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Information technology — Telecommunications and information exchange between systems — Services for Computer Supported Telecommunications Applications (CSTA) Phase III

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Services pour applications en télécommunications supportées par ordinateur (CSTA) en phase III

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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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. 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 document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 18051 was prepared by Ecma International (as ECMA-269) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

This fourth edition cancels and replaces the third edition (ISO/IEC 18051:2005), which has been technically revised.

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Introduction

This International Standard defines Phase III of Services for Computer Supported Telecommunications Applications (CSTA). This International Standard is part of a suite of Standards and Technical Reports for Phase III of CSTA. All of the Standards and Technical Reports in the suite are based on practical experience of Ecma member companies and each one represents a pragmatic and widely-based consensus.

Phase III of CSTA extends the previous Phase I and Phase II Standards in major theme directions as well as numerous details. This incorporates technology based upon the *versit* CTI Encyclopedia (Version 1.0), which was contributed to Ecma by *versit*.

The 3rd edition of ISO/IEC 18056, XML Protocol for Computer Supported Telecommunications Applications (CSTA) Phase III, specifies a set of XML schemas for this 4th edition of Phase III Services for CSTA.

The 3rd edition of ECMA-348, Web Services Description Language (WSDL) for CSTA Phase III, specifies a set of WSDL schemas for this 4th edition of Phase III Services for CSTA.

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Information technology — Telecommunications and information exchange between systems — Services for Computer Supported Telecommunications Applications (CSTA) Phase III

1 Scope

This International Standard specifies the Services and Event Reports for Computer-Supported Telecommunications Applications, Phase III (CSTA).

This International Standard is focused on providing application service interfaces to a Switching Function, Computing Function and a Special Resource Function. A CSTA application interface is disassociated from the various user-network interfaces and network-network interfaces CSTA applications may serve, observe or manipulate. Because CSTA operates with existing telecommunications interfaces indirectly, it operates generically, so that differences among various existing interfaces are hidden from CSTA applications. Support of user-to-network interfaces is outside the scope of CSTA.

Although most terminal equipment (TE) is suitable for use with CSTA, there will be instances of TE that will not be suitable in certain circumstances. Examples are:

- FAX terminals and modems that are unable to adjust their transmission modes to prevent carrier conflict when both parties are alerted via CSTA during call establishment;
- functional terminals that perform telecommunication functions outside the control of the Switching Function.

Services defined in this International Standard allow functional integration between a computing network and a telecommunications network. Computing platforms (i.e., Application Programming Interfaces - APIs) that support such functionally-integrated applications are outside the scope of this International Standard.

Communication between the computing and switching (i.e., telecommunications) networks may take place via intervening networks ranging from simple point-to-point connections to local- or wide-area telecommunications networks.

This International Standard is part of a suite of CSTA Standards and Technical Reports that provide a comprehensive description of the architectural and practical issues involved in applying, implementing, and utilizing CSTA-based computer telephony integration (CTI) applications.

2 Conformance

This Clause specifies the conformance requirements for a Switching Function, Special Resource Function, and a Computing Function.

Conformance requirements specify the parts of this International Standard that a CSTA conformant implementation shall support.

This International Standard specifies an operational model (Clause 6, “CSTA Operational Model” and Clause 9, “Generic Service Requirements”) that defines a collection of objects (e.g. domains and sub-domains, logical and physical elements, calls) and the relationships between these objects.

The behaviours of CSTA-conformant services, features, and event reports are determined by this model.

2.1 Switching Function

In order to conform to this International Standard a switching function shall support the following as a minimum:

1. the requirements pertaining to CSTA features as specified in Clause 6, “CSTA Operational Model”;
2. the requirements as specified in Clause 9, “Generic Service Requirements”;

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3. the Get Switching Function Capability service for all CSTA profiles specified in 2.1.3, “CSTA Profiles” unless otherwise noted in the profile;
4. at least one of the Application Association Establishment sequences, including the mandatory services specified in the sequence, as specified in Clause 7, “Association Establishment”;
5. at least one of the profiles as specified in 2.1.3, “CSTA Profiles”.

2.1.1 Conformant Services

In order to conform to a specific CSTA *service* an implementation shall support the following as a minimum:

1. the requirements of the service as specified by its service description, service request parameters, service response parameters, and operational model including connection state transitions, monitoring event sequences, and functional requirements;
2. the requirements associated with each parameter used in the service as specified by its parameter description, format, and functional requirements in Clause 12, “Parameter Types”;
3. all of the events that are associated with its service completion criteria, as documented in its event monitoring tables;
4. for service requests that contain a device identifier parameter, an implementation shall support, at a minimum, the Diallable Digits format as specified in 10.1.1, “Diallable Digits”.

2.1.2 Conformant Events

In order to conform to a specific CSTA *event* an implementation shall support the following as a minimum:

1. the requirements of the event as specified by its event description, event parameters, event causes, and functional requirements;
2. the requirements associated with each parameter used in the event as specified by its parameter description, format, and functional requirements in Clause 12, “Parameter Types”;
3. for events that contain a device identifier parameter, an implementation shall support, at a minimum, the Switching Function Representation format as specified in 10.1.2, “Switching Function Representation”.

2.1.3 CSTA Profiles

Some CSTA services and events are grouped together as profiles.

2.1.3.1 Basic Telephony Profile

This profile includes the following:

1. CSTA Services: Answer Call, Clear Connection, Make Call, Monitor Start (with the monitorType of device-type), and Monitor Stop.
2. CSTA Events: Connection Cleared, Delivered, Established, Failed, Network Reached, Originated, and Service Initiated.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.2 Routeing Profile

If the switching function supports Routeing Services as specified in Clause 20, “Routeing Services”, it shall support a minimum set of Routeing Services that includes: Route Request, Route Select, and Route End (from the switching function only).

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Other Routeing services may be provided in any combination in addition to this set.

If a switching function supports the routeing for digital data calls, then the Route Register and CSTA Route Register Cancel shall also be included in the minimum set.

2.1.3.3 Level 1a Voice Browser Profile

This profile includes the following:

1. CSTA Services: Answer Call, Clear Connection, Single Step Transfer Call (of a connected call), Monitor Start (with the monitorType of device-type), and Monitor Stop.
2. CSTA Events: Connection Cleared, Delivered, Established, Failed, and Transferred.

Note that the Get Switching Function Capability service is not a required service in this profile.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.4 Level 1b Voice Browser Profile

This profile includes the following:

1. CSTA Services: Answer Call, Clear Connection, Deflect Call (of a connected call), Monitor Start (with the monitorType of device-type), and Monitor Stop.
2. CSTA Events: Connection Cleared, Delivered, Diverted, Established, and Failed.

Note that the Get Switching Function Capability service is not a required service in this profile.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.5 Level 2 Voice Browser Profile

This profile includes the following:

All of the services and events in either the Level 1a Voice Browser Profile or the Level 1b Voice Browser Profile and the following:

1. additional CSTA Service: Make Call.
2. additional CSTA Events: Network Reached, Originated.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.6 Minimal uaCSTA Call Control Profile

This profile includes the following:

1. CSTA Services: Answer Call, Clear Connection, Deflect Call, Hold Call, Make Call, Retrieve Call, and Single Step Transfer.
2. CSTA Events: There are no CSTA events specified as part of this profile. This profile assumes that an application uses mechanisms defined outside of this International Standard (SIP Subscribe/Notify, for example) to obtain call/connection information that can be used in CSTA services rather than using CSTA events to obtain this information.

Note that the Get Switching Function Capability service is not a required service in this profile.

Other CSTA services (and events) may be provided in any combination in addition to this set.

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2.1.3.7 Basic uaCSTA Call Control Profile

This profile includes the following:

1. CSTA Services: Answer Call, Clear Connection, Deflect Call, Hold Call, Make Call, Retrieve Call, Single Step Transfer, Monitor Start (with a monitorType of device-type), and Monitor Stop.
2. CSTA Events: Connection Cleared, Delivered, Diverted, Established, Failed, Held, Network Reached, Retrieved, Service Initiated, and Transferred.

Note that the Get Switching Function Capability service is not a required service in this profile.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.8 Advanced uaCSTA Call Control Profile

This profile includes the following:

1. CSTA Services: Alternate Call, Answer Call, Clear Connection, Consultation Call, Deflect Call, Hold Call, Make Call, Reconnect Call, Retrieve Call, Single Step Transfer, Transfer Call, Monitor Start (with a monitorType of device-type), and Monitor Stop.
2. CSTA Events: Connection Cleared, Delivered, Diverted, Established, Failed, Held, Network Reached, Originated, Retrieved, Service Initiated, and Transferred.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.9 Conferencing uaCSTA Call Control Profile

This profile includes the following:

1. CSTA Services: The CSTA services in this profile must include all of the services in either the Basic or the Advanced uaCSTA Call Control Profile plus the Conference Call service and the Single Step Conference service.
2. CSTA Events: The CSTA events in this profile must include all of the events in either the Basic or the Advanced uaCSTA Call Control Profile plus the Conferenced event.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.10 Basic uaCSTA Device Feature Profile

This profile includes the following:

1. CSTA Services: The CSTA services in this profile must include all of the services in either the Basic or the Advanced uaCSTA Call Control Profile plus the Set Do Not Disturb service and the Set Forwarding service.
2. CSTA Events: The CSTA events in this profile must include all of the events in either the Basic or the Advanced uaCSTA Call Control Profile plus the Do Not Disturb event and the Forwarding event.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.11 Speaker uaCSTA Device Feature Profile

This profile includes the following:

1. CSTA Services: The CSTA services in this profile must include all of the services in either the Basic or the Advanced uaCSTA Call Control Profile plus the Set Speaker Mute and Set Speaker Volume services.

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2. CSTA Events: The CSTA events in this profile must include all of the events in either the Basic or the Advanced uaCSTA Call Control Profile plus the Speaker Mute and Speaker Volume events.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.12 Basic Speech Service Profile

The Basic Speech Service Profile involves primarily the Listener and Prompt resources and includes the following services and events:

1. Services and Events from one or more of the following profiles:
   a. Basic Telephony Profile;
   b. Level 1a or 1b Voice Browser Profile;
   c. Level 2 Voice Browser Profile;
   d. Minimal uaCSTA Call Control Profile;
   e. Basic uaCSTA Call Control Profile.
2. CSTA Services: Clear, Monitor Start (device type monitoring), Monitor Stop, Query Voice Attribute, Set Voice Attribute, Start, Stop.
3. CSTA Events: Bookmark Reached, Completed, Interruption Detected, Not Recognized, Recognized, Silence Timeout Expired, Speech Detected, Voice Error Occurred.

Other CSTA services and events may be provided in any combination in addition to this set.

2.1.3.13 Advanced Speech Service Profile

The Advanced Speech Service Profile includes all the resources, services and events in the Basic Speech Service Profile with additional Prompt Queue and DTMF resources and the following services and events:

1. CSTA Services: Activate, Deactivate, Queue, Reposition, Resume, Suspend.
2. CSTA Events: DTMF Detected, Emptied, Started, Voice Attribute Changed.

Other services and events may be provided in any combination in addition to this set.

2.1.4 Support of Service Requests And Manual Mode

A conformant switching function may support a given service defined in this International Standard through the CSTA service boundary but is not required to support the equivalent service in a manual mode.

A conformant switching function may support a feature associated with an equivalent CSTA service defined in this International Standard through manual mode but is not required to support the equivalent service through the service boundary.

2.2 Special Resource Function Conformance

In order to conform to this International Standard a special resource function shall support the following as a minimum:

1. the requirements pertaining to CSTA features as specified in Clause 6, “CSTA Operational Model”;
2. the requirements as specified in Clause 9, “Generic Service Requirements”;
3. for a supported service, the special resource function shall not reject as unsupported all of the events specified in the monitoring event sequences associated with the service;
4. the atomic service request acknowledgment model as specified in 9.2, “Service Response (Acknowledgements)”.

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2.2.1 Conformant Services

In order to conform to a specific CSTA *service* an implementation shall support the following as a minimum:

1. the requirements of the service as specified by its service description, service request parameters, service response parameters, and operational model including connection state transitions, monitoring event sequences, and functional requirements;
2. the requirements associated with each parameter used in the service as specified by its parameter description, format, and functional requirements in Clause 12, “Parameter Types”;
3. all of the events that are associated with its service completion criteria, as documented in its event monitoring tables.

2.2.2 Conformant Events

In order to conform to a specific CSTA *event* an implementation shall support the following as a minimum:

1. the requirements of the event as specified by its event description, event parameters, event causes, and functional requirements;
2. the requirements associated with each parameter used in the event as specified by its parameter description, format, and functional requirements in Clause 12, “Parameter Types”.

2.2.3 Support of Service Requests And Manual Mode

A conformant special resource function may support a given service defined in this International Standard through the CSTA service boundary but is not required to support the equivalent service in a manual mode.

A conformant special resource function may support a feature associated with an equivalent CSTA service defined in this International Standard through manual mode but is not required to support the equivalent service through the service boundary.

2.3 Computing Function Conformance

In order to conform to this International Standard a computing function shall support the following as a minimum:

1. the requirements pertaining to CSTA features as specified in Clause 6, “CSTA Operational Model”;
2. the requirements as specified in Clause 9, “Generic Service Requirements”;
3. for a supported service, the computing function shall not reject as unsupported all of the events specified in the monitoring event sequences associated with the service;
4. the “Single Physical and Logical Element” and “Logical Element Only” device configurations as specified in 6.1.1.3, “Device Configurations”;
5. for service requests, the Diallable Digits format of Device Identifiers as specified in 10.1.1, “Diallable Digits”;
6. for events, all formats of Device Identifiers as specified in 10.1, “Device Identifier Formats”;
7. the “No Appearance Addressability” and the “Individual Appearance Addressability” of referencing device elements as specified in 6.1.5, “Referencing Devices, Elements, Appearances and Device Configurations”;
8. both types of service request acknowledgment models (e.g., Atomic and Multi-Step) as specified in 9.2, “Service Response (Acknowledgements)”;
9. all failure models as specified in 6.7.2, “Connection Failure”;

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10. both switching function options of handling unsupported parameters in service requests as specified in the capability exchange services;
11. both the fixed and local view of the primaryOldCall and the secondaryOldCall parameters in the Conferenced and the Transferred events;
12. all bi-directional services for which it registered, whether explicitly (i.e., via a service registration service such as System Status Register) or implicitly (i.e., the switching function does not support registration but does support (as indicated through the capabilities exchange services) a particular bi-directional service and therefore may issue a service request to the computing function);
13. at least one of the Application Association Establishment sequences, including the mandatory services specified in the sequence, as specified in Clause 7, “Association Establishment”. Note that, in order to interwork with all Switching Functions, the Computing Function should support all of the Application Association Establishment sequences.

3 References

ISO/IEC 8649:1996	Information technology - Open Systems Interconnection - Service definition for the Association Control Service Element (this corresponds to ITU-T Rec. X.217 1995)
ISO/IEC 8824-1:2002	Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation
ISO/IEC 11571:1998	Information technology - Telecommunications and information exchange between systems - Private Integrated Services Networks - Addressing
ISO/IEC 11572:2000	Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Circuit mode bearer services - Inter-exchange signalling procedures and protocol
ISO/IEC 11582:2002	Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Generic functional protocol for the support of supplementary services - Inter-exchange signalling procedures and protocol
ISO/IEC TR 18053:2000	Information technology - Telecommunications and information exchange between systems - Glossary of definitions and terminology for Computer Supported Telecommunications Applications (CSTA) Phase III
ISO/IEC 22534:2005	Information technology - Telecommunications and information exchange between systems - Application session services
ITU-T Rec. E.131:1988	Subscriber control procedures for supplementary telephone services
ITU-T Rec. E.164:2005	The international public telecommunication numbering plan
ITU-T Rec. H.225.0:2006	Call signalling protocols and media stream packetization for packet-based multimedia communication systems
ITU-T Rec. Q.2931:1995	B-ISDN - Digital subscriber signalling system No. 2 (DSS 2) - User-network interface (UNI) layer 3 specification for basic call/connection control
ITU-T Rec. Q.931:1998	ISDN user-network interface layer 3 specification for basic call control
IETF RFC 3066	Tags for the Identification of Languages (January 2001)
IETF RFC 3261	SIP: Session Initiation Protocol (June 2002)

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4 Definitions and Abbreviations

The definitions and abbreviations given in ISO/IEC TR 18053 apply.

5 Functional Architecture

The objective of CSTA Architecture is to define the inter working mechanisms between the Computing, Special Resource, and the Switching Functions independently from their physical implementations.

6 CSTA Operational Model

The CSTA domain contains Switching, Computing and Special Resource Domains separated by the CSTA Service Boundary.

The CSTA domain concept is illustrated in Figure 6-1. It shows that the Switching and Computing Domains comprise Computing Functions (1, 2 and 3) and Switching Functions (1, 2 and 3) respectively.

Each Function[1)] provides access to the objects in its sub-domain. An application acts upon the objects in the domain via the Functions over the CSTA Service Boundary.

This Standard specifies the messages (Services and Event Reports), and their associated behaviour, over the CSTA Service Boundary. These messages originate and terminate at the Functions.

CSTA applications operate in the context of a relationship between two or more Functions over the CSTA Service Boundary. In Figure 6-1, such relationships are shown as lines between Computing Functions and Switching Functions. Association establishment specified in Clause 7, “Association Establishment”, on page 85, explains the different ways to manage such relationships.

A Sub-Domain may include objects such as CSTA calls, devices, connections and messages. A Sub-Domain may have one or more Functions.

The Function provides an abstract view of the part of a Sub-Domain that an application can control and/or observe, called the Application Working Domain.

One Function may provide different Application Working Domains based on considerations such as the application's design, licensing policy, security constraints, etc. These considerations and the associated administration are outside the scope of this Standard.

1) Special Resource Functions (SRFs) are functions that are typically "added-on" to a Switching or Computing Function. They can be modeled as part of either one of the two other Functions or as something totally independent.

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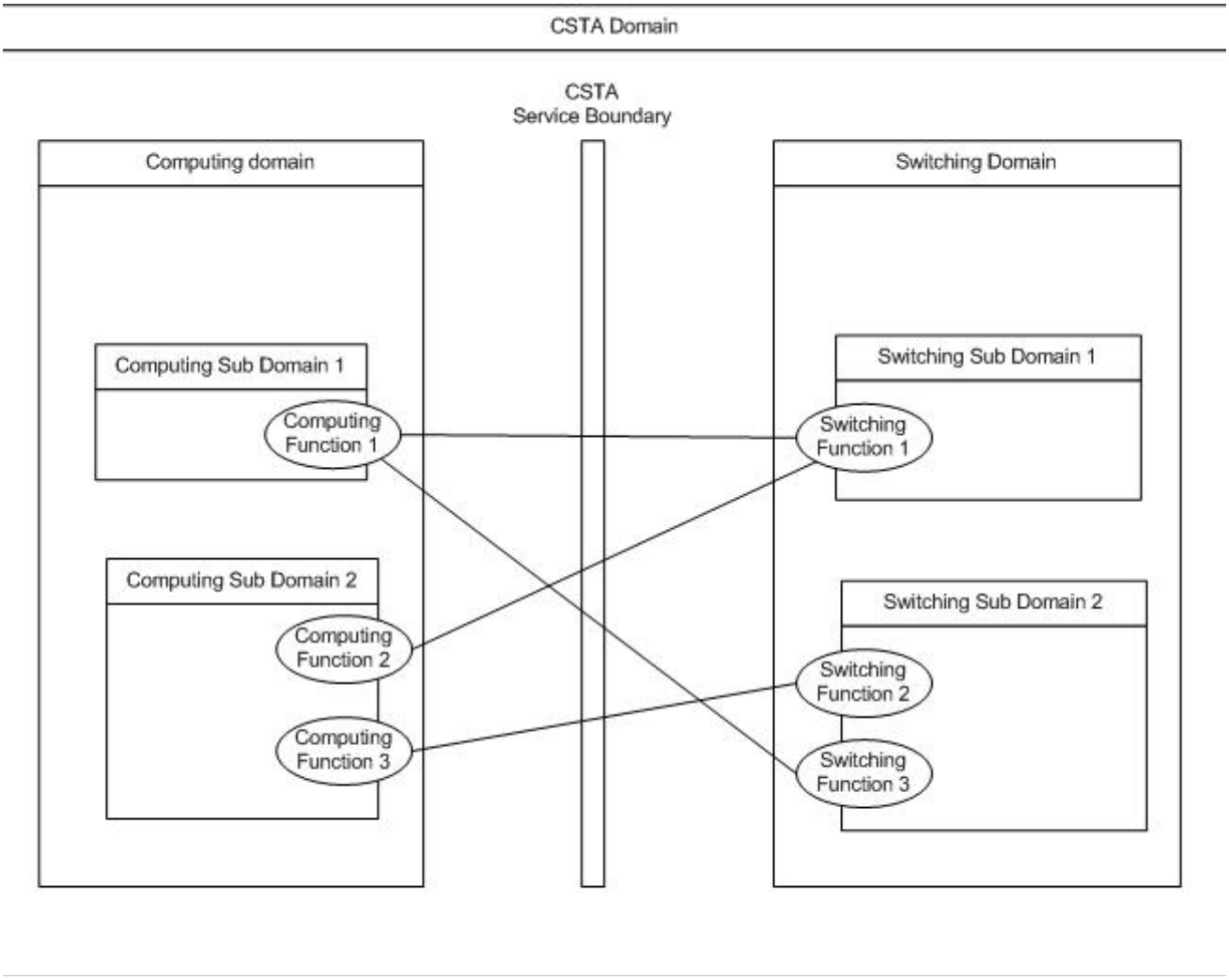
Figure 6-1 CSTA Operational Model



6.1 Switching Sub-Domain Model

The Switching Sub-Domain includes objects such as CSTA calls, devices and connections. A Switching Sub-Domain may have one or more Switching Functions.

The Switching Function provides an abstract view of the part of a switching sub-domain that an application can control and/or observe, called the Application Working Domain.

One Switching Function may provide different Application Working Domains based on considerations such as the application's design, licensing policy, security constraints, etc., and is under administration of the Switching Sub-Domain.

6.1.1 Device

CSTA enables manipulation and observation of devices that allow users to access telecommunications services.

NOTE It is not claimed that this International Standard alone supports ISDN (or any other) devices because, for example, of the additional information required to support such devices in PISNs. CSTA only provides a facility for passing ISDN (or other) specific information to allow, for example, a selection among ISDN devices sharing the same directory number (bearer capability, subaddress, etc.). Another example, that applies generally to telecommunications networks (including ISDN and OSI), is specifying the originator for a call that is established via CSTA. With the current signalling

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support, each party in a call can act only as a called party because the “network” is acting to originate the call. This situation has implications for both the network-to-terminal signalling and any application-level signalling that is significant to the calling party (e.g., issuing A_Associate).
Devices that are visible or controllable via CSTA are known as *CSTA Devices*.

CSTA Devices can be either physical devices (such as buttons, lines, trunks, and stations) or logical devices (such as groups of devices, pilot numbers, and automatic call distribution groups). CSTA Devices have attributes that allow CSTA to monitor and manipulate them. The attributes of any CSTA Device shall be:

1. **Device Type** - differing types of CSTA Device can be used for various purposes and can be manipulated and observed differently within CSTA. CSTA Device Types are listed and defined in 6.1.1.4, “Device Categories”.
2. **Media Characteristics** - CSTA devices have distinct capabilities and characteristics defined by their media features. CSTA represents these characteristics by the following attributes.
   - **Media Class:** A CSTA Device shall belong to at least one and may belong to more than one media class. The Media Class can be used in Call Control services to help select a device for a call or it can be used in call control events to report the media class associated with the call. The following media classes are defined in CSTA:
     - **Audio** - 3.1 KHz audio. Devices in this class are used to make audio calls excluding speech calls. It includes G3 FAX and facsimile machines.
     - **Data** - Devices in this class are used to make digital data calls (both circuit switched and packet switched). This class includes digital computer interfaces and G4 facsimile machines.
     - **Image** - Devices in this class are used to make digital data calls involving imaging, or high-speed, circuit-switched data in general. This class includes digital video telephones and CODECs.
     - **Voice** - Devices in this class are used to make speech calls. This class includes standard telephones.
     - **Chat** - Devices in this class support calls involving text-based messages that are exchanged between other devices in the call.
     - **Email** - Devices in this class can support receiving calls associated with electronic mail systems (i.e. a CSTA Call that represents an Email).
     - **Message** - Devices in this class support receiving and displaying messages such as Instant Messages (IM), Short Message Service (SMS), and Multi-Media Service (MMS) messages. The specific type is not provided.
     - **IM** (Instant Message) - Devices in this class support calls involving a text message. This is a non-interactive call (i.e. only one device involved with the call at one time). This is a specific type of Message media class associated with Instant Messaging systems.
     - **SMS** (Short Message Service) - Devices in this class support calls involving a text message. This is a non-interactive call (i.e. only one device involved with the call at one time). This is a specific type of Message media class associated with Short Message Services systems.
     - **MMS** (Multi-Media Message Service) - Devices in this class support calls involving a multi media text message. This is a non-interactive call (i.e. only one device involved with the call at one time). This is a specific type of Message media class associated with Multi-Media Message Services systems.
     - **Other** - A class comprising devices not in one of the above classes.
   - **Media Stream Information**: The media stream associated with a CSTA Device has attributes such as **Connection Rate**, **Bit Rate**, and **Delay Tolerance**. This information can be used in CSTA

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services to help select the media stream information for a call or to report the media stream information associated with an existing call.

- **Protocol Specific Information**: Many protocols provide additional information beyond what is standardized in CSTA to help distinguish devices. CSTA provides a mechanism where protocol specific information can be passed in CSTA messages to help select a specific device for a call or to provide additional information about the protocol specific information associated with the call. This information consists of:
  - The type of call control information elements (e.g. ISDN, SIP).
  - A character string that contains the protocol specific information elements. For example, in ISDN, the information may include Bearer Capability, Subaddress (for both calling and called devices), High Layer compatibility, and Low Layer compatibility as defined in ECMA-143. In another example when SIP protocols are used, the information may include the SIP header information as defined in IETF RFC 3261.

  Refer to 12.2.18, “MediaCallCharacteristics”, for a description of the Media Characteristics that are used in Call Control services to select devices for a call and in Call Control events to report the media Characteristics associated with the devices involved with the call.

3. **CSTA Device Identifier** - Each device that can be observed and/or manipulated shall be referenced across the CSTA Service Boundary. To accomplish this, each device shall be identified using a Device Identifier.
   - Throughout this standard, the term *Device Identifier* shall always mean CSTA *Device Identifier*.
   - Device Identifiers may be static or, only when used in the context of a connection identifier, dynamically-assigned.
   - A static Device Identifier shall be stable over time. It shall remain constant and unique between calls, associations and within both the switching and computing functions. An example of a static Device Identifier is an ITU-T Rec. E.164 Directory Number.
   - It may be useful for the Switching Function to convert a Device Identifier to another static form for use in service interactions. An example, it might be useful to transform a Public Directory Number into a Private Directory Number. This transformation allows service interactions to be independent of the identification mechanism and allows reduction in the amount of data exchanged. This shortened form of Device Identifier is known as a CSTA Short Form Device Identifier.
   - A static Device Identifier may be used in conjunction with “MediaCallCharacteristics”, as specified in 12.2.18, “MediaCallCharacteristics”, on page 130, in order to distinguish among CSTA Devices that share a Device Identifier.
   - A dynamically-assigned Device Identifier is temporary (lasting for the duration of a call) and may be created at any appropriate time. Once a CSTA Device has been included in a call, it may be desirable to continue to refer to the particular instance of the CSTA Device associated with this call for manipulation or tracking. A static Device Identifier may not always be sufficient because it may not be available or because it is too long and cumbersome for efficient use. In these cases the Switching Function can dynamically assign a Device Identifier as a device reference or handle for the duration of the call. Management of the dynamically-assigned Device Identifier is discussed in 6.1.6.
   - The **Device Identifier Status** indicates if an actual Device Identifier is being provided in a parameter or the reason why it is not being provided. The set of possible values for the Device Identifier Status is:
     - *Provided* - A Device Identifier is present.
     - *Not Known* - Indicates that the switching function cannot provide the Device Identifier but knows that the device exists.

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- *Not Required* - Indicates that the device is not relevant in this case.
- *Not Specified* - Indicates that the device cannot be specified.
- *Restricted* - Indicates that the device cannot be specified due to regulatory and/or privacy reasons.

- The parameter type associated with a particular Device Identifier determines how it is interpreted, restrictions on its use, and the Device Identifier Statuses that are applicable. These parameter types (AssociatedCalledDeviceID, AssociatedCallingDeviceID, CallingDeviceID, CalledDeviceID, DeviceID, RedirectionDeviceID, and SubjectDeviceID) are specified in 12.3, “Identifier Parameter Types”, on page 137.
- The format of a Device Identifier is specified in Clause 10, “CSTA Device Identifier Formats”.

4. **Device State** - A CSTA Device itself does not have a state or status directly associated with it. The elements, components and calls associated with the CSTA Device do have states and statuses associated with them. The following is the list of these states and statuses associated with a CSTA Device:

   - A connection state is the state of a CSTA Device’s logical element’s connection into a call. This state is associated with Call Control features/services. For more information on connection states, refer to Clause 6.1.3, “Connection”, beginning on page 49.
   - The status of the physical components associated with a physical element of a CSTA Device. (e.g., the hookswitch status). For more information, refer to Clause 21, “Physical Device Features”, beginning on page 414.
   - The status of the logical device features/services associated with a logical element of a CSTA Device. (e.g., the forwarding and do not disturb status). For more information, refer to Clause 22, “Logical Device Features”, beginning on page 460.

5. **Device Elements** - A CSTA Device represents various types of telephony endpoints in a switching sub-domain and allows access to telephony services. A CSTA Device can range from a single endpoint (e.g., station) to a set of associated endpoints that form a group. Each CSTA Device is represented by its attributes (e.g., identifier, state(s), type) as well as its features/services. These attributes/features/services are grouped into two categories which are referred to as *device elements*. A device element encompasses the control and observation of a specific set of CSTA Device attributes/features/services. The device elements are: *physical element* and *logical element*.

   The logical element of a CSTA Device encompasses the set of attributes/features/services (e.g., Make Call, Set Forward) that have any association with the control and observation of a call at a CSTA Device (i.e., connection). The physical element of a CSTA Device encompasses the set of attributes/feature/services that have any association with physical components of the CSTA Device that would potentially make up the user interface of the device.

   All addressable (i.e., has a single identifier) CSTA Devices consist of one of the following device element combinations.

Figure 6-2 Logical Element Only

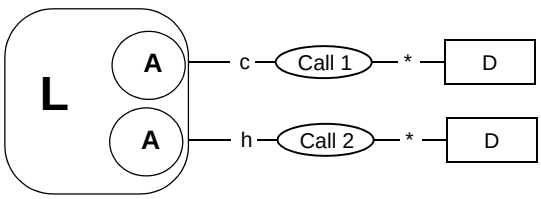

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Figure 6-3 Physical Element Only

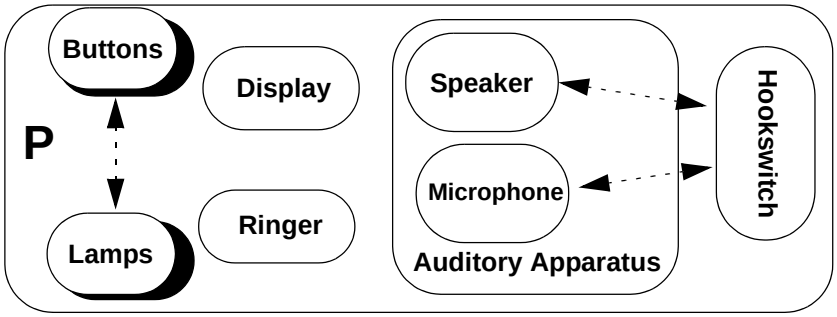
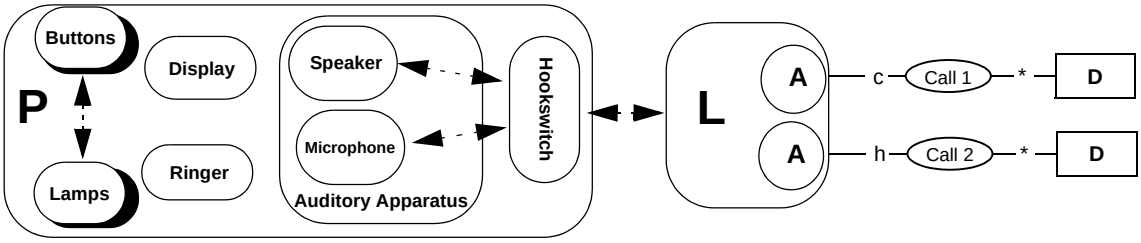


Figure 6-4 A Logical and Physical Element



D	represents another device
P	represents the identifiers for the physical elements
L	represents the identifiers for the logical elements
A	represents an appearance of a logical element

indicates that there is an interaction and/or association between the elements or components of an element.

For example, a “plain old telephone set” (POTS) consists of a logical and physical element. A computing function learns about the devices, their elements, and their associated attributes\features\services in a switching sub-domain by using the capabilities exchange services (refer to 13.1 beginning on page 149). The following sections describes the device elements and the device attributes/features/services that are associated with the elements in detail.

6.1.1.1 Physical Element

The physical element represents the attributes of the physical components and their associated features/ services that make up the user interface of a device (e.g., the components of a telephone set). A physical component at a CSTA Device can be a piece of hardware or a virtual (e.g., software) representation of a piece of hardware. For example, a set of buttons on a device (i.e., physical components of the device) could be comprised of a piece of hardware with 12 buttons and a switching function software representation of 12 more be tons. As a reselt, the device has a set of 24 buttons associated with its physical element.

The combinations of physical components associated with the physical element are switching function specific. The following features/services are controlled and observed through the physical element:

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- The Physical Device features/services, such as Button Press, Get/Set Hookswitch Status, and Get/Set Speaker Volume.
- The I/O Services such as Start Data Path and Send Data (when applied to the physical element of a device).

Note that these features/services also include the associated events and monitoring of these events.

The physical element of a device is observed and/or controlled within the switching function through an assigned Device Identifier.

Note that if the device is a combination of logical and physical elements, the assigned Device Identifier is the same for both elements.

In order for the physical components to interact or be associated with calls at the device, the device shall have a logical device element (for more details, see 6.1.1.2, “Logical Element”) and/or some association(s) with a logical element(s) from another device(s) (for more details, see 6.1.1.3, “Device Configurations”). The physical components interact with calls through these logical device element(s) but it is device and switching function specific as to how these components actually interact and are associated with the calls.

The following sections describe the physical components that can be associated with the physical element of the device. All physical components shall be controlled and observed in conjunction with the physical element (i.e., associated with the physical element’s Device Identifier).

6.1.1.1.1 Auditory Apparatus

An auditory apparatus is a component which is used to convert electronic signals into voice/speech (i.e., a speaker) and/or convert voice/speech into electronic signals (i.e., a microphone) but at a minimum shall have either a speaker or a microphone. A physical element can have several auditory apparatuses associated with it. Each auditory apparatus can be used independent of each other. An auditory apparatus has several attributes which can be controlled and observed by a computing function. The following are those attributes:

1. *Auditory Apparatus type* - There are several types of auditory apparatuses. Each type representing a different physical configuration and/or function. The following is the list of auditory apparatus types:
    a. *Handset* - An auditory apparatus that is held in a person’s hand and contains a microphone and speaker.
    b. *Headset* - An auditory apparatus that is worn on a person’s head and contains a microphone and speaker.
    c. *Speakerphone* - An auditory apparatus that does not require a person’s body to come into contact with the apparatus and contains a microphone and speaker.
    d. *Speaker-only phone* - A Speakerphone without a microphone.
    e. *Microphone-only*- A type that provides only a microphone.
    f. *Other* - An auditory apparatus that is unique to the given switching function.
2. *Auditory Apparatus Identifier* - Each auditory apparatus that can be observed and/or controlled within the switching function is referenced using an assigned identifier. The auditory apparatus identifiers associated with a given physical element’s Device Identifier are unique.This identifier is used to control and observe all auditory apparatus attributes except the hookswitch which is associated with the apparatus.
3. *Microphone* - The auditory apparatus may or may not have a microphone. If a microphone is present at the auditory apparatus, then there are two features of the microphone that may or may not be controlled (i.e., settable) and observed (i.e., readable).
    a. *Gain* - This is the level at which the microphone is generating the electronic signal. For more details, refer to the definition of the microphoneGainValue parameter in associated services and events.

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b. *Mute* - This is the capability to temporarily disable the microphone. For more details, refer to the definition of the microphoneMute parameter in associated services and events.

Both of these features are controlled and observed using the auditory apparatus identifier.

4. *Speaker* - The auditory apparatus may or may not have a speaker. If a speaker is present at the auditory apparatus, then there are two features of the speaker that may or may not be controlled (i.e., settable) and observed (i.e., readable).

   a. *Volume* - This is the level at which the speaker is boosting the electronic signal when generating the associated voice sound waves. For more details, refer to the definition of the speakerVolumeValue parameter in associated services and events.

   b. *Mute* - This is the capability to temporarily disable the speaker. For more details, refer to the definition of the speakerMute parameter in associated services and events.

   Both of these features are control and observed using the auditory apparatus identifier.

5. *Hookswitch association* - This identifies the particular hookswitch that is used to activate (i.e., put into use) and deactivate (i.e., remove from use) the auditory apparatus. It also indicates, if the particular hookswitch can be controlled (i.e., settable) and observed. For more details on hookswitches, refer to associated services and events.

6.1.1.1.2 Hookswitch

A hookswitch is a component which is used to activate (i.e., put into use or off-hook) or deactivate (i.e., remove from use or on-hook) an auditory apparatus(es). When a hookswitch is off-hook, it enables the auditory apparatus(es) to transmit and receive the electronic signals associated with sound, and when it is on-hook, this capability is disabled. A physical element can have several hookswitches associated with it. Each hookswitch can be used independently of each other. A hookswitch has one attribute which can be controlled and observed by a computing function. This attribute is the hookswitch identifier. This identifier is assigned by the switching function. The hookswitch identifiers associated with a given physical element's Device Identifier are unique. This identifier is used to control and observe the status of the particular hookswitch (i.e., on-hook, off-hook).

6.1.1.1.3 Button

A button is a component which executes a specific feature/service that is assigned to it. The most common implementation of this component, is a piece of hardware that is pressed and released, thereby executing the feature/service assigned to it (e.g., each of the number buttons on a station). However, an implementation can use any component that can produce a similar behaviour. A button can also have the capability of toggling between two settings of a feature/service (e.g., enabling and disabling Do Not Disturb, that is you press the button once, it enables the Do Not Disturb feature/service, and press again, it disables the feature/service). The button can also have the capability of looping through a series of features/services. Almost any feature/service or set of features/services can be assigned to a button, but generally a switching function makes visible buttons only with features/services that are not available through the components/attributes/features/services defined in this Standard. A button can also be used to represent another physical component (e.g., a hookswitch). A physical element can have many buttons associated with it. Each button can be used independently of each other. A button has the following attributes which can be controlled and observed by the computing function:

1. *Button Identifier* - Each button that can be observed and/or controlled within the switching function is referenced using an assigned identifier. The button identifiers associated with a given physical element's Device Identifier are unique. This identifier is used to control and observe all other button attributes.

2. *Button Label* - This is a label by which people interacting with the physical device refer to a given button. This label is a character string which is retained by the switching function. This attribute can also be changed (if supported) by the computing function. The meaning of a Button Label is specific to the users of a particular device and changing it does not change the function of the button.

3. *Button Function* - This is a feature which can be assigned by the switching function to describe the function associated with a given button. The switching function may reassign the functionality of a button

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and change this attribute as required (in response to other button presses, for example) but it may not be changed directly by the computing function.

4. *Button Associated Number* - This is a diallable digits format Device Identifier which is associated with the feature/service assigned to the button. This Device Identifier is used by the feature/service when it is executed by the button being pressed. This attribute is optional and only applies to buttons that have some form of associated number. This Device Identifier is initially assigned by the switching function and can be changed (if supported) at any time by either the switching or computing function.
5. *Button Press Indicator* - This indicates if the button can be pressed via the Button Press service.

6.1.1.1.4 Lamp

A lamp is a component that represents (i.e., indicates), for example, the status of, for example, a feature/service, physical component, logical device element or other CSTA device. The most common implementation of this component is a piece of hardware that emits light. However, an implementation can use any component that can produce a similar behaviour (e.g,. an icon presented on a display). A physical element can have many lamps associated with it. Each lamp can be used independently of each other. A lamp has several attributes which can be controlled and observed by the computing function. The following are those attributes:

1. *Lamp Identifier* - Each lamp that can be observed and/or controlled within the switching function is referenced using an assigned identifier. The lamp identifiers associated with a given physical element's Device Identifier are unique.This identifier is used to control and observe all other lamp attributes.
2. *Lamp Label* - This is a character string which is assigned by the switching function to describe the feature or service's status associated with this lamp. This attribute cannot be changed by the computing function.The meaning of the Lamp Label attribute is switching function specific.
3. *Lamp Mode* - This is the output of the lamp which is used to indicate the status of the (feature/service) or physical component. The output values are represented by the various ways light can be produced from a lamp. This output can be changed at any time by either the switching or computing function. For more details, refer to definition of the lampMode parameter.
4. *Lamp Brightness* - This attribute indicates the visible brightness of the lamp when it is on. This attribute can be changed by the switching function or by the computing function. For more details, refer to the definition of the lampBrightness parameter.
5. *Lamp Color* - This attribute is an additional characteristic of the lamp which helps distinguish it from other lamps. This attribute can only be changed by the switching function. For more details, refer to the definition of the lampColor parameter.
6. *Button Association* - This identifies a button that is associated with the lamp. The lamp can be used to represent either the status of the feature/service associated with the button or to represent the status of the toggle sequence.

6.1.1.1.5 Ringer

A *ringer* is a component associated with the physical element that provides indication that a device is being rung. There may be one or more ringers associated with a device.

A ringer has attributes that can be controlled and observed by a computing function. The following is a list of those attributes:

1. *Ringer Identifier* - Each ringer that can be observed and/or controlled within the switching function is referenced using an assigned identifier. The ringer identifiers associated with a given physical element's Device Identifier are unique. This identifier is used to control and observe all ringer attributes associated with the device.

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2. *Ring Mode* - This attribute describes if the ringer is engaged in a ringing cycle. It will remain *ringing* for the entire ringing cycle (e.g. across consecutive instances of a ringing pattern). Typically only one ringer on a physical element can be rung at one time.
3. *Ring Count* - This attribute describes the number of ring cycles (instances of ring pattern) that the ringer has completed. This attribute is set to 0 immediately before the first ring cycle starts. Note that this is used to query the most recent ring count even after ringing has ceased.
4. *Ring Pattern* - This attribute describes the type of Ring Pattern associated with a ringer. Each individual Ring Pattern cycle may consist of zero or more periods of audible ringing followed by a silent phase. The Ring pattern may be used to help audibly distinguish the types of calls at a device or to uniquely identify a ringer. The meaning of the Ring Pattern is switching function specific.
5. *Ring Volume* - This is the level at which the ringer is set to ring. This information is associated with the ringer until it is reset by the switching function or until it is changed via the Set Ringer Status service.

6.1.1.1.6 Display

A *display* is a component which presents a two dimensional array of characters associated with the physical element. A physical element can have several displays. A display may be real or virtual; that is it may or may not actually be present on the physical device itself. Displays have eight attributes as visualized in Figure 6-5, “Display Attributes”:

1. Display Identifier - To identify a specific display on a physical device.
2. *Logical Rows* - The number of rows on the logical display.
3. *Logical Columns* - The number of columns on the logical display.
4. *Physical Rows* - The number of rows on the physical display. This number is always smaller or equal to *Logical Rows*.
5. *Physical Columns* - The number of columns on the physical display. This number is always smaller or equal to *Logical Columns*.
6. *Physical Base* - The location of the first character of the physical display expressed as (LogicalRowNbr,LogicalColumnNbr) and identified in Figure 6-5 as (**pbr,pbc**). Note that the top-left most position in the logical display is defined as (**0,0**).
7. *Character Set* - Normally ASCII, but may be also be Unicode or a proprietary character set used by the switching function. This attribute is fixed for a given display.
8. *Contents* - A character string which represents the contents of the logical display. Spaces are always present so the size of this string is always the product of the number of logical rows and logical columns. The *contents* can be observed and/or set (if supported) by the computing function. When setting the value of the *Contents*, an offset (starting point in logical display) and a length field (number of characters to be set) shall be given).

The following figure visualizes these attributes further:

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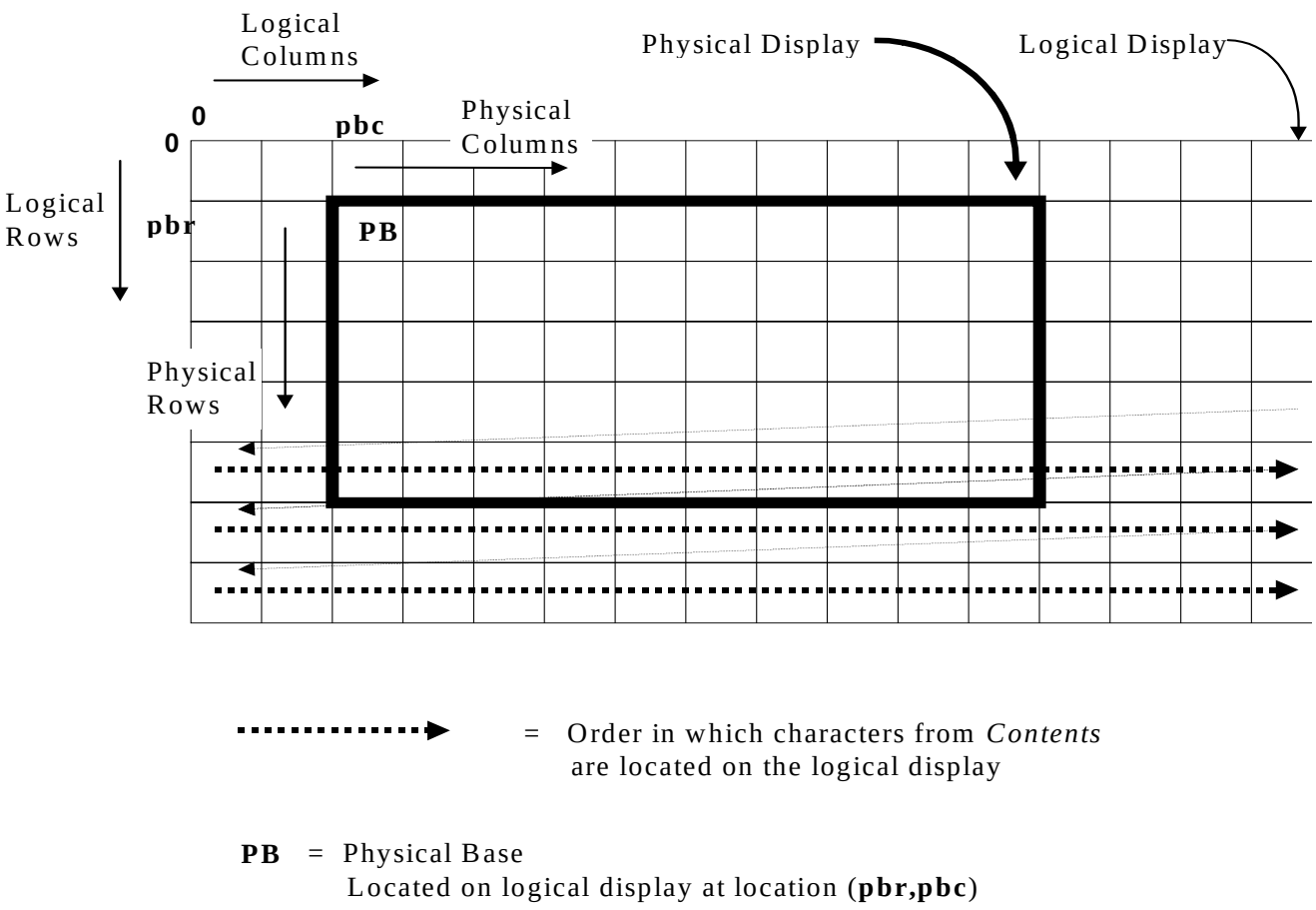
Figure 6-5 Display Attributes



6.1.1.2 Logical Element

A logical element is the part of a device that is used to manage and interact with calls at a device. This element represents the isochronous media stream channels (e.g., ISDN bearer channels) and associated call handling facilities that are used by the device when involved in a call (i.e.,via a connection). If a device also has a physical element, the logical element may interact with the physical element's components in order to convey call information (e.g., via lamps) to the user of the device, to provide/manage the media stream data of the call (e.g., via an auditory apparatus) for the user of the device, and to allow the user of the device to manage the calls (e.g., via buttons). The implementation of this interaction is device and switching function specific. The following are the call and call-related features/services that are controlled and observed through the logical element itself:

- Logical Device features/services which are used to indirectly control calls at the device such as Get/Set Forwarding, Get/Set Do Not Disturb and Get/Set Auto Answer.

Note that these features/services also include the associated events and monitoring of these events.

The logical element of a device is observed and/or controlled within the switching function through an assigned Device Identifier.

Note that if the device is a combination of logical and physical elements, the assigned Device Identifier is the same for both elements.

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The following sections describe the attributes and components of the logical element. These attributes/ component shall be controlled and observed in conjunction with the logical element (i.e., associated with the logical element's Device Identifier).

6.1.1.2.1 Appearance

An appearance is a receptor which is used to connect with at most a single call at the device. A logical element consists of one or more appearances. Appearances are also sometimes called *call appearances*. The number of appearances that a logical element can have is switching function and device specific. Changes in the number of addressable appearances for a logical element are reflected by the capabilities exchange services (13.1 beginning on page 149). Each appearance can be used independently. The following are the call and call-related features/services that are controlled and observed through an appearance for a particular call:

- Call Control features/services such as Make Call, Deflect Call, Answer Call.
- Call Associated features/services such as Associate Data, Generate DTMF, Generate Telephony Tones.
- Routeing Services such as Route Request, Route Select and Route End.
- Media Stream Access such as Attach Media Service, and Detach Media Service.
- I/O Services such as Start Data Path and Send Data (when applied to logical elements of a device.)

Note that these features/services also include the associated events and monitoring of these events.

An appearance has several attributes. The following are those attributes:

1. *Addressability* - The addressability of an appearance refers to whether or not the switching function is explicitly representing the appearance to the computing function.
   a. *Addressable* - An appearance is addressable if it can be explicitly referenced by the computing function at any time with or without the involvement in a call, through a CSTA static device identifier. Refer to Clause 10, "CSTA Device Identifier Formats" for a description of how addressable appearances are referenced.
   b. *Non-addressable* - An appearance is non-addressable if it can only be referenced, when it is involved with a call, through a CSTA connection identifier. In this case, the logical element dynamically creates and destroys appearances based on the call activity, call capabilities, and features/services of the device. Once the appearance is created (i.e., associated with a call), the corresponding Connection Identifier shall be used to control and observe the appearance. For example, when a call is presented to the device, the logical element creates an appearance to handle the call.
2. *Appearance Type* - The type of appearance is based on its relationship with other devices. The type of appearance determines the functionality and behaviour associated with the logical element of the device. There are two types of appearances: Standard and Bridged Appearances.

Refer to Annex A for a complete description of the types of appearances and their associated behaviour.

6.1.1.3 Device Configurations

A *device configuration* describes the arrangement of the various elements and appearances that can be directly associated with a given device. Multiple device configurations may be formed from the possible combinations of physical elements, logical elements, and different appearance types.

Device configurations are described in terms of a specific device configuration for a particular device:

1. *Device's element combination* - This indicates whether the device has a physical element only, a logical element only or both a logical and physical element.
2. *Other devices using the physical element* - This indicates the list of devices (i.e., their logical elements) that are using the physical element of the base device.

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3. *Other devices using the logical element* - This indicates the list of devices (i.e., their physical elements) that are using the logical element of the base device.
4. *The logical element's appearance addressability* - This is an attribute of the appearances of the logical element of the base device (if the logical element is present).
5. *The logical element's appearance type* - This is an attribute of the appearances of the logical element of the base device (if the logical element is present).
6. *The number of appearances associated with the logical element* - This is an attribute of the logical element of the base device (if the logical element is present).

As a set, these attributes describe the device configuration for a specific device. The following sections illustrate typical examples of device configurations that can exist in a switching sub-domain.

Note that in the following examples, where physical and logical elements form part of the same device, the application of a suffix number to the identifying letter identifies that they are parts of the same device (e.g. L1, P1 are a single device; L1, P2 are elements from different devices).

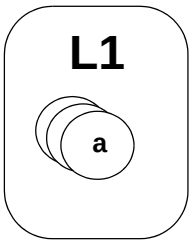
6.1.1.3.1 Logical Element Only

This device configuration has only one logical element (e.g., some Park devices). The following identify the attributes of this device configuration:

- *Device's element combination* - logical element only (L1)
- *Other devices using the physical element* - None
- *Other devices using the logical element* - None
- *The logical element's appearance addressability* - Non-addressable
- *The logical element's appearance type* - Selected-standard
- *The number of appearances associated with the logical element* - unlimited (switching function based limits)

Figure 6-6 is a diagram of a logical element only device configuration.

Figure 6-6 Logical Element Only Device Configuration



6.1.1.3.2 Single Physical and Logical Element

A *Single Physical and Logical Element* device configuration consists of a single physical element of the device associated with a single logical element of the device that contains non-addressable standard appearances. This device configuration could be used to model a basic telephone station device (e.g., a Plain Old Telephone Service (POTS) telephone or a featured telephone). The following identify the attributes of this device configuration:

- *Device's element combination* - both a logical and physical element (L1/P1)
- *Other devices using the physical element* - None
- *Other devices using the logical element* - None

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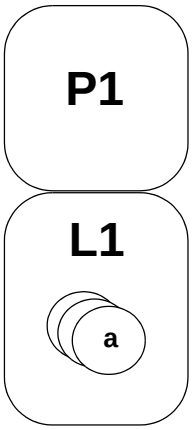
- *The logical element's appearance addressability* - Non-addressable
- *The logical element's appearance type* - Selected-standard
- *The number of appearances associated with the logical element* - unlimited (switching function based limits)

Figure 6-7 is a diagram of this device configuration.

Figure 6-7 Single Physical and Logical Element Device Configuration (One Device)



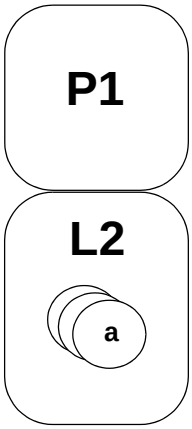
In this figure, the labels "L" and "P" represent the logical and physical elements of the device respectively.

Another variation of the single logical and physical element device configuration involves two different devices - one with a logical element only and one with a physical element only - that are associated with each other. From the perspective of the physical device element P1, the device configuration in this example can be represented as follows:

- *Device's element combination* - physical element only (P1)
- *Other devices using the physical element* - one device (L2)
- *Other devices using the logical element* - None
- *The logical element's appearance addressability* - N/A
- *The logical element's appearance type* - N/A
- *The number of appearances associated with the logical element* - N/A

Figure 6-8 is a diagram of this device configuration.

Figure 6-8 Single Physical and Logical Device Configuration (two devices)



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6.1.1.3.3 Multiple Logical Elements

A *multiple logical elements* device configuration consists of a single physical element associated with multiple logical elements containing standard appearances. A multi-line telephone station could be modeled using this device configuration. The following identify the attributes of this device configuration:

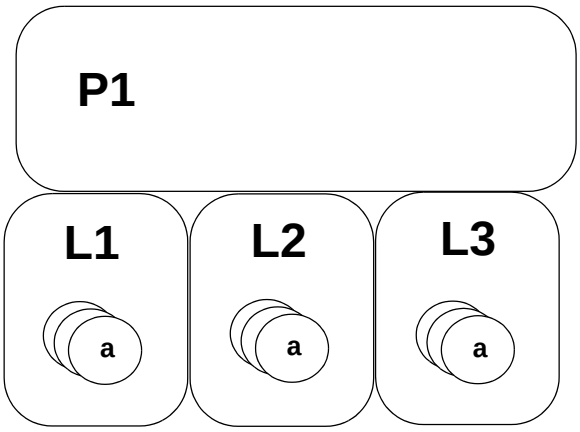
- *Device's element combination* - physical and logical element combination (L1/P1)
- *Other devices using the physical element* - two devices (L2,L3)
- *Other devices using the logical element* - None
- *The logical element's appearance addressability* - non-addressable
- *The logical element's appearance type* - Selected-standard
- *The number of appearances associated with the logical element* - unlimited (switching function based limits)

None of the logical elements in this device configuration need to be part of the same device as the physical element.

Multiple logical elements device configuration represents a single physical element (a telephone set) in a telephone system that supports only one appearance per logical element but has access to multiple calls simultaneously.

Figure 6-9 is a diagram of a multiple logical elements device configuration.

Figure 6-9 Multiple Logical Elements Device Configuration



6.1.1.3.4 Multiple Appearance

A *multiple appearance* device configuration consists of single physical element and a single logical element containing two or more addressable appearances. Multiple appearance device configurations are another way to represent a single telephone set that has access to multiple calls simultaneously. This approach could be used in a telephone system that supports addressable standard appearances. This device configuration is sometimes called a *call appearance station*. The following identify the attributes of this device configuration:

- *Device's element combination* - physical and logical element combination (L1/P1)
- *Other devices using the physical element* - None
- *Other devices using the logical element* - None
- *The logical element's appearance addressability* - addressable
- *The logical element's appearance type* - Selected-standard

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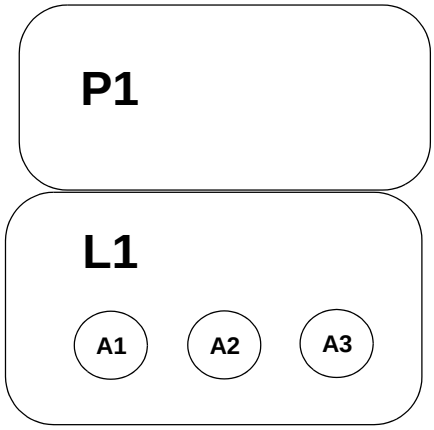
- *The number of appearances associated with the logical element* - 3 (A1, A2, A3)

Figure 6-10 is a diagram of a Multiple Appearance Device Configuration.

Figure 6-10 Multiple Appearance Device Configuration



6.1.1.3.5 Bridged

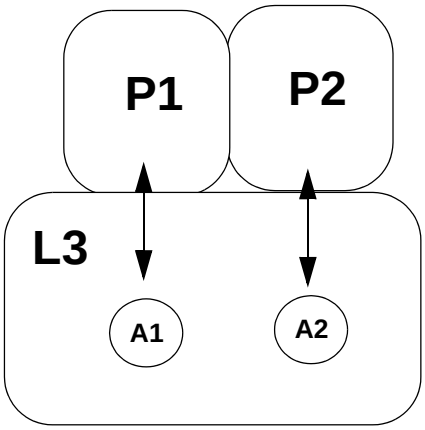
A *bridged* device configuration involves bridged appearances. The characteristics of a bridged device configuration depends upon whether the device configuration is for a physical or logical element.

In the example presented in Figure 6-11, the device configuration shown is for logical element L3 which has bridged appearances. The following identify the attributes of this device configuration:

- *Device's element combination* - logical element only (L3)
- *Other devices using the physical element* - None
- *Other devices using the logical element* - two devices (P1,P2)
- *The logical element's appearance addressability* - addressable
- *The logical element's appearance type* - Independent-shared-bridged
- *The number of appearances associated with the logical element* - 2 (A1 for P1 and A2 for P2)

Figure 6-11 is a diagram of a Bridged Device Configuration.

Figure 6-11 Bridged Device Configuration



The device configuration for the physical element P1 in this example, is shown in Figure 6-12. In P1's device configuration there are only two device elements rather than three; one is the physical element (P1) and one is

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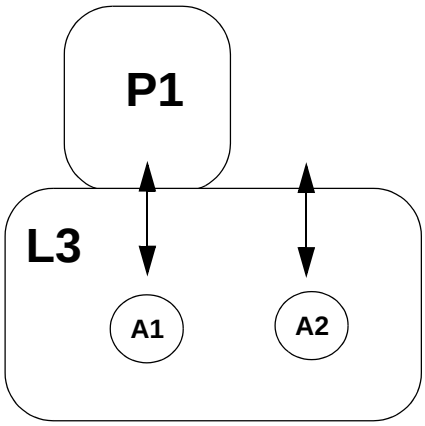
the logical element which has two addressable bridged appearances. The following identify the attributes of this device configuration:

- *Device's element combination* - physical element only (P1)
- *Other devices using the physical element* - one device (L3 using appearance A1)
- *Other devices using the logical element* - None
- *The logical element's appearance addressability* - N/A
- *The logical element's appearance type* - N/A
- *The number of appearances associated with the logical element* - N/A

Figure 6-12 is a diagram of a Bridged Device Configuration.

Figure 6-12 Bridged Device Configuration



6.1.1.3.6 Hybrid

A physical element associated with multiple logical elements that each have different types of appearances has a *hybrid* device configuration.

An arbitrary example of a hybrid device configuration is shown in Figure 6-13. This example consists of one physical element and three logical elements.

- device 1 has both a physical element (P1) and a logical element (L1) containing two addressable standard appearances
- device 2 has only a logical element (L2) with non-addressable standard appearances
- device 3 has only a logical element (L3) with three addressable bridged appearances

The following identify the attributes of this device configuration:

- *Device's element combination* - logical and physical element (L1/P1)
- *Other devices using the physical element* - two devices (L2, L3 using appearances A1 andA2)
- *Other devices using the logical element* - None
- *The logical element's appearance addressability* - addressable
- *The logical element's appearance type* - Selected-standard
- *The number of appearances associated with the logical element* - 3 (A1, A2, A3)

Figure 6-13 is a diagram of a Hybrid Device Configuration.

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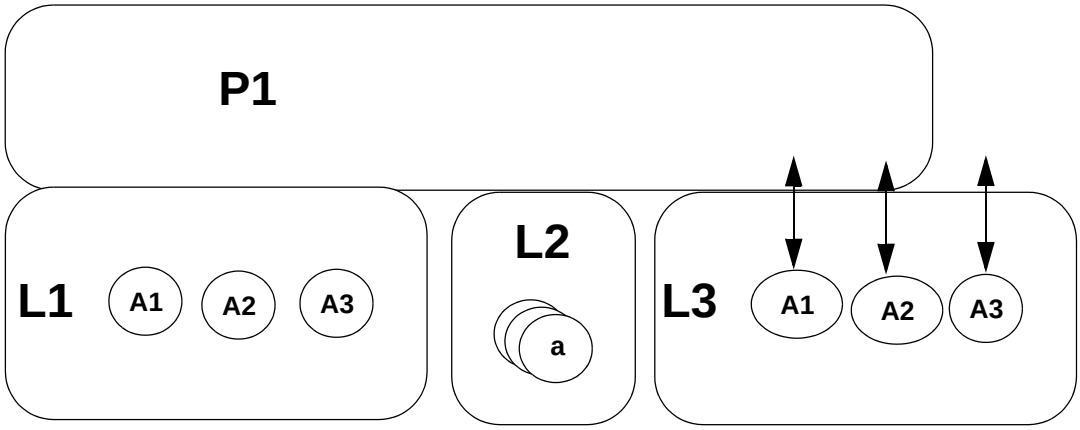
Figure 6-13 Hybrid Device Configuration



6.1.1.4 Device Categories

The device category of a particular device provides a generic indication of the device's behaviour and configuration. The computing function should use the device category along with other information provided by the capabilities exchange services to model a given device.

6.1.1.4.1 Station Device Category

This category of device can range from a basic "Plain Old Telephone Set" (POTS) device to a very complex feature telephone device. Station devices can be represented by any single device configuration type, or more commonly, as a hybrid of two or more different device configuration types. The physical component, if present, may have any combination of components. The logical element(s) may have any number of appearances appropriate for the type of device configuration.

6.1.1.4.2 Network Interface Device Category

A *Network Interface Device* is a category of device which is within the switching sub-domain and is connected to another telephone network.

A given switching sub-domain is connected to another telephone network(s) (which may or may not be thought of as other switching sub-domains) through one or more Network Interface Devices.

To indicate when a given call involves a Network Interface Device and an external device, the switching function provides a Network Reached event to the computing function specifying what Network Interface device is being used (if known), and what subsequent call-related information is subject to the capabilities of the network being used.

The following are examples which illustrate the use of Network Interface Devices.

In Figure 6-14, the switching sub-domain is centered on a PBX. The Network Interface Devices are distinct devices and are commonly referred to as "trunks."

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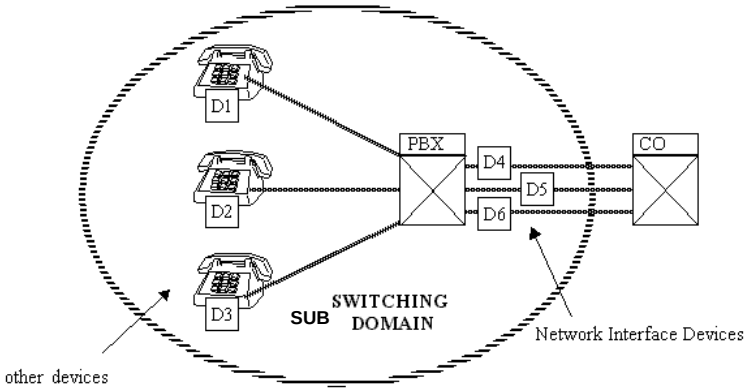
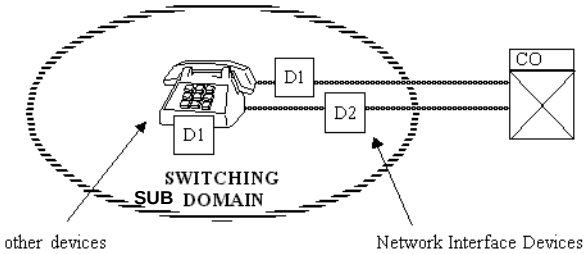
Figure 6-14 Trunks As Network Interface Devices



In Figure 6-15, the switching sub-domain is an individual telephone station connected directly to the public telephone network. In this example, the two Network Interface Devices represent two Central Office lines.

Figure 6-15 Central Office Lines As Network Interface Devices



6.1.1.4.3 ACD Device Category

An ACD (Automatic Call Distributor) is a device that distributes calls. An ACD device only consists of the distribution mechanism and may be associated with the devices to which the mechanism distributes calls.

A dynamic process, *Agent Log On* allows an association between an ACD device and a distributed-to device to be created, removed and changed at anytime. Refer to 6.1.1.6, “Agent”, on page 38 for a description of Agent and the Agent Log On Process.

An ACD device is represented as a logical element only device configuration. When a call is presented to an ACD device, a connection in the entering distribution mode of the alerting state is created. Calls that are presented to the ACD device may be queued before they are distributed. The conditions under which the call is queued are switching function specific. Many calls can be simultaneously enqueued, pending their distribution. The ACD device can, for example:

- distribute a call to an agent that had logged on to the ACD device
- distribute a call to an agent that had logged on to an ACD Group
- distribute a call to another ACD device (as well as any other type of internal or external device)
- queue a call to an ACD Group, or to resources that provide message playing, message prompting, voice response interaction, etc.

There are two ACD device models - visible ACD-related devices and non-visible ACD-related devices (note that an ACD device can support one or both models):

- *Visible ACD-Related Devices* - In this model, the ACD device, and the devices (e.g., voice announcement units, devices the call may queue to, other ACD devices, ACD groups, etc.) that can interact with the ACD

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device while the call is being handled by the ACD device, can be monitored/ controlled and are represented uniquely by the switching function with their own connection when associated with a call.

- *Non-Visible ACD-Related Devices* - In this model, the ACD device, and the devices (e.g., voice announcement units, devices the call may queue to, other ACD devices, ACD groups) that can interact with the ACD device while the call is being handled by the ACD device, are represented by the switching function using a single connection at the ACD device. Neither these devices, which interact with the ACD device, nor their connections to calls queued at the ACD device can be monitored or controlled. Note that when a single connection is used in this manner, all relationships between the call and the ACD device are terminated when the call is no longer part of the ACD device (diverted from the device, for example).

6.1.1.4.4 Park Device Category

A *park* device category is a device that is exclusively used by the switching function to park calls on behalf of other devices in the switching sub-domain. These calls, once parked, may be retrieved by a device in the switching sub-domain. The number of calls that can be parked at one of these devices is switching function specific. These devices can be represented by either a single physical and logical elements device configuration or a logical element only device configuration. The visibility of these devices within the switching sub-domain is switching function specific.

Note that calls may be parked at devices other than a Park device.

6.1.1.4.5 Group Device Category

A *group* device models a relationship between CSTA devices that is characterized by the fact that these devices share a common device identifier. This relationship can be permanent or temporary. The group model differs from the bridged appearances model in that the relationship is between devices' logical elements while for bridged appearances the relationship is between a logical element and a physical element.

The group device has a logical element that has relationships with the logical elements of the devices that are members of this group. The group device is referenced by the group device identifier.

A group device may have a distribution mechanism. The distribution mechanism may support queuing. When a group device has a distribution mechanism, the group device identifier represents both the distribution mechanism and the member devices.

Group Device Attributes

The attributes of a group device are (a group device may have more than one of these attributes (e.g., a hunt and pick group device):

- Hunt - The hunt attribute characterizes a group device (also called hunt group) that has the capability to distribute calls to the member devices according to different selection modes (e.g., cyclical, sequential, longest idle time). The association between the group device and the member devices is always fixed by the switching function. A hunt group may have the capability to queue these calls before they are distributed.
- Pick - The pick attribute characterizes a group device (also called pick group) that represents a collection of devices that can be used with the Group Pickup Call service. When a call is delivered to a device in the pick group, other devices in the group can be used to answer the particular call (i.e., picking the call). When the call is picked, it is diverted from the originally delivered device and connected to the device which picked the call. The details associated with the pick group feature are documented in the Group Pickup Call service. Only devices associated with the pick group device can pick a call from the given group unless the pick group device is addressable within the switching sub-domain and the pick group device is configured to allow devices outside the group to pick calls. The addressability of the pick device within the switching sub-domain is switching function specific. If the pick group device is addressable, its Device Identifier can only be used in conjunction with the Group Pickup Call service (i.e. the computing

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function has limited control and can not observe the pick group device). The number of devices that are associated with the pick group device is switching function and device specific. The association between the pick group device and the other devices is not visible within the switching sub-domain (i.e., does not have an explicit representation). The association between the pick group device and the other devices is fixed by the switching function. Changes in the number of devices associated with the pick group device are reflected by the capabilities exchange services.

- ACD - The ACD attribute characterizes a group device (also called an ACD group) that has a distribution mechanism similar to a hunt group. In addition, this group device represents an explicit association between the distribution mechanism (the ACD) and the distributed-to-devices. A dynamic process, *Agent Log On* allows an association between an ACD group and the distributed-to devices to be created, removed and changed at anytime. Refer to 6.1.1.6, “Agent”, on page 38 for a description of Agent and the Agent Log On Process.
- User - The User attribute characterizes a group device whose member devices are associated with a user. The association between the group device and the member devices can be fixed (e.g., through provisioning) or can be dynamic (e.g. SIP registration procedures).
- Agent - The Agent attribute characterizes a group device whose member devices are associated with a user via the log in procedures described in 6.1.1.6, “Agent”, on page 38.
- Other - The Other attribute characterizes a group device whose characteristics are switching function-dependent.

Group Device and Monitoring

Monitoring of a group device in which the group device includes a distribution mechanism may follow either the *group inclusive* or the *group exclusive* model. The switching function may support either model, or both models simultaneously (with individual group devices supporting either the inclusive or exclusive model). The model(s) supported by a switching function is indicated by the Get Switching Function Capabilities service.

In the group inclusive model, the scope of a monitor on the group device includes the distribution mechanism and all member devices. In the group exclusive model, the scope of the monitor on the group device includes only the distribution mechanism.

The events reported to the monitor of a group device are the same as those reported to monitors of the individual member devices, with the following exceptions:

- A single Monitor Start service request is set on the group device identifier.
- The events for the member devices, if they are in the scope of the monitor, are reported with the cross reference identifier of the monitor set on the group device.
- When an incoming call is received, the called device represents the group device and the subject device (e.g., alerting device) represents the member device.

In addition, if the group device supports a distribution mechanism, all events reported for the call when it is present at the distribution mechanism (e.g., queued), are reported with a connection identifier consisting of the call identifier and the group device identifier. When the call leaves the distribution mechanism to be delivered to a member device, a Diverted event is generated.

Some services applied to the group device are applied to all member devices of the group device (e.g., Set Agent State). This capability is indicated by the capabilities exchange services.

Monitoring a User

A user can be represented as a user group device. When a user group device is monitored all members of the user group device are included in the scope of the monitor (group inclusive model).

A device can become a member of the user group device through provisioning or by dynamic association.

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For example a URI may be used to represent a user (in SIP this is called a user's Address of Record (AOR)). CSTA can model this user as a user group device and represent the user's AOR using the CSTA URI deviceID format.

When a device registers with a user (using SIP registration procedures, for example), it becomes associated with the user through the user's AOR. In CSTA, this device becomes a member of monitored user's group device. When the user group device is monitored, call and/or device activity at the device (depending upon the parameters in the Monitor Start service request) are reported through the user group device monitor.

Since there can be multiple (SIP) devices registered for the same user, the user group device can contain multiple members.

The CSTA capability exchange services can be used to obtain the members of the user group device.

6.1.1.4.6 Routeing Device Category

A Routeing Device is a device that assists in the routeing of calls.

Refer to 6.7.8, "Routeing Services" for a description of how a Routeing Device is used with CSTA Routeing services.

6.1.1.4.7 Voice Unit Device Category

A Voice Unit device allows messages consisting of voice stream data to be created, manipulated, played to a Connection, or recorded from a Connection. A Voice Unit device can be observed and controlled using the CSTA Voice services (Clause 26, "Voice Services & Events", on page 541) and a state model as shown in Figure 6-16, "Voice Unit Operational Model". A Voice Unit device could be used to implement a voice mail system.

A Voice Unit device may be implemented either as a device as part of the Switching Sub-Domain or as a device as part of the Special Resource Sub-Domain.

A Connection Identifier is used to indicate the call that the Voice Unit device relates to a message. Typically the Voice Unit device will record some portion of the call or play a message as some portion of a call. There are some Voice services (e.g., Delete Message and Concatenate Message) that deal with the control of messages and do not require an interaction with a call.

A globally unique Message Identifier is used to allow manipulation of messages, many of which survive the life of multiple calls.

A Voice Unit state is a state that a Voice Unit device may take in relating a call with a message. It relates a call to its message in terms of playing, recording, pausing, suspending, changing playback speed, etc. Voice Units may have several states concurrently with respect to different calls and messages. Voice Unit states shall be reported by Voice Event Reports. A typical transition model for Voice Unit states is shown in the following figure.

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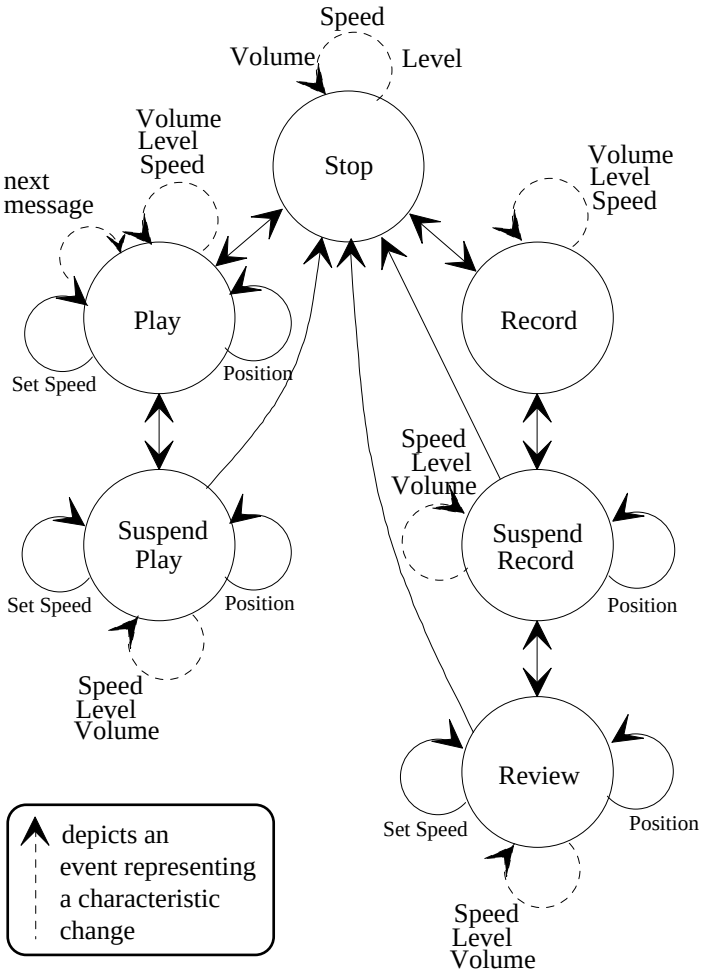
Figure 6-16 Voice Unit Operational Model



In Figure 6-16, “Voice Unit Operational Model”, the states (circles) presented comprise the CSTA Voice Unit state set. Arrows represent transitions between states and show the typical states that may be entered from a given state. These transitions form the basis for providing Voice Event Reports when they occur. The circular transitions show the effects of the Reposition and Set Speed Services. The following states are defined:

Stop	the state where a call and a message are not currently interacting.
Play	the state where a message delivers its voice stream data to a call.
Suspend Play	the state where a message that was in the Play state is temporarily suspended in its delivery. This state (rather than Stop) is entered when it the message is intended to be continued from its current position.
Record	the state where a message is created from the voice stream data in a call.
Suspend Record	the state where a message that was in the record state is temporarily suspended from recording. This state (rather than Stop) is entered when recording is intended to be continued from its current position.
Review	The state where a message that was in the Suspend Record state delivers recorded voice stream data back to the call. This allows the party who is creating the message to examine the voice stream data recorded so far.

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6.1.1.4.8 Generic Interactive Voice Device Category

Interactive Voice Devices (IVDs) model Speech/DTMF input and speech output processing in CSTA. A Connection identifier is used to indicate the call the IVD is interacting with.

A Device Identifier is used to indicate an Interactive Voice device. Typically, an input IVD captures the voice and converts it into a textual description. The conversion is based on a collection of rules herein called the grammar. Similarly, an output IVD produces voice based on a textual description generated by the Computing Function. An IVD can coordinate the playback of multiple voice outputs.

Interactive Voice Devices are call-wide in that the behaviour of an IVD can be affected by other IVDs connected to the same call. For example, the Computing Function can delegate an input IVD to automatically cut off speech output to facilitate the “barge-in” effect (Clause 6.1.1.4.11, “Prompt Interactive Voice Device Category”, on page 34), and one input IVD can reset or prevent timeout for other input IVDs (Clause 6.1.1.4.9, “Listener Interactive Voice Device Category”, on page 31 and Clause 6.1.1.4.10, “DTMF Interactive Voice Device Category”, on page 33). This Standard specifies the functional requirements of the call-wide behaviour for Interactive Voice Devices.

Because of their interactive nature, interactive voice devices are typically monitored so that events can be delivered to Computing Function in a timely fashion.

Interactive Voice Devices are controlled and observed using the services and events specified in Clause 26, “Voice Services & Events”, on page 541.

A single Interactive Voice Device can contain multiple interactive voice resources that share a single connection. Each of these resources is individually addressable through a resource identifier.

A Generic Interactive Voice Device (or Generic IVD) has one or more resources that are involved with Speech and/or DTMF processing. It may include functionality of a Listener, DTMF, Prompt, Prompt Queue, or a Message Interactive Voice Device. For example Listener and DTMF resources may be combined to form a type of “input” interactive voice device.

A Generic IVD and all other types of IVDs may be implemented either as a device as part of the Switching Sub-Domain or as a device as part of the Special Resource Sub-Domain.

The following sections describe specific types of Interactive Voice Devices specified in this Standard.

6.1.1.4.9 Listener Interactive Voice Device Category

A Listener Interactive Voice Device (or Listener IVD) that has one or more resources that are involved only with processing speech input.

Tasks that can be performed by a Listener IVD include:

- speech recognition: converts speech into a textual transcription. The result is often accompanied by a confidence score that indicates how trustworthy the transcript is.
- utterance verification: validates speech against a given transcription. In the case where the transcription is not provided *a priori*, a speech recognition stage usually precedes the verification process.
- speaker recognition: identify the speech from a speaker database. As in the case of speech recognition, the result is often accompanied by a confidence score. The word sequence of the utterance spoken can be known or unknown to the Computing Function.
- speaker verification: validates whether a speech waveform is indeed produced by a given target. The word sequence of the utterance spoken can be known or unknown.
- speaker enrollment: allows speech recognition to adapt to a speaker's voice, or enroll a speaker's voice signature for verification.

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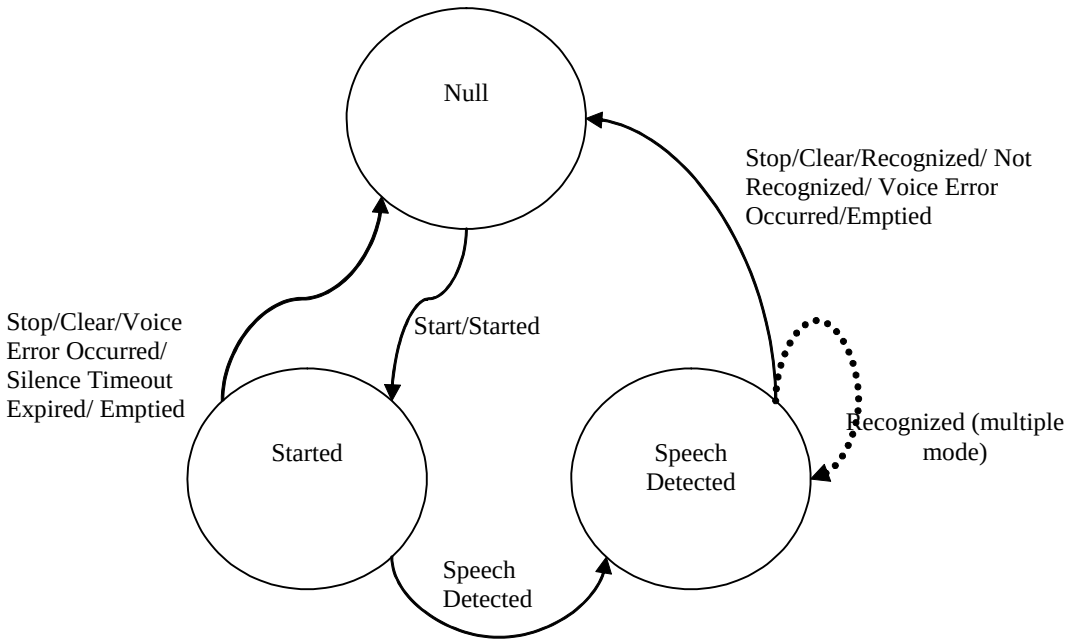
A Listener IVD may perform one or more tasks listed above and may provide options to capture and return the audio alongside with the textual outcome.

Figure 6-17, “Listener Resource Operational Model” specifies the states and their transitions for a particular Listener resource. The following states are defined:

Null	the state in which the call and the Listener resource are not interacting.
Started	the state in which the Listener resource is processing audio in the call.
Speech Detected	the state in which speech-like sound is detected in the call and the Listener resource has started the process of matching the audio to the grammar.

Figure 6-17 Listener Resource Operational Model



Typically, a Listener resource is brought to a Started state by the Start service (Clause 26.1.14, “Start”, on page 565), after which state transitions may take place automatically. To report progress, each automatic state transition raises a corresponding Voice Event (Clause 26.2, “Events”, on page 572).

A Listener resource can have one of the following three modes:

- automatic, in which a Listener resource will determine automatically whether the speech signal has ended in the call. Typically, the end of speech is characterized by an extended period of silence called End Silence.
- single, in which the Computing Function must utilize Stop or Clear services (Clause 26.1, “Services”, on page 541) to end the audio collection process. This mode mandates the Listener resource to ignore extended silence amidst the audio and produce a single interpretation on the captured audio.
- multiple, in which the Listener resourcemay loop around the Speech Detected state and therefore may produce multiple outcomes. An explicit Voice service request (either Stop or Clear, Clause 26.1, “Services”) must be used to stop or cancel further speech processing.

After leaving the Null state, a Listener resource can encounter one of the following timeout conditions and reset itself back to the Null State:

- Silence timeout: the maximum time allowed before entering the Speech Detected state.

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- Babble timeout: the maximum time allowed to stay in the Speech Detected state.
- Maximum timeout: the maximum time allowed before returning to the Null state.

Multiple Listener IVDs can optionally be conferenced or joined to a single call where they process the same audio stream. One and only one Start service request (Clause 26.1.14, “Start”) directed at any of the Listener resources is needed to bring all of the Listener resources connected to the same call out of the Null State. Subsequent Start service requests issued against a non Null Listener resource has no effect. Once the Listener resource connected to the same call leaves the Null State, individual Listener resources proceed with their own state transitions and, if monitored, raise their own events. Listener resources performing the same task on the same call, however, do compete against one another: the first Listener resource matching the grammar to the utterance will cause all others connected to the same call to abandon their grammar matching processes and make corresponding state transitions based on their modes: while Listener resources of automatic or single modes return to the Null state, the multiple mode Listener resources returns to the Speech Detected state.

When a Listener and a DTMF IVD are conferenced or joined to a single call, they also compete on the same audio. See Clause 6.1.1.4.10, “DTMF Interactive Voice Device Category” for the specification of the operational model.

6.1.1.4.10 DTMF Interactive Voice Device Category

A DTMF Interactive Voice device (or DTMF IVD) has one or more resources that are involved only with interpreting a sequence of DTMF characters based on the grammars. In contrast to the CSTA Data Collection Services, a DTMF resource utilizes grammars to parse the DTMF string rather than just reporting it. For example, a three consecutive DTMF strokes of key “8” may be interpreted as an area code of a telephone number, a transaction amount, or even as a way to enter the letter “V”. The Computing Function may utilize different grammars and cause the DTMF resource to report appropriate results.

As specified in Figure 6-18, “DTMF Resource Operational Model”, a DTMF resource will be in one of the following states:

Null	the state in which the call and the DTMF resource are not interacting.
Started	the state in which the DTMF resource starts processing the audio in the call.
DTMF Detected	the state in which the DTMF character is detected in the call.

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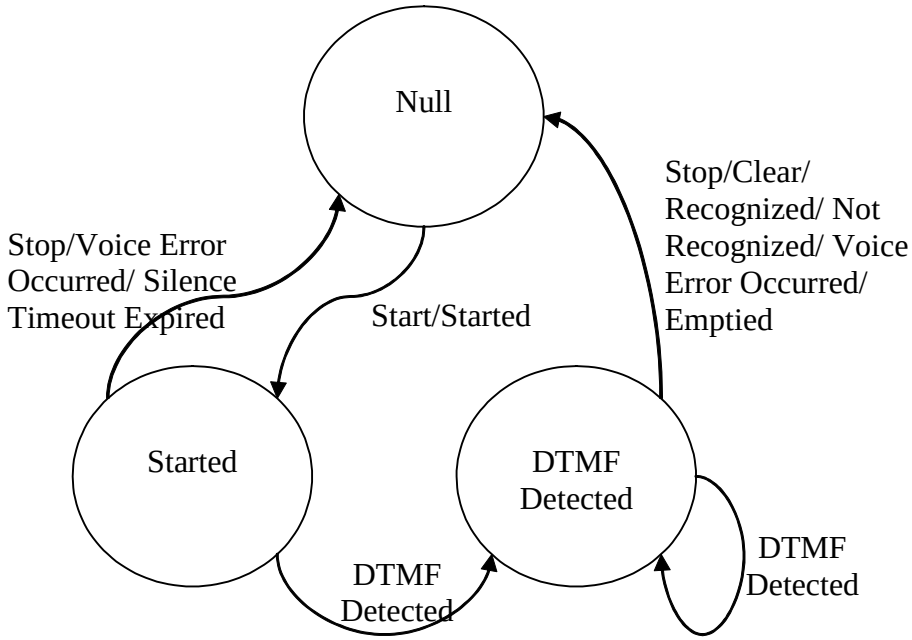
Figure 6-18 DTMF Resource Operational Model



Typically, a DTMF resource is brought to a Started state by the Start service (Clause 26.1.14, “Start”, on page 565), after which state transitions may take place automatically. To report progress, each automatic state transition raises a corresponding Voice Event (Clause 26.2, “Events”, on page 572).

After leaving the Null state, a DTMF resource can encounter one of the following timeout conditions and reset itself back to the Null state while raising a corresponding timeout event:

- Silence timeout: the maximum time allowed before entering the DTMF Detected state.
- Inter-digit timeout: the maximum time allowed before making a transition from the DTMF Detected state unless the last key completes a DTMF sequence that traverse a grammar rule in its entirety. For the latter case, the DTMF resource waits for a period of End Silence and transitions into the Null State if no successive DTMF is detected.

Multiple DTMF IVDs can optionally be conferenced or joined to a single call. At any given time, though, at most one of the resources can be in a non Null state. Any attempt to enter the Started state while another DTMF resource is not at the Null state will result in a Voice Error Occurred event (Clause 26.2.18, “Voice Error Occurred”, on page 587).

Multiple DTMF and Listener IVDs can be conferenced or joined to the same call and enter their respective Started states. In such case, the two types of resources receive the same media stream from the call, and the first resource to leave the Started state will prevent the other from incurring a silence timeout and resetting back to the Null state. However, either type of resource that returns to the Null state will, after raising proper Voice events, cause the other to follow immediately back to its Null state as well. This, for instance, enables the use of DTMF to stop a Listener without Maximum or Babble Timeout.

6.1.1.4.11 Prompt Interactive Voice Device Category

An Prompt Interactive Voice device (or Prompt IVD) has one or more resources that are involved only with producing audio output from a text that describes the output generation process. The audio can be a combination of pre-recorded audio and text to speech synthesis. Prompt playback is facilitated through the Prompt Queue (Clause 6.1.1.4.12, “Prompt Queue Interactive Voice Device Category”, on page 35) IVD that

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manages the playback by storing copies of the voice generated by the Prompt and sends them to the media conduit at a proper time.

The text input to the Prompt resource may contain bookmarks. When the playback reaches the position of a bookmark, the Bookmark Reached event is generated (Clause 26.2.1, “Bookmark Reached”, on page 573). The event can be used as a synchronisation cue to update other user interface related properties such as the cursor on a display, for instance.

Each prompt can be set as auto-interruptible. A DTMF resource or a Listener resource can cause a prompt to be interrupted. When set as auto-interruptible, a caller's “barge-in” on the playback, either through DTMF or speech commands, will automatically cut off the speech output without the intervention of the Computing Function. Whether a prompt is set auto-interruptible or not, the Interruption Detected Event (Clause 26.2.5, “Interruption Detected”, on page 576) will always be reported should there be any input activity during playback and a monitor is placed on the call or the Prompt IVD.

The attributes of a Prompt resource can be controlled by the Set Voice Attributes service (Clause 26.1.13, “Set Voice Attribute”, on page 562). A Prompt resource is not involved with a call and therefore does not have a state model. The CSTA Queue service is used to copy a prompt to a Prompt resource which is attached to a call.

6.1.1.4.12 Prompt Queue Interactive Voice Device Category

Prompt Queue Interactive Voice Device (or Prompt IVD) has one or more resources that are involved only with serializing audio being played back to the call.

A Prompt Queue resource stores the concatenated voices generated by Prompt resources in the order of the Queue services made at individual Prompt resources. A Prompt Queue resource allows the Computing Function to construct phrases by concatenating voices from a collection of prompts. For example, a Computing Function may decide to confirm with the caller on a choice of a city with a sentence “I heard you said Seattle. Is this correct?” While “I heard you said…” and “Is this correct?” can be pre-recorded waveforms, the city name must be dynamically synthesized based on interaction context. Such an explicit confirmation can be achieved by three consecutive Queue Services directed at three Prompt resources: first on the pre-recorded “I heard you said…”, followed by the synthesized city name and the pre-recorded “Is this correct?”.

A Prompt Queue resource conceptually holds one or more subqueues that are delimited by the Start service (Clause 26.1.14, “Start”, on page 565). Figure 6-19, “Operational Model of a subqueue in a Prompt Queue Resource” specifies the life cycle of a subqueue. The following states are specified:

Formed the state in which a subqueue is initiated by an incoming prompt either when the Prompt Queue resource is empty, or the last subqueue in the Prompt Queue resource has entered the Ready state. All subsequent incoming prompts are appended to this subqueue in the order of arrival.

Ready the state in which a subqueue is scheduled to be played as soon as its preceding subqueue, if any, is depleted. Any subqueue must enter this state before its contents can be played out to the call.

Playing the state in which a subqueue has reached to the front of the Prompt Queue resource and its constituent prompts are being played in sequence.

Null an empty subqueue.

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Figure 6-19 Operational Model of a subqueue in a Prompt Queue Resource

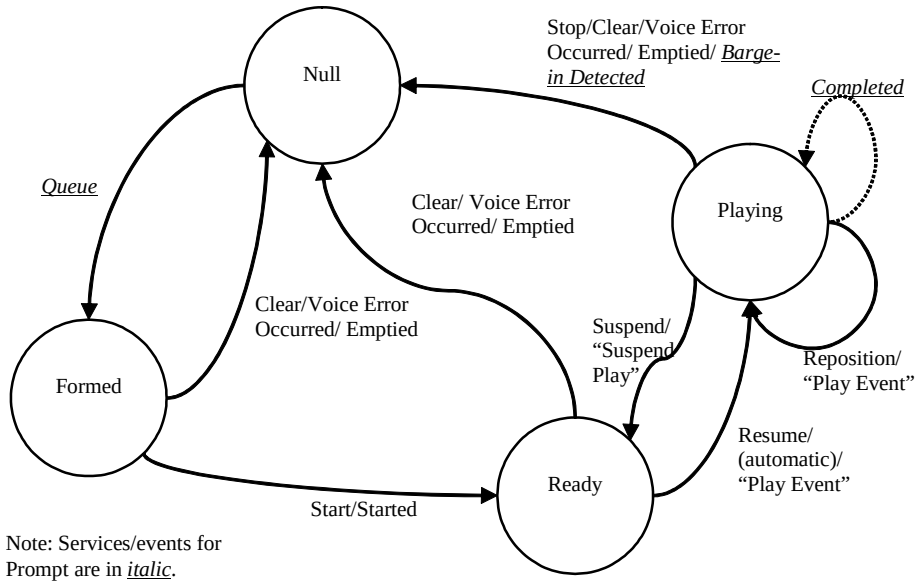

Figure 6-20, "A Relationship of prompts and Prompt Queue Resource" specifies the relationship between subqueues and the Prompt Queue resource in general. Many Voice services and events have the scope at the level of subqueues. Specifically, the Emptied event is generated when all the prompts in a subqueue has been played, even though there are still one or more subqueues stored in the Prompt Queue resource. When an individual prompt encounters errors or is interrupted during playback, the Prompt Queue resource flushes the remaining prompts to the subqueue boundary, not the entire queue. Since the rest of the subqueues are not affected, the audio playback may not be halted if the following subqueue is in the Ready state. The Clear, Query Voice Attribute, Set Voice Attribute, Suspend, and the Resume services, however, have the scope of the entire Prompt Queue resource.

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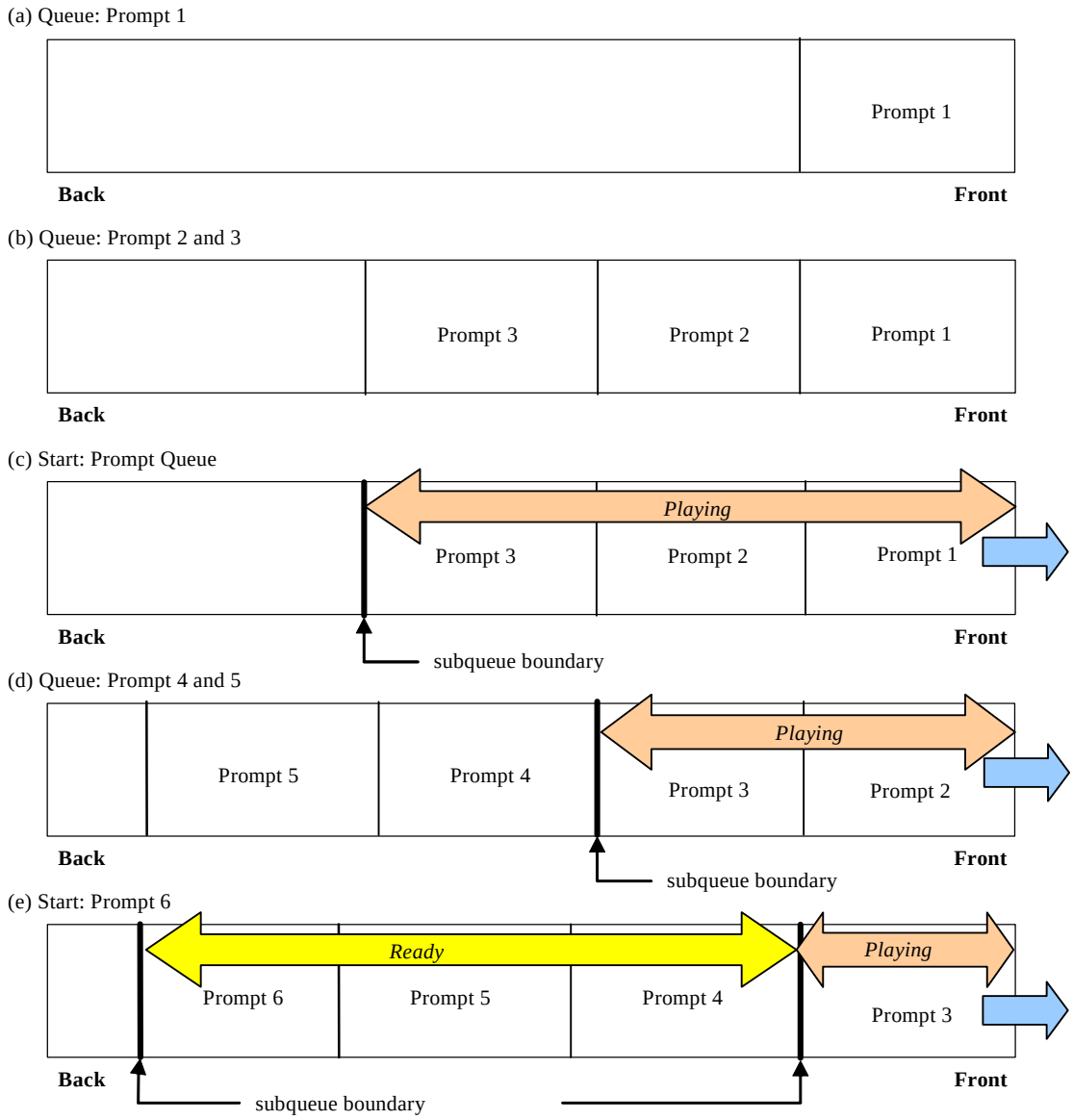
Figure 6-20 A Relationship of prompts and Prompt Queue Resource



Typically, a subqueue is the most natural unit to administer voice responses. The main purpose of a Prompt Queue resource, which hosts a queue of subqueues, is to insure a high quality of service in the prompt playback, especially for the cases where a real time concatenation and prompt synthesis is not achievable. For example, after obtaining a command from the caller, the Computing Function can queue up several “waiting” prompts into a Prompt Queue resource while the command is being processed. Commonly used waiting prompts include a musical segment intermixed with reassuring phrases such as “lease remain on the line as your call is important to us”. To insure the caller's audio channel is engaged, the Computing Function may need to insure that all the results are properly synthesized and entered into a subqueue to the Prompt Queue resource before stopping the waiting prompts.

6.1.1.4.13 Message Interactive Voice Device Category

A Message Interactive Voice Device has one or more resources that are involved only with processing messages.

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Each resource follows the operational model of a Voice Unit as shown in 6.1.1.4.7, “Voice Unit Device Category”, on page 29.

6.1.1.4.14 Other Device Category

A device in this category has characteristics (i.e., device configuration, capabilities, type of elements, element components) which are switching function specific.

6.1.1.5 Named Device Types

Switching Function implementations may indicate that a device is of a particular device type. The following device types may be used for this purpose but the interpretation of a given device type is implementation specific.

- ACD
- ACD Group
- Button
- Button Group
- Conference Bridge
- Line
- Line Group
- Operator
- Operator Group
- Parking Device
- Station
- Station Group
- Trunk
- Trunk Group
- Other
- Other Group

6.1.1.6 Agent

An agent represents a device’s association and activities with one or more ACD devices or ACD groups.

An agent becomes associated with a specific ACD device or ACD group by the process of logging on. There are two Agent Log On Models that may be supported by a switching function (as indicated by the capability exchange services). Note that multiple models may be supported by a switching function and by a single agent.

- *Log On to an ACD device* - In this model an agent logs on to ACD device and becomes associated with the activities of the ACD device. There is no association with any ACD group. This may be achieved by using the Set Agent State service (loggedOn) without providing the ACD group parameter. Note that this capability cannot be simultaneously supported with the Log On to an ACD Group (implicit/one step) described below.
- *Log On to an ACD Group* - In this model an agent becomes associated with the activities of an ACD group. This may be accomplished by the following:
    - explicit/one step - by using the Set Agent State (loggedOn) service and supplying the ACD group parameter

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