
**Information technology — Generic digital
audio-visual systems —**

**Part 2:
System dynamics, scenarios and protocol
requirements**

*Technologies de l'information — Systèmes audiovisuels numériques
génériques —*

Partie 2: Dynamique, scénarios et exigences de protocole des systèmes

Reference number
ISO/IEC 16500-2:1999(E)



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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 16500 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 16500-2 was prepared by DAVIC (Digital Audio-Visual Council) and was adopted, under the PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

ISO/IEC 16500 consists of the following parts, under the general title *Information technology — Generic digital audio-visual systems*:

- *Part 1: System reference models and scenarios*
- *Part 2: System dynamics, scenarios and protocol requirements*
- *Part 3: Contours: Technology domain*
- *Part 4: Lower-layer protocols and physical interfaces*
- *Part 5: High and mid-layer protocols*
- *Part 6: Information representation*
- *Part 7: Basic security tools*
- *Part 8: Management architecture and protocols*
- *Part 9: Usage information protocols*

Introduction

ISO/IEC 16500 defines the minimum tools and dynamic behavior required by digital audio-visual systems for end-to-end interoperability across countries, applications and services. To achieve this interoperability, it defines the technologies and information flows to be used within and between the major components of generic digital audio-visual systems. Interoperability between these components and between individual sub-systems is assured through specification of tools and specification of dynamic systems behavior at defined reference points. A reference point can comprise one or more logical (non-physical) information-transfer interfaces, and one or more physical signal-transfer interfaces. A logical interface is defined by a set of information flows and associated protocol stacks. A physical interface is an external interface and is fully defined by its physical and electrical characteristics. Accessible reference points are used to determine and demonstrate compliance of a digital audio-visual subsystem with this international standard.

A summary of each part follows.

ISO/IEC 16500-1 (DAVIC 1.3.1a Part 2) defines the normative digital audio-visual systems technical framework. It provides a vocabulary and a Systems Reference Model, which identifies specific functional blocks and information flows, interfaces and reference points.

ISO/IEC 16500-2 (DAVIC 1.3.1a Part 12) defines system dynamic behavior and physical scenarios. It details the locations of the control functional entities along with the normative protocols needed to support the systems behavior. It is structured as a set of protocol walk-throughs, or “*Application Notes*”, that rehearse both the steady state and dynamic operation of the system at relevant reference points using specified protocols. Detailed dynamics are given for the following scenarios: video on demand, switched video broadcast, interactive broadcast, and internet access.

ISO/IEC 16500-3 (DAVIC 1.3.1a Part 14) provides the normative definition of DAVIC Technology Contours. These are strict sets of Applications, Functionalities and Technologies which allow compliance and conformance criteria to be easily specified and assessed. This part of ISO/IEC 16500 contains the full details of two contours. These are the Enhanced Digital Broadcast (EDB) and Interactive Digital Broadcast (IDB). ISO/IEC 16500-3 specifies required technologies and is a mandatory compliance document for contour implementations.

ISO/IEC 16500-4 (DAVIC 1.3.1a Part 8) defines the toolbox of technologies used for lower layer protocols and physical interfaces. The tools specified are those required to digitize signals and information in the Core Network and in the Access Network. Each tool is applicable at one or more of the reference points specified within the Delivery System. In addition a detailed specification is provided of the physical interfaces between the Network Interface Unit and the Set Top Unit and of the physical interfaces used to connect Set Top Boxes to various peripheral devices (digital video recorder, PC, printer). The physical Delivery System mechanisms included are copper pairs, coaxial cable, fiber, HFC, MMDS, LMDS, satellite and terrestrial broadcasting.

ISO/IEC 16500-5 (DAVIC 1.3.1a Part 7) defines the technologies used for high and mid-layer protocols for ISO/IEC 16500 digital audio-visual systems. In particular, this part defines the specific protocol stacks and requirements on protocols at specific interfaces for the content, control and management information flows.

ISO/IEC 16500-6 (DAVIC 1.3.1a Part 9) defines what the user will eventually see and hear and with what quality. It specifies the way in which monomedia and multimedia information types are coded and exchanged. This includes the definition of a virtual machine and a set of APIs to support interoperable exchange of program code. Interoperability of applications is achieved, without specifying the internal design of a set top unit, by a normative Reference Decoder Model which defines specific memory and behavior constraints for content decoding. Separate profiles are defined for different sets of multimedia components.

ISO/IEC 16500-7 (DAVIC 1.3.1a Part 10) defines the interfaces and the security tools required for an ISO/IEC 16500 system implementing security profiles. These tools include security protocols which operate across one or both of the defined conditional access interfaces CA0 and CA1. The interface CA0 is to all security and conditional access functions, including the high speed descrambling functions. The interface CA1 is to a tamper resistant device used for low speed cryptographic processing. This cryptographic processing function is implemented in a smart card.

ISO/IEC 16500-8 (DAVIC 1.3.1a Part 6) specifies the information model used for managing ISO/IEC 16500 systems. In particular, this part defines the managed object classes and their associated characteristics for managing the access network and service-related data in the Delivery System. Where these definitions are taken from existing standards, full reference to the required standards is provided. Otherwise a full description is integrated in the text of this part. Usage-related information model is defined in ISO/IEC 16500-9.

ISO/IEC 16500-9 (DAVIC 1.3.1a Part 11) specifies the interface requirements and defines the formats for the collection of usage data used for billing, and other business-related operations such as customer profile maintenance. It also specifies the protocols for the transfer of Usage Information into and out of the ISO/IEC 16500 digital audio-visual system. In summary, flows of audio, video and audio-visual works are monitored at defined usage data collection elements (e.g. servers, elements of the Delivery System, set-top boxes). Information concerning these flows is then collected, processed and passed to external systems such as billing or a rights administration society via a standardised usage data transfer interface.

Additional Information

ISO/IEC TR 16501 is an accompanying Technical Report. Further architectural and conformance information is provided in other non-normative parts of DAVIC 1.3.1a (1999). A summary of these documents is included here for information.

ISO/IEC TR 16501 (DAVIC 1.3.1a Part 1) provides a detailed listing of the functionalities required by users and providers of digital audio-visual applications and systems. It introduces the concept of a contour and defines the IDB (Interactive Digital Broadcast) and EDB (Enhanced Digital Broadcast) functionality requirements which are used to define the normative contour technology toolsets provided in ISO/IEC 16500-3.

DAVIC 1.3.1a Parts 3, 4 and 5 are DAVIC technical reports. They provide additional architectural and other information for the server, the delivery-system, and the Service Consumer systems respectively. Part 3 defines how to load an application, once created, onto a server and gives information and guidance on the protocols transmitted from the set-top user to the server, and those used to control the set-up and execution of a selected application. Part 4 provides an overview of Delivery Systems and describes instances of specific DAVIC networked service architectures. These include physical and wireless networks. Non-networked delivery (e.g. local storage physical media like discs, tapes and CD-ROMs) are not specified. Part 5 provides a Service Consumer systems architecture and a description of the DAVIC Set Top reference points defined elsewhere in the normative parts of the specification.

DAVIC 1.3.1a Part 13 is a DAVIC technical report, which provides guidelines on how to validate the systems, technology tools and protocols through conformance and / or interoperability testing.

Information technology — Generic digital audio-visual systems — Part 2: System dynamics, scenarios and protocol requirements

1 Scope

The purpose of this part of ISO/IEC 16500 is to specify normative protocols and associated dynamic system behavior, including session and connection manipulation, configuration and download, for an ISO/IEC 16500 system. The emphasis is on the significant dynamic system entities (e.g., session control, call/connection control), the behavior of these entities (e.g., information flows, entity actions, parameters passed) and the allowable physical placement(s) of these entities in a DAVIC system (i.e., physical instances). As such, this part of ISO/IEC 16500 complements the static systems reference model described in ISO/IEC 16500-1, specifying normative dynamic behavior as well as specifying the protocol(s) required to realize this behavior.

The protocols themselves are specified primarily through the use of "Protocol Network Architecture" diagrams which visually illustrate, for each of the defined physical instances and application scenarios, the various protocol stacks which are to be used. Detailed specification of the individual protocol tools themselves (e.g., the detailed protocol messages used to realize the DAVIC dynamic flow behavior) is provided in ISO/IEC 16500-5 (mid- and higher layers) and ISO/IEC 16500-4 (lower layers) of this specification.

This results in instance specifications made up of building blocks from the DAVIC tool set organized in a manner describing a system which performs DAVIC functions.

2 Normative references

Detailed bibliographic references for the normative protocols identified in this part of ISO/IEC 16500 (e.g. in Table 9.2-28 and Table 9.2-29) are provided in ISO/IEC 16500-2 Annex E.

3 Definitions

This clause defines new terms, and the intended meaning of certain common terms, used in this part of ISO/IEC 16500. Annex A of ISO/IEC 16500-1 defines additional terms and, in some cases, alternative interpretations that are appropriate in other contexts. For convenience, the normative definitions below are included in the annex.

- 3.1 **call entity** or **connection entity**: user or network process which terminates S4 flow (c/c).
- 3.2 **functional control entities**: call/connection entity and session entity.
- 3.3 **functional entity**: process which terminates an information flow.
- 3.4 **proxy signaling agent**: signaling process performing end point signaling function on behalf of the end user. Extended definition is required if proxy is used also in hybrid network, e.g., MPEG HFC and ATM.
- 3.5 **Q.2931 MACRO**: single notation which summarizes the exchange of information (S4 flow) between call/connection control entities during the call set-up or release phases.
- 3.6 **session entity**: user or network process which terminates S3 flow (ses).

4 Acronyms and abbreviations

This clause defines the acronyms and abbreviations used in this part of ISO/IEC 16500. Annex B of ISO/IEC 16500-1 defines acronyms and abbreviations used within ISO/IEC 16500.

c/c	call/connection entity
CRM	Connection Resource Manager
DSDM	DAVIC System Dynamic Modeling
e-e cntrl	end-to-end control

MPTS	Multi-Program Transport Stream (ISO/IEC 13818–1 MPEG-2 Systems)
pses	Pseudo-session control entity (used in some Internet Access scenarios)
Ses	Session control entity
SPTS	Single Program Transport Stream (ISO/IEC 13818–1 MPEG-2 Systems)

5 Conventions

The style of ISO/IEC 16500 follows the *Guide for ITU-T and ISO/IEC JTC1 co-operation. Appendix H: Rules for presentation of ITU-T | ISO/IEC common text (March, 1993)*.

6 Requirements for DAVIC Systems

DAVIC systems are characterized as follows:

- The system must be built from the set of tools defined in ISO/IEC 16500.
- The system must reflect one of the allowable physical instances specified in this part of ISO/IEC 16500.
- The system must illustrate DAVIC behavior at the various reference points as defined in ISO/IEC 16500-1.
- The system must perform functionalities outlined in ISO/IEC TR 16501.
- The system dynamic behavior must be in accordance with the dynamic flow scenarios, entity actions, and parameters, and protocols specified in this part of ISO/IEC 16500, utilizing the detailed protocols specified in ISO/IEC 16500-4 and ISO/IEC 16500-5.
- The reference points must be accessible to allow effective interoperability testing at the reference points and throughout the system as appropriate.

7 Implementation Procedure

The following list defines the procedure for the description of a DAVIC system instance:

1. Define the instance in terms of the static DAVIC reference model of ISO/IEC 16500-1 and one of the allowed physical allocations of the dynamic functional entities specified in this part of ISO/IEC 16500. Identify the required protocol tools outlined in ISO/IEC 16500 from the physical instances, dynamic behavior and the protocol network architecture diagrams of this part of ISO/IEC 16500.
2. Define the identified points using the tools outlined in ISO/IEC 16500.
3. Identify the required DAVIC functionalities and demonstrate the implementation of these functions through the network instance, utilizing the system dynamic behavior as specified in the dynamic flows of this part of ISO/IEC 16500.
4. Repeat steps 2 through 3 for the various network types (i.e., for the various physical layer access technologies) to which the instance applies.

8 Instance Development Tool

The instance development tool for definition of a DAVIC system is defined with the following elements:

- Service Provider System (SPS) (e.g., the video server for the case of VoD)
- Delivery System comprising:
 - Core Network (CN)
 - Access Network (AN)
- Service User System (e.g., the Set Top Unit)
- Information Flows S1, S2, S3, S4, S5
- Reference Points A11, A10, A9, A4, A1, A0 (Note: A0 and A4 is not shown in Figure 9.1-1 below. See ISO/IEC 16500-1 for this information).
- Functional Entities: c/c, ses, content source, content sink, e-e cntrl

The SPS, CN, AN, SUS, Information Flows, and Reference Points are as defined in DAVIC static system reference model of ISO/IEC 16500-1.

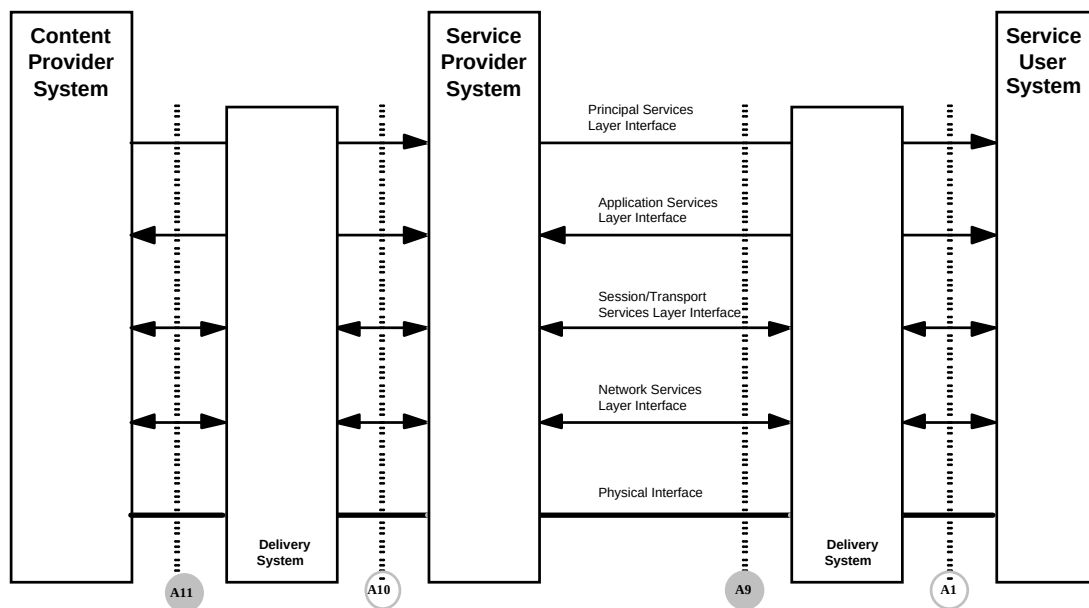


Figure 9.1-1 — DAVIC System Reference Model

The details of the relationships internal to and external to the SPS, Delivery System and SUS are as defined in the DAVIC static Systems Reference Model of ISO/IEC 16500-1.

9 DAVIC System Dynamic Modeling (DSDM) and Required Protocols

9.1 General

9.1.1 DAVIC System Dynamic Modeling

The DAVIC System Dynamic Modeling describes the following:

- Functional Entities used within the Dynamic Model(s)
- DAVIC Physical Scenarios (Physical Instances) for the allowable location(s) of the control functional entities.
- System Dynamic Flows which describe the dynamics of the DAVIC System for, e.g., the following actions, where appropriate:
 - ◆ Session & Call/connection Establishment
 - ◆ Adding Resources
 - ◆ Releasing Resources
 - ◆ Session Transfer
 - ◆ Service Transfer
 - ◆ Session & Call/connection Release
- Functional Entity Actions (performed by entities in conjunction with the dynamic flows)
- DAVIC Dynamic Flow Parameters (carried within the dynamic flows)

Collectively, these descriptive mechanisms specify the overall system dynamic behavior required of a DAVIC system for each application area (e.g., VoD, Interactive Broadcast, etc.)

9.1.2 Protocols Required for System Operation

The protocols required for the dynamic operation of a DAVIC compliant systems are identified in this part of ISO/IEC 16500 (for each application scenario) by means of either protocol network architecture diagrams, tables, or via descriptive text. Regardless of the means of identification, these protocols identified here are actually pointers to further detailed information specified in either ISO/IEC 16500-4 or ISO/IEC 16500-5 or in other documents as appropriate.

9.2 DSDM for VoD

9.2.1 Functional Entities Used in Dynamic Modeling for VoD

Figure 9.2-1 shows the key dynamic functional entities within a DAVIC VoD system.

- Content Source (e.g., MPEG Video Pump)
- Content Sink (e.g., Video decoder in an STU)
- e-e cntrl: entity which terminates the S2 flow and performs end-to-end control (e.g., VCR-like control: pause, fast forward, etc.)
- ses: Session Control Entities which terminate the S3 flow and coordinate the manipulation of resources, e.g., connections, in a DAVIC service instance
- c/c: call/connection control which terminate the S4 flow and set up conventional network connections

Other dynamic functional entities are introduced in the appropriate sections for the corresponding additional capabilities.

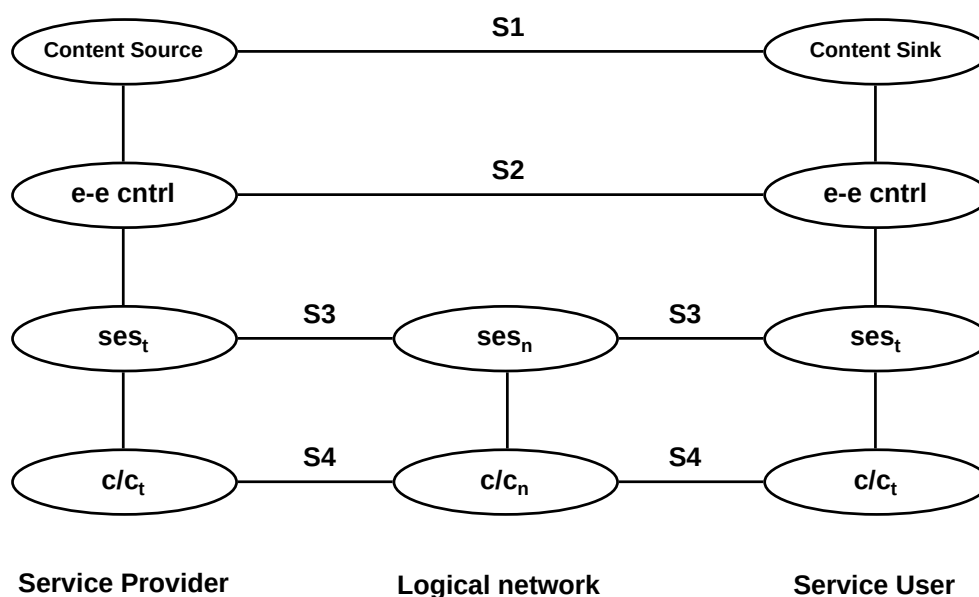


Figure 9.2-1 — Functional Entities and Relationships of a DAVIC System Instance

Figure 9.2-2 shows a mapping of the dynamic functional entities onto the DAVIC static Systems Reference Model. It should be noted that this figure illustrates, for simplicity, only the physical scenario in which the Service Client (i.e., the Set Top Unit) contains call/connection control signaling (c/c(t)). In other scenarios, as shown in Figure 9.2-3, this entity is located within the delivery system, either in the access or core network, and is called "proxy signaling".

9.2.2 Alternative DAVIC Physical Scenarios for the VoD Control Functional Entities

The DAVIC physical scenarios are a particular allocation of control functional entities (e.g., ses(t), ses(n), c/c(t), c/c(n)) to a specific physical entity or location within a DAVIC VoD system (e.g., STU, access network, etc.). This section also includes a physical scenario which describes the case when pre-provisioned connection resources (VP or VC) are utilized .

The three physical scenarios shown in Figure 9.2-3 are supported in DAVIC VoD. Physical scenario 1 is the only scenario supported for HFC when ATM is terminated in the access. All three scenarios are supported for ATM end-to-end. (Additional physical scenarios are introduced in the appropriate sections.)

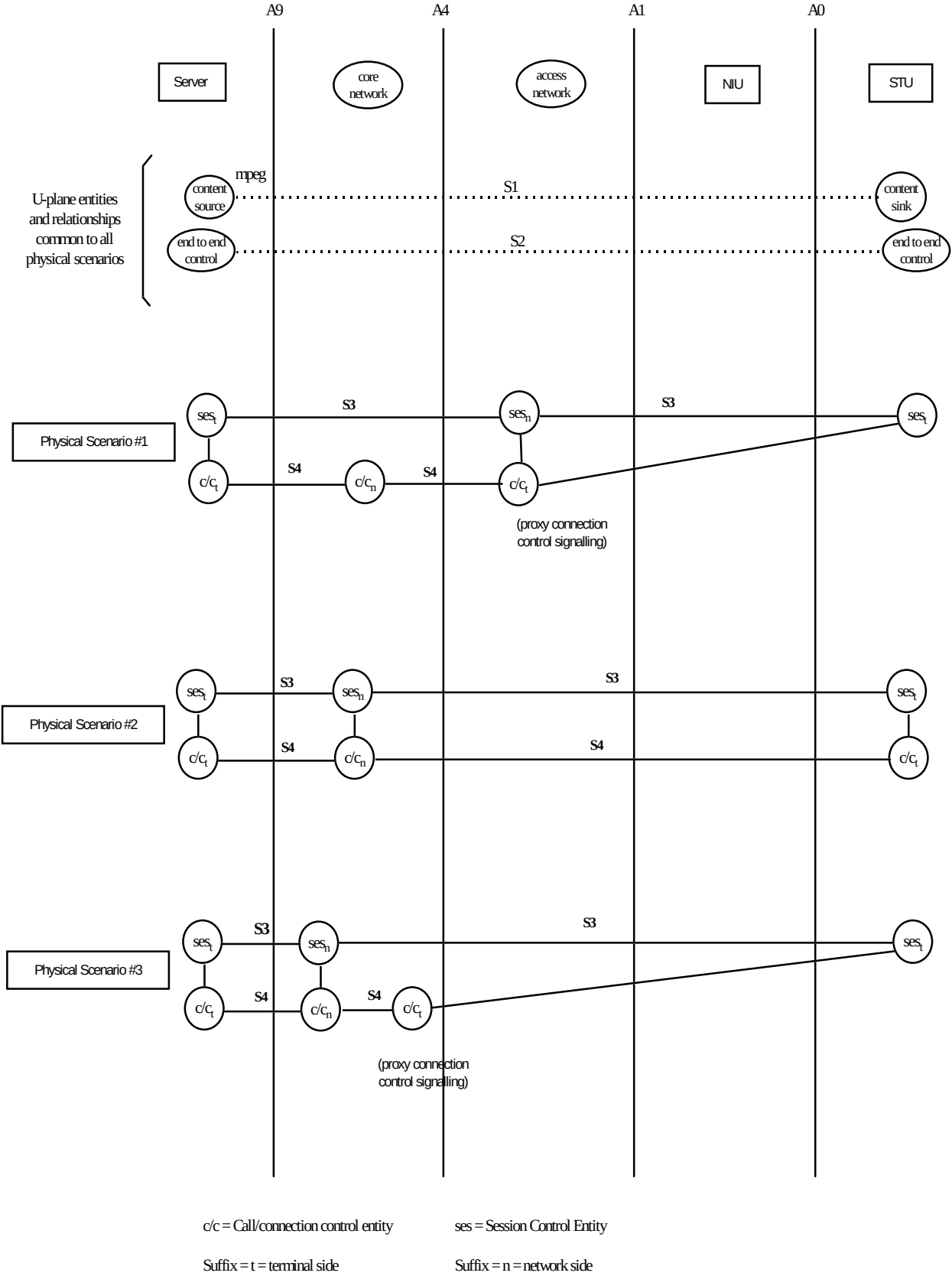


Figure 9.2-3

9.2.2.2 Physical Scenario 4, PVC, pre-provisioned connection resources

The physical scenario model depicted in Figure 9.2-4 shows the case where one or more than one static connection resources (VP or VC) are pre-provisioned. Case 4a shows both the ses(n) and CRM (Connection Resource Manager) located in the access whereas Case 4b shows both ses(n) and CRM located in the core network. As is the case for SVC's discussed earlier, only the Scenario 4a is supported for HFC when ATM is terminated in the access. Both 4a and 4b are supported for ATM end-to-end.

In the case of ATM access network, the connection resources may be end-to-end between the STU and the server, or the server side connection resources and the client side connection resources may be separate.

Physical Scenario 4a includes the case where the client side connection resources are not ATM connections but, rather, are HFC-specific resources providing MPEG transport streams. In this case, the CRM has the capability of establishing the connection between the ATM connections on the server side and the HFC resources on the client side.

In both of these scenario's (4a and 4b), the session manager ses(n) is co-located with a functional entity called CRM (Connection Resource Manager). CRM has knowledge about the pre-provisioned connection resources and selects an appropriate VC (and its VCI) when the ses(n) receives the request.

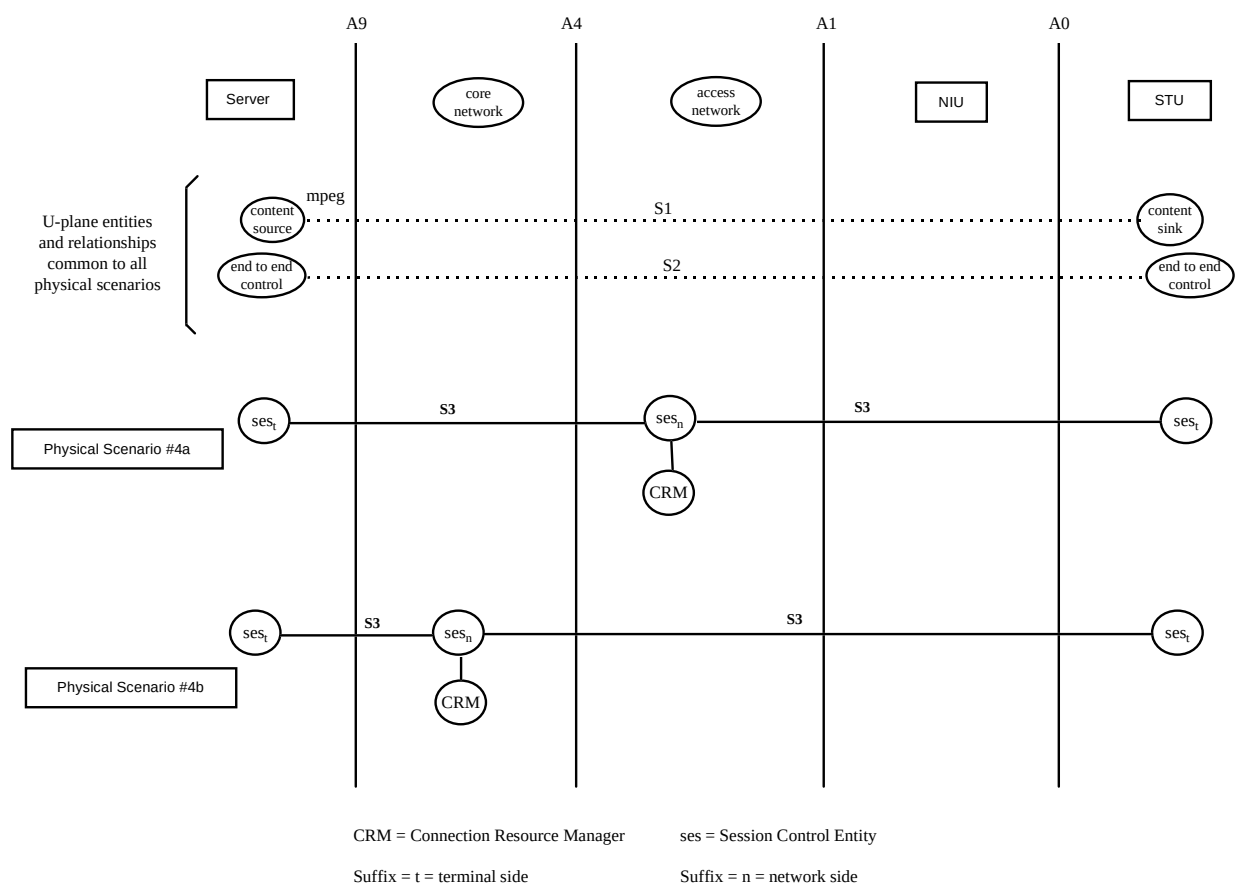


Figure 9.2-4

9.2.3 System Dynamic Flows for VoD

The dynamic behavior of a DAVIC system is described by sequences of information flows which carry information (e.g., parameters) between the control functional entities. Actions taken by functional entities as a result of the information received in these flows are described in clause 9.2.4. The parameters carried in these flows are specified in clause 9.2.5.

When interacting functional entities are located in separate physical equipment or different geographical locations, protocol messages are used to transport these parameters.

Figure 9.2-5 illustrates the relationships between functional entities, flows, protocol entities, and protocol messages.

Figure 9.2-6 through Figure 9.2-12 show the dynamic behavior of a DAVIC VoD system. The following dynamic flow scenarios are illustrated:

- Session & Call/Connection Setup
- Resource Add
 - STU-initiated
 - Server-initiated
- Resource Delete
 - STU-initiated
 - Server-initiated
- Transfer of Session & Call/Connections Between Servers
- Service Transfer
- Session & Call/Connection Release:
 - STU-initiated
 - Server-initiated
 - Network-initiated

It should be noted that the STU-initiated Resource Add and Resource Delete are only considered informative rather than normative DAVIC VoD system. However, they are shown here in order to illustrate completeness, consistency, and (optional) extendibility for more symmetrical DAVIC VoD and other systems.

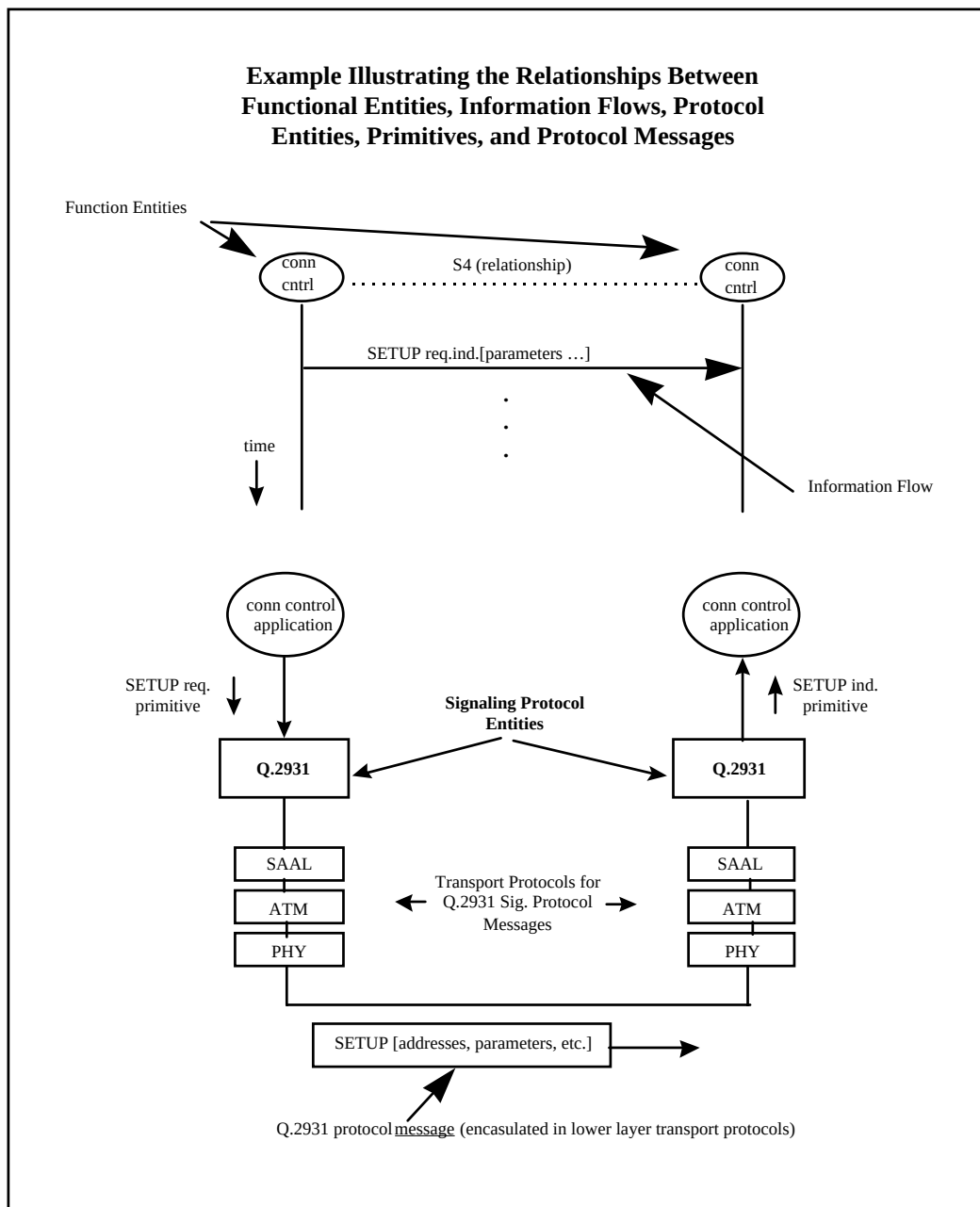


Figure 9.2-5

DAVIC Dynamic System Modeling -- Session & Call/Connection Setup Scenario

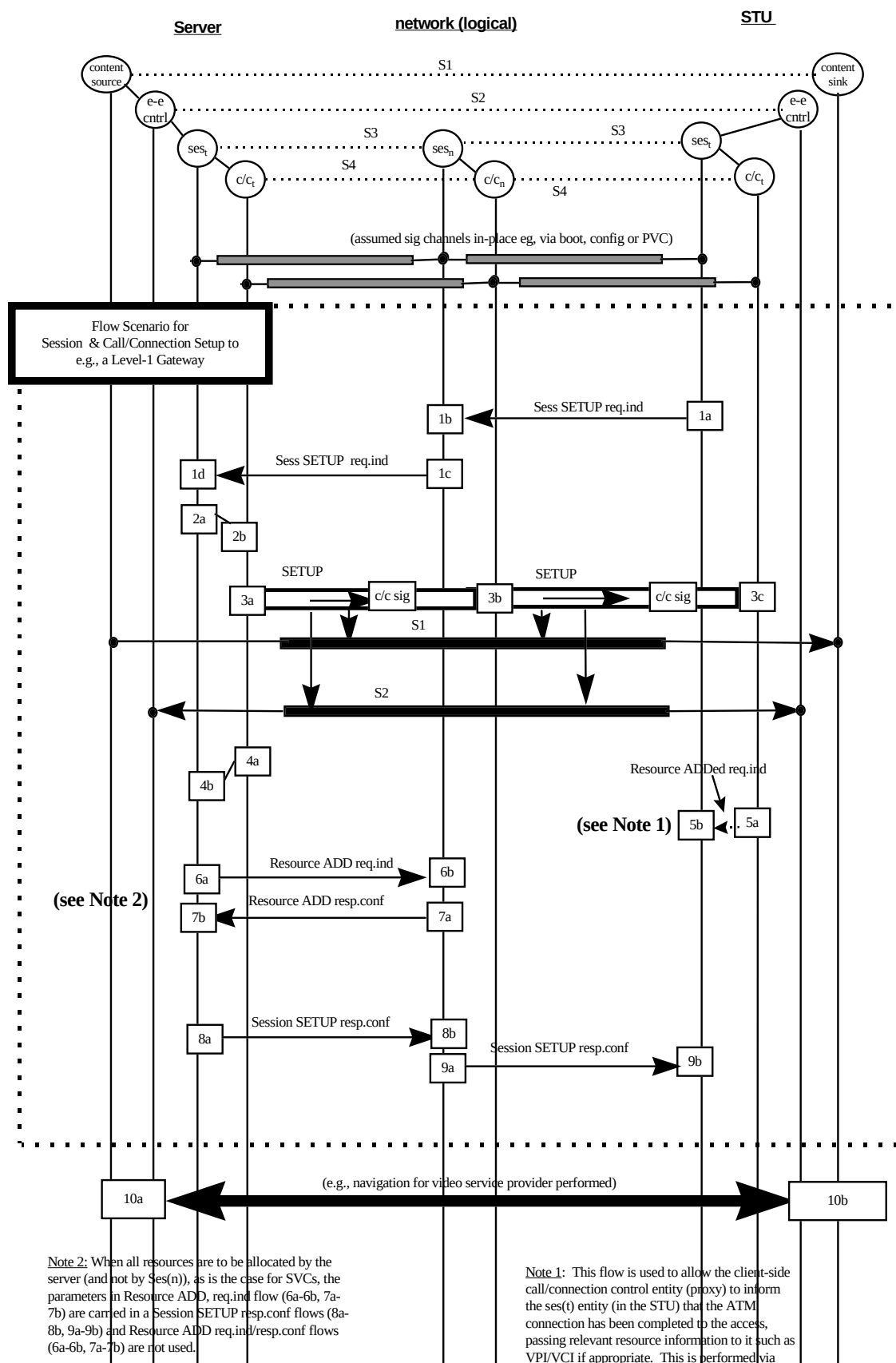


Figure 9.2-6

DAVIC Dynamic System Modeling -- Resource Add Scenarios

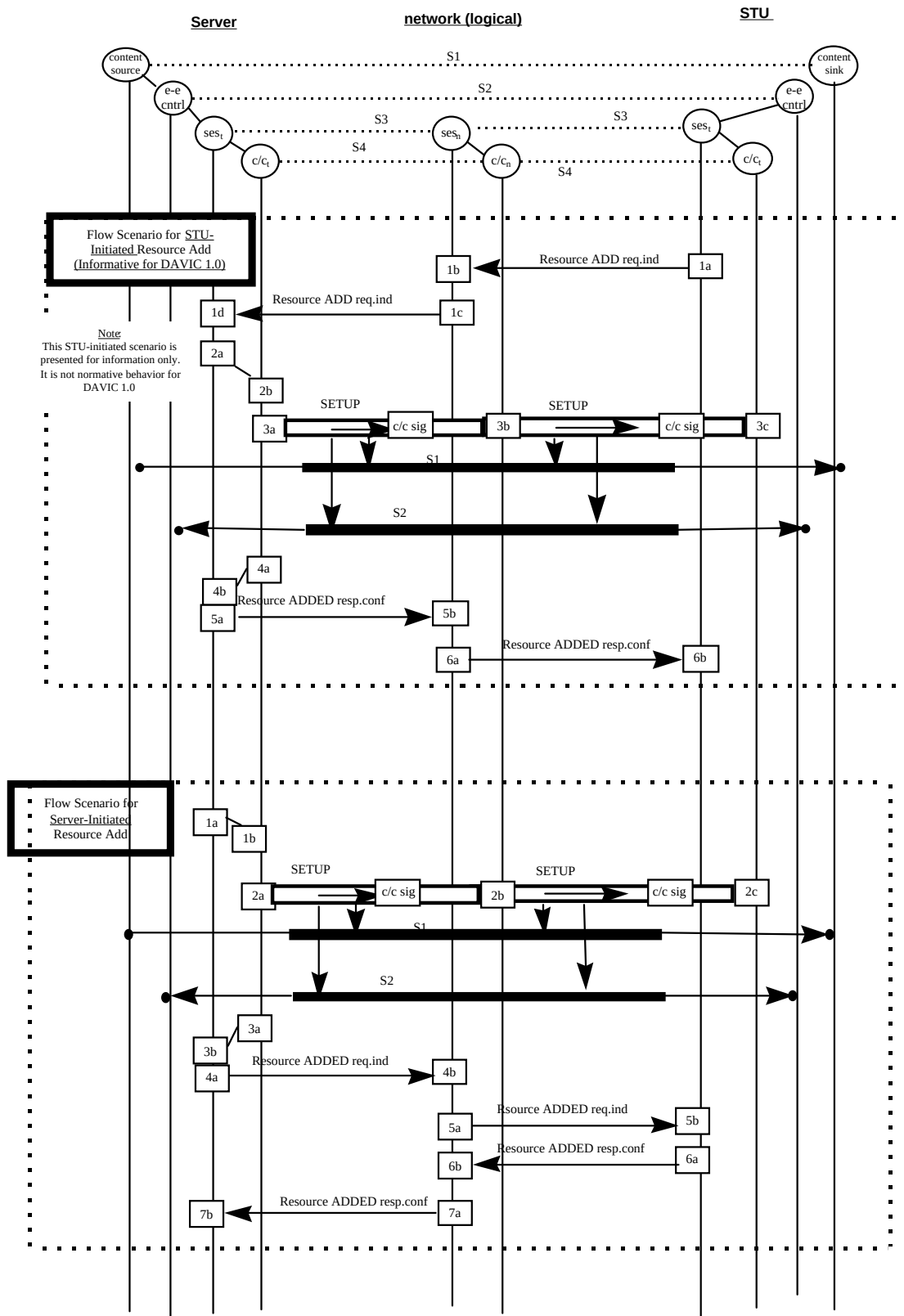


Figure 9.2-7

DAVIC Dynamic System Modeling -- Resource Delete Scenarios

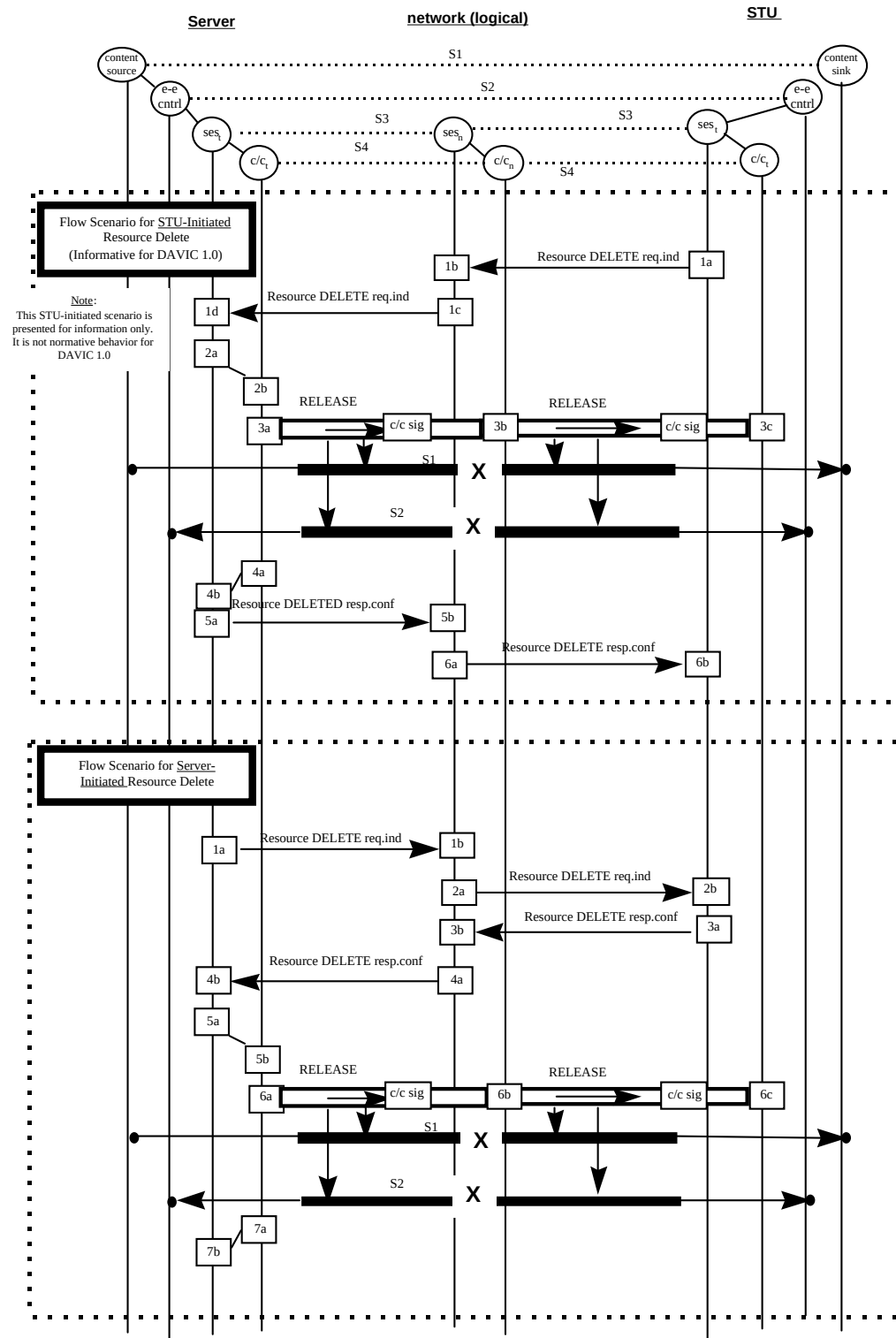


Figure 9.2-8

DAVIC Dynamic System Modeling -- Scenario For Transfer of Session & Call/Connections Between Servers

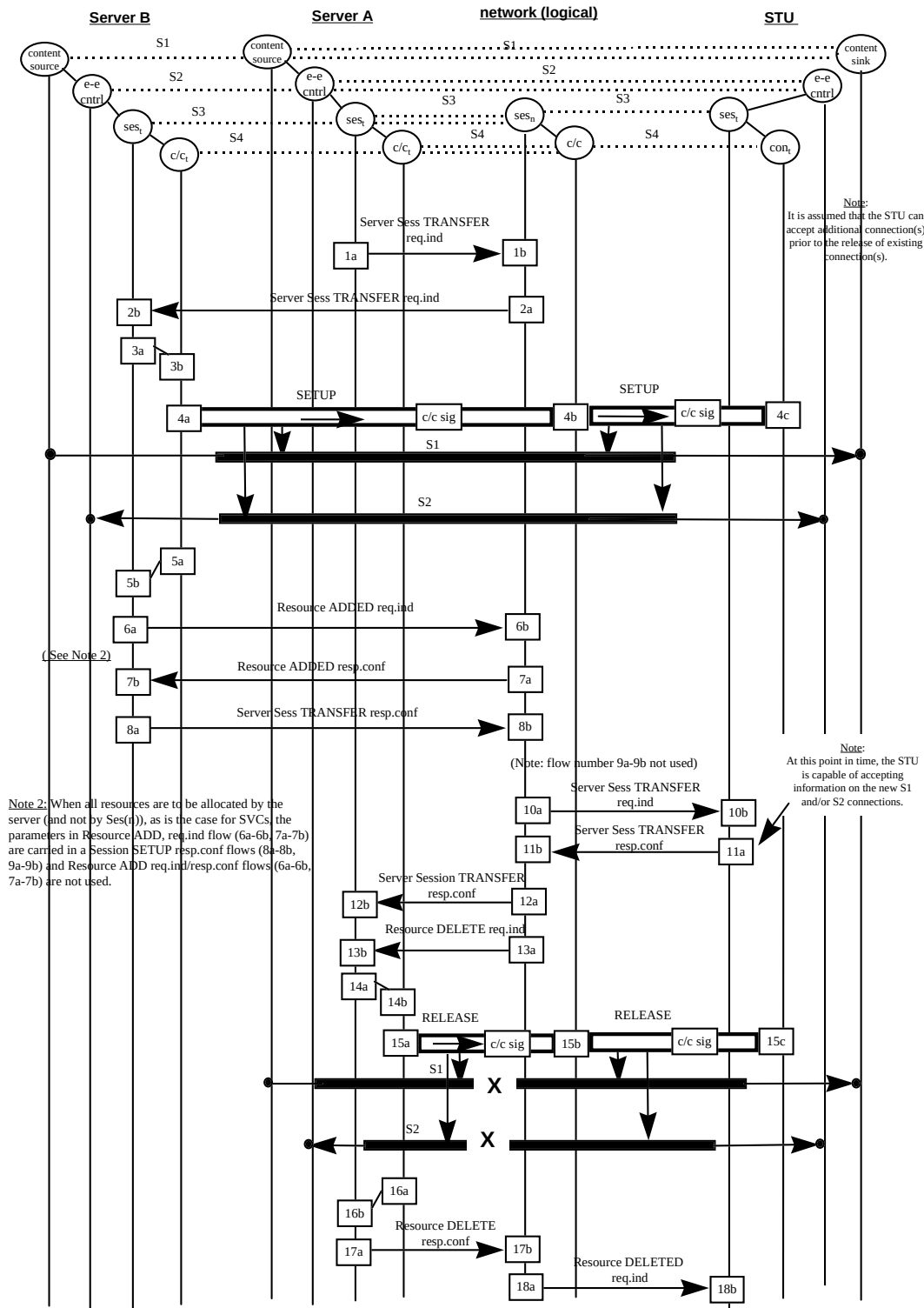


Figure 9.2-9

DAVIC Dynamic System Modeling -- Scenario for Service Transfer between Servers

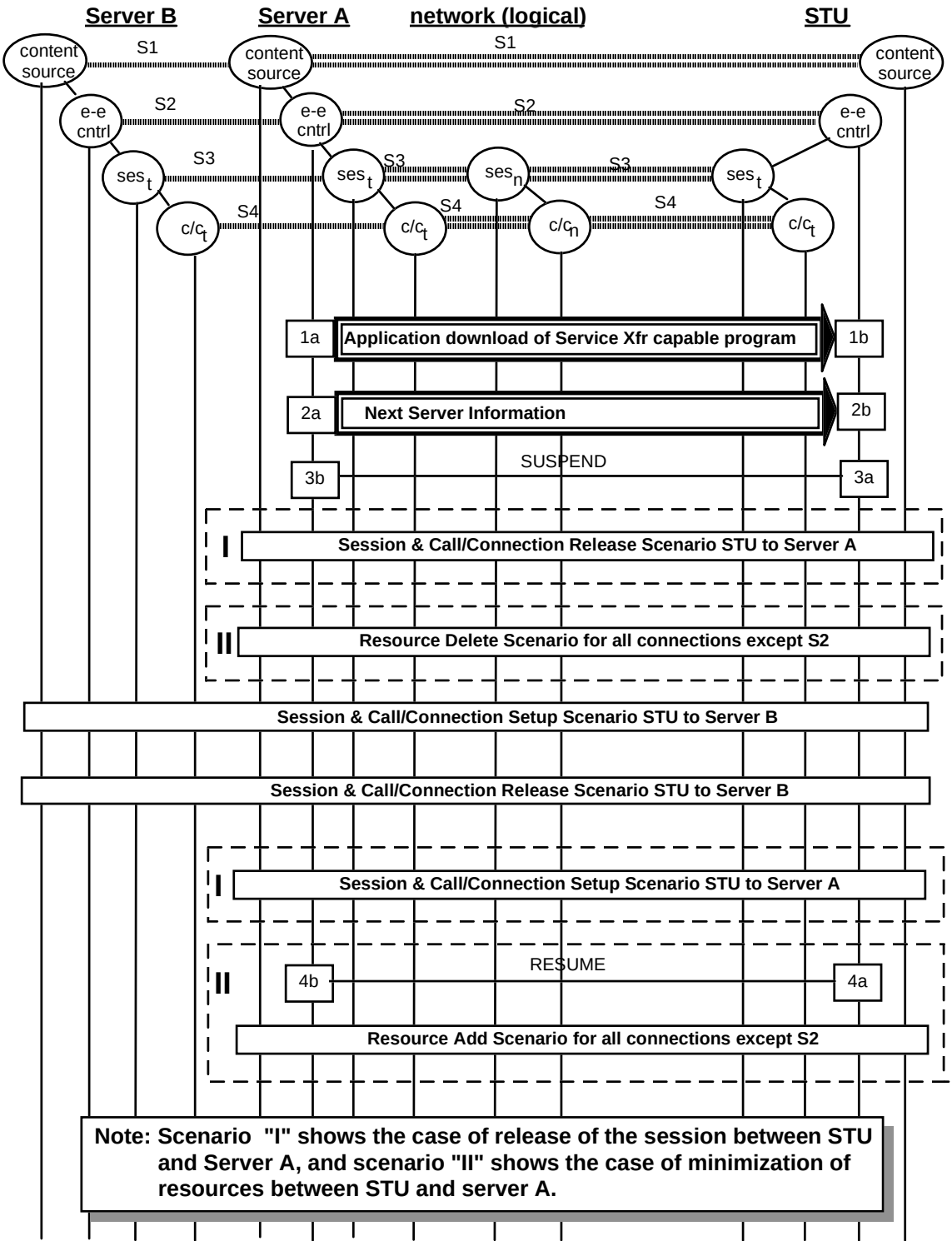


Figure 9.2-10

DAVIC Dynamic System Modeling -- Session & Call/Connection Release Scenarios

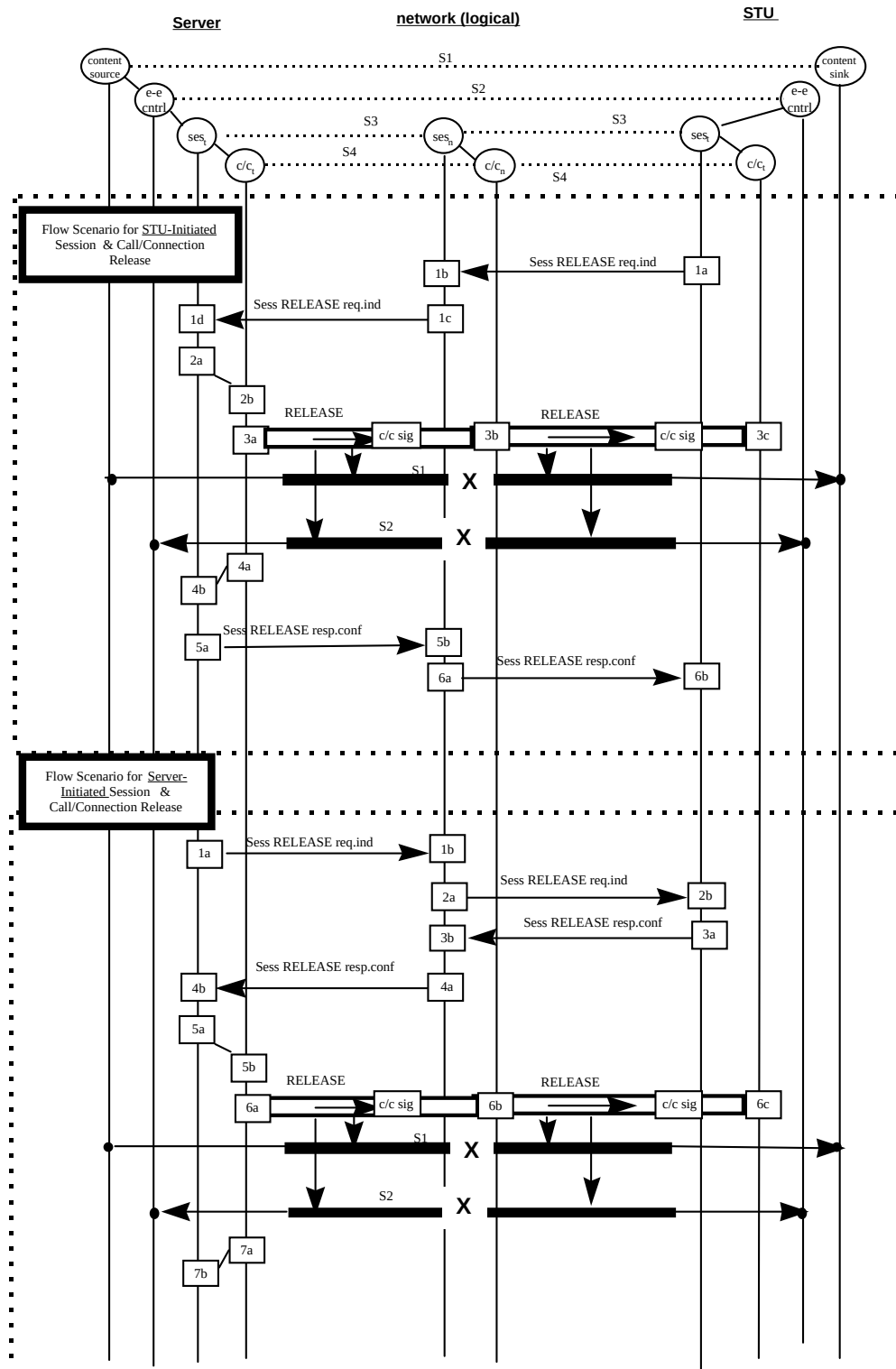


Figure 9.2-11

16 DAVIC 1.3.1a Part 12 (1999)

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The Functional Entity Actions are described for both switched (SVC) and pre-provisioned connections (VP or VC) physical scenarios.

9.2.4.1 Functional Entity Actions for the System Flows for Physical Scenarios 1–3 (SVC)

Table 9.2-1 — Session & Call/Connection Establishment

1a–1b	The STU sends a session set-up request indication to the network session entity.
1c–1d	The network sends a session set-up request indication to the Server.
2a–2b	The Server Session entity instructs the Server call/connection entity to set-up S1 and S2 connections from the Server to the STU.
3a–3b–3c	Network connection control signaling is used to establish S2 and optionally S1. (see note 1, note 3)
4a–4b	Server call/connection entity informs the Server session entity of completion of connection establishment.
5a–5b	This flow is only used in physical scenarios 1 and 3. The client-side call/connection control entity (proxy) informs the ses(t) entity that the ATM connection has been completed to the access.
6a–6b	Server informs network of connection set-up. (see note 2)
7a–7b	Network acknowledges the server's connection set-up. (see note 2, note 3)
8a–8b	Server confirms session set-up to the Network.
9a–9b	The Network informs STU of added connection and confirms session set-up. In the physical scenario #3 ATM access network, the network informs the client of the added resources indicating their connection identifiers (VPCI and VCI).
10a–10b	U-Plane communication between STU and server via S1 and S2.

Note 1: A call/connection signaling MACRO is used for each connection establishment.

Note 2: When all resources are to be allocated by the server (and not by Ses(n)), as is the case for SVCs, the parameters in Resource ADD, req.ind flow (6a-6b, 7a-7b) are carried in a Session SETUP resp.conf flows (8a-8b, 10a-10b) and Resource ADD req.ind/resp.conf flows (6a-6b, 7a-7b) are not used.

Note 3: If the connection or resource cannot be added, then the session must be cleared.

Table 9.2-2 — Addition Of Resources (STU Initiated)

1a–1b	STU requests resource addition to Network.
1c–1d	The Network requests resource addition to the Server.
2a–2b	The Server session entity asks the Server call/connection entity to add connection to the session.
3a–3b–3c	Network connection control signaling is used to establish S2 and optionally S1. (see note)
4a–4b	The Server call/connection entity informs the Server session entity of completion of connection establishment.
5a–5b–5c	Server informs network of connection set-up.
6a–6b	The Network informs STU Session entity about added connection resource.

Table 9.2-3 — Addition of Resources (Server Initiated)

1a-1b	The Server session entity asks the Server connection entity to add connection to the session.
2a-2b-2c	Network connection control signaling is used to establish S2 and optionally S1. (see note)
3a-3b	The Server call/connection entity informs the Server session entity of completion of connection establishment.
4a-4b	Server informs network of connection set-up.
5a-5b	The Network informs STU Session entity about added connection resource. In the physical scenario #3, the network also informs the connections identifiers of the added connections.
6a-6b	The STU acknowledges the added connection notification to the Network.
7a-7b	Network acknowledges the server's added connection set-up.

9.2.4.2 Deletion of Resources

Table 9.2-4 — Deletion of Resources (STU Initiated)

1a-1b	STU requests resource deletion to Network.
1c-1d	The Network requests resource deletion to the Server.
2a-2b	The Server session entity asks the Server call/connection entity to Release connection to the session.
3a-3b-3c	Network connection control signaling is used to release S2 and optionally S1. (see note)
4a-4b	The Server call/connection entity informs the Server session entity of completion of connection release.
5a-5b	Server informs network of release of the connection.
6a-6b	The Network informs STU Session entity about the released connection resource.

Table 9.2-5 — Deletion of Resources (Server Initiated Release)

1a-1b	The Server requests release of the connection resource to the Network.
2a-2b	The Network requests release of the connection resource to the STU.
3a-3b	The STU confirms connection resource release to the Network.
4a-4b	The Network confirms connection resource release to the Server.
5a-5b	The Server Session entity requests the Server call/connection entity to Release the connection.
6a-6b 6c	Network Control Signaling is used to Release the Connections.
7a-7b	Server call/connection entity informs the Server session entity of completion of the release of the connection.

9.2.4.3 Session Transfer between Servers (under control of ses(n)) (Informative, pending resolution of user-user specification problems in DSM-CC)

Table 9.2-6 - Session Transfer

1a-1b	Server A Session entity requests a transfer to Server B. The request is sent to the Network session entity.
2a-2b	The Network Session entity sends a request for session transfer to Server B.
3a-3b	The Server B Session entity request the Server B call/connection entity to set-up a connection between Server B and the STU. Note: The STU is assumed to be able to accept additional connections for S1 and S2 prior to the release of existing connections for S1 and S2
4a-4b-4c	Network Control Signaling is used to set-up the connection between Server B and the STU.
5a-5b	Server B call/connection entity informs the Server B session entity of the connection establishment between Server B and the STU.
6a-6b	Server B notifies the Network of the completion of the connection establishment.
7a-7b	The Network confirms to Server B the added resources.
8a-8b	Server B acknowledges the session transfer to the Network.
9a-9b	(flow numbered 9a-9b is not used in this dynamic scenario)
10a-10b	The Network session entity informs the STU of the Session transfer request from Server A to Server B. Also, the Network informs the STU of the added connection resources. In the physical scenario #3, the network also informs the STU of the connection identifiers (VCIs) of the newly assigned connections.
11a-11b	The STU confirms Session Transfer.
12a-12b	The Network confirms to Server A the session transfer.
13a-13b	The Network requests to Server A to release the connection resources between Server A and the STU.
14a-14b	Server A session entity requests the Server A call/connection entity to release the connections between Server A and the STU.
15a-15b-15c	The network control signaling is used to release connections between Server A and the STU.
16a-16b	The Server A call/connection entity informs the Server A session entity of completion of release of the connections.
17a-17b	The Server A confirms to the Network release of connections between Server A and the STU.
18a-18b	The Network confirms the release from Server A to the STU.

9.2.4.4 Service Transfer between Servers (under control of ses(n))

Table 9.2-7 - Service Transfer

1a-1b	Server A e-e control downloads the Service Transfer capable program to the STU when or before the STU accesses the service on Server A.
2a-2b	Server A e-e control sends the next server, i.e., Server B and next Service information to the STU and prompts the Service Transfer capable program in the STU to execute a Service Transfer.
3a-3b	The STU e-e control sends a SUSPEND to the Server A e-e control indicating its preference whether it wants to release the session with Server A or wants Server A to minimize the session resources after the service suspension. Note: If the STU does not want to return to Server A, it can execute a normal session release without a suspend context.
4a-4b	In case the STU had requested Server A to minimize its session resources, its e-e control sends the RESUME to the Server A e-e control to resume to full service from the time it left off.

Note: A call/connection signaling MACRO is used for each connection establishment or release.

9.2.4.5 Session & Call/Connection Release.**Table 9.2-8 - Session Release --STU-Initiated Release**

1a-1b	STU requests the Network to Release the Session.
1c-1d	The Network requests the Server to Release the Session.
2a-2b	The Server Session entity requests the Server call/connection entity to Release the connection.
3a-3b-3c	Network Control Signaling is used to Release the Connections.
4a-4b	Server call/connection entity informs the Server session entity of completion of the release of the connection.
5a-5b	The Server confirms the Network the release of the session.
6a-6b	The Network confirms to the STU the release of the session.

Table 9.2-9 - Session Release --Server Initiated Release

1a-1b	The Server requests release of the session to the Network.
2a-2b	The Network requests release of the session to the STU.
3a-3b	The STU confirms session release to the Network. (It is mandatory that the STU perform Session Release upon receipt of flow 2a-2b.)
4a-4b	The Network confirms session release to the Server.
5a-5b	The Server Session entity requests the Server call/connection entity to Release the connection.
6a-6b 6c	Network Control Signaling is used to Release the Connections.
7a-7b	Server call/connection entity informs the Server session entity of completion of the release of the connection.

Table 9.2-10 - Session Release --Network-Initiated Release

1a-1b	The Network requests release of the session to the STU.
2a-2b	The STU confirms session release to the Network. (It is mandatory that the STU perform Session Release upon receipt of flow 1a-1b.)
3a-3b	The Network requests release of the session to the Server.
4a-4b	The Server Session entity requests the Server call/connection entity to Release the connection(s).
5a-5b-5c	Network Control Signaling is used to Release the Connections.
6a-6b	Server call/connection entity informs the Server session entity of completion of the release of the connection.
7a-7b	Server session entity informs the Network session entity of completion of the release of the Session and connection(s).

**9.2.4.6 Functional Entity Actions for the Physical Scenario #4,
(pre-provisioned VPs or VCs)**

Note: For the physical scenario #4, only for the case where the connection resources of the both ends are pre-provisioned ATM connection resources are described.

The following amendments have been made to 9.4.1 to reflect the functional entity actions required for the Physical Scenario #4.

Table 9.2-11 - Session & Call/Connection Establishment (PVC Case)

6a-6b	In the physical scenario #4, the server requests connection resources.
6b-7a	In the physical scenario #4, the network selects appropriate connections for the server and the client and adds them to the session. If the server side connections and the client side connections are separate, the network connects the server side connections with the client side connections.
7a-7b	In the physical scenario #4, the network also confirms the requested resources and sends the connection identifiers (VPCI and VCI) of the resources.
9a-9b	In the physical scenario #4, the network informs the client of the added resources indicating their connection identifiers (VPCI and VCI).

9.2.4.7 Addition of Resources

Table 9.2-12 - Addition of resource (STU Initiated) (PVC)

1a-1b	The client requests resources.
1b-1c	In the physical scenario #4, the network selects the appropriate connections for the Server and the STU and adds them to the session. If the server side connections and the client side connections are separate, the network connects the Server side connections with the client side connections.
1c-1d	In the physical scenario #4, the network also informs the connections identifiers of the added connections.
2a-2b	In the physical scenario #4, this step is skipped.
3a-3b-3c	In the physical scenario #4, this step is skipped.
4a-4b	In the physical scenario #4, this step is skipped.
6a-6b	In the physical scenario #4, the network confirms the requested connections and informs the Server of the connection identifiers of the added connections.

Table 9.2-13 - Addition of resource (Server Initiated)—(PVC)

1a-1b	In the physical scenario #4, this step is skipped.
2a-2b-2c	In the physical scenario #4, this step is skipped.
3a-3b	In the physical scenario #4, this step is skipped.
4a-4b	In the physical scenario #4, the Server requests resources.
4b-5a	In the physical scenario #4, the network selects the appropriate connections for the Server and the STU and adds them to the session. If the server side connections and the client side connections are separate, the network connects the Server side connections with the client side connections.
5a-5b	In the physical scenario #4, the network also informs the connections identifiers of the added connections.
7a-7b	In the physical scenario #4, the network confirms the requested connections and informs the Server of the connection identifiers of the added connections.

9.2.4.8 Deletion of Resources

Table 9.2-14 - Deletion of resources (STU Initiated)—(PVC)

5b-6a	In the physical scenario #4, the network removes the connections from the session. If the client side connections are associated with the server side connections, the network clears this association.
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Table 9.2-15 - Deletion of Resources (Server Initiated) (PVC)

3b–4a	In the physical scenario #4, the network removes the connections from the session. If the client side connections are associated with the server side connections, the network clears this association.
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9.2.4.9 Session Transfer (PVC) (Informative, pending resolution of user-user specification problems in DSM-CC)

Table 9.2-16 - Session Transfer—(PVC)

6a–6b	In the physical scenario #4, the Server B requests connection resources.
6b–7a	In the physical scenario #4, the network selects appropriate connections for the Server B and the client. If the server side connections and the client side connections are separate, the network associates the client side connections and the server side connections. Some of the client side connections used in the session with the Server A may be reused in the new session with the Server B. In such cases, the network clears the association between the client side connections and the Server A side connections, and then re-associates the client side connections with the connections for the Server B.
7a–7b	In the physical scenario #4, the network confirms the connection resource request and informs the Server of the connection identifiers (VCIs) of the newly assigned connections.
9a–9b	In the physical scenario #4, the network also informs the STU of the connection identifiers (VCIs) of the newly assigned connections.
12a–13a	In the physical scenario #4, the network clears the remaining association between the client side connections and the Server A side connections.

9.2.4.10 Session Release

Table 9.2-17 - Session release (STU Initiated)—(PVC)

5b–6a	In the physical scenario #4, the network removes the connections from the session. If the client side connections are associated with the server side connections, the network clears this association.
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Table 9.2-18 - Session Release (Server Initiated) (PVC)

3b–4a	In the physical scenario #4, the network removes the connections from the session. If the client side connections are associated with the server side connections, the network clears this association.
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9.2.5 DAVIC Dynamic Flow Parameters for VoD

The following tables show the parameters, which are included in the message flows of clause 9.3. The column "Flow" references the individual message flow as in clause 9.3, "Status" highlights whether the parameter is included in the current specification, or whether it needs further examination, "Parameter" is the name of the parameter and "Comment" identifies the value and semantics, which goes with the parameter.

9.2.5.1 Session & Call/Connection Setup Scenario (Normative)

Table 9.2-19

Flow	Status	Parameter	Comment
1a-1b Ses SETUP req.ind		session_id	uniquely assigned by STU, = device_id & arbitrary additional value, unique on this STU
		client_id	E.164 NSAP address at the A1 interface of the client.
		server_id	E.164 NSAP address at the A9 interface of the server.
		compatibility_descriptor	conveys a list of specific Hardware/Software at the STU available to the server.
		service_info	= rPathSpec, indicates to the server initial service specific information, e.g., about service selection = (initial) service name
1c-1d Sess SETUP req.ind		session_id	identical to 1a-1b
		client_id	identical to 1a-1b, with the possibility that the SESn replaces the physical address by a logical address (e.g., for reasons of privacy)
		server_id	physical NSAP E.164 address of the Server which the STU wants to establish a session with (identical to 1a-1b. If in 1a-1b a logical address was used, this address has to be replaced by the physical address for this step).
		compatibility_descriptor	identical to 1a-1b
		service_info = rPathSpec	identical to 1a-1b
2a-2b ses(t)-c/c(t) flow in Server		session_id	identical to step 1
		client_ATM_id	physical or logical E.164 address of the port, the STU is connected to, possibly including a sub-address, based on client_id of step 1c-1d.
		resource_#, resource_attribute(s)	uniquely assigned by the Server, parameters which describe the ATM connection(s) to be set up: - bandwidth - QoS - any other necessary parameters, such as AAL parameters, broadband bearer capabilities, etc.
3a-3b-3c Connection setup		all c/c signaling parameters	see ISO/IEC 16500-5, Clause 9.3.1.3
4a-4b c/c(t)-ses(t) flow in Server		session_id	identical to step 2 = 1
		resource_#	as in step 2
		status_id	indicates status and reason of requested resource (e.g., OK or failed, because of...)
		VPI/VCI	correlates ATM connection identifiers with resource identifier
5a-5b Resource ADD req.ind		session_id	identical to step 4 = 1
		VPI/VCI (as seen by STU!)	correlates ATM connection identifiers with resource identifier
		status_id	indicates status and reason of requested resource (e.g., OK or failed, because of...)
			Note: See Note 1 in Clause 9.2.1 and Note 2 on Fig. 9-6.

6a–6b Resource ADD req.ind		session_id	identical to step 4 = 1 (However, see Note 2 in Clause 9.4.1.1)
		resource_# (as seen by the server), resource_group_tag_# resource_descriptor(s)	
		service_context_list	= connection_binding_list: indicates the "usage" of the resource in the context of the application, e.g., "S1".
7a–7b Resource ADD resp.conf		session_id	identical to step 6 = 1 (However, see Note 2 in Clause 9.4.1.1)
		resource_# (as seen by the server), resource_descriptor(s)	identical to step 6 = 1
8a–8b Session SETUP resp.conf		session_id	identical to step 7 = 1 (However, see Note 2 in Clause 9.4.1.1)
9a–9b Session SETUP resp.conf		session_id	identical to step 8 = 1 (However, see Note 2 in Clause 9.4.1.1)
		service_context_list	identical to step 6
		resource_# (as seen by the STU), resource_group_tag# resource_descriptor(s)	identical to step 6

9.2.5.2 Add Resource Scenario—STU initiated (Informative)

Table 9.2-20

Flow	Status	Parameter	Comment
1a-1b Resource ADD req.ind		session_id	uniquely assigned by STU, = device_id & arbitrary additional value, unique on this STU
		resource_# (as seen by the STU), resource_group_tag# resource_descriptor(s)	describes the resources the STU asks for.
		service_context_list	= connection_binding_list: indicates the "usage" of the resource in the context of the application, e.g., "S1".
1c-1d Resource ADD req.ind		session_id	see 1a-1b
		resource_# (as seen by the server), resource_group_tag# resource_descriptor	identical to 1a-1b
		service_context_list	identical to 1a-1b.
2a-2b SESSSt-CONt flow in Server		session_id	identical to step 1
		client_ATM_id	physical or logical E.164 address of the port, the STU is connected to possibly including a sub-address, based upon session_id.
		resource_# resource_attribute(s)	uniquely assigned by the STU, parameters which describe the ATM connection(s) to be set up: bandwidth QoS any other necessary parameters, such as AAL parameters, broadband bearer capabilities, etc.
3a-3b-3c Connection Setup		all c/c signaling parameters	see ISO/IEC 16500-5, Clause 9.3.1.2
4a-4b CONt-SESSSt flow in Server		session_id	identical to step 2 = 1
		resource_#	as in step 2
		status_id	indicates status and reason of requested resource (e.g., OK or failed, because of...)
		VPI/VCI	correlates ATM connection identifiers with resource identifier
5a-5b Resource ADDED resp.conf		session_id	identical to step 4 = 1
		resource_# (as seen by STU), resource_group_tag# resource_descriptor(s)	(Note: The resource_# is considered one element of the resource_descriptor) It still has to be clarified, at which level of detail information is needed for this flow.
		response	indicates whether the request to add resource has been successful.
6a-6b Resource ADDED resp.conf		session_id	identical to step 5 = 1

	resource_#, resource_descriptor(s)	identical to 5a-5b.
	response	identical to 5a-5b

9.2.5.3 Add Resource Scenario—Server-initiated (Normative)

Table 9.2-21

Flow	Status	Parameter	Comment
1a–1b SESSt-CONt flow in Server		session_id	The identifier of the session that connections to be created are added to.
		client_ATM_id	physical or logical E.164 address of the port, the STU is connected to, possibly including a sub-address, based on client_id of step 1c-1d of Session & Call/Connection Setup Scenario within this sub-section.
		resource_#, resource_attribute(s)	uniquely assigned by the Server, parameters which describe the ATM connection(s) to be set up: - bandwidth - QoS - any other necessary parameters, such as AAL parameters, broadband bearer capabilities, etc.
2a–2b–2c Connection setup		all c/c signaling parameters	See ISO/IEC 16500-5, Clause 9.3.1.2
3a–3b CONt-SESSt flow in Server		session_id	identical to the one in step 1
		resource_#	identical to the one in step 1
		status_id	indicates status and reason of requested resource (e.g., OK or failed, because of...)
		VPI/VCI	correlates ATM connection identifiers with resource identifier
4a–4b Resource ADD req.ind		session_id	identical to the one in step 1
		resource_# (as seen by server), resource_group_tag# resource_descriptor(s)	identical to the one in step 1.
		service_context_list	=connection_binding_list: indicates the usage of the resources in the context of the application, e.g., S1. Note: DAVIC has to agree on the semantics and usage of this field.
5a–5b Resource ADDED req.ind		session_id	identical to the one in step 1
		resource_# (as seen by STU), resource_group_tag# resource_descriptor(s)	the number and the descriptor for the added resources that are visible to the client.
		service_context_list	identical to the one in step 4
6a–6b Resource ADDED req.ind		session_id	identical to the one in step 1
		resource_# (as seen by STU), resource_group_tag# resource_descriptor(s)	identical to the one in step 5 except the status code.
7a–7b Resource ADD resp.conf		session_id	identical to the one in step 1

	resource_# (as seen by server), resource_group_tag# resource_descriptor(s)	identical to the one in step 4 except the status code.
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9.2.5.4 Delete Resource Scenario—STU-initiated (Informative)

Table 9.2-22

Flow	Status	Parameter	Comment
1a–1b		session_id	identifier of the session, resources shall be deleted from
		resource_id(s) (as seen by STU), (resource_count)	parameters which describe the ATM connection(s) to be deleted
2a–2b		resource_id(s) (as seen by server), (resource_count)	parameters which describe the ATM connection(s) to be deleted
3a–3b–3c		all c/c signaling parameters	see ISO/IEC 16500-5, Clause 9.3.1.2
4a–4b		resource_id(s), (resource_count)	parameters which describe the ATM connection(s) deleted
5a–5b		session_id	identical to step 1
		resource_id(s) (as seen by server), (resource_count)	parameters which describe the ATM connection(s) deleted
6a–6b		session_id	identical to step 1
		resource_id(s) (as seen by STU), (resource_count)	parameters which describe the ATM connection(s) deleted

9.2.5.5 Delete Resource Scenario—Server-initiated (Normative)

Table 9.2-23

Flow	Status	Parameter	Comment
1a–1b Resource DELETE req.ind		session_id	identifier of the session, resources shall be deleted from
		resource_id(s) seen by server), (resource_count)	parameters which describe the ATM connection(s) to be deleted
		reason	indicates the reason the connection has been requested to be released
2a–2b Resource DELETE req.ind		session_id	identical to 1
		resource_id(s) (as seen by STU), (resource_count)	parameters which describe the ATM resources to be deleted.
		reason	identical to 1
3a–3b Resource DELETE resp.conf		session_id	identical to 2
		resource_id(s) (as seen by STU), (resource_count)	identical to 2 = 1
		response	indicates the response from the STU. Possible values are specified by DSM-CC
4a–4b Resource DELETE resp.conf		session_id	identical to 3 = 1
		resource_id(s) (as seen by server), (resource_count)	identical to 1
		response	identical to 3
5a–5b SESt–c/ct RELEASE message		resource_id(s), (resource_count)	parameters which describe the ATM connection(s) to be deleted
6a–6b–6c ATM call RELEASE signaling		all c/c signaling parameters	see ISO/IEC 16500-5, Clause 9.3.1.2
7a–7b c/ct–SESt RELEASE message		resource_id(s), (resource_count)	parameters which describe the ATM connection(s) deleted

9.2.5.6 Session and Call/Connection Release Scenarios—STU-Initiated (Normative)

Table 9.2-24

Flow	Status	Parameter	Comment
1a–1b Sess RELEASE req.ind		session_id	identifier of the session to be released, obtained from Sess SETUP req.ind in Session & Call/Connection Setup Scenario within this subsection.
		reason	indicates the reason the session has been requested to be released
1c–1d Sess RELEASE req.ind		session_id	identical to 1a–1b
		reason	identical to 1a–1b
2a–2b SESt–C/Ct server internal communication		session_id	identical to 1
		resource_#(s)	identifies all the resources within the session to be released
3a–3b–3c		none	all ATM connections are released, not parameters are exchanged
4a–4b C/Ct–SESt server internal communication		session_id	identical to 2 = 1
5a–5b		session_id	identical to 4 = 1
		response	indicates the status of the session release request
5a–5b		session_id	identical to 5 = 1
		response	identical to 5 = 1

9.2.5.7 Session and Call/Connection Release Scenario—Server-Initiated (Normative)

Table 9.2-25

<i>Flow</i>	<i>Status</i>	<i>Parameter</i>	<i>Comment</i>
1a–1b Sess RELEASE req.ind		session_id	identifier of the session to be released, obtained from Sess SETUP req.ind in Session & Call/Connection Setup Scenario within this subsection.
		reason	indicates the reason the session has been requested to be released
2a–2b		session_id	identical to 1
		reason	identical to 1
3a–3b		session_id	identical to 2 = 1
		response	indicates client's response to the session release request
4a–4b		session_id	identical to 3 = 1
		response	indicates the status of the session release request
5a–5b SESt-C/Ct flow in server		resource # (s), resource_count	parameters which identify the ATM connection(s) to be released and the session the connections) are associated with.
6a–6b–6c Connection release		all c/c signaling parameters	see ISO/IEC 16500-5, Clause 9.3.1.2
7a–7b C/Ct-SESt flow in server		status_id	indicates the status of the ATM connections subsequent to the release request

9.2.5.8 Transfer of Session Between Servers (under the control of ses(n)) (Informative, pending resolution of user-user specification problems in DSM-CC)

Table 9.2-26

Flow	Status	Parameter	Comment
1a–1b		session_id	identifier of the session to be transferred
		server_B_id	physical or logical NSAP E.164 address of the server, the session shall be transferred to.
		service_info	information for indication to the server B initial service specific information, e.g., about service selection, user related information, e.g., authentication information
		resource_#, resource_group_tag_# resource_descriptor(s) (as seen by server)	parameters which identify the ATM resources currently (still) existing in the session
2a–2b		session_id	identical to 1
		client_id	E.164 NSAP address, which includes: AFI = 45 E.164 = E.164 (native) address of the UNI at A1, which is the physical location of the UNI of the STU. HO-DSP = IP address of STU, which is assumed to be assigned during network configuration ESI = (unique) MAC address of the STU, which is assumed to be burned in by the manufacturer SEL = DAVIC reserved, default = all 0 The coding of these fields is described in ISO/IEC 8348 (See Session & Call/Connection Setup Scenario within this subsection.)
		server_A_id	logical or physical NSAP E.164 address of the Server from which the session is transferred
		resource_# , resource_group_tag_#	parameters which identify the ATM connections currently (still) existing in the session)
		resource_descriptor(s) (as seen by server)	This allows server B to derive the bandwidths and resources currently allocated to the session.
		service_info	identical to 1
3a–3b SESt-C/Ct flow in Server		session_id	identical to 1
		client_ATM_id	physical or logical E.164 address of the port, the STU is connected to, possibly including a sub-address, based on client_id of step 2a–2b.
		resource_#, resource_attribute(s)	uniquely assigned by the Server, parameters which describe the ATM connection(s) to be set up: - bandwidth - QoS - any other necessary parameters, such as AAL parameters, broadband bearer capabilities, etc.
4a–4b–4c Connection setup		all c/c signaling parameters	see ISO/IEC 16500-5, Clause 9.3.1.2 (These connections are new additional ATM connections which terminate at the STU. There may be situations, where the STU is not capable of accepting these additional connections. This will result in a session transfer reject by Server B. See step 8a–8b It)

5a–5b CONt-SESt flow in Server	session_id	identical to step 3 = 1
	resource_#(s)	identical to step 3
	status_id	indicates status and reason of requested resource (e.g., OK or failed, because of...)
	VPI/VCI	correlates ATM connection identifiers with resource identifier
6a–6b Resource ADD req.ind	session_id	identical to step 5 = 1
	resource_# (as seen by server), resource_group_tag# resource_descriptor(s)	
	service_context_list	= connection_binding_list: indicates the 'usage' of the resource in the context of the application, e.g., 'S1'.
7a–7b Resource ADD resp.conf	session_id	identical to step 6 = 1
	resource_# (as seen by server), resource_descriptor(s)	identical to step 6 = 1
8a–8b	session_id	identical to step 7 = 1
	response	indicates why the session transfer was accepted (or not)
9a–9b	(this 9a-9b flow is not used in this scenario)	
10a–10b	session_id	identical to step 8 = 1
	resource_# (as seen by STU) , resource_group_tag# resource_descriptor(s)	identical to step 6 = 1
	service_context_list	= connection_binding_list: indicates the 'usage' of the resource in the context of the application, e.g., 'S1'.
	reason	indicates to the STU, why the session transfer was not accepted by Server B (if this is the case), e.g., 'not sufficient resources'
11a–11b	session_id	identical to step 10 = 1
	response	indicates why the session transfer was accepted (or not) by the STU
12a–12b	session_id	identical to step 11 = 1
	response	indicates why the session transfer was accepted (or not) by the STU or server B.
13a–13b	session_id	identical to step 12 = 1
	reason	indicates the reason the session has been requested to be released.
14a–14b SESt-CONt server internal communication	session_id	identical to 13 = 1
	resource_#(s)	identifies all the resources within the session to be released
15a–15b–15c	none	all ATM connections are released, not parameters are exchanged.
16a–16b CONt-SESt server internal communication	resource_#(s)	identifies all the resources within the session to be released
17a–17b	session_id	identical to 14 = 1

		resource_id(s), (resource_count)	parameters which describe the ATM connection(s) deleted
18a–18b		session_id	identical to 17 = 1
		resource_id(s), (resource_count)	identical to 17

9.2.5.9 Flow Scenario: Service Transfer between Servers

Table 9.2-27

1a-1b Service Transfer capable program application Download			Application download is carried at the beginning when the specific service is accessed in Server A from which the transfer is initiated.
2a-2b Next Server information		server_id	this is the server_id of Server B in standard IDL format
		service_info	=rPathSpec, used below to indicate to the Server B initial service specific information, e.g., about service selection = (initial) service name.
		ticket_info	this contains an encrypted form of the ticket the STU uses when establishing a session with Server B indicating that the issuer is Server A and relates to a specific prior contract with Server B for billing and commission reimbursements. It may also include the aPrincipal (an end-user identification as received from the STU) for security.
3a-3b SUSPEND		suspend_reason	the STU indicates its preference if the UserContext on Server A must be suspended or the resources minimized. Below scenario I covers the case when the session with Server A is released and Scenario II covers the case when the session with Server A is kept but its resources are minimized
		user_context	the Server A provides the UserContext from which the service on Server A will be resumed in full when STU returns to Server A.
Scenario I Session & Call/Connection Release		parameters as in STU initiated Session and Call/Connection Release Scenario	STU releases its session with Server A after receiving the user_context from 3
Scenario II Resource Delete		parameters as in Server initiated Resource Delete Scenario	Server A minimizes all the resources in the session except for S2 information flow.
Session & Call/Connection Setup		parameters as in STU initiated Session and Call/Connection Setup Scenario	STU establishes a session with Server B and passes the service_info and ticket_info provided earlier in 2. Note: both uuData and privateData in DSM-CC userData shall be used.
Session & Call/Connection Release		parameters as in STU or Server initiated Session and Call/Connection Release Scenario	STU or Server B releases the session.
Scenario I Session & Call/Connection Setup		parameters as in STU initiated Session and Call/Connection Setup Scenario	STU re-establishes a session with Server A and passes the user_context received in 3. STU resumes the service from where it last left off.
Scenario II 4a-4b RESUME		user_context	provides user_context received in 3.
Scenario II Resource Add		parameters as in Server initiated Resource Add Scenario	Server A adds all the resources in the session except for S2 and resumes the service from where it was left of.

9.2.5.10 Resource Descriptors used in dynamic flows for VoD

Depending on the scenario and the endpoint, there is a specific view of the session which is defined using resource descriptors which are included in the messages. This section defines the possible scenarios and the resource views (both at the Server and STU) that are associated with them.

- Download Phase, Multiple ATM SVCs
- Video Play Phase, Multiple ATM SVCs
- Single Asymmetric ATM SVC

1- Download Phase, Multiple ATM SVCs

This example uses separate ATM SVCs in order to carry the flows identified below:

- Download Data downstream
- Download Data Response upstream
- Download Control downstream
- Download Control upstream
- RPC

Two scenarios are considered:

- End-to-End ATM
In this case the ATM SVC is maintained intact between the Server and the Client
- Core ATM network and non-ATM HFC Client access
In this case the flows being carried on the ATM SVC are mapped to non-ATM resources through the non-ATM resource descriptors.

1-A End-to-End ATM

The top diagram in Figure 9.2-13 provides the list of resource descriptors communicated from the Server to the Network and the Network to the Client. Since it is end-to-end ATM the resource numbers and the association tags are unchanged.

In the bottom diagram in Figure 9.2-13, the flows corresponding to DownloadControl, DownloadData and RPC are carried on separate ATM SVCs, Resource Number 1, 2 and 3 respectively and use the respective Association Tags 1, 2 and 3. The bindings to the interfaces are done using the Association Tags. Through the bindings, the information format at the interfaces is expected to be in IP format.

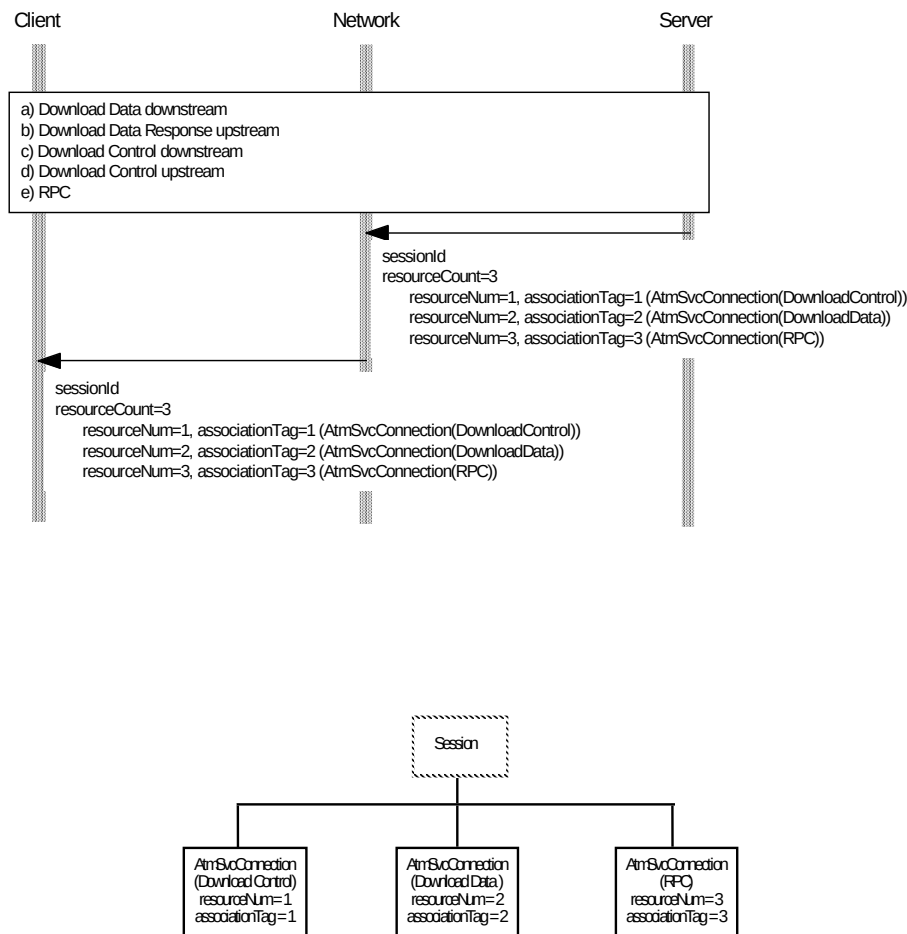


Figure 9.2-13 End-to-End ATM, Download Phase, Multiple ATM SVCs Server and Client Views

1-B Non-ATM HFC Client View

The top diagram in Figure 9.2-14 provides the list of resource descriptors communicated from the Server to the Network and the Network to the Client. Since the ATM terminates in the Network, new resources between the Network and the Client are used over the non-ATM HFC. The flows on the ATM SVC are mapped into those new non-ATM HFC resources. Although the resource numbers for each flow on the Client side are different, the association tags are kept the same.

Each of the DownloadControl, DownloadData and RPC consists of 2-way flows. The downstream flows are carried on the MPEG TS and the upstream flows are carried on TDMA referred to by the Notify resource descriptor. The bindings to the corresponding interfaces are done using the Association Tags. Through the bindings, the information format at the interfaces is expected to be in IP format.

Since the MPEG TS is carried over TsDownstreamBandwidth, Resource Number 20, the SRM assigns an Association Tag 50 to associate it with the MpegProgram Resource Number 30. The Association Tag in this instance is used to identify a stack and does not appear in interface bindings at the User-to-User level.

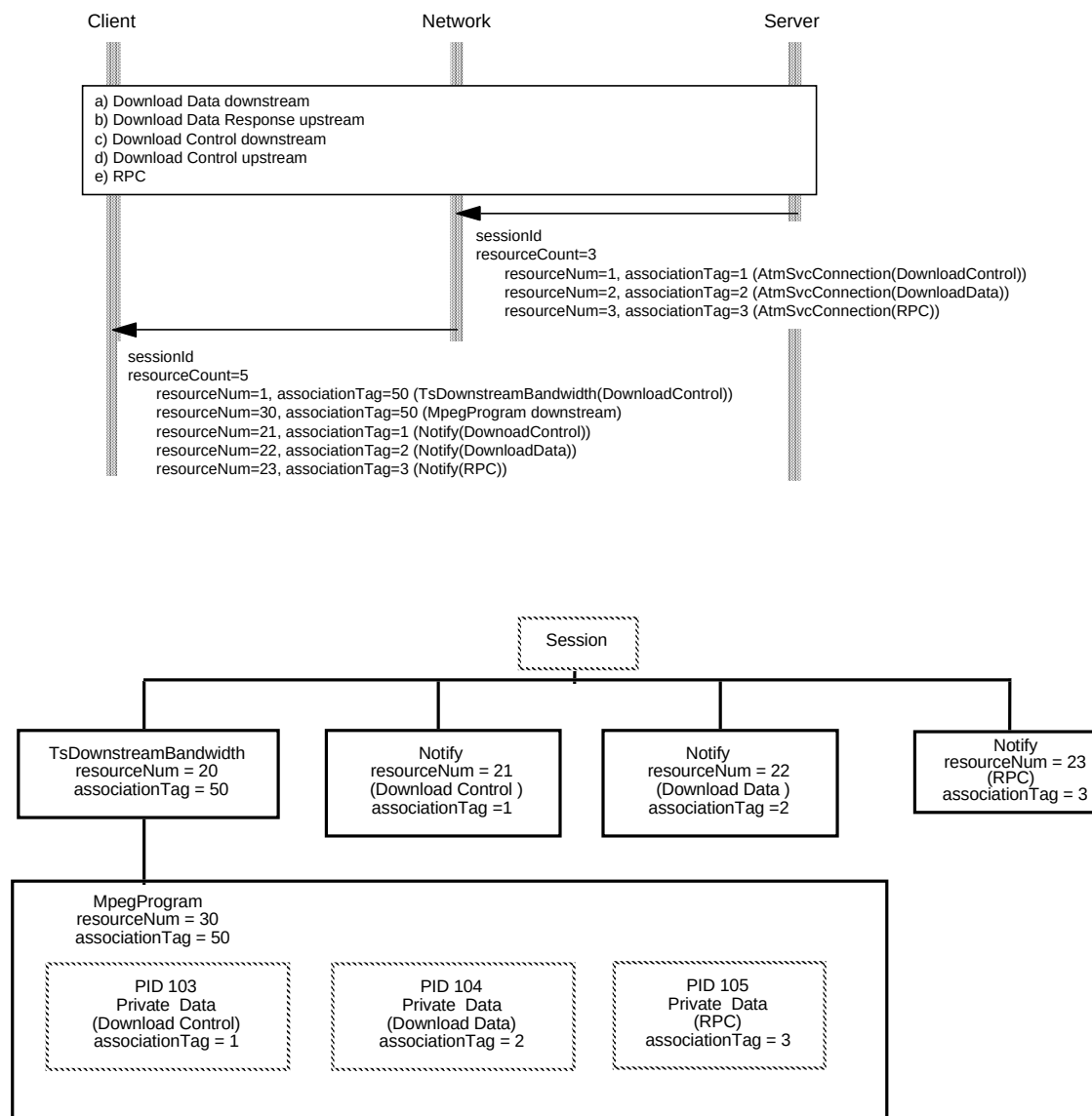


Figure 9.2-14 Non-Association TagM HFC Client View Corresponding to Download Phase, Multiple Association TagM SVCs Server and Client Views

2- Video Play Phase, Multiple Association TagM SVCs

This example uses separate Association TagM SVCs in order to carry the flows identified below:

- MPEG Audio/Video/Data downstream
- RPC

Two scenarios are considered:

End-to-End Association TagM: (In this case the Association TagM SVC is maintained intact between the Server and the Client)

Core Association TagM network and non-Association TagM HFC Client access: (In this case the flows being carried on the Association TagM SVC are mapped to non-Association TagM resources through the non-Association TagM resource descriptors.)

2-A End-to-End Association TagM

The top diagram in Figure 9.2-15 provides the list of resource descriptors communicated from the Server to the Network and the Network to the Client. Since it is end-to-end Association TagM the resource numbers and the association tags are unchanged.

In the bottom diagram in Figure 9.2-15, the flows corresponding to MPEG Audio/Video/Data downstream and RPC are carried on separate Association TagM SVCs, Resource Number 1 and 3 respectively and use the respective Association Tags 1 and 3. The Association Tag 4 identifies a stack and is not used in the bindings. The bindings to the corresponding interfaces are done using the Association Tags 10, 11, 6 and 3. Through the Association Tag 3 binding the information format at the interface is expected to be in IP format.

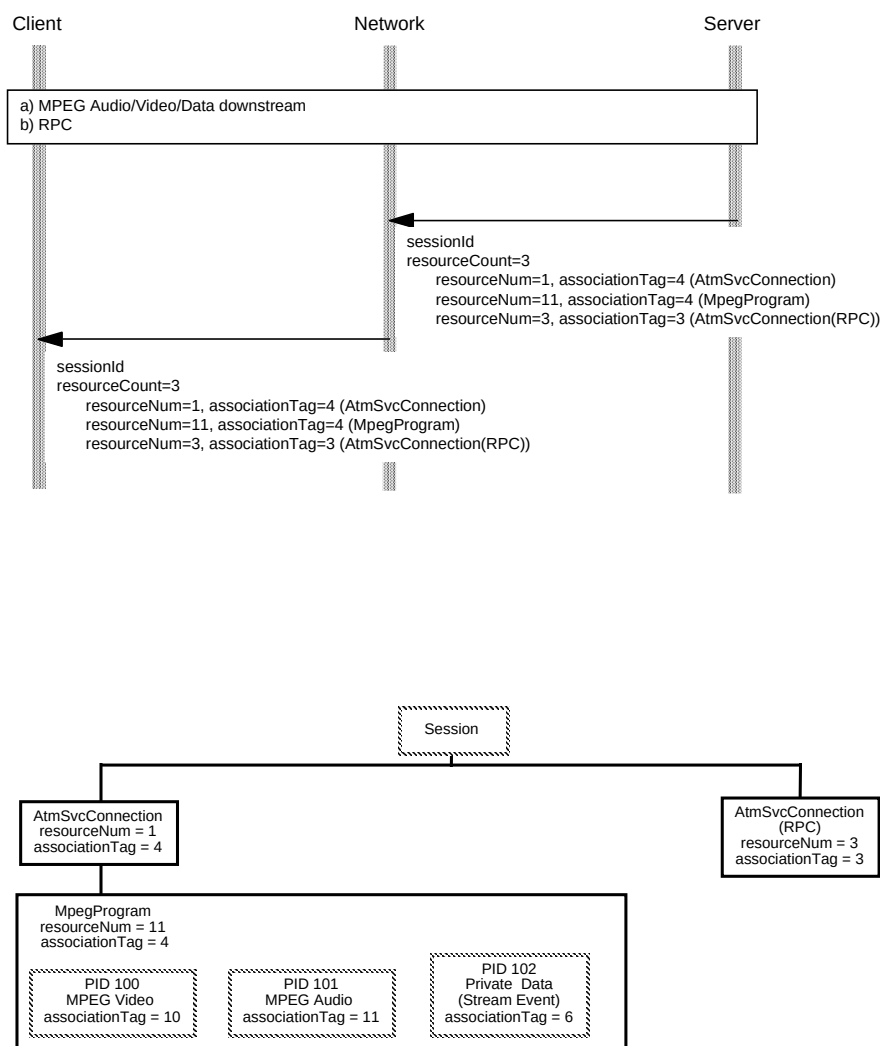


Figure 9.2-15 End-to-End Association TagM, Video Play Phase, Multiple Association TagM SVCs Server and Client Views

2-B Non-Association TagM HFC Client View

The top diagram in Figure 9.2-16 provides the list of resource descriptors communicated from the Server to the Network and the Network to the Client. Since the Association TagM terminates in the Network, new resources between the Network and the Client are used over the non-Association TagM HFC. The flows on the Association TagM SVC are mapped into those new non-Association TagM HFC resources. Although the

resource numbers for each flow on the Client side are different, the association tags are kept the same.

In the bottom diagram of Figure 9.2-16, the MPEG Audio/Video/StreamEvent consist of only downstream flows, the RPC consists of 2-way flows. Both MPEG Audio/Video/StreamEvent and RPC downstream flows are carried on the MPEG TS and the RPC upstream flow is carried on TDMA referred to by the Notify resource descriptor. The bindings to the corresponding interfaces are done using the Association Tags.

Since the MPEG TS is carried over TsDownstreamBandwidth, Resource Number 20, the SRM assigns an Association Tag 50 to associate it with the MpegProgram Resource Number 11. The Association Tag in this instance is used to identify a stack and does not appear in interface bindings at the User-to-User level.

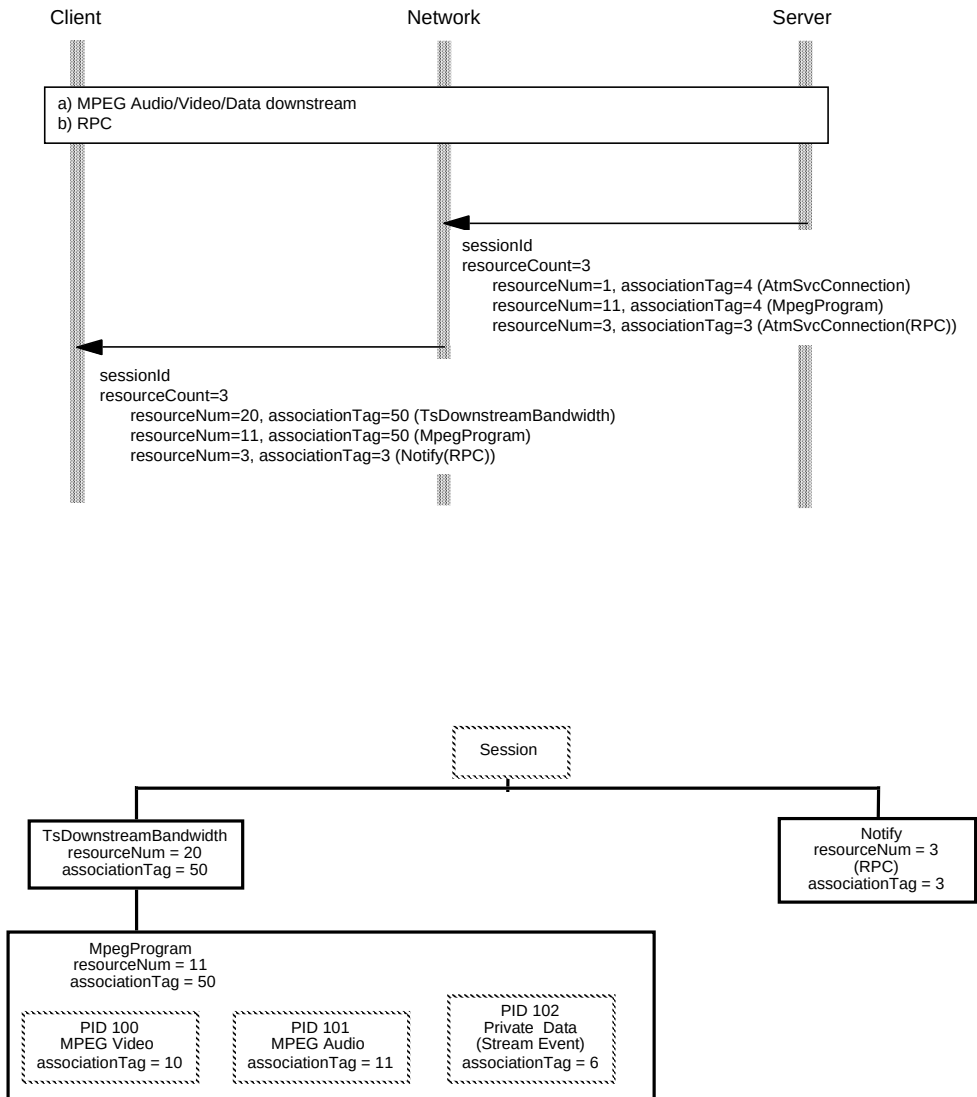


Figure 9.2-16 Non-Association TagM HFC Client View Corresponding to Video Play Phase, Multiple Association TagM SVCs Server View

3- Single Asymmetric Association TagM SVC

This example uses a single asymmetric Association TagM SVC in order to carry the flows identified below:

- MPEG Audio/Video/Data downstream
- RPC over TCP/IP downstream flow over private data on MPEG TS
- RPC over TCP/IP upstream flow over Association TagM
- Download Control and Data downstream flow in TCP/IP over private data on MPEG TS
- Download Control and Data Response upstream flow over Association TagM

Note: The use of TCP/IP in Download data will be reviewed for replacement by UDP/IP over the reflector for the June meeting.

Two scenarios are considered:

End-to-End Association TagM: (In this case the Association TagM SVC is maintained intact between the Server and the Client)

Core Association TagM network and non-Association TagM HFC Client access: (In this case the flows being carried on the Association TagM SVC are mapped to non-Association TagM resources through the non-Association TagM resource descriptors.)

Note: In case of TCP/IP, while the SVC connection is established, the TCP/IP connection is not. In step 8a-8b the IP resource descriptor is sent. The Download service at the server immediately begins to listen at the specified port. the TCP/IP connection is made by the STU Download service after receiving the IP resource descriptor in 9a-9b.

3-A End-to-End Association TagM

The top diagram in Figure 9.2-17 provides the list of resource descriptors communicated from the Server to the Network and the Network to the Client. Since it is end-to-end Association TagM the resource numbers and the association tags are unchanged.

The bottom diagram in Figure 9.2-17 shows how the SharedResource descriptor is used to share the AtmSvcConnection between the MpegProgram and Ip descriptors.

The MPEG Transport Stream Resource number, Resource Number 10, through SharedResource, Resource Number 11 shares the AtmSvcConnection, Resource Number 1 with the other IP connections. The link between the MPEG TS and the SharedResource is maintained through the Association Tag, Association Tag 1. The Audio, the Video and the StreamEvent carried in PIDs 100, 101 and 102 respectively are assigned the Association Tags 10, 11 and 6 respectively.

Since the RPC consists of 2-way flows, the downstream is carried on the MPEG TS, PID 204 and the upstream is carried on the IP connection Resource Number 12. Association Tag 2, links the two directions to the same interface. The SharedResource, Resource Number 13 also is tagged at Association Tag 2. Similarly the PID, Resource Number 14 and Resource Number 15 for Download are tagged at Association Tag 3.

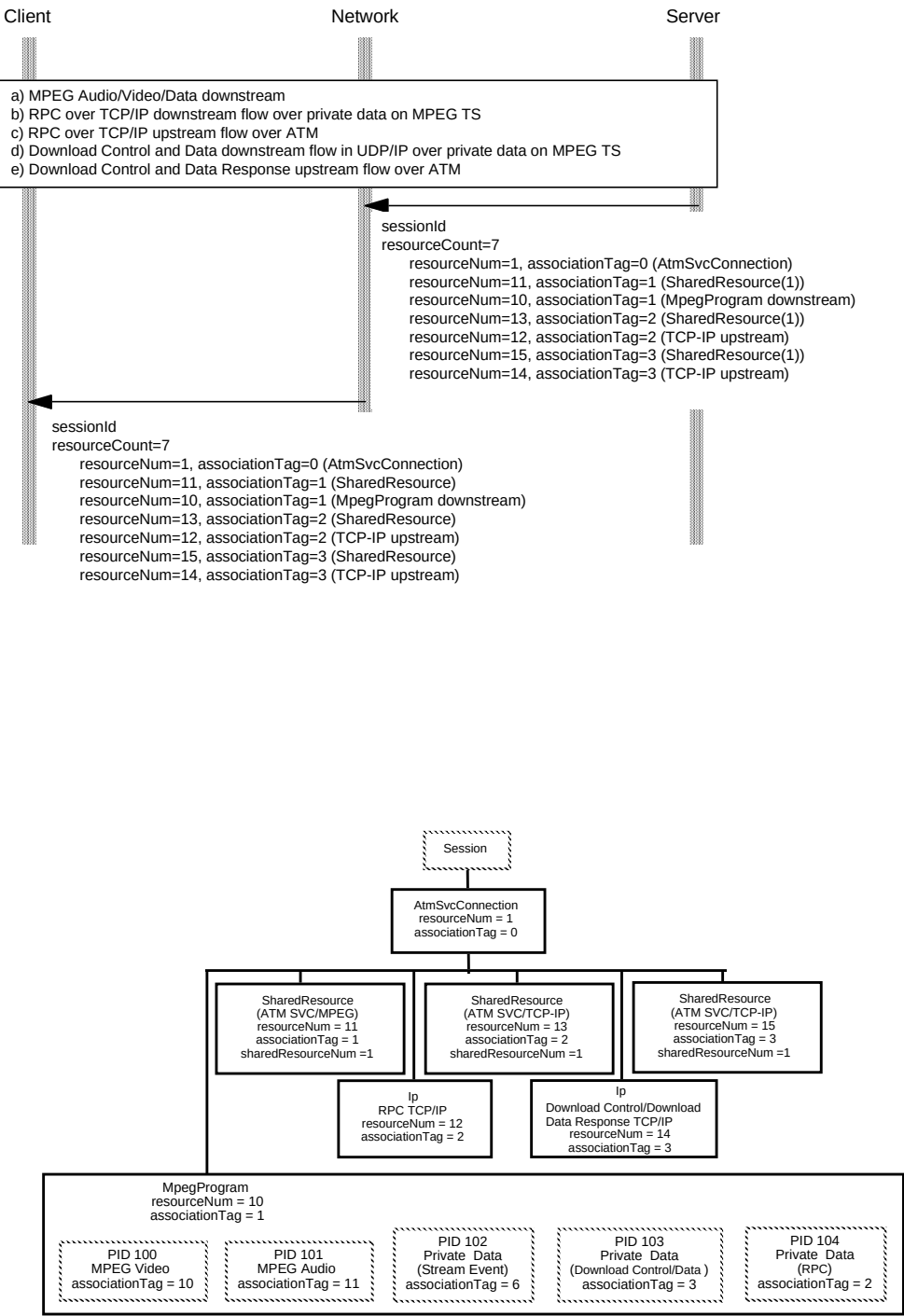


Figure 9.2-17 End-to-End Association TagM, Single Asymmetric Association TagM SVC Server and Client Views

3-B Non-Association TagM HFC Client View

The top diagram in Figure 9.2-18 provides the list of resource descriptors communicated from the Server to the Network and the Network to the Client. Since the Association TagM terminates in the Network, new