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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Directory services  
architecture for audiovisual and multimedia services

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**Directory services architecture for call  
forwarding and preferences**

Recommendation ITU-T H.350.6



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# Recommendation ITU-T H.350.6

## Directory services architecture for call forwarding and preferences

### Summary

Recommendation ITU-T H.350.6 describes a simple lightweight directory access protocol (LDAP) and ITU-T X.500 schemas to represent call forwarding and call preference information in an ITU-T H.350 directory. It is intended to represent addresses to which calls should be forwarded in the case that an endpoint does not answer a call. It can direct calls to simple ITU-T H.320, ITU-T H.323 or session initiation protocol (SIP) addresses, or complex forwarding schemes such as time of day preferences, web pages, electronic mail or other applications. Implementers should review Recommendation ITU-T H.350 in detail before proceeding with this Recommendation.

This revised version of Recommendation ITU-T H.350.6 introduces some corrections to the previous version, primarily updaters of ITU-T X.500 ASN.1 contained in clause 8.

This Recommendation includes an electronic attachment containing a schema configuration file for callPreferenceURI.

### History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.350.6	2004-03-15	16
1.0	ITU-T H.350.6 attachment	2004-03-15	16
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### Keywords

Directory services, ITU-T H.235.0, ITU-T H.320, ITU-T H.323, ITU-T X.500, LDAP, SIP.

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# Recommendation ITU-T H.350.6

## Directory services architecture for call forwarding and preferences

### 1 Scope

This Recommendation<sup>1</sup> describes a simple lightweight directory access protocol (LDAP) and ITU-T X.500 schemas to represent call forwarding and call preference information in an ITU-T H.350 directory. It is intended to represent addresses to which calls should be forwarded in the case that an endpoint does not answer a call. It can direct calls to simple ITU-T H.320, ITU-T H.323 or session initiation protocol (SIP) addresses, or complex forwarding schemes such as time of day preferences, web pages, electronic mail or other applications. Implementers should review [ITU-T H.350] in detail before proceeding with this Recommendation.

The scope of this Recommendation does not include normative methods for the use of the LDAP directory itself or the data it contains.

#### 1.1 Extending the schema

The callPreferences classes may be extended as necessary for specific implementations. See the base [ITU-T H.350] for a discussion on schema extension.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T H.323] Recommendation ITU-T H.323 (2009), *Packet-based multimedia communications systems*.
- [ITU-T H.350] Recommendation ITU-T H.350 (2011), *Directory services architecture for multimedia conferencing*.
- [ITU-T H.350.1] Recommendation ITU-T H.350.1 (2011), *Directory services architecture for H.323*.
- [ITU-T H.350.2] Recommendation ITU-T H.350.2 (2011), *Directory services architecture for H.235*.
- [ITU-T H.350.3] Recommendation ITU-T H.350.3 (2011), *Directory services architecture for H.320*.
- [ITU-T H.350.4] Recommendation ITU-T H.350.4 (2011), *Directory services architecture for SIP*.
- [ITU-T H.350.5] Recommendation ITU-T H.350.5 (2011), *Directory services architecture for non-standard protocols*.

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<sup>1</sup> This Recommendation includes an electronic attachment containing a text file with a schema configuration for callPreferenceURI.

- [ITU-T X.500] Recommendation ITU-T X.500 (2008) | ISO/IEC 9594-1:2008, *Information technology – Open Systems Interconnection – The Directory: Overview of concepts, models and services.*
- [ITU-T X.501] Recommendation ITU-T X.501 (2008) | ISO/IEC 9594-2:2008, *Information technology – Open Systems Interconnection – The Directory: Models.*
- [ITU-T X.509] Recommendation ITU-T X.509 (2008) | ISO/IEC 9594-8:2008, *Information technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks.*
- [ITU-T X.511] Recommendation ITU-T X.511 (2008) | ISO/IEC 9594-3:2008, *Information technology – Open Systems Interconnection – The Directory: Abstract service definition.*
- [ITU-T X.518] Recommendation ITU-T X.518 (2008) | ISO/IEC 9594-4:2008, *Information technology – Open Systems Interconnection – The Directory: Procedures for distributed operation.*
- [ITU-T X.519] Recommendation ITU-T X.519 (2008) | ISO/IEC 9594-5:2008, *Information technology – Open Systems Interconnection – The Directory: Protocol specifications.*
- [ITU-T X.520] Recommendation ITU-T X.520 (2008) | ISO/IEC 9594-6:2008, *Information technology – Open Systems Interconnection – The Directory: Selected attribute types.*
- [ITU-T X.525] Recommendation ITU-T X.525 (2008) | ISO/IEC 9594-9:2008, *Information technology – Open Systems Interconnection – The Directory: Replication.*
- [IETF RFC 3261] IETF RFC 3261 (2002), *SIP: Session Initiation Protocol.*
- [IETF RFC 4510] IETF RFC 4510 (2006), *Lightweight Directory Access Protocol (LDAP): Technical Specification Road Map.*
- [IETF RFC 4511] IETF RFC 4511 (2006), *Lightweight Directory Access Protocol (LDAP): The Protocol.*

### 3 Definitions

This Recommendation defines the following terms:

**3.1 call server:** A protocol-specific signalling engine that routes video or voice calls on the network. In [ITU-T H.323], this entity is a gatekeeper. In SIP, this entity is a SIP Proxy Server. Note that not all signalling protocols use a call server.

**3.2 commObject:** An LDAP object class defined in [ITU-T H.350] that represents generic multimedia conferencing endpoints.

**3.3 endpoint:** A logical device that provides video and/or voice media encoding/decoding, and signalling functions. Examples include:

- 1) a group teleconferencing appliance that is located in a conference room;
- 2) an IP telephone;
- 3) a software program that takes video and voice from a camera and microphone, encodes it and applies signalling using a host computer.

Note that from the perspective of most signalling protocols, gateways and MCUs are special cases of endpoints.

**3.4 enterprise directory:** A canonical collection of information about users in an organization. Typically this information is collected from a variety of organizational units to create a whole. For example, Human Resources may provide name and address, Telecommunications may provide the telephone number, Information Technology may provide the e-mail address, etc. For the purposes of this architecture, it is assumed that an enterprise directory is accessible via LDAP.

**3.5 white pages:** An application that allows end users to look up the address of another user.

## 4 Abbreviations

This Recommendation uses the following abbreviations:

LDAP            Lightweight Directory Access Protocol  
NOTE – This is consistent [IETF RFC 4510].

LDIF            LDAP Data Interchange Format

## 5 Conventions

In this Recommendation, the following conventions are used:

"Shall" indicates a mandatory requirement.

"Should" indicates a suggested but optional course of action.

"May" indicates an optional course of action rather than a recommendation that something takes place.

References to clauses, subclauses, annexes and appendices refer to those items within this Recommendation, unless another specification is explicitly listed.

## 6 Object class definitions

The callPreferenceURI is a URI consisting of two parts: a URI and a label. Because it is its own unique object class, the directory can be searched for the presence of this attribute.

### 6.1 URI

The URI portion is merely a pointer that points to an address at which can be found the desired call forwarding address. In the most basic case, the URI will be an LDAP URI that points to another ITU-T H.350 entry elsewhere in the same ITU-T H.350 directory. For example, if an ITU-T H.323 entry is described by an h323IdentitydialedDigits attribute, its callPreferenceURI may point to another h323IdentitydialedDigits attribute elsewhere in the same directory. In this case, the URI is an LDAP URI.

It is possible to represent more complex call preference behaviour if the URI points to an object outside the ITU-T H.350 directory. For example, the URI could be a mailto: URI of the form *mailto:user@host.domain*, which would tell a call server to interpret the desired call preference behaviour to initiate an electronic mail message. Similarly, a callPreferenceURI could be a URL pointing to a web page that contains a web form for the calling party to fill out and submit, or even a game to play. A more advanced scenario may be supported if the URL target represents an XML document or call processing language script which describes conditional call preferences.

Note that it is the responsibility of the implementer to ensure that the data populating the directory is able to be interpreted by the call server that will be accessing that data.

## 6.2 Label

The label portion of callPreferenceURI contains an indication of the type of call forwarding for simple forwarding types. Types not defined here may be supported by the implementer. The form of the label is:

type:argument

where type is a string indicating the type of call forwarding, and argument is a string indicating the time in milliseconds after which the call forwarding should occur. The two values are delimited by a colon.

**Table 6-1 – Call forwarding types**

Type	Type description
b	Forward on busy
n	Forward on no answer
u	Forward unconditionally
f	Forward on destination not found

For example, a label of n:4000 indicates that calls should be forwarded to the target URI after four seconds if the called endpoint does not answer. Similarly, f:250 indicates that the call should be forwarded to the target URI after 250 milliseconds if the destination is not located.

## 6.3 callPreferenceURIObject object class

```
OID: 0.0.8.350.1.1.8.2.1
objectclasses: (0.0.8.350.1.1.8.2.1
NAME 'callPreferenceURIObject'
DESC 'callPreference object'
SUP top AUXILIARY
MAY ( callPreferenceURI )
)
```

## 6.4 callPreferenceURI attribute

```
OID: 0.0.8.350.1.1.8.1.1
attributetypes: (0.0.8.350.1.1.8.1.1
NAME 'callPreferenceURI'
DESC 'Labeled URI format to point to forwarded address and type of forwarding'
EQUALITY caseExactMatch
SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 )
```

Application utility class

standard

Number of values

multi

Definition

Specifies a URI. The value of the attribute found at the URI target is the address to which calls should be forwarded.

Permissible values (if controlled)

Notes

When representing more than one call forwarding behaviour, use a separate callPreferenceURI for each. One for no answer, another for busy, etc.

## Semantics

### Example applications for which this attribute would be useful

A user desires that if he does not answer, calls should be forwarded to a different number. However, if the user is busy (i.e., on the phone), then the calling party should be directed to a mailto: link, which will cause an electronic mail application to open on the calling party's application.

### Example (LDIF fragment)

```
callPreferenceURI:
ldap://directory.acme.com/dc=acme,dc=com??sub?(h323IdentitydialedDigits=1234) b:2000 //
Forward on busy after 2 seconds
```

## 7 callPreferenceURI LDIF files

This clause contains a schema configuration file for callPreferenceURI that can be used to configure an LDAP server to support this class.

```
# callPreferenceURIObject Object Schema
#
# Schema for representing a callPreferenceURIObject Object in an LDAP Directory
#
# Abstract
#
# This Recommendation defines the schema for representing callPreferenceURIObject
# object in an LDAP directory [LDAPv3]. It defines schema elements
# to represent a callPreferenceURIObject object [callPreferenceURIObject].
#
#           .1 = Communication related work
#           .1.8 = callPreferenceURIObject
#           .1.8.1 = attributes
#           .1.8.2 = objectclass
#           .1.8.3 = syntax
#
#
# Attribute Type Definitions
#
#   The following attribute types are defined in this Recommendation:
#
#       callPreferenceURI
dn: cn=schema
changetype: modify
#
# if you need to change the definition of an attribute,
#           then first delete and re-add in one step
#
# if this is the first time you are adding the genericIdentity
# objectclass using this LDIF file, then you should comment
# out the delete attributetypes modification since this will
# fail. Alternatively, if your ldapmodify has a switch to continue
# on errors, then just use that switch -- if you are careful
#
delete: attributetypes
attributetypes:(0.0.8.350.1.1.8.1.1 NAME 'callPreferenceURI' )
-
#
# re-add the attributes -- in case there is a change of definition
#
#
add: attributetypes
attributetypes: (0.0.8.350.1.1.8.1.1
  NAME 'callPreferenceURI'
  DESC 'Labeled URI format to point to forwarded address and type of forwarding'
  EQUALITY caseExactMatch
  SUBSTR caseExactSubstringsMatch
```

```

SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 )
-
# Object Class Definitions
#
# The following object class is defined in this Recommendation:
#
#     callPreferenceURIObject
#
# callPreferenceURIObject
#
#
delete: objectclasses
objectclasses: (0.0.8.350.1.1.8.2.1 NAME 'callPreferenceURIObject' )
-
add: objectclasses
objectclasses: (0.0.8.350.1.1.8.2.1
    NAME 'callPreferenceURIObject'
    DESC 'callPreference object'
    SUP top AUXILIARY
    MAY ( callPreferenceURI )
)
-
#
# end of LDIF
#

```

## 8 Using ITU-T H.350 with ITU-T X.500 directories

### 8.1 IMPORTS of ITU-T X.500 ASN.1

To satisfy all the IMPORTS clauses the following modules are needed:

- BasicAccessControl ([ITU-T X.501])
- DSAOperationalAttributeTypes ([ITU-T X.501])
- EnhancedSecurity ([ITU-T X.501])
- InformationFramework ([ITU-T X.501])
- OperationalBindingManagement ([ITU-T X.501])
- ServiceAdministration ([ITU-T X.501])
- UsefulDefinitions ([ITU-T X.501])
- AttributeCertificateDefinitions ([ITU-T X.509])
- AuthenticationFramework ([ITU-T X.509])
- CertificateExtensions ([ITU-T X.509])
- MTSAbstractService ([ITU-T X.509])
- PKIX1Implicit93 ([ITU-T X.509])
- DirectoryAbstractService ([ITU-T X.511])
- SpkmGssTokens ([ITU-T X.511])
- DistributedOperations ([ITU-T X.518])
- HierarchicalOperationalBindings ([ITU-T X.518])
- CommonProtocolSpecification ([ITU-T X.519])
- DirectoryOSIProtocols ([ITU-T X.519])
- DirectoryOperationalBindingTypes ([ITU-T X.519])
- OSIProtocolSpecification ([ITU-T X.519])
- SelectedAttributeTypes ([ITU-T X.520])
- DirectoryShadowAbstractService ([ITU-T X.525])

– ldap ([IETF RFC 4511])

It is noted that these modules can be downloaded from the [ITU-T ASN.1 module database](#).

## 8.2 ASN.1 representation

ITU-T H.350.6 elements may be used in an ITU-T X.500 directory architecture by using the ASN.1 representation of the object classes defined here.

```
CallPreferenceURIObject { itu-t(0) recommendation(0) h(8) 350 1 cr(1) call(8) module(4)
}
DEFINITIONS ::=
BEGIN

-- callPreferenceURIObject Object Schema

-- Schema for representing a callPreferenceURIObject Object in an LDAP Directory

-- Abstract

-- This Recommendation defines the schema for representing callPreferenceURIObject
-- object in an LDAP directory [LDAPv3]. It defines schema elements
-- to represent a callPreferenceURIObject object [callPreferenceURIObject].

--
--           .1 = Communication related work
--           .1.8 = callPreferenceURIObject
--           .1.8.1 = attributes
--           .1.8.2 = objectclass
--           .1.8.3 = syntax

IMPORTS

-- from Rec. ITU-T H.350
h350-cr
    FROM CommURI { itu-t(0) recommendation(0) h(8) 350 1 cr(1) commURI(1) module(4) }

-- from Rec. ITU-T X.501 | ISO/IEC 9594-2
ATTRIBUTE, OBJECT-CLASS, top
    FROM InformationFramework {joint-iso-itu-t ds(5) module(1) informationFramework(1)
6}

-- from Rec. ITU-T X.520 | ISO/IEC 9594-6
UnboundedDirectoryString, caseExactMatch, caseExactSubstringsMatch
    FROM SelectedAttributeTypes {joint-iso-itu-t ds(5) module(1)
selectedAttributeTypes(5) 6} ;

-- Attribute Type Definitions

-- The following attribute types are defined in this Recommendation:

-- callPreferenceURI

callPreferenceURI ATTRIBUTE ::= {
    WITH SYNTAX UnboundedDirectoryString
    EQUALITY MATCHING RULE caseExactMatch
    SUBSTRINGS MATCHING RULE caseExactSubstringsMatch
    ID { at 1 } }

-- Object Class Definitions

-- The following object class is defined in this Recommendation:

-- callPreferenceURIObject

-- callPreferenceURIObject
```

```
callPreferenceURIObject OBJECT-CLASS ::= {
    SUBCLASS OF { top }
    MAY CONTAIN { callPreferenceURI }
    ID { oc 1 } }

call-Id          OBJECT IDENTIFIER ::= { h350-cr call-Id(8) }
at              OBJECT IDENTIFIER ::= { call-Id at(1) }
oc              OBJECT IDENTIFIER ::= { call-Id oc(2) }

END -- end of ASN.1
```

## **Annex A**

### **Indexing profile**

(This annex forms an integral part of this Recommendation.)

Indexing of attributes is an implementation-specific activity and depends upon the desired application. Non-indexed attributes can result in search times sufficiently long to render some applications unusable. This annex indexing profile describes an indexing configuration for callPreference attributes that will be optimized for efficient call server lookup. Use of this profile is optional.

callPreference: equality

## **Appendix I**

### **Electronic attachment**

(This appendix does not form an integral part of this Recommendation.)

The associated zip file for Recommendation ITU-T H.350.6 contains file `callPreferenceURI.ldif.txt` with a text-only version of the LDIF file described in clause 7.

The zip file is available for free download at: <http://www.itu.int/rec/T-REC-H.350.6>.

## Bibliography

- [b-Howes-1] Howes, T.A., Smith, M.C., and Good, G.S. (1998), *Understanding and Deploying LDAP Directory Services*, New Riders Publishing, ISBN: 1578700701.
- [b-Howes-2] Howes, T.A., and Smith, M.C. (1997), *LDAP Programming Directory-Enabled Applications with Lightweight Directory Access Protocol*, New Riders Publishing, ISBN: 1578700000.





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