

SmartTrunk User's Guide

9032680



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Declaration of Conformity Addendum

Application of Council Directive(s): 89/336/EEC

73/23/EEC

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Conformance to Directive(s)/Product Standards: EC Directive 89/336/EEC

EC Directive 73/23/EEC

EN 55022

EN 50082-1

EN 60950

Equipment Type/Environment: Networking Equipment, for use in a

Commercial or Light

Industrial Environment.

We the undersigned, hereby declare, under our sole responsibility, that the equipment packaged with this notice conforms to the above directives.

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Introduction

Traditional 802.1D Spanning Tree Bridges only allow one active data path between any two switches; all other parallel data paths are in Standby or Blocking mode. If one interface or path should fail, then the other interface automatically comes out of Blocking mode and forwards all of the traffic. This is fine for redundancy purposes. However, it is not the most efficient use of resources.

SmartTrunk, also referred to as SmartTrunking, is Cabletron Systems' terminology for load balancing or load sharing. SmartTrunk provides the ability to take full advantage of the network's redundant bandwidth. SmartTrunk divides network traffic across multiple ports in parallel to provide additional throughput. The SmartTrunk application can be used with any of Digital's MultiSwitch 700 switch modules (except ATM modules).

SmartTrunking

A physical port configured in a SmartTrunk Group must:

- Be connected in a point-to-point link (full-duplex is recommended)
- Be connected to a port that is also configured as part of a SmartTrunk Group
- Have Spanning Tree protocol enabled

Whenever a physical port is configured in a SmartTrunk Group, the port will send proprietary protocol messages (see PLAP and LLAP information in the Compatibility section). Once the two switches at opposite ends of the link agree that the trunking state is enabled, the SmartTrunk Group is established. As additional ports are identified as belonging to the same SmartTrunk Group, the SmartTrunk Group is automatically reconfigured to take advantage of the additional paths.

Packet Distribution

Packet distribution is based on hardware family type:

MultiSwitch 700

Packet distribution among the ports in the group is accomplished by adding the **destination** and **source** MAC addresses and then applying the modulus operator to the sum using the number of active ports in the group. The remainder, which falls into the range of the number of ports in the group, will dictate which port will be used by the address. This gives a random distribution of the packet load, but insures that the same destination-source flow always goes out the same port. This alleviates the possibility of out-of-order packets.

Modulus Examples

Ports contained in the trunk are labeled from zero (0) to one less than the number of ports in the group. For example, if the physical ports in the group are 1 3 5 7 9, packet distribution would be based on the trunking port number assigned. Trunking port numbers are 0 1 2 3 4.

The modulus operator divides the first number by the second number and yields a whole number remainder:

$$(\text{sum of addresses}) \text{ modulus } (\text{number of trunk ports}) = \text{remainder}$$

For example:

$$5 \text{ mod } 4 = 1 \text{ (Four goes into five once with a remainder of one)}$$

$$4 \text{ mod } 5 = 4 \text{ (Five goes into four no times with a remainder of four)}$$

The remainder is the useful number that will fall between zero (0) and one less than the number of trunk ports. This remainder will dictate which trunk port is used to send the traffic by matching it to the trunking port number.

Compatibility - DEC Hunt Groups and GigaSwitch Router (GSR)

SmartTrunking for the MultiSwitch 700 is based on, and compatible with, DEC Hunt Groups. Adopting the DEC Hunt Groups protocol allows the MultiSwitch 700 to be trunked together with the GigaSwitch Router (GSR) and other DEC equipment supporting this feature. (See the firmware release notes for the compatibility of the individual image selected).

SmartTrunking and Hunt Groups are comprised of two protocols:

- Logical Link Aging Protocol (LLAP) - Assists in learning and aging.
- Physical Link Affinity Protocol (PLAP) - Monitors and maintains the trunking states.

Chassis with Multiple SmartTrunk Groups

A SmartTrunk “group” consists of two or more ports, and defines a single logical connection to a MultiSwitch 700 module. By creating identical groups on modules in two different MultiSwitch 700 chassis, a point-to-point SmartTrunk can be established between the switches to increase the available bandwidth and provide link redundancy.

Figure 1-1 depicts a single example of a network with several MultiSwitch 700 chassis using SmartTrunking. In this example, a module in one MultiSwitch 700 (chassis #1) supports two different SmartTrunk groups to other MultiSwitch 700 chassis (#2 and #3). Group “A” forms the SmartTrunk that connects a module in chassis #1 to a module in chassis #3. Group “B” forms a separate SmartTrunk that connects the same module in chassis #1 to a module in chassis #2. Thus, the module in chassis #1 is shown as having “multiple groups” when viewed through management screens (through a Local Management console or remote management software).

SmartTrunk can be configured in a number of different ways on MultiSwitch 700 modules. A MultiSwitch 700 module can be configured to support a single SmartTrunk groups consisting of virtually any number of ports (essentially limited to the number of ports on the module). Or, a module can be configured to support multiple SmartTrunk groups, creating trunk connections to several other switches (see Figure 1-1). The particular configuration chosen for each MultiSwitch 700 module depends on the overall network design.

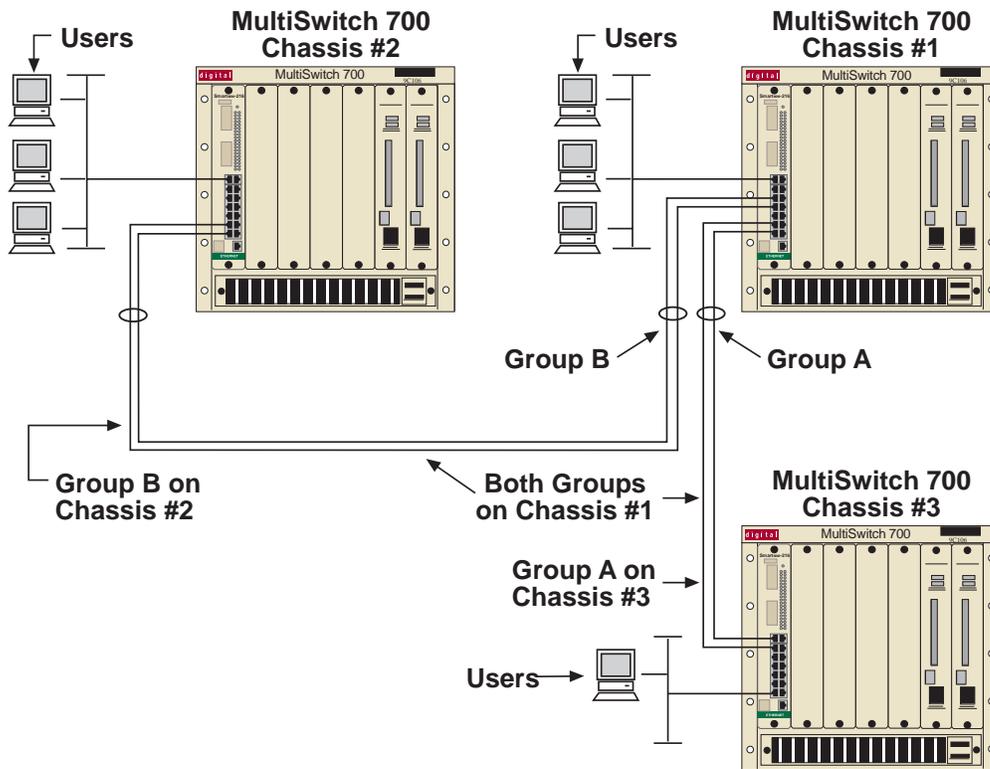


Figure 1-1. Chassis with Multiple SmartTrunk Groups Enabled

SmartTrunk and Port Connections

The SmartTrunk application dynamically determines network loops and is used concurrently with the Spanning Tree protocol. The SmartTrunk application only acknowledges its neighboring switches. If a user goes through several switch hops, then loops back to the first switch hop (creating a loop), a common connection between two switches (any two) will go into a blocking state (see Figure 1-2).

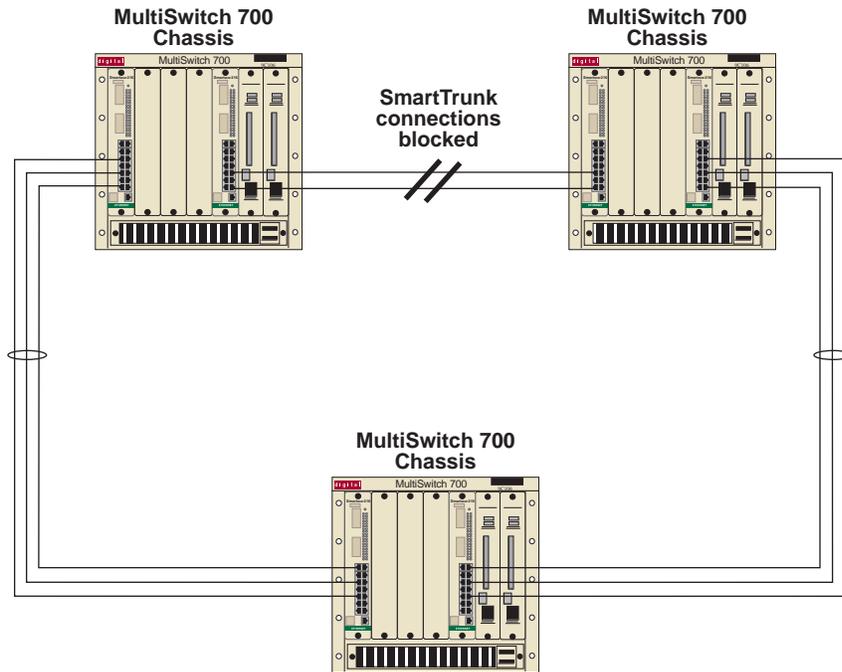


Figure 1-2. SmartTrunk with a Network Loop

Port costs are considered by SmartTrunk when disabling a looped configuration. SmartTrunk will place the higher path costs of the group interfaces into a blocked state.

Path cost will be calculated using the following equations:

Speed

The speed of the interface (typically in megabits). For example, 10, 100, or 1000 (see Table 1-1).

Table 1-1. Example Port Speeds

Port Type	Speed
10 Mb, Half Duplex	100
10 Mb, Full Duplex	50
100 Mb, Half Duplex	10
100 Mb, Full Duplex	5

Active Trunk Links

The number of links participating in the trunking group.

If all the ports in the trunking group are the same speed and configured to the same duplex mode, the equation is:

$$\frac{1000}{\text{Speed} \times \# \text{ of ports}}$$

If the ports in the trunking group are different speeds, the equation is:

$$\frac{1000}{\text{Speed 1} + \text{Speed 2} + \text{Speed 3} + \text{Speed n} \dots}$$

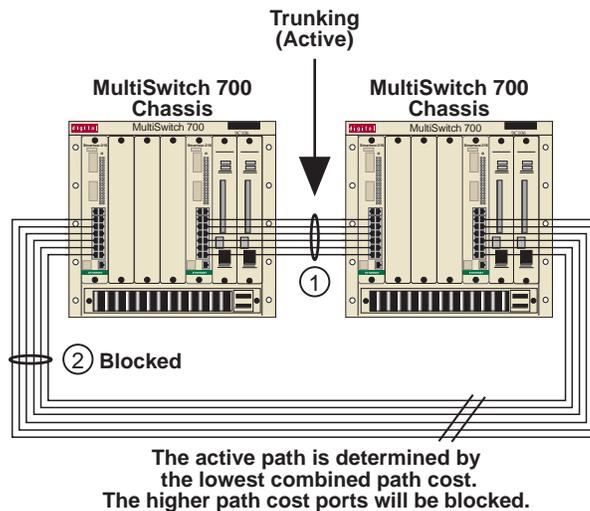
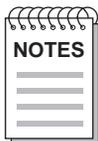


Figure 1-3. A Redundant Standby Path for Trunking

Multiple trunks can also be established between chassis-based switches, but only one group of trunk ports will be active. The trunked ports do not necessarily need to be on the same module. A Blocked state for all ports in the Group in Standby will be reflected on the SmartTrunking Local Management screen.



When this configuration is used, only one module's SmartTrunk Group will be active. The second path will block and serve as a backup to the currently active path. (The active trunking path will be determined by the module providing the lowest path cost.)

Refer to the release notes for image-specific restrictions while using SmartTrunking.



The only time path cost is calculated is when a port is added or removed from the trunking group. While the trunking group is operational, losses of link or PLAP on a port will not result in path cost recalculation. In order for a redundant group to become active, the **entire** primary group must become inactive or disabled.

Correspondence

Documentation Comments

If you have comments or suggestions about this manual, send them to DIGITAL Network Products:

Attn.:	Documentation Project Manager
E-MAIL:	doc_quality@lkg.mts.dec.com

World Wide Web

To locate product-specific information, refer to the DIGITAL Network products home page on the World Wide Web at the following locations:

North America:	http://www.networks.digital.com
Europe:	http://www.networks.europe.digital.com
Asia Pacific:	http://www.networks.digital.com.au

Getting Help

Contact your Digital representative for technical support. Before calling, having the following information ready:

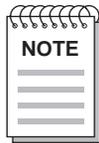
- A description of the failure
- A description of any action(s) already taken to resolve the problem (e.g., changing mode switches, rebooting the unit, etc.)
- A description of your network environment (layout, cable type, etc.)
- Network load and frame size at the time of the trouble (if known)
- The device history (i.e., have you returned the device before, is this a recurring problem, etc.)

SmartTrunk Configuration

Prior to entering information in the SmartTrunking Configuration Screen, you should understand the concept of SmartTrunk (see Chapter 1) and the SmartTrunk Configuration Rules.

SmartTrunk Configuration Rules

The following rules apply when configuring ports for SmartTrunking.



Failure to follow these rules will produce poor network performance.

1. SmartTrunking ports should be configured to Full Duplex.
2. You cannot loop front panel ports back to the same module, to the same chassis, or to different modules within that chassis. Loops are intended to connect one chassis to another chassis.
3. You must enable Spanning Tree before you enable SmartTrunk.
If a network loop exists and SmartTrunk becomes disabled, then as long as Spanning Tree is enabled, the Spanning Tree algorithm will respond and block the necessary ports.
4. If a network loop exists and SmartTrunk becomes disabled, and Spanning Tree is also disabled, then an infinite packet loop will occur and cripple the network.
5. If a SmartTrunking port becomes unusable, all other traffic is redirected over the remaining port(s) in the group.
6. Backplane ports (FTM) on chassis-based switches cannot be configured as SmartTrunk ports and are not eligible to participate in trunking.

7. An end station plugged directly into a port configured for SmartTrunking will not be allowed to communicate. No traffic will flow into the port.
8. The same SmartTrunk group **cannot** be split onto two separate modules (see Figures 2-1 and 2-2).

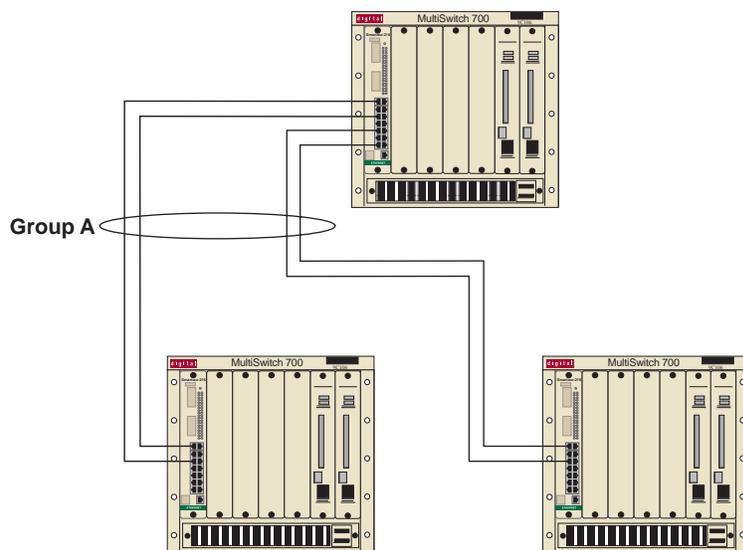


Figure 2-1. ILLEGAL CONFIGURATION (Example 1)

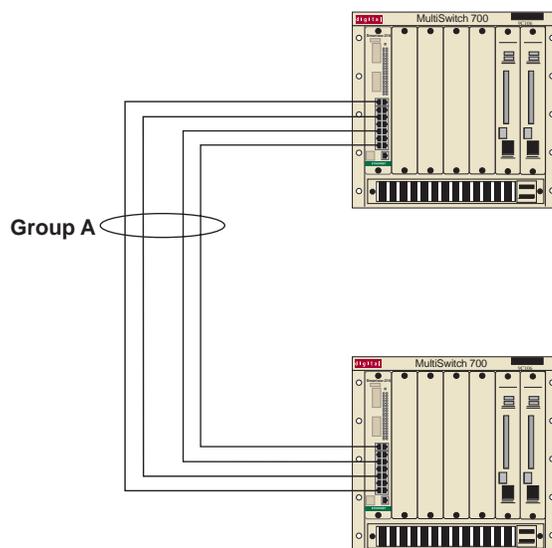


Figure 2-2. ILLEGAL CONFIGURATION (Example 2)

SmartTrunking Configuration Screen

To select the SmartTrunking Configuration Screen from the Module Configuration Menu:

1. Use the arrow keys to highlight the SmartTrunking Configuration option.
2. Press the **ENTER** key. The SmartTrunking Configuration Screen, Figure 2-3, appears.

```

DLE22-MA LOCAL MANAGEMENT

SmartTrunking Configuration

Device Type: DLE22-MA                               Firmware Revision: XX.XX.XX
                                                    BOOTPROM Revision: XX.XX.XX

SmartTrunk Group:
SmartTrunk Logical Port:

      Port      State      Port      State      Port      State
      -----      -----      -----

SmartTrunk State: [ENABLED]
Add/Remove Group:                               Group: [ ADD ]
Display Group:                                   Port: [REMOVE]

SAVE      UPDATE                               EXIT      RETURN

```

Figure 2-3. SmartTrunking Configuration Screen

The following section briefly explains each field on the SmartTrunking Configuration Screen.

SmartTrunk Group

The title of the group that is active in the screen.

SmartTrunk Logical Port

Identifies the bridge port number used by all members of the SmartTrunking group.

SmartTrunk State (Toggle)

Used to enable or disable SmartTrunking for all groups defined on the device.

- ENABLE - Select to change state to On
- ENABLED - Currently On
- DISABLE - Select to change state to Off
- DISABLED - Currently Off

Add/Remove Group

A user-defined 32-character string describing the group of SmartTrunk ports.

Group

Is either of the following:

- ADD - Create a SmartTrunk Group Name. The name field will become empty, awaiting user input.
- DELETE - Remove the SmartTrunk Group Name. The name field will automatically fill with SmartTrunk names found on the device. Users may either type in the name to be deleted or use the SmartTrunk Group field to toggle through the list of names found on the switch.

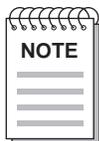
Display Group

A list of the SmartTrunk groups available on this device. Selecting a group updates the table in the center of the screen. The table displays the ports and current state of the members included in the group. If no groups have been created (Added), then this field will remain blank and the table will display no data.

Port

When State is:

- ADD - Displays the ports available to add to the displayed group. Ports assigned to other trunk groups will not show up in this list because they are not available to add.
- REMOVE - Displays a list of ports currently assigned to the active SmartTrunk group. They are the only ports available for deletion.



A SmartTrunk port in a disabled state will not allow any traffic to flow until the appropriate corresponding trunk group is connected. Inadvertently configuring a user-attached port to a member of a SmartTrunking group will result in the user losing network connectivity.

UPDATE (Command)

Refreshes the table currently displayed.

After making modifications, you must select the **SAVE** command to save your changes.

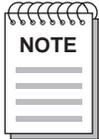
The **NEXT** and **PREVIOUS** commands will be displayed when there are more than 18 ports.

- To access ports on the device not seen on the primary screen, use the arrow keys to highlight the **NEXT** command at the bottom of the screen, then press the **Return** key.
- To view the previous screen of ports, use the arrow keys to highlight the **PREVIOUS** command at the bottom of the screen, then press the **Return** key.

Exiting the SmartTrunking Configuration Screen

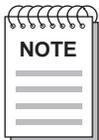
To exit the SmartTrunking Configuration Screen, use the arrow keys to highlight **RETURN** and press the **Return** key.

Helpful Hints for Configuring SmartTrunk



This procedure must be completed on both switches participating in Trunking.

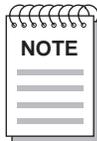
1. Navigate through Local Management to the SmartTrunking Configuration Screen.
2. Using the arrow keys, move the cursor to the **Add/Remove Group** field.
3. Type the name of the SmartTrunk group you wish to create.
4. Highlight the **SAVE** command, and then press the **Return** key.



The group must be created and saved prior to adding ports to the group.

5. Using the arrow keys, move the cursor to the **Port** field.
6. Select the port that is to become part of the SmartTrunk Group just created. Press the Spacebar to change the port number.
7. Using the arrow keys, highlight the **ADD** field, and then press the **Return** key. The port and state will be added to the table on the trunking page. The port will no longer show in the list of ports that can be added.
8. Repeat steps 5 through 7 to select the next port to be added. If the ports to be added to the group are sequential, start by selecting the lowest port value and continue to press the **Return** key while on the **ADD** field. The ports will increment automatically as you press **Return**.

9. After all ports have been added, highlight the **SmartTrunk State** field. Press the **Spacebar** to select **ENABLED**.



In order to minimize the interruption to network traffic while trunking is being configured, it is recommended that a port between the switches remains outside the group until the trunking links are active.

As soon as you enable a trunking group on one end of the trunk, all traffic will stop until the other end of the trunk is enabled. Leaving one port out of the group will allow traffic to flow between switches while trunking is configured and initialized. After the trunk group is running, the single port will block and the trunking path will become the active data path. At this point, the single port may be added to the trunking group.

If this is not possible, it is recommended that the trunking groups be created, and ports added on both ends of the trunk before trunking is enabled. Reducing the time between enabling both ends of the group will reduce network interruptions.

10. Highlight the **SAVE** command, and then press the **Return** key.
11. Repeat this procedure on the device that is connected to the trunk ports just configured.
12. Once both ends of the Trunk are configured, port states for the group will change from Disabled to Enabled.

Creating a Second Trunk Group

To create a second trunk Group:

1. Highlight the **Add/Remove Group** field. Make sure the [ADD/DELETE] field to the right on the same line is configured to [ADD].
2. Type the name of the SmartTrunk group you wish to create. Highlight the **SAVE** field, and then press the **Return** key.



The group must be created and saved prior to adding ports to the group.

3. Continue to add ports to the group as described in the preceding section.

Removing an Entire Trunk Group

To remove an entire trunk Group:

1. Using the arrow keys, highlight the Group: **[ADD/DELETE]** field (on the same line as the **Add/Remove Group** field). Press the **Spacebar** to select **[DELETE]**.
2. If the name of the group to be deleted doesn't appear on the **Add/Remove Group** field, type the name of the SmartTrunk group you wish to delete.

It is also possible to use the **Display Group** field to toggle through existing groups. This will automatically update **Add/Remove Group** field. Once the proper name appears in the **Add/Remove Group** field, highlight the **SAVE** command, and then press the **Return** key. The group will be removed.



All ports in the group will be released. It is not necessary to remove ports from a group before deleting the group.

Removing a Port from a Group

To remove a port from a Group:

1. Select the group to have a port removed. If the name of the group to be deleted doesn't appear on the **Add/Remove Group** field, type the name of the SmartTrunk group you wish reconfigure. It is also possible to use the **Display Group** field to toggle through existing groups. This will automatically update the **Add/Remove Group** field. Once the proper name appears in the **Add/Remove Group** field, proceed to step 2.
2. Highlight the **[ADD/DELETE]** field (to the right of the Port field). Press the **Spacebar** to select **[DELETE]**.
3. Move the cursor to the **Port** field. Select the port that is to be removed from the SmartTrunk Group. Press the **Spacebar** to change the port number. Only ports that are currently members of the group will be displayed.
4. Once the port is selected, highlight the **[DELETE]** field.
5. To delete the port, press the **Return** key.
6. Continue to press the **Return** key and all ports will be deleted.
7. Highlight the **SAVE** command, and then press the **Return** key.

