



# IMA Dynamic Bandwidth

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The IMA Dynamic Bandwidth feature introduces the ability to configure Cisco IOS software to automatically manage changes in the total bandwidth of an Asynchronous Transfer Mode (ATM) interface configured with an Inverse Multiplexing over ATM (IMA) group. In previous releases of Cisco IOS software, the network administrator was required to manually adjust PVC bandwidth every time an individual physical link went up or down. These manual adjustments are tedious, and quickly become cumbersome in a scalable environment.

## History for the IMA Dynamic Bandwidth Feature

Release	Modification
12.0(30)S1	This feature was introduced.
12.0(31)S	This feature was integrated into Cisco IOS Release 12.0(31)S.

## Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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## Prerequisites for Implementing IMA Dynamic Bandwidth

- An ATM interface must be configured for IMA operation.
- An IMA group interface must be configured.

## Restrictions for Implementing IMA Dynamic Bandwidth

- This feature is supported only for ATM permanent virtual circuits (PVCs). Switched virtual circuits (SVCs) are not supported.
- This feature is supported only for the unspecified bit rate (UBR), available bit rate (ABR), and variable bit rate nonreal-time (VBR-NRT) quality of service (QoS) classes.
- The algorithm used to implement this feature is applied only when dynamic changes to an IMA group interface occur. It is not applied at VC creation on router bootup.
- Incorrect QoS parameters may be applied to PVCs if the IMA Dynamic Bandwidth feature is disabled after a change in total bandwidth, and then reenabled after another change in total bandwidth.

## Information About IMA Dynamic Bandwidth

To configure the IMA Dynamic Bandwidth feature, you should understand the following concepts:

- [IMA Groups, page 2](#)
- [Dynamic Changes in Bandwidth Availability, page 2](#)
- [How the IMA Dynamic Bandwidth Feature Works, page 3](#)
- [Benefits of the IMA Dynamic Bandwidth Feature, page 3](#)

## IMA Groups

IMA provides the capability to send and receive a single high-speed ATM data stream over multiple slower-speed physical links. The originating stream of ATM cells is divided so that complete ATM cells are sent in round-robin order across the set of ATM links.

IMA requires the configuration of a logical ATM interface. The logical ATM interface is called an IMA group, and consists of multiple physical ATM links. VCs are configured under the IMA group interface, and can send data over any or all of the physical ATM links in the group.

## Dynamic Changes in Bandwidth Availability

When multiple T1 or E1 lines are grouped into an IMA group, the total available bandwidth is the sum of the bandwidth of each line. If one or more of the lines goes down, the total bandwidth available on the IMA group interface is reduced. If a line then come back up, the total available bandwidth increases. These dynamic changes in available total bandwidth impact the bandwidth that is available for any VC configured on the IMA group interface.

## Benefits of the IMA Dynamic Bandwidth Feature

Prior to Cisco IOS 12.0(31)S, the Cisco IOS software was unable to adjust PVC bandwidth automatically in response to changes in the total IMA group interface bandwidth. The network administrator was required to manually adjust PVC bandwidth every time an individual physical link went up or down. These manual adjustments are tedious, and quickly become cumbersome in a scalable environment.

The IMA Dynamic Bandwidth feature provides the ability to configure Cisco IOS software to automatically adjust PVC bandwidth in response to changes in the total available IMA group interface bandwidth. This feature eliminates the manual intervention previously required every time an individual link goes up or down, and allows the available bandwidth to be used effectively at all times.

## How the IMA Dynamic Bandwidth Feature Works

When the total available bandwidth on an IMA group interface changes, all of the PVCs configured on that interface are re-created.

If necessary and applicable for a particular PVC based on its QoS class, new values are applied for the following parameters when PVCs are re-created:

- PCR—peak cell rate
- MCR—minimum cell rate
- SCR—sustainable cell rate

The following steps are performed by the Cisco IOS software to determine what value should be assigned to a parameter when a PVC is re-created in response to a change in total available bandwidth:

- A value is calculated for the parameter. The calculation takes into account the configured value for the parameter, the active value for the parameter (if it is different from the configured value), and the change in total available bandwidth.
- The calculated value is compared to the configured value of the parameter and to the maximum available cell rate, and a new value is determined. The new value is applied when the PVC is re-created.

**Note**

The configured value of a parameters is not overwritten in the configuration file by any new value that is applied in response to dynamic bandwidth changes.

The following sections describe how the new parameter values are determined when a PVC is re-created for supported QoS classes:

- [UBR PVCs](#)
- [ABR PVCs](#)
- [VBR-NRT PVCs](#)

**UBR PVCs**

When the total available bandwidth changes, PVCs configured with UBR QoS are re-created as follows:

- If the PCR configuration is set to the default, the PVC is re-created with a PCR value equal to the maximum available rate.

- If the configured PCR value is less than the calculated PCR value, the PVC is re-created with the configured PCR value.
- If the configured PCR value is greater than the calculated PCR value, the PVC is re-created with a new PCR value. The new PCR value will be the lower of the following values:
  - The calculated PCR value
  - The maximum available cell rate

#### ABR PVCs

When the total available bandwidth changes, PVCs configured with ABR QoS are re-created as follows:

- If the configured PCR value is less than the calculated PCR value, the PVC is re-created with the configured PCR value.
- If the configured PCR value is greater than the calculated PCR value, the PVC is re-created with a new PCR value. The new PCR value will be the lesser of the following values:
  - The calculated PCR value
  - The maximum available cell rate
- If the configured MCR value is less than the calculated MCR value, the PVC is re-created with the configured MCR value.
- If the configured MCR value is greater than the calculated MCR value, the PVC is re-created with the calculated MCR value.

#### VBR-NRT PVCs

If the total available bandwidth decreases or increases, VBR-NRT PVCs will be re-created as follows:

- If the configured PCR value is less than the calculated PCR value, the PVC is re-created with the configured PCR value.
- If the configured PCR value is greater than the calculated PCR value, the PVC is re-created with a new PCR value. The new PCR value will be the lesser of the following values:
  - The calculated PCR value
  - The maximum available cell rate
- If the configured SCR value is less than the calculated SCR value, the PVC is re-created with the configured SCR value.
- If the configured SCR value is greater than the calculated SCR value, the PVC is re-created with the calculated SCR value.

## How to Enable IMA Dynamic Bandwidth

This section contains the following required procedure:

- [Enabling IMA Dynamic Bandwidth, page 4](#)

## Enabling IMA Dynamic Bandwidth

The IMA Dynamic Bandwidth feature allows Cisco IOS software to make dynamic adjustments to VC bandwidth in response to changes in the overall IMA interface bandwidth.

Perform this task to enable the IMA Dynamic Bandwidth feature.

**Note**

Incorrect QoS parameters may be applied to PVCs if the IMA Dynamic Bandwidth feature is disabled after a change in total bandwidth, and then reenabled after another change in total bandwidth.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **interface atm *slot/ima group-number***
4. **atm bandwidth dynamic**

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>interface atm <i>slot/ima group-number</i></b>  <b>Example:</b> Router(config)# interface atm 3/ima 1	Configures an IMA group and enters interface configuration mode.
<b>Step 4</b>	<b>atm bandwidth dynamic</b>  <b>Example:</b> Router(config-if)# atm bandwidth dynamic	Enables the automatic management of changes in the total bandwidth of an ATM interface configured with an IMA group.

## Configuration Examples for IMA Dynamic Bandwidth

This section contains the following configuration example:

- [Enabling the IMA Dynamic Bandwidth Feature: Example, page 6](#)

## Enabling the IMA Dynamic Bandwidth Feature: Example

The following example creates IMA group 1, enables automatic bandwidth management, and assigns a physical ATM interface to the IMA group:

```
interface atm3/ima 1
  atm bandwidth dynamic
!
interface atm0/1
  ima-group 1
```

## Additional References

The following sections provide references related to the IMA Dynamic Bandwidth feature.

### Related Documents

Related Topic	Document Title
Information about configuring IMA	“Configuring ATM” chapter in the <i>Cisco IOS Wide-Area Networking Configuration Guide</i>
Wide-area networking commands including command syntax, command mode, command history, defaults, usage guidelines, and examples	<i>Cisco IOS Wide-Area Networking Command Reference</i>

### Standards

Standards	Title
None	—

### MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### RFCs

RFCs	Title
None	—

## Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	<a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a>

## Command Reference

This section documents the new **atm bandwidth dynamic** command.

# atm bandwidth dynamic

To enable the automatic management of changes in the total bandwidth of an Asynchronous Transfer Mode (ATM) interface configured with an Inverse Multiplexing over ATM (IMA) group, use the **atm bandwidth dynamic** command in interface configuration mode. To disable automatic management of changes in total IMA group bandwidth, use the **no** form of this command.

**atm bandwidth dynamic**

**no atm bandwidth dynamic**

**Syntax Description** This command has no arguments or keywords.

**Defaults** Changes in total IMA group bandwidth are not automatically managed.

**Command Modes** Interface configuration

Command History	Release	Modification
	12.0(31)S	This command was introduced.

**Usage Guidelines** When the **atm bandwidth dynamic** command is enabled, all of the permanent virtual circuits (PVCs) configured on an IMA group interface are re-created if the total available IMA group bandwidth changes. There must be at least one active link on the IMA group interface for dynamic bandwidth changes to take effect.

Automatic bandwidth management is supported only for the following quality of service (QoS) classes:

- UBR—unspecified bit rate
- ABR—available bit rate
- VBR-NRT—variable bit rate nonreal-time

If necessary and applicable for a particular PVC based on its QoS class, new values are applied for the following parameters when PVCs are re-created:

- peak cell rate (PCR)—all supported QoS classes
- minimum cell rate (MCR)—ABR QoS
- sustainable cell rate (SCR)—VBR-NRT QoS

The algorithm used to implement automatic bandwidth management is applied only when dynamic changes to an IMA group interface occur. It is not applied at virtual circuit creation on router bootup.



**Note** Incorrect QoS parameters may be applied to PVCs if the **atm bandwidth dynamic** command is disabled after a change in total bandwidth, and then reenabled after another change in total bandwidth.

**Examples**

The following example creates IMA group 1, enables automatic bandwidth management, and assigns a physical ATM interface to the IMA group:

```
interface atm3/ima 1
  atm bandwidth dynamic
!
interface atm0/1
  ima-group 1
```

**Related Commands**

Command	Description
<b>ima-group</b>	Defines physical links as IMA group members.
<b>interface atm</b>	Configures an ATM interface and enters interface configuration mode.
<b>interface atm ima</b>	Configures an IMA group.

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