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ATM UNI Signaling Support on Cisco Routers and Switches

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Introduction

This document explains Cisco support for User-Network Interface (UNI) signaling standards.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

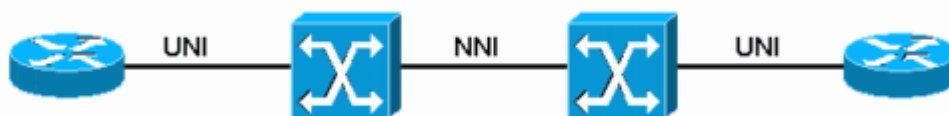
This document is not restricted to specific software and hardware versions.

Conventions

For more information on document conventions, refer to the [Cisco Technical Tips Conventions](#).

Background Information

UNI is a protocol that defines messages for establishing switched virtual circuits (SVCs) on demand. UNI signaling messages are not carried end to end; in other words, the UNI signaling stack of the calling user does not communicate directly with the UNI signaling stack of the called (destination) user. Rather, each user or end system exchanges UNI messages with the first ATM switch in the network. The network switches then exchange a different set of messages over the Network-to-Network Interface (NNI).



UNI Versions—3.0, 3.1, 4.0


The ATM Forum and the International Telecommunications Union Telecommunication Standardization Sector (ITU-T) publish standards on ATM technology. Normally, the ATM Forum adapts the ITU-T recommendations and creates implementation agreements.

The ITU-T standards for UNI signaling are Q.2931 and Q.2971, plus numerous additions in the Q.29xx series of standards. The ATM Forum standards are UNI 3.0/3.1 and UNI 4.0. UNI 4.0 summarizes many of the Q.29xx standards and defines some minor changes and additions.

UNI 2.0 was the first signaling agreement of the ATM Forum, and it defined permanent virtual circuits (PVCs) only. Later, UNI 3.0 introduced support for SVCs.

Importantly, UNI 3.0 was based on a pre-standard ITU-T signaling recommendation, Q.93B. Changes by the ITU-T to its Q.9xxx signaling standards prompted the ATM Forum to incorporate these changes in UNI 3.1. The ITU-T changes include:

- Redesignating the signaling protocol from Q.93B to Q.2931
- Replacing the Q.SAAL1, Q.SAAL2, and Q.SAAL3 standards of the Service-Specific Connection-Oriented Protocol (SSCOP) on the signaling plane with Q.2201, Q.2120, and Q.2130.

Further changes by the ITU-T led the ATM Forum to publish UNI 4.0. The ATM Forum defines separate signaling, traffic management, Private Network Node Interface (PNNI), Interim Local Management Interface (ILMI), and interface-specific recommendations with UNI 4.0. To view the full text of these documents, refer to the ATM Forum [Approved Specifications](#)  page.

UNI 4.0 Features

UNI 4.0 introduces these new features:

- Leaf-initiated join (LIJ), wherein an end system can join an existing point-to-multipoint connection.

Note: LIJ is being removed from UNI signaling 4.1. The current draft text for chapter 6 states: "This section has been deleted since the Leaf Initiated Join capability has been removed."

- Anycast address format to identify services available across an ATM network. An application or an end system signals the group address of a particular service. The ATM switch, knowing about registered services via ILMI, routes the request across the network to the nearest instance of this service. The source then establishes a point-to-point connection to the destination.
- Support for the available bit rate (ABR) service class.
- Traffic negotiation via a minimum traffic descriptor and an alternate traffic descriptor.
- Field in an information element to indicate explicitly the support of frame discard for a device.
- Signaling of quality of service (QoS) parameters.
- Supplementary services to support ISDN calls over ATM. Defined in UNI 4.0 Annex 4: Supplementary Services and in ITU-T Q.2951/Q.2971, these services include:
 - Direct Dialing In (DDI)
 - Multiple Subscriber Number (MSN)
 - Calling Line ID Presentation (CLIP)
 - Connected Line ID Presentation (COLP)
 - Subaddressing (SUB)

The UNI 4.0 recommendation states that a compliant switch must support multipoint connections, LIJ, and Anycasting. All added features are optional ATM end systems.

UNI 4.0 Feature Support

This table outlines support for UNI 4.0 features on Cisco routers and ATM switches:

Number	Capability	Terminal Equipment	Cisco IOS® Router Support	Switching System	Cisco IOS Switch Support
1	Point-to-Point calls	M	Yes	M	Yes
2	Point-to-Multipoint calls	O	Yes	M	Yes
3	Signaling of Individual	M	Yes	M	Yes

	QoS Parameters		(12.1)		(11.3WA4)
4	Leaf-Initiated Join	O	No	O	No
5	ATM Anycast	O	No	Note 1	Partially (12.0)
6	ABR Signaling for Point-to-Point Calls	O	Yes (12.1)	O	Yes (11.3WA4)
7	Generic Identifier Transport	O	Yes ^(b)	O	Yes (11.3WA4)
8	Virtual UNIs	O	No	O	IOS Option
9	Switched Virtual Path (VP) Service	O	No	O	Yes (11.3WA4)
10	Proxy Signaling	O	No	O	No
11	Frame Discard	O	Yes	O (Note 2)	Yes
12	Traffic Parameter Negotiation	O	Yes ^(a)	O	Yes (11.3WA4)
13	Supplementary Services	—	—	—	—
13.1	Direct Dialing In (DDI)	O	No	O	No
13.2	Multiple Subscriber Number (MSN)	O	No	O	No
13.3	Calling Line ID Presentation (CLIP)	O	No	O	No
13.4	Calling Line ID Restriction (CLIR)	O	No	O	No
13.5	Connected Line ID Presentation	O	No	O	No

	(COLP)				
13.6	Connected Line ID Restriction (COLR)	O	No	O	No
13.7	Subaddressing (SUB)	O	Partial (b)	Note 3	Partial ^(b)
13.8	User-User Signaling (UUS)	O	Yes ^(b)	O	Yes (11.3WA4)

Note 1: This capability is optional for public networks/switching systems and is mandatory for private networks/switching systems.

Note 2: Transport of the Frame Discard indication is mandatory.

Note 3: This capability is mandatory for networks/switching systems (public and private) that support only native E.164 address formats.

(a) There is no Cisco IOS application support as of 12.2T, but it is supported by router signaling (12.1).

(b) This is planned for an upcoming release of Cisco IOS Software.

UNI Signaling Support on Cisco Routers

Cisco IOS Software Release 12.0(3)T introduced support for UNI 4.0 in Cisco IOS Software-based routers. Most interface hardware, including the PA-A3 and the ATM Interface Processor (AIP), supports UNI 4.0. This support specifically includes ABR SVCs or PVCs on some ATM hardware. However, none of the UNI 4.0 supplementary services are supported.

As of Cisco IOS Software Release 12.1, all routers support UNI 4.0 Traffic Management features that match the ATM service categories they support. For example, a 7500 series router with an AIP can signal variable bit rate (VBR) and unspecified bit rate (UBR) calls with a UNI 4.0 switch, and auto configuration negotiates the UNI version to be UNI 4.0.

Issue the **atm uni-version** command to manually set the UNI version on an ATM interface.

```
3640(config-if)# atm uni-version ?
  3.0  UNI Version 3.0
  3.1  UNI Version 3.1
  4.0  UNI Version 4.0
```

Since the user and network sides of a UNI connection must use the same UNI version, take care to avoid version mismatches by using ILMI link autodetermination, which is enabled by default as of Cisco IOS Software Release 12.0. Issue the **atm auto-configuration** command to reenble it.

UNI Signaling Support on Campus ATM Switches

Cisco campus ATM switches, such as the LS1010 and Catalyst 8500 series, support UNI 4.0 and most of its features. This support specifically includes ABR VCs and traffic negotiation for all SVCs. It does not include the proxy agent function or LIJs, which generally are not supported and are viewed as needing additional development by the ATM Forum.

It is best to leave ILMI link autodetermination enabled and allow ILMI to negotiate the UNI version between the user and network ends. However, you may issue the following command to manually set the ATM UNI version on an ATM switch interface:

```
Switch(config)# interface atm card/subcard/port [.vpt#]
Switch(config-if)# atm uni [side {network / user}] [type {private /
public}][version {3.0 / 3.1 / 4.0}]
```

When manually setting the UNI version, also disable ILMI auto configuration with the **no atm auto-configuration** command to avoid mismatched settings.

When connecting Cisco ATM switches to non-Cisco equipment, verify that the UNI version matches at both ends. Occasionally, version negotiation fails with non-standard switches.

Type—Private or Public

ATM networks distinguish between two types of UNIs—public and private. Simply stated, a private ATM interface defines a connection between an ATM end system and an ATM switch in a private ATM network, such as a campus network between buildings or between locations in the same metropolitan area. A public ATM interface defines a connection between an ATM end system and an ATM switch in a public ATM network, such as one owned and operated by a service provider. A private network interfaces to a public network via UNI, which in this case is called a public UNI.

During ILMI link negotiation procedures, an ATM interface queries the `atmfAtmLayerUniType` object of the peer interface to determine whether it is configured as public (1) or private (2). The output below was generated from the **debug snmp packet** and **debug atm ilmi** commands on an LS1010 switch. It captures a connected router interface advertising a `peer UNI Type` of 2.

Note: Some of the output below appears on multiple lines due to space limitations.

```
1w1d: ILMI(ATM0/0/0): Querying peer device type.
1w1d: ILMI:peerDeviceTypeQuery not completed
1w1d: ILMI:peerPortTypeQuery not completed
1w1d: ILMI(ATM0/0/0): From Restarting To WaitDevAndPort
  <ilmi_query_peerdevAndportType>
1w1d: ILMI(ATM0/0/0):Sending out Request 6551
1w1d: ILMI(ATM0/0/0):Sending out Request 6552

!--- An ATM interface running ILMI sends several requests in succession
!--- to poll different object IDs. Request 6552 is for the peer UNI type.

1w1d: SNMP: Response, reqid 6551, errstat 0, erridx 0
  atmfAtmLayerEntry.10.0 = 1
1w1d: ILMI(ATM0/0/0):Response received for request 6551
1w1d: SNMP: Response, reqid 6552, errstat 0, erridx 0
  atmfAtmLayerEntry.8.0 = 2
1w1d: ILMI(ATM0/0/0):Response received for request 6552
```

*!--- The response is reported by **debug snmp packet**.*

```
1w1d: ILMI(ATM0/0/0): Peer Device Type is 1
1w1d: The peer UNI Type on (ATM0/0/0) is 2
```

*!--- The response is reported by **debug atm ilmi**.*

```
1w1d: ILMI(ATM0/0/0): From WaitDevAndPort To DeviceAndPortComplete
<ilmi_find_porttype>
```

Link Side—Network or User

During ILMI auto configuration, two ATM devices query the peer `atmAtmLayerDeviceType` object to determine the UNI link side value. A value of one (1) indicates the user side, and a value of two (2) indicates node or network side.

The output below was generated from the **debug snmp packet** and **debug atm ilmi** commands on an LS1010 switch.

Note: Some of the output below appears on multiple lines due to space limitations.

```
1w1d: ILMI(ATM0/0/0): Querying peer device type.
1w1d: ILMI:peerDeviceTypeQuery not completed
1w1d: ILMI:peerPortTypeQuery not completed
1w1d: ILMI(ATM0/0/0): From Restarting To WaitDevAndPort
<ilmi_query_peerdevAndportType>
1w1d: ILMI(ATM0/0/0):Sending out Request 6551
```

!--- Request 6551 is for the peer UNI type.

```
1w1d: ILMI(ATM0/0/0):Sending out Request 6552
1w1d: SNMP: Response, reqid 6551, errstat 0, erridx 0
atmAtmLayerEntry.10.0 = 1
```

*!--- The response is reported by **debug snmp packet**.*

```
1w1d: ILMI(ATM0/0/0):Response received for request 6551
1w1d: SNMP: Response, reqid 6552, errstat 0, erridx 0
atmAtmLayerEntry.8.0 = 2
1w1d: ILMI(ATM0/0/0):Response received for request 6552
1w1d: ILMI(ATM0/0/0): Peer Device Type is 1
```

*!--- The response is reported by **debug atm ilmi**.*

```
1w1d: The peer UNI Type on (ATM0/0/0) is 2
1w1d: ILMI(ATM0/0/0): From WaitDevAndPort To DeviceAndPortComplete
<ilmi_find_porttype>
```



Normally, Cisco router interfaces and Catalyst ATM modules negotiate to side user. This output was captured on a PA-A3 ATM port adapter:

```
7200-1>show interface atm 3/0
ATM3/0 is up, line protocol is up
Hardware is ENHANCED ATM PA
Internet address is 1.1.1.1/8
MTU 4470 bytes, sub MTU 4470, BW 149760 Kbit, DLY 80 usec,
```

```
reliability 255/255, txload 1/255, rxload 1/255
NSAP address: 47.00918100000000902B03E001.111111111111.11
Encapsulation ATM, loopback not set
Keepalive not supported
Encapsulation(s): AAL5
4096 maximum active VCs, 2 current VCCs
VC idle disconnect time: 300 seconds
Signaling vc = 1, vpi = 0, vci = 5
UNI Version = 4.0, Link Side = user
```

!--- Output suppressed.

Related Information

- [ITU-T User-Network Interface \(UNI\) Specification](#) 
- [ATM Forum UNI Specifications](#) 
- [ATM Technology Support Pages](#)
- [Technical Support - Cisco Systems](#)

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