Passport 7400, 15000, 20000

Call Server Guide

241-5701-405

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General availability. Contains information on Passport 7400, Passport 15000, and Passport 20000 for the PCR5.2 GA release.

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About this document

The 241-5701-405 *Passport 7400, 15000, 20000 Call Server Guide* describes the Passport Call Server for Passport networks.

The term network in the context of this document refers in general to any switching network, and often the Passport network in particular. The term user refers to the customer equipment connected to the network. For instance, an router is a user.

The following topics are discussed in this section:

Who should read this document and why

The 241-5701-405 *Passport 7400, 15000, 20000 Call Server Guide* is intended for personnel assigned the task of setting up and operating the call-routing services for Passport-only networks.

What you need to know

The Passport Call Server supports the following DNA based services:

- Frame Relay

- Internet Protocol (IP) interface over Frame Relay or IPIFR

How this document is organized

The 241-5701-405 *Passport 7400, 15000, 20000 Call Server Guide* contains the following sections:

- “Provisioning the call server” (page 19)
- “Troubleshooting” (page 29)
- “Understanding Passport call-routing services” (page 33)
- “Compliances” (page 55)
- “Address plans” (page 57)

What’s new in this document

The following changes or feature additions were made to this document:

- “Structural changes” (page 14)

Structural changes

This document was restructured into a modular, task-based format to improve the usability of the information. The following changes were made to this document.

- Procedures were grouped into higher-level tasks.
- Task flow charts were added to improve navigation through tasks and procedures, to set tasks and procedures in context, and to provide a visual representation of prerequisites and configuration paths.
- Procedures were restructured into a modular format.
- Purpose statements were added to tasks and procedures to provide context.
- Prerequisites were divided into those applicable to an entire task. those applicable only to a specific procedure, and those applicable only to a specific procedure step. Prerequisites applicable to an entire task were placed in the appropriate task-level prerequisite section, prerequisites applicable only to a specific procedure were placed in the prerequisite section of the procedure, and prerequisites applicable only to a specific step were placed in the step.

- ‘Where’ statements were removed from procedures and the content placed in the ‘Variable values’ table following the procedure.
- A ‘Procedure Job Aid’ section was added to procedures where appropriate. This consists of information that supports the procedure, such as a component hierarchy figure, a checklist, or a diagram.
- Conceptual and reference information were removed from procedures, placed in the appropriate conceptual or reference section, and cross-referenced from the procedure where appropriate. If no appropriate conceptual or reference section existed in which to place such information removed from the procedures, the information was placed in temporary sections called ‘Supporting information’ and ‘Additional information’ at the end of the affected chapter. Only supporting information is cross-referenced from the procedure. The supporting and additional information sections will be removed when an appropriate location for the information is created.

Text conventions

This document uses the following text conventions:

- `nonproportional spaced plain type`

  Nonproportional spaced plain type represents system generated text or text that appears on your screen.

- **`nonproportional spaced bold type`**

  Nonproportional spaced bold type represents words that you should type or that you should select on the screen.

- *italics*

  Statements that appear in italics in a procedure explain the results of a particular step and appear immediately following the step.

  Words that appear in italics in text are for naming.

- `[optional_parameter]`

  Words in square brackets represent optional parameters. The command can be entered with or without the words in the square brackets.

- `<general_term>`

  Words in angle brackets represent variables which are to be replaced with specific values.

- UPPERCASE,lowercase

  Passport commands are not case-sensitive and do not have to match commands and parameters exactly as shown in this document, with the exception of string options values (for example, file and directory names) and string attribute values.

- |

  This symbol separates items from which you may select one; for example, ON|OFF indicates that you may specify ON or OFF. If you do not make a choice, a default ON is assumed.

- ...

  Three dots in a command indicate that the parameter may be repeated more than once in succession.

The term absolute pathname refers to the full specification of a path starting from the root directory. Absolute pathnames always begin with the slash (/) symbol. A relative pathname takes the current directory as its starting point, and starts with any alphanumeric character (other than /).

Related documents

Throughout the 241-5701-405 *Passport 7400, 15000, 20000 Call Server Guide*, specific documents are listed to indicate where more information on a particular topic is available. These documents include:

- 241-5701-030 *Passport 7400, 15000, 20000 Overview*
- 241-5701-045 *Passport 7400, 15000, 20000 Management System User Interface Guide*
- 241-5701-270 *Passport 7400, 15000, 20000 Software Installation Guide*
- 241-5701-520 *Passport 7400, 15000, 20000 Troubleshooting and Testing*

- 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*
- NN10600-605 *Passport - MDM Network Security: Operations*
- 241-5701-611 *Passport 7400, 15000, 20000 Data Collection Guide*
- 241-5701-901 *Passport 7400, 15000, 20000 Frame Relay Fundamentals*
- 241-5701-902 *Passport 7400, 15000, 20000 Configuring Frame Relay*
- 241-5701-410 *Passport 7400, 15000, 20000 Call Redirection Server Guide*
- 241-5701-415 *Passport 7400, 15000, 20000 Hunt Group Server Guide*
- 241-5701-060 *Passport 7400, 15000, 20000 Components*

Refer to 241-5701-001 *Passport 7400, 15000, 20000 Documentation Guide*, for a complete list of Passport documents.

The following related Preside Multiservice Data Manager documents will also help you navigate through the call-routing services for Frame Relay networks:

- 241-6001-100 *Preside MDM Installer Guide*
- 241-6001-303 *Preside MDM Administrator Guide*

Note: If you are migrating from Preside Multiservice Data Manager connectivity via the IP interface over virtual circuits (IPIVC) to IPIFR, you can also see 241-5701-271 *Passport 7400, 15000, 20000 Network Management Connectivity* where you will find more detailed information on migration.

How to get more help

For information on training, problem reporting, and technical support, see the “Nortel Networks support services” section in the *product overview document.*

Chapter 1
Provisioning the call server

Provision the Passport call-routing services to translate DNAs to routable addresses.

- “Prerequisites to provisioning the call server” (page 19)
- “Provisioning the call server task flow” (page 19)

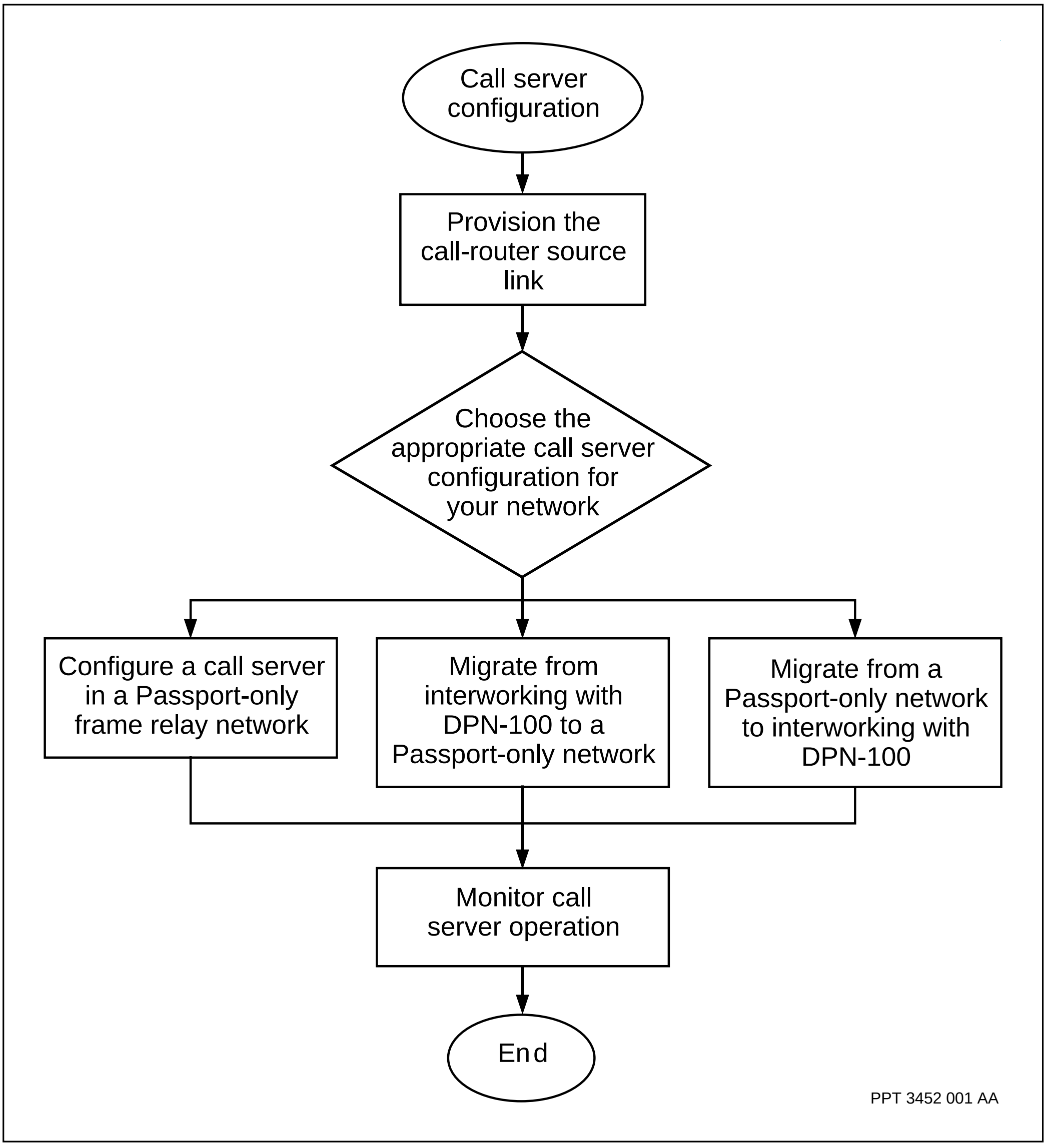
Prerequisites to provisioning the call server

- If you are unfamiliar with Passport call server concepts, see “Understanding Passport call-routing services” (page 33).
- Before the procedures in this section can be performed, the call server software must be installed using the procedures in 241-5701-270 *Passport 7400, 15000, 20000 Software Installation Guide*

Provisioning the call server task flow

This task flow shows you the sequence of procedures you perform to provision the call server. To link to any procedure, go to “Task flow navigation” (page 20).

Figure 1
Provisioning the call server task flow



Task flow navigation

- “Provision the call-router source link” (page 22)

- “Configure a call server in a Passport-only frame relay network” (page 24)
- “Migrate from interworking with DPN-100 to a Passport-only network” (page 25)
- “Migrate from a Passport-only network to interworking with DPN-100” (page 26)
- “Monitor call server operation” (page 27)

Provision the call-router source link

Every Passport node in the network should be provisioned with a *CR* component. Every *CR* component in the Passport subnet should have the same provisioning data. If a CSRM is connected to the Passport network, the CSRM provides the call routing services and the *CR* component becomes dormant.

Procedure steps

1 Enter into provisioning mode:

```
start prov
```

2 Add the call-server software to the CP:

```
set sw lpt/cp featurelist callserver
```

3 Perform a semantic check to ensure consistency across all components and their data:

```
check prov
```

4 Use the activate prov command to propagate the editing view throughout the node:

```
activate prov
```

Note: The activate prov command causes the editing view to become the current view.

5 Save the new view:

```
save prov
```

6 Use the confirm prov command to ensure that connectivity to the operator has been maintained:

```
confirm prov
```

Note: If you do not confirm the provisioning at this point, an automatic rollback will occur. This means the node will restart using the last committed view saved on disk.

7 Commit the provisioning. This saves the current view to disk and ensures that the next time the node starts up, the data you have provisioned in the preceding steps becomes the current view.

```
commit prov
```

8 Add a *CallRouter* component:

`add CallRouter`

9 Add a numbering plan to the CR, for example:

`add CR NPI/X121`

Note: You can add either the X121 or E164 numbering plans to the CR, or both.

10 Add a prefix DNA to the numbering plan:

`add CR NPI/X121 DNA/3021842300`

11 Set the MID for each DNA:

`set CR NPI/X121 DNA/3021842300 moduleId 84`

12 Perform a semantic check to ensure consistency across all components and their data:

`check prov`

13 Save the new view:

`save prov`

14 Use the activate prov command to propagate the editing view throughout the node:

`activate prov`

Note: using the activate prov command causes the editing view to become the current view.

15 Use the confirm prov command to ensure that connectivity to the operator has been maintained:

`confirm prov`

Note: If you do not confirm the provisioning at this point, an automatic rollback will occur. This means the node will restart using the last committed view saved on disk.

16 Commit the provisioning. This saves the current view to disk and ensures that the next time the node starts up, the data you have provisioned in the preceding steps becomes the current view.

`commit prov`

17 Exit provisioning mode:

`end prov`

Configure a call server in a Passport-only frame relay network

Configure the call server in a network consisting of Passport-only nodes.

Procedure steps

1. Add the call-server feature to the control processor (CP).
2. Add the *CallRouter* (*CR*) component to each of the Passport nodes.
3. Provision the *NumberingPlanId* (*Npi*) subcomponent of the *CR* component.
4. For each Passport node, provision the prefix DNAs in the *CR* component.

   Note: The provisioned data for the *CR* component must be the same on every Passport node in the subnet.

Migrate from interworking with DPN-100 to a Passport-only network

Migrate the call server feature from a network that interworks with DPN-100 switches to one using Passport-only nodes.

Procedure steps

1 Ensure that IPIFR has been provisioned and is operating on each node.

2 Add the call-server feature to each Passport.

3 Add the *CR* component to each of the Passport nodes.

4 Add the *Npi* subcomponent of the *CR* component.

5 For each Passport node, provision the prefix DNAs in the *CR* component.

Note: The provisioned data for the *CR* component must be the same on every Passport node in the subnet.

6 Disconnect the call server resource module (CSRM) from the Passport subnet.

Migrate from a Passport-only network to interworking with DPN-100

Migrate the call server feature from a network consisting of Passport-only nodes to one that interworks with DPN-100 switches.

Procedure steps

1. If you have interconnecting subnets, add prefix DNAs (which map to RID, but not MID) provisioned in the *CR* component to the source call router (SCR) of the CSRM, replacing the MIDs with the RID of the Passport subnet.

   OR

2. If you do not have interconnecting subnets, add all the prefix DNAs provisioned in the *CR* component to the SCR of the CSRM replacing the MIDs with the RID of the Passport subnet.
3. Connect the CSRM to the Passport-only network.
4. Delete the *CR* component from each Passport node.

Monitor call server operation

Monitor call server operation to determine whether the call server feature is operating within expected parameters. For troubleshooting information, see “Troubleshooting” (page 29).

Prerequisites

- If you are unfamiliar with any of the components listed here, see 241-5701-060 *Passport 7400, 15000, 20000 Components*

Procedure steps

1 List all DNAs in the CR in the X.121 numbering plan.

list cr npi/X121

2 Display the provisioned attributes for a DNA in the X.121 numbering plan.

display -p cr npi/X121 dna/x

3 Display the CR statistics for the X121 numbering plan.

display cr npi/X121

Chapter 2 Troubleshooting

This chapter provides guidelines on how to solve problems that can occur after the call servers for Passport-only Frame Relay networks are operational. After reading the following sections, you will understand how to react quickly and effectively to these problems.

This chapter describes common problems encountered with this feature, probable causes, and corrective measures. Such problems include:

- failure of call setup
- call server provisioning failure
- problems in adding prefix DNAs
- memory exhaustion

The troubleshooting process

The objective of effective troubleshooting is to identify the problem quickly, isolate the cause, and resolve the fault as quickly as possible in order to avoid disruption in service or loss of data.

The following flowchart lists the three main steps to troubleshooting.

1 Identify the problem.

Note: An alarm will usually indicate which component has failed. Another indicator might be a change in throughput. When the problem has been identified, refer to the appropriate table in this chapter.

2 Determine the cause.

Note: Determine the cause by using the procedures described in "Handling problems" (page 30).

3 Resolve the problem.

Note: Refer to the "Corrective measures" column in the appropriate table described in "Handling problems" (page 30).

Subsequent sections in this chapter identify the most common problems encountered when operating your Passport node.

Handling problems

Table 1, "Handling problems," (page 30) provides guidelines on how to respond to problems that may occur when you are using this feature. The first column describes the problem, the second column provides a probable cause for that problem, and the third column explains how to correct the problem.

Note: Problems which occur when your service is up and running may not be confined only to the *CallRouter* component.

Table 1
Handling problems

Problems that may occur	Probable causes	Corrective measures
Call fails to set up	The CR is not provisioned on the node of the master end.	Provision the CR.
	There is no prefix DNA that matches the slave (destination) DNA.	Provision a prefix for it on the CR.
	The prefix DNA that matches the destination DNA is not mapped to the correct MID.	Provision a longer prefix for the DNA or check that the FR DNA on the destination side is correct.
(Sheet 1 of 3)		

Table 1 (continued)
Handling problems

Problems that may occur	Probable causes	Corrective measures
Call fails to set up	The CSRM is still connected and does not have your prefix. (Passport 7400 only)	If you are not interworking with DPN-100, check first for the *CallRouter* components on the Passport nodes and then disconnect the CSRM.
		If you are interworking with DPN-100, add the prefixes to SCR of CSRM. (For details, see NTP 241-7401-110 *Passport 7400, DPN-100 Interworking Guide*.)
	You cannot route to the destination.	Use the ping command to see if the destination node is reachable. (For details, see NTP 241-5701-050 *Passport 7400, 15000, 20000 Commands*.) If the node is not reachable, check for congestion or a lack of connection.
	PVC provisioning data is not accurate. (DNAs are not provisioned correctly.)	Check destination DNAs of master end for correct provisioning.
Cannot provision the call server	Networking is not in the list of software available.	Add networking.
	The call server feature not added to CP or added but not activated.	Add the feature, if necessary, and then activate it.
	You are not using the appropriate version (1.3) of the software.	Upgrade the software version.
(Sheet 2 of 3)		

Table 1 (continued)
Handling problems

Problems that may occur	Probable causes	Corrective measures
Problems in adding prefix DNAs	Insufficient memory.	Review memory considerations for this feature and add memory to the CP if necessary. (Refer to “Memory impacts” (page 38).) The maximum number of prefixes which you can add depends on how much memory is available.
Problems in adding prefix DNAs	The prefix you are trying to add has already been provisioned by wildcard.	Choose a different prefix to provision.
	You have exceeded the maximum length provisioned in the *Mod Vcs* component.	Change the maximum length in the mod VCS component or provision a shorter prefix.
Memory exhaustion	The engineering guidelines may not have been followed exactly.	Review the engineering guidelines and make sure that you have followed them exactly as directed. Refer to “Considerations and recommendations for installing and provision the call server” (page 38).
(Sheet 3 of 3)		

Chapter 3
Understanding Passport call-routing services

This section provides conceptual information about the Passport call-routing services including the following topics:

- Passport call-routing services overview
- How to use the call server
- Considerations and recommendations for installing and provision the call server
- Routing aspects of the call server

Passport call-routing services overview

This overview introduces the call-routing services for Passport-only networks, defining Passport subnets and prefixes for data network addresses (DNA), and describing

- What is a Passport subnet?
- What is a prefix DNA?
- What are the call-routing services?
- What are the benefits?
- How are they deployed?
- How are they used with the IP interface over Frame Relay?
- How are they used with Voice Networking?
- Characteristics and limitations

What is a Passport subnet?

When a stand-alone Passport network has its own routing identifier (RID) it is referred to as a subnet. Each Passport switch in the subnet has its own module identifier (MID), which must be unique within the RID. A Passport subnet is defined as a group of interconnecting Passport modules, which share the same RID. You may have multiple Passport subnets interconnecting in the network.

What is a prefix DNA?

A data network address (DNA) is made up of many digits. The total length of the DNA depends on the address plan selected and the provisioning of the maximum length in the module-wide virtual-circuit system (*Mod Vcs*) component.

The prefix DNA is a set of digits. The prefix represents all DNAs with first digits exactly matching that set of digits. A prefix DNA can contain a wildcard character (?) in any position. A wildcard represents any digit ranging from 0 to 9. The length of the prefix DNA cannot exceed the maximum permissible DNA length provisioned.

What are the call-routing services?

The initial release of Passport required call-routing and network features from designated DPN-100 resource modules (RM). Specific RMs were designated as the call server resource modules (CSRM) for a Passport subnet and provisioned accordingly. (See 241-7401-110 *Passport 7400, DPN-100 Interworking Guide* for details.)

Now, the basic call-routing services on a Passport-only network remove the need for an attached CSRM. As a result, you need to manage only one type of node, the Passport, instead of two. You do not have to manage a DPN-100 module. The Passport call-routing services translate the DNA to a routable address.

Two advanced services related to call routing are call redirection and hunt groups.

A call redirection server (CRS) provides call redirection for DPRS services, such as frame relay, in Passport-only networks. Call redirection servers direct failed call attempts to alternative destinations. A CRS improves the frame relay service's availability by redirecting a call attempt that would otherwise fail when the destination cannot be reached. The RID redirection capability of the CRS can be used for splitting a large RID subnet into smaller RID subnets. For more information on call redirection, see 241-5701-410 *Passport 7400, 15000, 20000 Call Redirection Server Guide*.

A hunt group is a single data network address (DNA) that represents a group of service DNAs. When users call the DNA assigned to the hunt group, the server forwards the call to one of the hunt group members. For more information on hunt groups, see 241-5701-415 *Passport 7400, 15000, 20000 Hunt Group Server Guide*.

The Passport call-routing services do not provide call-routing services for any DPN-100 module that is connected to the Passport network.

What are the benefits?

With these call-routing services, you can configure the Passport nodes as a stand-alone network and eliminate the need for managing a DPN-100 CSRM.

Since no CSRM is connected to the Passport subnet, fewer control packets are sent.

How are they deployed?

Deploy the call-routing services for Passport-only networks as follows:

1 Provision the call servers and IPIFR for each Passport in the network.

   Detailed provisioning instructions for the call servers is in "Provisioning the call server" (page 19). Refer to 241-5701-275 *Passport 7400, 15000, 20000 Commissioning Guide* for procedures to provision the IPIFR.

2 Provision all Passport nodes with a call router (CR).

You can interwork these call-routing services with configurations involving DPN-100 equipment such as CSRMs, access modules (AM), and RMs. Both can exist together, but the CSRM services will be used when the CSRM is directly connected to a Passport subnet. That is, the CSRM will override the call server when the CSRM is provisioned to support the RID of the connected subnet. The CSRM is only available with Passport 7400 switches.

However, you can migrate

- a Passport-only network to a mixed network with DPN-100 modules and Passport nodes
- a mixed DPN-100 and Passport network to a Passport-only network

For migration details, see“Provisioning the call server” (page 19).

How are they used with the IP interface over Frame Relay?

To configure a Passport-only network, you also require the *IpiFr* component. This component allows a direct connection from Preside Multiservice Data Manager to the Passport and establishes transmission control protocol and internet protocol (TCP/IP) connections over permanent virtual circuits. (For more information, see 241-5701-271 *Passport 7400, 15000, 20000 Network Management Connectivity*.)

How are they used with Voice Networking?

Each Passport node in a network that supports Voice Networking calls must be provisioned with a Call Router (CR). Alternately, if a CSRM is available through a DPN Gateway, the CSRM will service all Passport nodes which are in the same RID. You can determine if a CSRM is visible to the node by using the following command:

display rtg dpn

Whichever method you use—CR or CSRM—the NPI (E.164 or X.121) and the DNA must be provisioned in the CR or CSRM to allow routing between nodes in the network. (See 241-7401-755 *Passport 7400 Voice Networking Guide* for details on how to use DNAs to route Voice Networking calls.)

Characteristics and limitations

The characteristics of this feature are as follows:

- Each Passport node can support only one *CallRouter* component.
- The call router resides on the control processor (CP). Note that the call router cannot be provisioned on a function processor (FP).

The limitations of this feature are as follows:

- Every Passport node in the Passport-only network must be provisioned with a *CallRouter* component.

- The Passport nodes that are not provisioned with a *CallRouter* component will not be able to establish intermodule outgoing calls.
- The provisioning data for all call-routing systems must be identical within the Passport subnet.
- If a CSRM (Passport 7400 only) is connected to the Passport subnet, the CSRM provides the call-routing services and the *CallRouter* component on the Passport becomes dormant.

How to use the call server

This feature is used only with Passport-only subnets. These subnets are not directly connected to a DPN-100 call-server resource module (CSRM).

The information in this section only applies to Passport 7400 series switches.

If you are migrating from an interworked DPN-100 and Passport network

Provision IP interface over Frame Relay (IPIFR). IPIFR allows Preside Multiservice Data Manager workstations to connect directly to a Passport-only Frame Relay network. For more information on how to provision IPIFR, see 241-5701-271 *Passport 7400, 15000, 20000 Network Management Connectivity*.

For Preside Multiservice Data Manager workstation control, use the call servers in conjunction with IPIFR. If you are migrating from an interworked DPN-100 and Passport network to a Passport-only network, you must change your Preside Multiservice Data Manager connection from IP interface over virtual circuits (IPIVC) to IPIFR.

Refer to the following procedures:

- “Migrate from interworking with DPN-100 to a Passport-only network” (page 25)
- “Configure a call server in a Passport-only frame relay network” (page 24)

If you are not migrating from an interworked network

The IPIFR is likely already provisioned for you. Check NTP 241-5701-271 *Passport 7400, 15000, 20000 Network Management Connectivity*, for details.

For more information on the start-up program, see NTP 241-5701-271 *Passport 7400, 15000, 20000 Network Management Connectivity*.

Provision the call routers

Provision the call routers (CR) on every node in each Passport subnet. Each subnet should have its own prefixes. Nodes within a particular subnet should have the same call-router provisioning data.

Considerations and recommendations for installing and provision the call server

Consider the following matters before you provision this feature:

- “Address recommendations” (page 38)
- “Memory impacts” (page 38)
- “DNA lengths” (page 39)
- “RID subnet considerations” (page 39)

Address recommendations

This feature supports two types of address plans: X.121 and E.164. For more information, see “Address plans” (page 57)

You can have many DNAs on a single Passport. It is important to group the DNAs to simplify the task of managing them. Group the DNAs so that you have a few prefixes shared by the DNAs within a single Passport.

Memory impacts

Follow these guidelines to minimize memory consumption in the control processor (CP). The call router uses CP memory. When you provision, group the DNAs so that

- FR DNAs within a Passport node use the same group of prefixes, especially if you are planning to use interconnecting subnets
- nodes within a subnet all use a small group of prefixes
- the full set of DNAs is not duplicated
- memory is conserved

DNA lengths

The module-wide virtual-circuit system (*Mod Vcs*) component provisions the maximum length for X.121 and E164. The default maximum is 15 but you can change it. For more information on this component, see 241-5701-060 *Passport 7400, 15000, 20000 Components*.

The length of the prefix DNAs is checked against the maximum length provisioned in the *Mod Vcs* component. Their length cannot exceed this maximum.

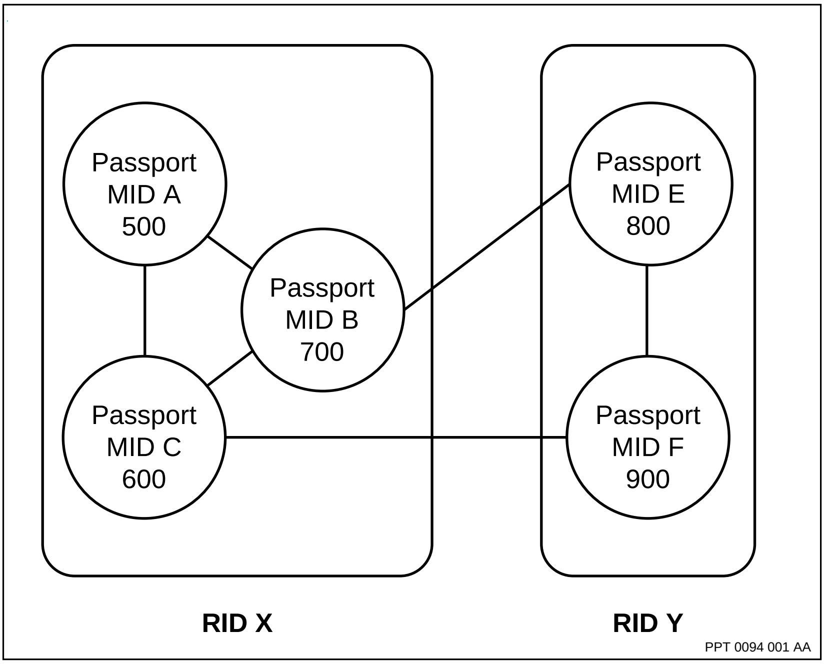
RID subnet considerations

The provisioned data for the *CallRouter* component must be the same for every Passport node in the subnet, and consistent for Passport nodes between subnets.

The provisioning data in the *CR* component between subnets should not be the same.

You may want to create and use Preside Multiservice Data Manager templates to simplify provisioning for every module in every subnet. For more information, see 241-6001-023 *Preside MDM Configuration Management for Passport User Guide*.

Figure 2
Example of interconnecting RID subnets



Using the example in Figure 2, "Example of interconnecting RID subnets," (page 40), the following is an example of the DNAs, RIDs, and MIDs for each subnet:

Table 2
RID Y examples

DNA	RID	MID
3021500	0	A
3021600	0	B
3021700	0	C
3021800	Y	0
3021900	Y	0

Table 3
RID X examples

DNA	RID	MID
3021500	X	0
3021600	X	0
3021700	X	0
3021800	0	E
3021900	0	F

Without the interconnecting RID subnet feature

If you do not plan to use the interconnecting RID subnet feature, group the prefixes for the node for the MIDs, but not the RIDs.

For evolving to the interconnecting RID subnet feature

If you plan to use the interconnecting RID subnet feature eventually, but not immediately, have the nodes within the RID subnet use the same set of prefix DNAs.

Routing aspects of the call server

This chapter describes the routing aspects of the call server for Passport-only networks, including:

- Passport-connection address-resolution system
- call-packet routing
- prefix data network addresses (DNA), routing identifier (RID), and module identifier (MID) mapping (impacts)
- RID retry
- how the call server typically operates, and how it operates when used with the interconnecting RID subnets feature

Passport-connection address-resolution system

The Passport-connection address-resolution system performs the call routing for this feature. This system consists of two components, the *CallRouter* (*CR*) component and the *NumberingPlanId* (*Npi*) component, which are both under the root component. The component hierarchy is described in 241-5701-060 *Passport 7400, 15000, 20000 Components*

The *CR* component is a database containing prefix DNAs mapped to a Passport MID or RID. The prefix DNA is mapped to a MID for Passports within the subnet, and to a RID for Passports outside the subnet. The call router translates a called DNA to a Passport MID or RID, according to the best match, not necessarily the first match.

The *Npi* component is also a database containing all DNAs provisioned in the node and mappings to the component that owns each DNA. The NPI on the destination Passport node translates the DNA to an application.

The Passport call-address resolution system supports two types of address plans: X.121 and E.164. Detailed descriptions of these address plans are in “Address plans” (page 57)

Call-packet routing

The call router routes the virtual circuit (VC) call-request packets.

The call-request packet arrives at the call router on the originating Passport node. The call router examines the called address digit by digit, starting with the first digits of the international address until the destination switch is determined. Thus an arbitrary number of digits up to a full address may participate in determining the destination switch. Generally, if fewer digits are needed to determine the destination switch, the translation is faster, and the database uses less memory.

If the DNA in the call-request packet translates to a Passport MID, the packet is forwarded to the *Npi* component on the destination Passport node identified by the MID. If the *Npi* component translates the DNA to an application, the packet is forwarded to the application on the Passport node. If any one of the two translations is unsuccessful, an abort with the reason “address not found” is sent back to the originator.

If the DNA in the call-request packet translates to a Passport RID, the packet is forwarded to the closest call router in the Passport subnet of the mapped RID. The call router will then map it to a Passport MID. The packet is then forwarded to the NPI on the destination Passport node identified by the MID. If NPI translates the DNA to an application, then the packet is forwarded to the application on the Passport node.

If a CSRM (Passport 7400 only) is connected to the Passport subnet that has the call router provisioned, then the CSRM provides all the call routing services. The call router becomes dormant. Once the CSRM is disconnected from the Passport subnet, the call router provides the basic call routing services.

Optionally, a Passport-only network can include call redirection servers. Call redirection servers (CRS) direct failed call attempts to alternative destinations. A CRS has a database of primary addresses mapped to alternative addresses or RID/MID locations. When a destination cannot be reached, the CRS redirects the call to an alternative location. Fore more information on call redirection servers, see 241-5701-410 *Passport 7400, 15000, 20000 Call Redirection Server Guide*.

Prefix DNAs and RID/MID mapping

The *CallRouter* component represents a provisioned database of prefix DNAs to PassportPassport MIDs and RIDs to map called DNAs to a Passport MID (within the subnet) or otherwise to RIDs. If there are interconnecting Passport subnets, the prefix DNAs in another subnet will map to the Passport subnet's RID. The *CallRouter* component resides on the CP for every Passport node in the subnet.

RID retry

RID retry can be used to simplify call routing when different regional networks are interconnected by trunks. The simplification is achieved by designating a core RID in each regional network as the interconnecting RID. Other regional networks always map the prefix DNA of this regional network to the designated interconnecting RID. (You must ensure that there is no duplication of RID values in the resulting interconnected network.)

To minimize CR table size and maintenance throughout the interconnected network, you can implement the two-phase RID retry scheme that uses interconnecting RIDs amongst the regional networks.

When RID retry is not implemented, a call-request packet is routed in three phases:

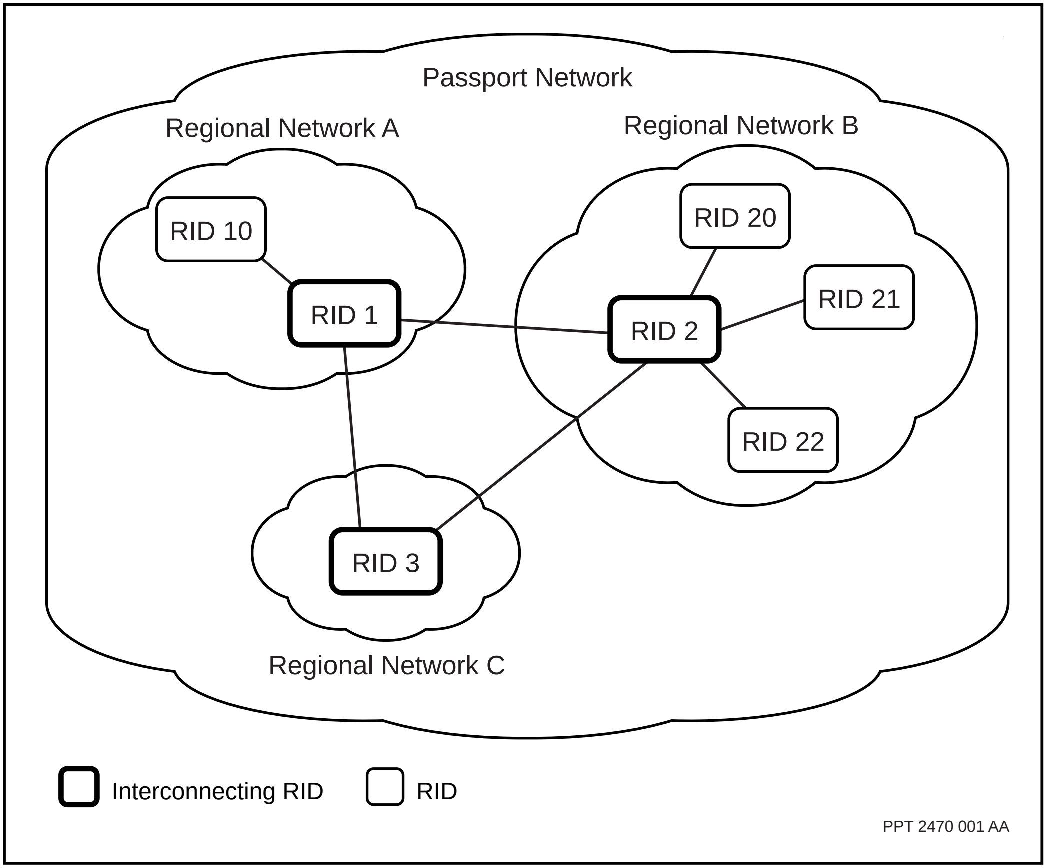
- the CR maps the prefix DNA to a RID
- the CR at the destination RID subnet maps the prefix DNA to a MID
- the NPI at the destination node maps the prefix DNA to the application PID

The RID retry feature allows the CR to re-map the prefix DNA to a RID. The CR table already contains mapping information of prefix DNA to either RID or MID. The RID re-mapping operation can be attempted twice along the call path. On the third attempt, the call request packet is redirected.

Two-phase RID retry

When two or more regional networks are interconnected over trunks, the CR tables in each network must be updated so that calls can be routed from one regional network to another. Each regional network maintains CR entries for the regional network, and an entry for the prefix address of every other regional network. For instance, the prefix address may be represented by a four-digit data network identification code (DNIC). Each DNIC is mapped to the interconnecting RID for the regional network. The interconnecting RID is the RID that is designated to receive call requests from other regional networks. Figure 3, “Interconnecting RIDS between regional networks,” (page 45) shows three regional networks merged together using interconnecting RIDs to route calls between the regional networks.

Figure 3
Interconnecting RIDS between regional networks



Interconnecting RIDs

Calls are sent from the CR on the originating regional network to the CR of the interconnecting RID on the destination network. The CR on the interconnecting RID routes calls destined to DNAs that are MID-mapped directly to the node that supports the DNA. The CR on the interconnecting RID also forwards calls destined to other DNAs that are RID-mapped to the other RIDs, presumably within the same destination regional network. Calls that cannot be MID-mapped or RID-mapped are redirected.

Two-phase RID retry allows you to interconnect regional networks over trunks, and allows regional networks to manage local resources without updating CR tables throughout all the interconnected regional networks.

Typical operation of the call server

The call-server (call router) feature provides call routing in a Passport-only Frame Relay network and removes the need for the Passport subnet to be connected to a CSRM. To enable a Passport-only network to be configured, this feature also requires a Preside Multiservice Data Manager connection through IPIFR, which provides provisioning and network monitoring access.

If you are using interconnecting RID subnets, each RID should have its own provisioned database of prefix DNAs. The *CR* component must be provisioned on every Passport node. Each node within a subnet must have the same provisioning.

If a CSRM is connected to the Passport subnet, the call services function is provided by the CSRM, even if the *CallRouter* components have been provisioned for each node on the Passport-only network.

A direct CSRM connection is only supported on Passport 7400 series switches.

The figure, “Example of call-routing services from the CSRM” (page 48) illustrates the behavior of a Passport subnet when its call-routing services are provided by a CSRM, as follows:

1. The Passport virtual circuit process creates a call request packet and sends it to the closest CSRM. The call request packet includes the DNA, RID, MID, and process identifier (PID) of the source, and the DNA of the destination.

   Note: By default, CSRM routing on Passport 7400 nodes is set to closest. You can provision CSRM routing as shared so that each subsequent call request packet alternates between two CSRMs. For more information, see 241-7401-110 *Passport 7400, DPN-100 Interworking Guide*.

2. The CSRM interprets the DNA and determines the RID and MID of the destination Passport. This information is inserted in the call request packet and sent to the destination Passport.

3 The call request packet arrives at the destination Passport. The Passport local call routing system determines the PID for the destination. It is placed in the call accept packet along with the information in the call request packet and sent back to the source.

Figure 4
Example of call-routing services from the CSRM

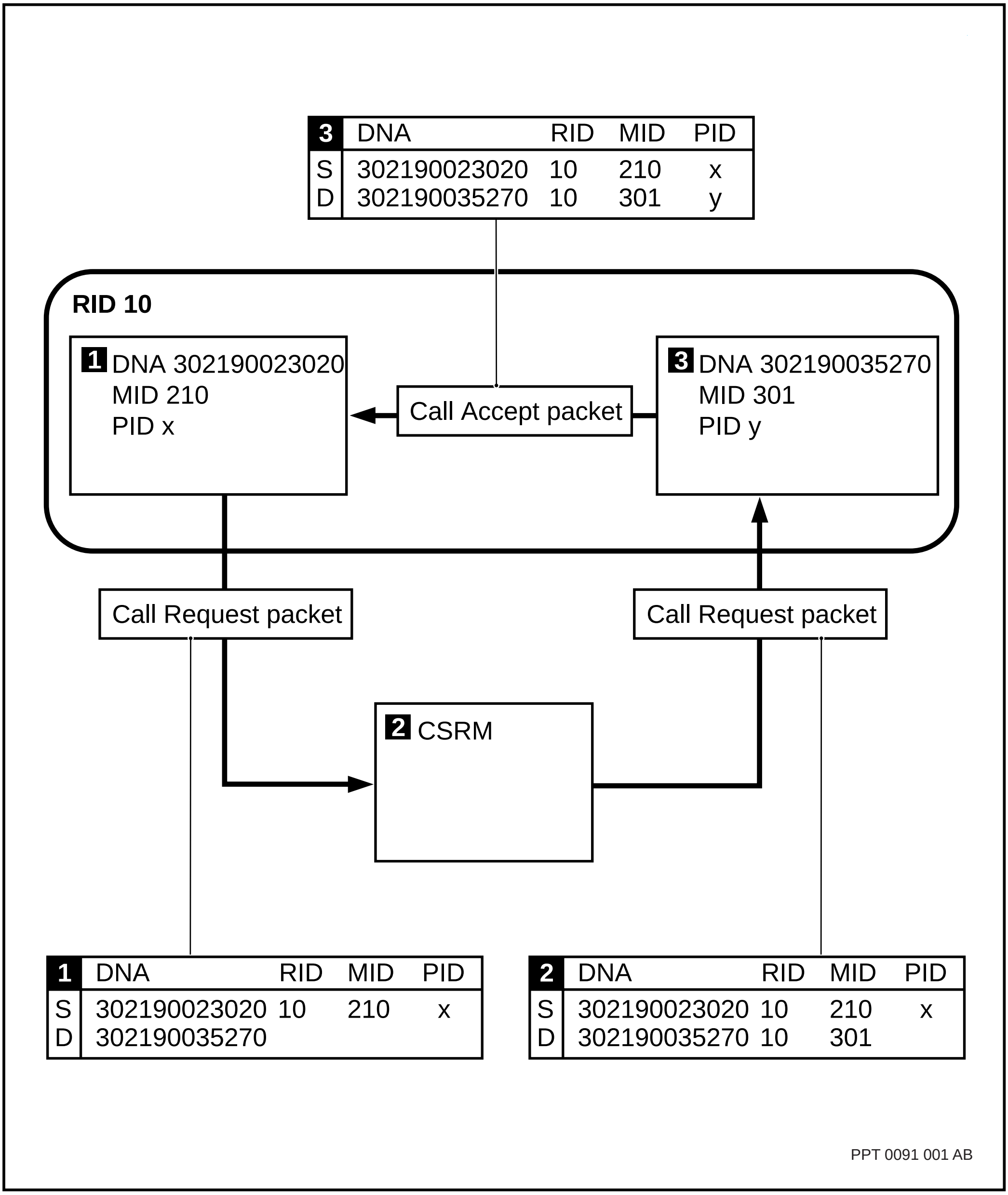


Figure 5, “Example of the CallRouter (CR) component in a single RID subnet,” (page 50) shows an example of the call-server feature deployed in a single-RID subnet.

1 The Passport virtual circuit process creates a call request packet and sends it to the call router. The call request packet includes the DNA, RID, MID, and PID of the source, and the DNA of the destination.

2 The defined prefix-DNA maps the DNA of the destination to either a MID or a RID. If it maps to a MID, the MID of the destination is put in the call request packet. In this case the call router also knows that the destination Passport is in the same RID subnet as the source Passport, and therefore can also put the destination RID in the call request packet. The call request packet is then sent to the destination Passport.

3 The call request packet arrives at the destination Passport. The Passport local call routing system determines the PID for the destination. It is placed in the call accept packet along with the information in the call request packet and sent back to the source.

Figure 5
Example of the CallRouter (CR) component in a single RID subnet

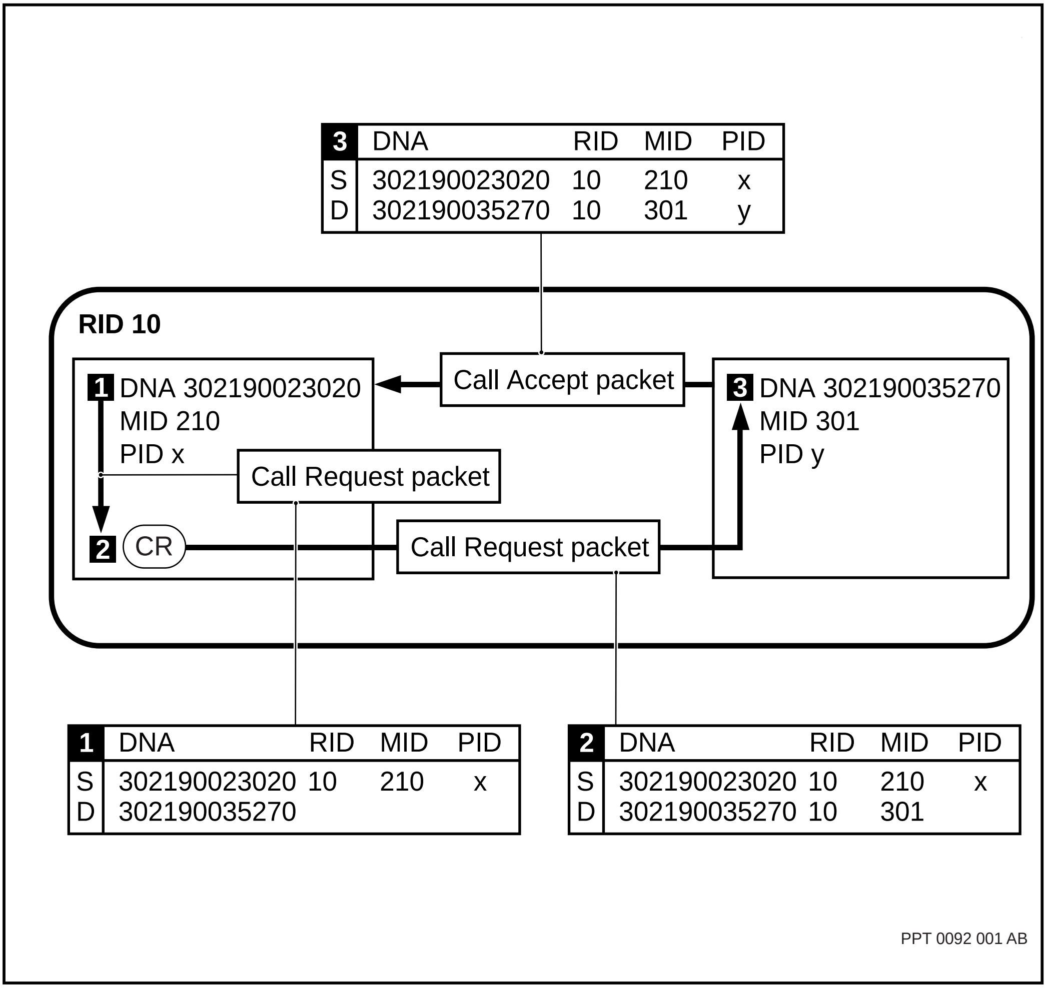


Figure 6, “Example of the CallRouter (CR) component used with multiple RID subnets,” (page 52) shows an example of the call-server feature deployed in multiple-RID subnets.

1 The Passport virtual circuit process creates a call request packet and sends it to the call router. The call request packet includes the DNA, RID, MID, and PID of the source, and the DNA of the destination.

2 The defined prefix-DNA maps the DNA of the destination to either a MID or a RID. If it maps to a RID, the RID of the destination is put in the call request packet. In this case, the call router also knows that the destination Passport is in a different RID subnet than the source Passport. The call request packet is then sent to the closest Passport in the destination RID subnet.

3 The call request packet is delivered to the call router in the Passport in the destination RID subnet. This call router uses its defined prefix DNAs to map the DNA to the MID of the destination Passport. The call request packet is then sent to the destination Passport.

4 The call request packet arrives at the destination Passport. The Passport local call routing system determines the PID of the destination. It is placed in the call accept packet along with the information in the call request packet and sent back to the source.

Figure 6
Example of the CallRouter (CR) component used with multiple RID subnets

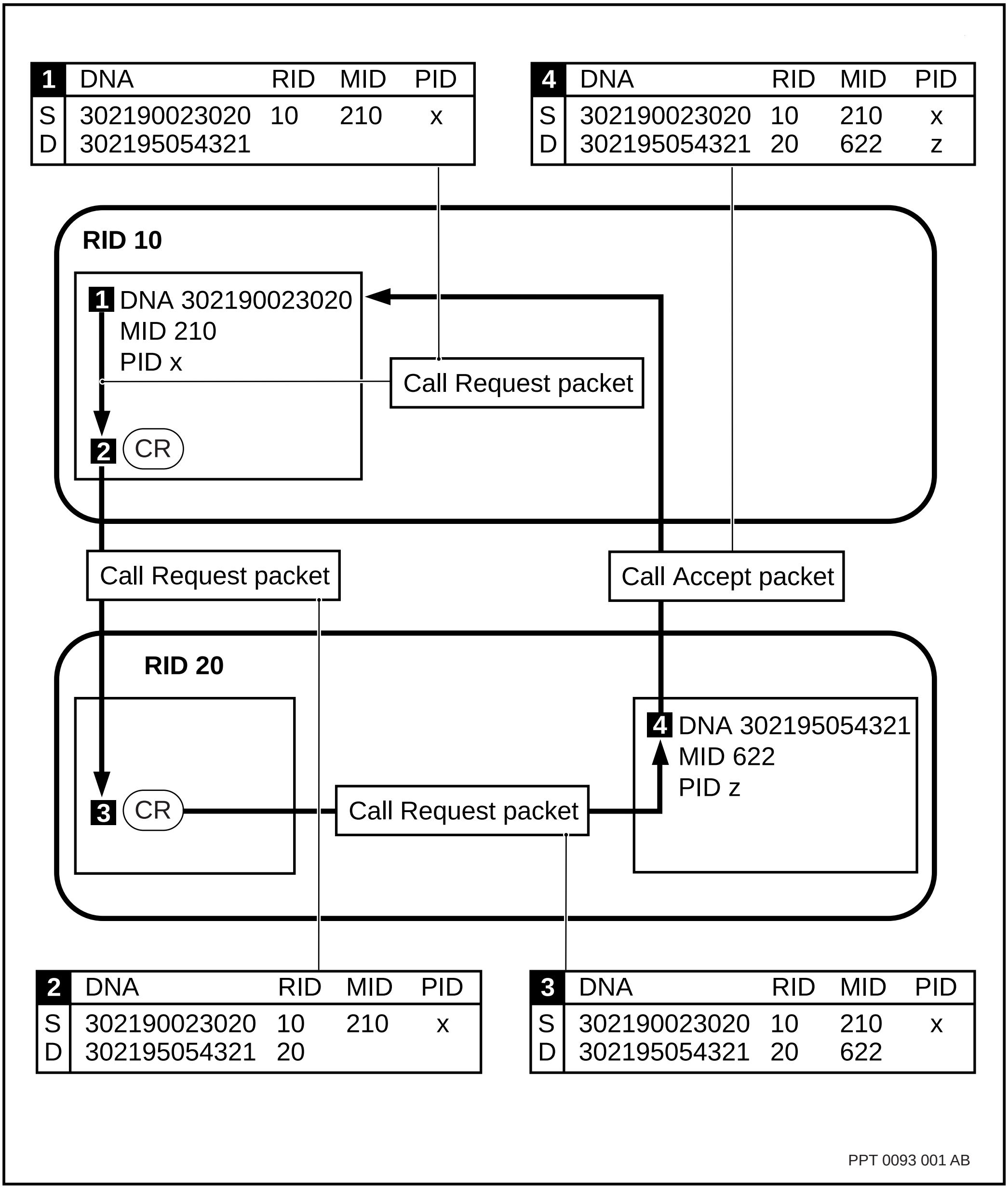


Figure 7, “Example of RID retry in a merged network environment,” (page 54) shows an example of the RID retry feature deployed in a merged network environment.

1 The Passport virtual circuit process creates a call request packet and sends it to the call router. The call request packet includes the DNA, RID, MID, and PID of the source, and the DNA of the destination.

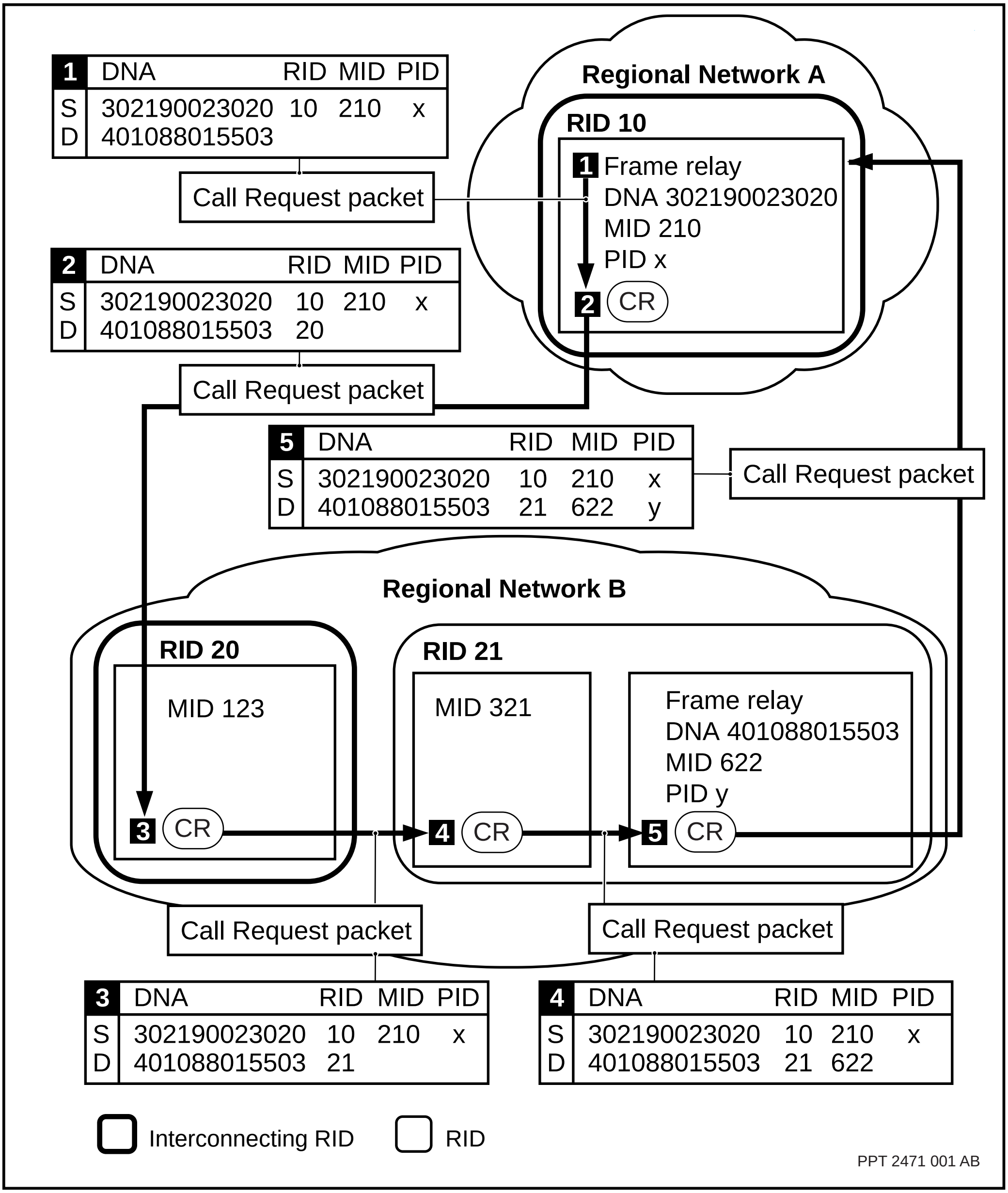
2 The defined prefix-DNA maps the DNA of the destination to either a MID or a RID. If it maps to a RID, the RID of the destination is put in the call request packet. In this case, the call router knows that the destination Passport node is in a different RID subnet from the source Passport node. The call request packet is then sent to the closest Passport node in the destination RID subnet (of another regional network).

3 The call request packet is delivered to the call router in the interconnecting RID subnet of the destination regional network. This call router uses its defined prefix-DNA to map the DNA. However, the mapping result is to another RID within the destination regional network. The call request packet is then sent to the closest Passport node in the destination RID subnet (within the same destination regional network).

4 The call request packet is delivered to the call router in the destination RID subnet of the destination regional network. This call router uses its defined prefix-DNA to map the DNA to the MID of the destination Passport node. The call request packet is then sent to the destination Passport node.

5 The call request packet arrives at the destination Passport node. The Passport local call routing system determines the PID of the destination. The PID is placed with the other information in the call request packet and sent back to the source.

Figure 7
Example of RID retry in a merged network environment



Appendix A
Compliances

This feature complies with the following address-plan standards:

- CCITT Recommendation X.121, International Numbering Plan for Public Data Networks (Geneva, March 1988)
- CCITT Recommendation E.164, Numbering Plan for the ISDN Era (Geneva, March 1988)

Appendix B
Address plans

This appendix describes the X.121 and E1.64 address plans, including

- “Address definition” (page 57)
- “Passport-based address translation” (page 59)

Address definition

This feature supports two address plans: X.121 and E1.64.

X.121 definition

X.121 is defined as the CCITT numbering plan standard for public switched packet data networks (PSPDN).

For X.121, Passport networks implement the following formats in accordance with CCITT recommendations:

- The full X.121 international address must be less than or equal to 14 digits in length.
- An international address is made up of one of the following components:
  - a data country code (DCC) of exactly three digits (see Figure 8, “DNIC format,” (page 58)), and a nationally defined national number (NN) of up to 11 digits
  - a DNIC of exactly four digits (see Figure 8, “DNIC format,” (page 58)), and a nationally defined network terminal number (NTN) of up to ten digits

Figure 8
DNIC format

```
DNIC:        Y          X          X          X

             |--        +--        |          |--- Network digit
                        |
                        |-----------
                                              DCC
                                              X = a digit from 0 to 9
                                              Y = a digit from 2 to 7
```

Note 1: The 1988 version of CCITT X.121 Recommendation (Tables 1 and 2) specifies that the initial digits 9 and 0 of an International format X.121 address, indicate respectively, escape to E.164 (analogue access) and escape to E.164 (digital access). As a result, the use of a Pseudo-DNIC with an initial digit of 9 or 0 in DPN-100 networks is not advisable. The network envelope X.32 Enable option is used to control whether a network treats an initial digit of 9/0 as an X.121 Pseudo-DNIC (option OFF) or as an escape code to E.164 (option ON). Some existing DPN-100 networks are known to use Pseudo-DNIC with initial digit (or 0). It should be noted that it will not be possible for these networks to support interworking with another network that uses E.164 addresses for e.g. ISDN or X.32 services.

Note 2: The DNICs of the form "111X" as defined in CCITT Recommendation X.121 are also supported.

PPT 0097 001 AA

E.164 definition

E.164 is defined as the CCITT numbering plan standard for ISDN packet and circuit mode terminals.

Passport-based address translation

Translation of both numbering plans is based on what is known as a prefix DNA, which is the first "n" digits of the full international address (DNIC+NTN or CC+NSN) where "n" can range from 1 to 15 digits.

On a Passport switch, Passport examines the called address digit-by-digit starting with the first digit of the international address until the destination switch is determined. Thus, an arbitrary number of digits up to a full address can participate in determining the destination switch. Generally, if fewer digits need to be used to determine the destination switch, the translation is faster and the CP memory usage is less.

When defining prefix DNAs, "wild" digits can be used so that the digit position specified by the wild digit is ignored when making a routing decision. This will reduce the number of prefix DNAs needed to properly route the calls.

Also, prefix DNAs of prefix DNAs can be defined. For example, if it is desired that all X.121 DNAs beginning with 30211123 go to one MID while all other X.121 DNAs beginning with 3021112 go to another MID, then only the two X.121 prefix DNAs (302311123 and 3021112) need to be entered in the service data. This can also reduce the amount of data entry and storage required to support the numbering plan.

X.121 and E.164 address translation

The following prefix DNA mappings are possible for X.121 and E.164:

- prefix DNA maps to RID
- prefix DNA maps to MID

If a DNA is translated to a RID, the call is sent to the call-routing system of the Passport subnet containing the destination switch on the network.

If a DNA is translated to a MID, the call is sent to the call-routing system on the destination switch.

Each Passport has a local DNA database (*Npi* component off Root), which is responsible for the final stage of call routing: that of getting the call to its final destination (for example, usually an access port). Thus, it must "translate" the address it receives from the *CR* component to a purely internal entity identifying that destination. Both numbering plans are handled in the same way.

> ***Note:*** If a Passport becomes isolated (the Passport becomes unavailable due to network link failure(s)), calls can still be set up to and from addresses that exist on the particular module. This is true for both numbering plans.

Addressing plan strategies

Designing an addressing plan for long-term network flexibility is an important exercise. A scalable addressing plan retains its structure even with significant network growth and change. Addressing plan strategies include the following points:

- do not include RIDs, MIDs, or other topology information in the DNA structure
- divide the DNA into geographical area: DNIC, area or region code, site code, city or node detail, and Fruni or line code

Figure 9
Sample DNA mappings

3021	901	23	12345
DNIC	area code	module code	line code or Fruni code

3021	99	01	22	1401
DNIC	region code	site code	module code	line code or Fruni code

Address plan example (two-node network)

In the example shown in Figure 10, “Example of a two-node network,” (page 61), a simple two-node network is shown with its corresponding RID and MID values. With this example in mind, some general guidelines can be established for using prefix-DNAs. To reduce memory consumption when provisioning, it is recommended that as few prefix-DNAs as possible be mapped to a single Passport module.

The ideal is, of course, one prefix-DNA per Passport module. It is also best to avoid the worst case in which there is no grouping of DNAs on a single module basis. This would result in having to provision every DNA in the subnet into every CR in each Passport module, thereby resulting in higher memory consumption. Since the CR finds the best possible match, exceptions can be provisioned.

For example, in Figure 10, “Example of a two-node network,” (page 61), if it is now desired for MID 65 to also contain all DNAs that begin with the digits 302195022555. The CR provisioning data on both modules are listed in Table 4, “Address plan example DNAs,” (page 62):

Figure 10
Example of a two-node network

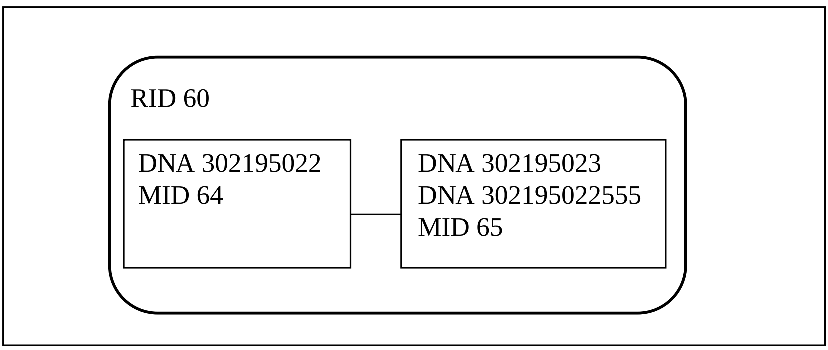


Table 4
Address plan example DNAs

prefix-DNA	RID	MID
302195022	60	64
302195023	60	65
301295022555	60	65

Passport 7400, 15000, 20000

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