40 1f 00 00 d7 0f 00 00 00 01 04 00 02
00000270 00 f9 01 31 00 01 00 11 2b 00 00 bf 08 00 00 41
00000280 00 00 00 02 00 40 01 31 00 01 00 40 1f 00 00 59
00000290 06 00 00 41 00 00 00 02 00 40 01 00 00 00 00 00
000002a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
...
000003f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

02 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_FORMATS (2)

15 00 00 00 -> MSG_SNDIN_FORMATS::NumFormats = 0x15 = 21
9b 02 00 00 -> MSG_SNDIN_FORMATS::cbSizeFormatsPacket = 0x29b = 667 bytes
01 00 02 00 44 ac 00 00 10 b1 02 00 04 00 10 00 00 00 -> AUDIO_FORMAT
01 00 -> AUDIO_FORMAT::wFormatTag = 0x1 = 1
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
10 b1 02 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2b110 = 176400
04 00 -> AUDIO_FORMAT::nBlockAlign = 0x4 = 4
10 00 -> AUDIO_FORMAT::wBitsPerSample = 0x10 = 16
00 00 -> AUDIO_FORMAT::cbSize = 0x0 = 0

02 00 02 00 44 ac 00 00 47 ad 00 00 00 08 04 00 20 00 f4 07 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
47 ad 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0xad47 = 44359
00 08 -> AUDIO_FORMAT::nBlockAlign = 0x800 = 2048
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 07 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 44 ac 00 00 db ac 00 00 00 08 04 00 02 00 f9 07 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
db ac 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0xacdb = 44251
00 08 -> AUDIO_FORMAT::nBlockAlign = 0x800 = 2048
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 07 -> data

02 00 02 00 22 56 00 00 27 57 00 00 00 04 04 00 20 00 f4 03 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff
-> AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2

```

```

22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
27 57 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x5727 = 22311
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 03 07 00 00 01 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 22 56 00 00 b9 56 00 00 00 04 04 00 02 00 f9 03 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
b9 56 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x56b9 = 22201
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 03 -> data

02 00 01 00 44 ac 00 00 a3 56 00 00 00 04 04 00 20 00 f4 07 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
a3 56 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x56a3 = 22179
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 07 07 00 00 01 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 44 ac 00 00 6d 56 00 00 00 04 04 00 02 00 f9 07 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
6d 56 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x566d = 22125
00 04 -> AUDIO_FORMAT::nBlockAlign = 0x400 = 1024
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 07 -> data

02 00 02 00 11 2b 00 00 19 2c 00 00 00 02 04 00 20 00 f4 01 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
19 2c 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2c19 = 11289
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 11 2b 00 00 a9 2b 00 00 00 02 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
a9 2b 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2ba9 = 11177

```

```

00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 01 -> data

02 00 01 00 22 56 00 00 93 2b 00 00 00 02 04 00 20 00 f4 03 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
93 2b 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2b93 = 11155
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 03 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 22 56 00 00 5c 2b 00 00 00 02 04 00 02 00 f9 03 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
5c 2b 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2b5c = 11100
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 03 -> data

31 00 01 00 44 ac 00 00 fd 22 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT
31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
44 ac 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0xac44 = 44100
fd 22 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x22fd = 8957
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65
00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

02 00 02 00 40 1f 00 00 00 20 00 00 00 02 04 00 20 00 f4 01 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
00 20 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x2000 = 8192
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 02 00 40 1f 00 00 ae 1f 00 00 00 02 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
02 00 -> AUDIO_FORMAT::nChannels = 0x2 = 2
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
ae 1f 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x1fae = 8110
00 02 -> AUDIO_FORMAT::nBlockAlign = 0x200 = 512
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2

```

```

f9 01 -> data

02 00 01 00 11 2b 00 00 0c 16 00 00 00 01 04 00 20 00 f4 01 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
0c 16 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x160c = 5644
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 11 2b 00 00 d4 15 00 00 00 01 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
d4 15 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x15d4 = 5588
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 01 -> data

31 00 01 00 22 56 00 00 7e 11 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT
31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
22 56 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x5622 = 22050
7e 11 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x117e = 4478
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65
00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

02 00 01 00 40 1f 00 00 00 10 00 00 00 01 04 00 20 00 f4 01 07 00 00 01 00 00 00
02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc 01 30 ff 88 01 18 ff ->
AUDIO_FORMAT
02 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_ADPCM (2)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
00 10 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x1000 = 4096
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
20 00 -> AUDIO_FORMAT::cbSize = 0x20 = 32
f4 01 07 00 00 01 00 00 00 02 00 ff 00 00 00 00 c0 00 40 00 f0 00 00 00 cc
01 30 ff 88 01 18 ff -> data

11 00 01 00 40 1f 00 00 d7 0f 00 00 00 01 04 00 02 00 f9 01 -> AUDIO_FORMAT
11 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_DVI_ADPCM (17)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
d7 0f 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0xfd7 = 4055
00 01 -> AUDIO_FORMAT::nBlockAlign = 0x100 = 256
04 00 -> AUDIO_FORMAT::wBitsPerSample = 0x4 = 4
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
f9 01 -> data

31 00 01 00 11 2b 00 00 bf 08 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT

```

```

31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
11 2b 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x2b11 = 11025
bf 08 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x8bf = 2239
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65
00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

31 00 01 00 40 1f 00 00 59 06 00 00 41 00 00 00 02 00 40 01 -> AUDIO_FORMAT
31 00 -> AUDIO_FORMAT::wFormatTag = WAVE_FORMAT_GSM610 (49)
01 00 -> AUDIO_FORMAT::nChannels = 0x1 = 1
40 1f 00 00 -> AUDIO_FORMAT::nSamplesPerSecond = 0x1f40 = 8000
59 06 00 00 -> AUDIO_FORMAT::nAvgBytesPerSecond = 0x659 = 1625
41 00 -> AUDIO_FORMAT::nBlockAlign = 0x41 = 65
00 00 -> AUDIO_FORMAT::wBitsPerSample = 0x0 = 0
02 00 -> AUDIO_FORMAT::cbSize = 0x2 = 2
40 01 -> data

00... 00 00 00 -> MSG_SNDIN_OPEN::ExtraData

```

4.1.6 Open PDU

The following is an annotated dump of an [Open PDU](#).

```

00000000 03 9d 08 00 00 0b 00 00 00 fe ff 02 00 44 ac 00
00000010 00 10 b1 02 00 04 00 10 00 16 00 10 00 03 00 00
00000020 00 01 00 00 00 00 00 10 00 80 00 00 aa 00 38 9b
00000030 71

03 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_OPEN (3)

9d 08 00 00 -> MSG_SNDIN_OPEN::FramesPerPacket = 0x89d = 2205
0b 00 00 00 -> MSG_SNDIN_OPEN::InitialFormat = 0xb = 11
fe ff -> MSG_SNDIN_OPEN::wFormatTag = WAVE_FORMAT_EXTENSIBLE (65534)
02 00 -> MSG_SNDIN_OPEN::nChannels = 0x2 = 2
44 ac 00 00 -> MSG_SNDIN_OPEN::nSamplesPerSecond = 0xac44 = 44100
10 b1 02 00 -> MSG_SNDIN_OPEN::nAvgBytesPerSecond = 0x2b110 = 176400
04 00 -> MSG_SNDIN_OPEN::nBlockAlign = 0x4 = 4
10 00 -> MSG_SNDIN_OPEN::wBitsPerSample = 0x10 = 16
16 00 -> MSG_SNDIN_OPEN::cbSize = 0x16 = 22
10 00 03 00 00 01 00 00 00 00 10 00 80 00 00 aa 00 38 9b 71 -> ExtraFormatData
10 00 -> WAVEFORMAT_EXTENSIBLE::wValidBitsPerSample = 0x10 = 16
03 00 00 00 -> WAVEFORMAT_EXTENSIBLE::dwChannelMask = 0x3
= SPEAKER_FRONT_LEFT | SPEAKER_FRONT_RIGHT
01 00 00 00 00 10 00 80 00 00 aa 00 38 9b 71 -> WAVEFORMAT_EXTENSIBLE::SubFormat
= KSDATAFORMAT_SUBTYPE_PCM {00000001-0000-0010-8000-00aa00389b71}

```

4.1.7 Format Change PDU

The following is an annotated [Format Change PDU](#).

```
00000000 07 0b 00 00 00
07 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_FORMATCHANGE (7)
0b 00 00 00 -> MSG_SNDIN_FORMATCHANGE::NewFormat = 0xb = 11
```

4.1.8 Open Reply PDU

The following is an annotated dump of an [Open Reply PDU](#).

```
00000000 04 00 00 00 00
04 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_OPEN_REPLY (4)
00 00 00 00 -> MSG_SNDIN_OPEN_REPLY::Result = S_OK (0)
```

4.2 Annotated Data Transfer Sequence

The following is an annotated dump of a data transfer sequence as described in section [1.3.2](#).

4.2.1 Incoming Data PDU

The following is an annotated dump of an [Incoming Data PDU](#).

```
00000000 05
05 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_DATA_INCOMING (5)
```

4.2.2 Data PDU

The following is an annotated dump of a [Data PDU](#).

```
00000000 06 d6 38 99 59 05 ac 56 93 24 05 d4 df 13 5a c6
00000010 7c b6 6e 7b 0b bb 2d d9 e9 5c 04 2e fc 64 d9 89
00000020 1d 59 89 71 1d 2d b1 b2 b1 e5 1c b9 4c 78 c1 f7
00000030 6d 13 3b b6 77 26 ed b6 bd eb b6 d9 60 df 4e 2d
00000040 59 a7 97 09 93 11 d3 76 9a 4d b9 60 5b c6 ca 3b
00000050 2d 2b 75 d9 a3 c4 18 99 36 49 d3 44 2e f6 c9 34
00000060 11 48 56 95 91 24 28 f5 c0 8f 76 24 17 6e 51 c2
00000070 ac 00 00 10 04 74 16 25 49 92 24 a1 61 da 44 44
00000080 49 92 24 d3 07 d7 cd a2 bd 95 e4 48 ae 06 07 4b
00000090 7d fb 38 52 e2 a8 24 2d 09 12 40 49 62 c3 6c 00
000000a0 12 24 49 f2 6c 8e ee 40 5e ce 86 20 49 22 45 cf
000000b0 8f 49 92 24 c9 37 76 35 61 78 dc b6 8d 2b 9c 38
000000c0 0c 49 92 24 d3 08 d7 d5 14 65 4c 10 80 04 00 f2
000000d0 db 7b db c6 53 e1 bc 23 99 64 73 92 24 49 55 39
000000e0 22 c9 7d 7d bb 80 33 19 4c 52 ee fe fb b4 db 96
000000f0 3f c6 8a 96 64 db 96 e5 88 51 52 1b b7 8d 78 5c
00000100 fe ff ff ff 51 e8 16 11 63 5f ac 22 cd 92 65
00000110 51 0f 98 1f 49 92 24 c9 cc 96 24 49 92 0c 3c 6d
00000120 f6 dc 48 92 94 77 8d 91 9d 51 d0 6f c9 91 24 89
00000130 95 67 b1 73 46 db 4c 99 a9 c0 25 77 2e 61 92 3d
00000140 42 6d df fe 5d df 93 f8 d6 95 53 a3 d1 ff 6f db
00000150 b6 bd 66 b2 ed d9 b6 6d 5b 77 7c db b6 6d 60 67
00000160 cf 14 27 49 92 24 6b a1 b0 19 31 57 67 99 eb 25
00000170 dd ea e2 9a 71 e1 25 49 92 be 9c 63 92 65 07 c5
00000180 c9 c2 c7 92 23 b4 4d
```



```
06 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_DATA (6)
d6... 23 b4 4d -> Data
```

4.3 Annotated Format Change Sequence

The following is an annotated format change sequence as described in section [1.3.3](#).

4.3.1 Server Format Change PDU

The following is an annotated [Format Change PDU](#).

```
00000000 07 0b 00 00 00
07 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_FORMATCHANGE (7)
0b 00 00 00 -> MSG_SNDIN_FORMATCHANGE::NewFormat = 0xb = 11
```

4.3.2 Client Format Change PDU

The following is an annotated [Format Change PDU](#).

```
00000000 07 0b 00 00 00
07 -> MSG_SNDIN_PDU_HEADER::Version = MSG_SNDIN_FORMATCHANGE (7)
0b 00 00 00 -> MSG_SNDIN_FORMATCHANGE::NewFormat = 0xb = 11
```

5 Security

5.1 Security Considerations for Implementers

All dynamic virtual traffic is secured by the underlying core RDP. An overview of the implemented security-related mechanisms is as described in [\[MS-RDPBCGR\]](#) section 5.

5.2 Index of Security Parameters

None.

6 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs:

- Windows® 7 operating system
- Windows Server® 2008 R2 operating system

Exceptions, if any, are noted below. If a service pack or Quick Fix Engineering (QFE) number appears with the product version, behavior changed in that service pack or QFE. The new behavior also applies to subsequent service packs of the product unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms SHOULD or SHOULD NOT implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term MAY implies that the product does not follow the prescription.

[<1> Section 2.2.2.2:](#) The following table shows codecs and associated format tags that are supported by default on Windows 7 and Windows Server 2008 R2, which support audio input redirection. Unless otherwise specified, information about these codecs may be found in [RFC2361](#).

Codec name	Format tag
Microsoft PCM	WAVE_FORMAT_PCM 0x0001
Microsoft Adaptive PCM	WAVE_FORMAT_ADPCM 0x0002
Microsoft ALAW	WAVE_FORMAT_ALAW 0x0006
Microsoft G.723	WAVE_FORMAT_MSG723 0x0042
Microsoft GSM	WAVE_FORMAT_GSM610 0x0031
Microsoft MULAW	WAVE_FORMAT_MULAW 0x0007

Microsoft Implementations deviate from the GSM standard [\[ETSI-GSM\]](#) while bitpacking coefficients, as described by the following example:

```
ITU-T Standard Implementation of GSM 610
if (((*c >> 4) & 0x0F) != GSM_MAGIC) return -1;
LARc[1] = (*c++ & 0xF) << 2; /* 1 */
LARc[1] |= (*c >> 6) & 0x3;
LARc[2] = *c++ & 0x3F;
LARc[3] = (*c >> 3) & 0x1F;
LARc[4] = (*c++ & 0x7) << 2;
LARc[4] |= (*c >> 6) & 0x3;
LARc[5] = (*c >> 2) & 0xF;
```

```

LARc[6] = (*c++ & 0x3) << 2;
LARc[6] |= (*c >> 6) & 0x3;
LARc[7] = (*c >> 3) & 0x7;
LARc[8] = *c++ & 0x7;

```

Microsoft Implementaion of GSM 610

```

LAR[1] = (ab[0] & 0x3F);
LAR[2] = ((ab[0] & 0xC0) >> 6) | ((ab[1] & 0x0F) << 2);
LAR[3] = ((ab[1] & 0xF0) >> 4) | ((ab[2] & 0x01) << 4);
LAR[4] = ((ab[2] & 0x3E) >> 1);
LAR[5] = ((ab[2] & 0xC0) >> 6) | ((ab[3] & 0x03) << 2);
LAR[6] = ((ab[3] & 0x3C) >> 2);
LAR[7] = ((ab[3] & 0xC0) >> 6) | ((ab[4] & 0x01) << 2);
LAR[8] = ((ab[4] & 0x0E) >> 1);

```

The ITU implementation is Most Significant Bit (MSB) to Least Significant Bit (LSB). The Microsoft Implementation is LSB to MSB. The following coefficients are represented as MSB to LSB. The first line is the bit position in the actual byte, the second line is the coefficient index, and the third line is the bit position of the coefficients.

ITU:

BYTE 0	BYTE 1	BYTE 2	BYTE 3
7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0
1 1 1 1	1 1 2 2 2 2 2 2	3 3 3 3 3 4 4 4	4 4 ...
5 4 3 2	1 0 5 4 3 2 1 0	4 3 2 1 0 4 3 2	1 0 ...

MS:

BYTE 3	BYTE 2	BYTE 1	BYTE 0
7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0
...	4 4 4 4 4 3	3 3 3 3 2 2 2 2	2 2 1 1 1 1 1 1
...	4 3 2 1 0 4	3 2 1 0 5 4 3 2	1 0 5 4 3 2 1 0

[<2> Section 3.3.2:](#) Windows servers will wait 5 seconds after sending a Version PDU. If the Version PDU from the client is not received within this time, the server terminates the protocol.

[<3> Section 3.3.2:](#) Windows servers will wait 5 seconds after sending a Sound Formats PDU. If the Sound Formats PDU from the client is not received within this time, the server terminates the protocol.

[<4> Section 3.3.2:](#) Windows servers will wait 5 seconds after sending an Open PDU. If the Open Reply PDU from the client is not received within this time, the server terminates the protocol.

7 Change Tracking

This section identifies changes that were made to the [MS-RDPEAI] protocol document between the May 2011 and June 2011 releases. Changes are classified as New, Major, Minor, Editorial, or No change.

The revision class **New** means that a new document is being released.

The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:

- A document revision that incorporates changes to interoperability requirements or functionality.
- An extensive rewrite, addition, or deletion of major portions of content.
- The removal of a document from the documentation set.
- Changes made for template compliance.

The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.

The revision class **Editorial** means that the language and formatting in the technical content was changed. Editorial changes apply to grammatical, formatting, and style issues.

The revision class **No change** means that no new technical or language changes were introduced. The technical content of the document is identical to the last released version, but minor editorial and formatting changes, as well as updates to the header and footer information, and to the revision summary, may have been made.

Major and minor changes can be described further using the following change types:

- New content added.
- Content updated.
- Content removed.
- New product behavior note added.
- Product behavior note updated.
- Product behavior note removed.
- New protocol syntax added.
- Protocol syntax updated.
- Protocol syntax removed.
- New content added due to protocol revision.
- Content updated due to protocol revision.
- Content removed due to protocol revision.
- New protocol syntax added due to protocol revision.

- Protocol syntax updated due to protocol revision.
- Protocol syntax removed due to protocol revision.
- New content added for template compliance.
- Content updated for template compliance.
- Content removed for template compliance.
- Obsolete document removed.

Editorial changes are always classified with the change type **Editorially updated**.

Some important terms used in the change type descriptions are defined as follows:

- **Protocol syntax** refers to data elements (such as packets, structures, enumerations, and methods) as well as interfaces.
- **Protocol revision** refers to changes made to a protocol that affect the bits that are sent over the wire.

The changes made to this document are listed in the following table. For more information, please contact protocol@microsoft.com.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
1.2 References	Added explanatory statement regarding the removal of the publishing year from Microsoft Open Specification document references.	N	Content updated.

8 Index

A

- Abstract data model
 - client ([section 3.1.1](#) 20, [section 3.2.1](#) 23)
 - server ([section 3.1.1](#) 20, [section 3.3.1](#) 25)
- Annotated data transfer sequence examples
 - [Data PDU](#) 40
 - [Incoming Data PDU](#) 40
 - [overview](#) 40
- Annotated format change sequence examples
 - [client Format Change PDU](#) 41
 - [overview](#) 41
 - [server Format Change PDU](#) 41
- Annotated initialization sequence examples
 - [client Sound Formats PDU](#) 34
 - [client Version PDU](#) 29
 - [Format Change PDU](#) 39
 - [Incoming Data PDU](#) 34
 - [Open PDU](#) 39
 - [Open Reply PDU](#) 40
 - [overview](#) 29
 - [server Sound Formats PDU](#) 29
 - [server Version PDU](#) 29
- [Applicability](#) 11
- [Audio recording](#) 21

C

- [Capability negotiation](#) 11
- [Change tracking](#) 45
- Client ([section 3.1](#) 20, [section 3.2](#) 23)
 - [abstract data model](#) 20
 - higher-layer triggered events ([section 3.1.4](#) 21, [section 3.2.4](#) 23)
 - initialization ([section 3.1.3](#) 20, [section 3.2.3](#) 23)
 - local events ([section 3.1.7](#) 23, [section 3.2.7](#) 25)
 - [message processing](#) 23
 - [data transfer sequence](#) 25
 - [format change sequence](#) 25
 - [initialization sequence](#) 23
 - [overview](#) 21
 - [sequencing rules](#) 23
 - [data transfer sequence](#) 25
 - [format change sequence](#) 25
 - [initialization sequence](#) 23
 - [overview](#) 21
 - timer events ([section 3.1.6](#) 23, [section 3.2.6](#) 25)
 - timers ([section 3.1.2](#) 20, [section 3.2.2](#) 23)

D

- Data model - abstract
 - client ([section 3.1.1](#) 20, [section 3.2.1](#) 23)
 - server ([section 3.1.1](#) 20, [section 3.3.1](#) 25)
- Data PDU
 - [processing](#) 27
 - [sending](#) 25
- Data transfer sequence

- annotated examples
 - [Data PDU](#) 40
 - [Incoming Data PDU](#) 40
 - [overview](#) 40
- [client](#) 25
 - [sending Data PDU](#) 25
 - [sending Incoming Data PDU](#) 25
- [server](#) 27
 - [processing Data PDU](#) 27
 - [processing Incoming Data PDU](#) 27

E

- [Examples](#) 29
 - annotated data transfer sequence
 - [Data PDU](#) 40
 - [Incoming Data PDU](#) 40
 - [overview](#) 40
 - annotated format change sequence
 - [client Format Change PDU](#) 41
 - [overview](#) 41
 - [server Format Change PDU](#) 41
 - annotated initialization sequence
 - [client Sound Formats PDU](#) 34
 - [client Version PDU](#) 29
 - [Format Change PDU](#) 39
 - [Incoming Data PDU](#) 34
 - [Open PDU](#) 39
 - [Open Reply PDU](#) 40
 - [overview](#) 29
 - [server Sound Formats PDU](#) 29
 - [server Version PDU](#) 29

F

- [Fields - vendor-extensible](#) 11
- Format Change PDU
 - processing
 - [client](#) 25
 - server ([section 3.3.5.1.7](#) 27, [section 3.3.5.3.2](#) 28)
 - sending
 - client ([section 3.2.5.1.7](#) 24, [section 3.2.5.3.2](#) 25)
 - [server](#) 27
- Format change sequence
 - annotated examples
 - [client Format Change PDU](#) 41
 - [overview](#) 41
 - [server Format Change PDU](#) 41
 - [client](#) 25
 - [processing Format Change PDU](#) 25
 - [sending Format Change PDU](#) 25
 - [server](#) 27
 - [processing Format Change PDU](#) 28
 - [sending Format Change PDU](#) 27

G

[Glossary](#) 7

H

Higher-layer triggered events

- client ([section 3.1.4](#) 21, [section 3.2.4](#) 23)
- server ([section 3.1.4](#) 21, [section 3.3.4](#) 26)

I

[Implementer - security considerations](#) 42

Incoming Data PDU

- processing ([section 3.3.5.1.4](#) 26, [section 3.3.5.2.1](#) 27)
- sending ([section 3.2.5.1.4](#) 23, [section 3.2.5.2.1](#) 25)

[Index of security parameters](#) 42

[Informative references](#) 8

Initialization

- client ([section 3.1.3](#) 20, [section 3.2.3](#) 23)
- server ([section 3.1.3](#) 20, [section 3.3.3](#) 26)

Initialization sequence

annotated examples

- [client Sound Formats PDU](#) 34
- [client Version PDU](#) 29
- [Format Change PDU](#) 39
- [Incoming Data PDU](#) 34
- [Open PDU](#) 39
- [Open Reply PDU](#) 40
- [overview](#) 29
- [server Sound Formats PDU](#) 29
- [server Version PDU](#) 29
- [client](#) 23
 - [processing Open PDU](#) 24
 - [processing Sound Formats PDU](#) 23
 - [processing Version PDU](#) 23
 - [sending Format Change PDU](#) 24
 - [sending Incoming Data PDU](#) 23
 - [sending Open Reply PDU](#) 24
 - [sending Sound Formats PDU](#) 24
 - [sending Version PDU](#) 23
- [server](#) 26
 - [processing Format Change PDU](#) 27
 - [processing Incoming Data PDU](#) 26
 - [processing Open Reply PDU](#) 27
 - [processing Sound Formats PDU](#) 26
 - [processing Version PDU](#) 26
 - [sending Open PDU](#) 27
 - [sending Sound Formats PDU](#) 26
 - [sending Version PDU](#) 26

[Introduction](#) 7

L

Local events

- client ([section 3.1.7](#) 23, [section 3.2.7](#) 25)
- server ([section 3.1.7](#) 23, [section 3.3.8](#) 28)

M

Message processing

- [client](#) 23

- [data transfer sequence](#) 25
- [format change sequence](#) 25
- [initialization sequence](#) 23
- [overview](#) 21

[server](#) 26

- [data transfer sequence](#) 27
- [format change sequence](#) 27
- [initialization sequence](#) 26
- [overview](#) 21

[Messages](#) 12

syntax

- [data transfer messages](#) 17
- [format change messages](#) 18
- [initialization messages](#) 12
- [overview](#) 12
- [transport](#) 12

[MSG_SNDIN_DATA packet](#) 18

[MSG_SNDIN_DATA_INCOMING packet](#) 17

[MSG_SNDIN_FORMATS packet](#) 13

[MSG_SNDIN_OPEN packet](#) 14

[MSG_SNDIN_OPEN_REPLY packet](#) 17

[MSG_SNDIN_VERSION packet](#) ([section 2.2.2.1](#) 13, [section 2.2.4.1](#) 18)

N

[Normative references](#) 7

O

Open PDU

- [processing](#) 24
- [sending](#) 27

Open Reply PDU

- [processing](#) 27
- [sending](#) 24

Overview (synopsis)

- [data transfer sequence](#) 9
- [format change sequence](#) 10
- [initialization sequence](#) 8
- [overview](#) 8

P

[Parameters - security index](#) 42

PDU (protocol data unit)

[processing Data](#) 27

processing Format Change

[client](#) 25

server ([section 3.3.5.1.7](#) 27, [section 3.3.5.3.2](#) 28)

processing Incoming Data ([section 3.3.5.1.4](#) 26, [section 3.3.5.2.1](#) 27)

[processing Open](#) 24

[processing Open Reply](#) 27

processing Sound Formats

[client](#) 23

[server](#) 26

processing Version

[client](#) 23

[server](#) 26

[sending Data](#) 25

- sending Format Change
 - client ([section 3.2.5.1.7](#) 24, [section 3.2.5.3.2](#) 25)
 - server 27
- sending Incoming Data ([section 3.2.5.1.4](#) 23, [section 3.2.5.2.1](#) 25)
- [sending Open](#) 27
- [sending Open Reply](#) 24
- sending Sound Formats
 - client 24
 - server 26
- sending Version
 - client 23
 - server 26
- [Preconditions](#) 10
- [Prerequisites](#) 10
- [Product behavior](#) 43
- Protocol data unit (PDU)
 - [processing Data](#) 27
- processing Format Change
 - client 25
 - server ([section 3.3.5.1.7](#) 27, [section 3.3.5.3.2](#) 28)
- processing Incoming Data ([section 3.3.5.1.4](#) 26, [section 3.3.5.2.1](#) 27)
- [processing Open](#) 24
- [processing Open Reply](#) 27
- processing Sound Formats
 - client 23
 - server 26
- processing Version
 - client 23
 - server 26
- [sending Data](#) 25
- sending Format Change
 - client ([section 3.2.5.1.7](#) 24, [section 3.2.5.3.2](#) 25)
 - server 27
- sending Incoming Data ([section 3.2.5.1.4](#) 23, [section 3.2.5.2.1](#) 25)
- [sending Open](#) 27
- [sending Open Reply](#) 24
- sending Sound Formats
 - client 24
 - server 26
- sending Version
 - client 23
 - server 26

R

- [Recording audio](#) 21
- [References](#) 7
 - [informative](#) 8
 - [normative](#) 7
- [Relationship to other protocols](#) 10

S

- [Security](#) 42
 - [implementer considerations](#) 42
 - [parameter index](#) 42

- Sequencing rules
 - client 23
 - [data transfer sequence](#) 25
 - [format change sequence](#) 25
 - [initialization sequence](#) 23
 - [overview](#) 21
 - server 26
 - [data transfer sequence](#) 27
 - [format change sequence](#) 27
 - [initialization sequence](#) 26
 - [overview](#) 21
- Server ([section 3.1](#) 20, [section 3.3](#) 25)
 - abstract data model ([section 3.1.1](#) 20, [section 3.3.1](#) 25)
 - higher-layer triggered events ([section 3.1.4](#) 21, [section 3.3.4](#) 26)
 - initialization ([section 3.1.3](#) 20, [section 3.3.3](#) 26)
 - local events ([section 3.1.7](#) 23, [section 3.3.8](#) 28)
 - [message processing](#) 26
 - [data transfer sequence](#) 27
 - [format change sequence](#) 27
 - [initialization sequence](#) 26
 - [overview](#) 21
 - [sequencing rules](#) 26
 - [data transfer sequence](#) 27
 - [format change sequence](#) 27
 - [initialization sequence](#) 26
 - [overview](#) 21
 - timer events ([section 3.1.6](#) 23, [section 3.3.7](#) 28)
 - timers ([section 3.1.2](#) 20, [section 3.3.2](#) 26)
 - [SNDIN_PDU_packet](#) 12
- Sound Formats PDU
 - processing
 - client 23
 - server 26
 - sending
 - client 24
 - server 26
- [Standards assignments](#) 11
- Syntax
 - [data transfer messages](#) 17
 - [format change messages](#) 18
 - [initialization messages](#) 12
 - [overview](#) 12

T

- Timer events
 - client ([section 3.1.6](#) 23, [section 3.2.6](#) 25)
 - server ([section 3.1.6](#) 23, [section 3.3.7](#) 28)
- Timers
 - client ([section 3.1.2](#) 20, [section 3.2.2](#) 23)
 - server ([section 3.1.2](#) 20, [section 3.3.2](#) 26)
- [Tracking changes](#) 45
- [Transport](#) 12
- Triggered events - higher-layer
 - client ([section 3.1.4](#) 21, [section 3.2.4](#) 23)
 - server ([section 3.1.4](#) 21, [section 3.3.4](#) 26)

V

- [Vendor-extensible fields](#) 11

Version PDU
 processing
 [client](#) 23
 [server](#) 26
 sending
 [client](#) 23
 [server](#) 26
[Versioning](#) 11

W

[WAVEFORMAT_EXTENSIBLE_packet](#) 16