

Data Access Network Solutions (DANS)

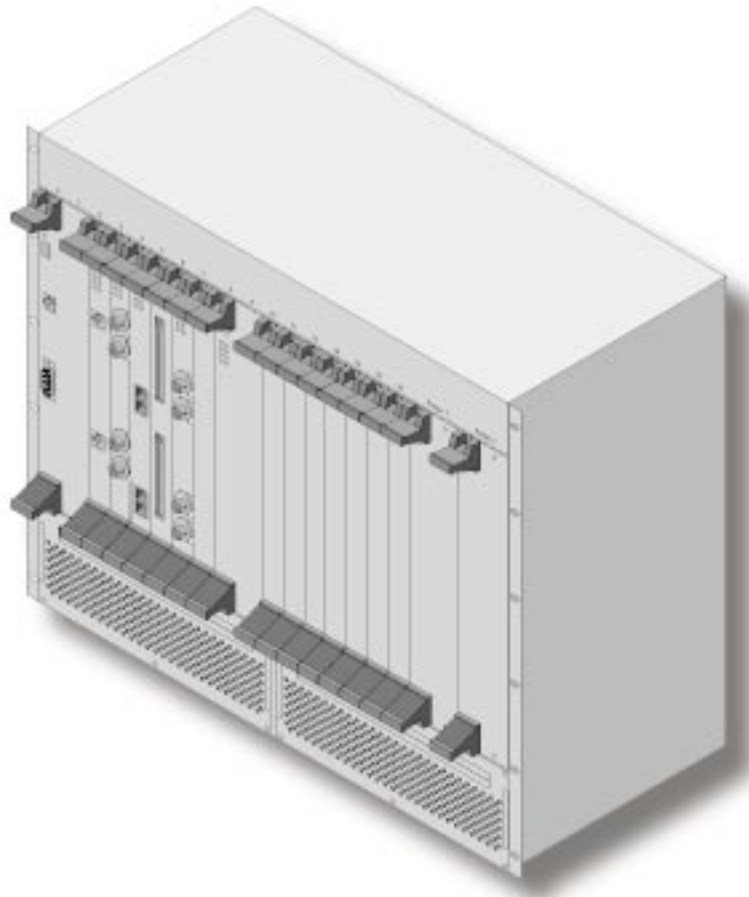
# RedBack

## SMS 1000

### Planning Guide

Final 01.01 April 16, 1999

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# About this document

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This document provides guidelines for planning a RedBack SMS 1000 running AOS Release 2.1. In general, this document provides high-level planning information with pointers to where more detailed information can be located.

## Audience

The intended audience of this document is the Nortel Networks DANS design and support community (for example, TAS and GTS) who are assumed to be:

- IP literate with an understanding of bridging, routing, and subnet masking
- familiar with common networking concepts such as WANs, serial links, Frame Relay, and ATM

## Organization

This document provides common RedBack SMS information; addendums to this document provide application-specific information (for the addendums currently available, see “Related documents”). This document is organized as:

- Chapter 1 provides an overview of the RedBack SMS 1000 product
- Chapter 2 lists the main Redback SMS 1000 features and specifications
- Chapter 3 describes the planning and engineering process for using a RedBack SMS 1000
- Chapter 4 outlines how to install and configure a RedBack SMS 1000
- Chapter 5 provides an alphabetical list of the acronyms and abbreviations used in this document

## Related documents

For related documents, refer to:

- *DANS RedBack SMS Documentation Guide*, DANS-RSMS-010
- *DANS IMMS Documentation Guide*, DANS-1MMS-010

## Document version, issue, and status

The version and issue of Nortel Networks DANS documents are indicated by a four-digit number, for example, 01.01. The first two digits indicate the product version; the second two digits indicate the document issue. The digits increase by one for a new product release and when the document content is changed; for example, 02.03 indicates document issue 03 for product release 02. The status of documents is indicated by Draft and Final; Draft indicates the initial document issue for review by DANS; Final indicates that the document has been reviewed and approved by DANS on the indicated date.

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# Introducing RedBack SMS 1000

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This section introduces the RedBack Subscriber Management System (SMS) 1000 in terms of:

- System overview
- Contexts and virtual private networks
- Tunnelling and multiple service providers
- Ports and physical connectors
- Circuit and Ethernet ports
- Binding associations
- Interface profiles and protocols
- Encapsulation and PPP
- RADIUS authentication and billing
- Subscriber records
- System management
- System configuration

## System overview

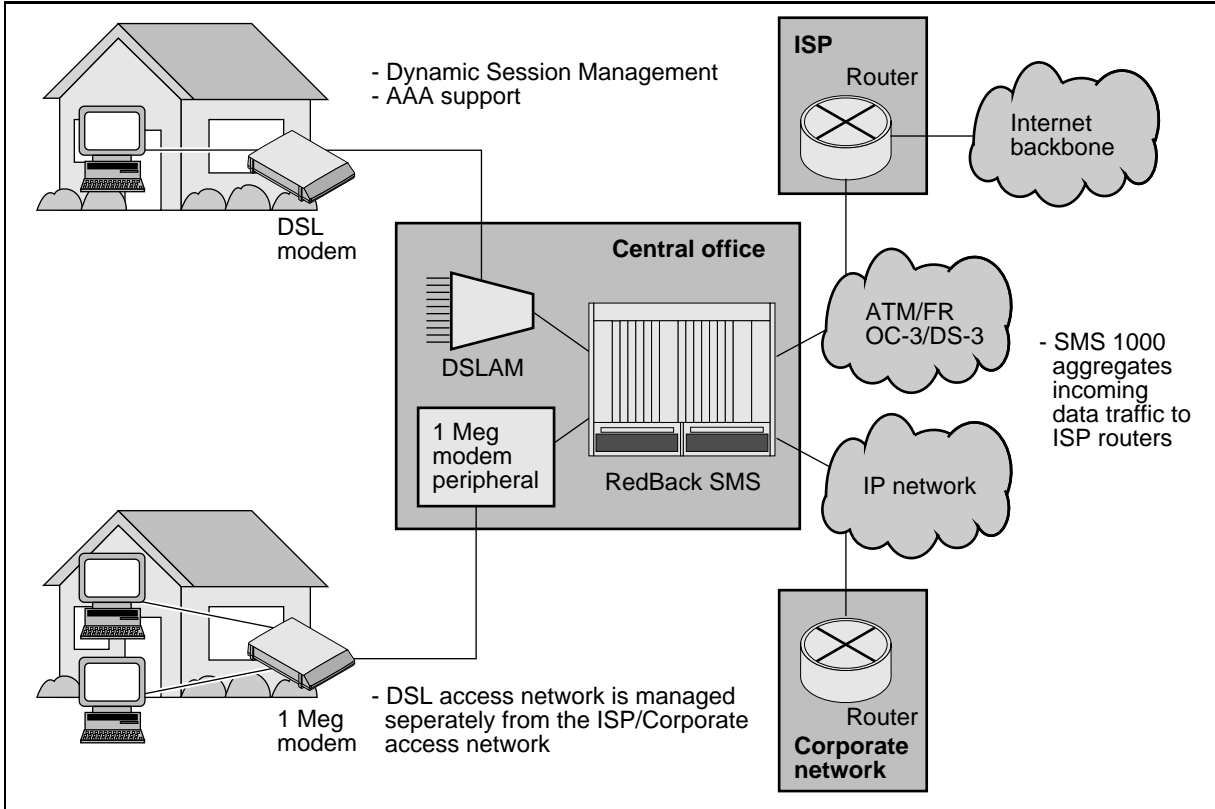
RedBack SMS 1000 is a high-density, intelligent networking device that aggregates data from DSL (digital subscriber line), cable modem, and other equipment (see Figure 1-1). It applies scalable user configuration and management, grooms the traffic to offload backbone routers, and enables connections to multiple destination networks. RedBack SMS 1000 provides PPP over Ethernet (PPPOE) and PPP over ATM making a DSL session perform in a similar way to a dial-up PPP session. End users can have multiple DSL PPP sessions with each being individually managed and dynamically routed to the required service provider.

The backbone network may be an ATM service or a Frame Relay service. Additionally, access to a public or private Internet backbone infrastructure can be achieved by the use of routing or tunneling.

A single RedBack system can be configured to be part of multiple corporate networks and private or public Internets. A single RedBack system participating in several networks at once is accomplished through the use of multiple network “contexts.” Each context creates a separate administrative domain for security, accounting, and management of a given high-speed access network and for the subscribers attached to it.

**Figure 1-1**  
**Integrating multiple DSL implementations**

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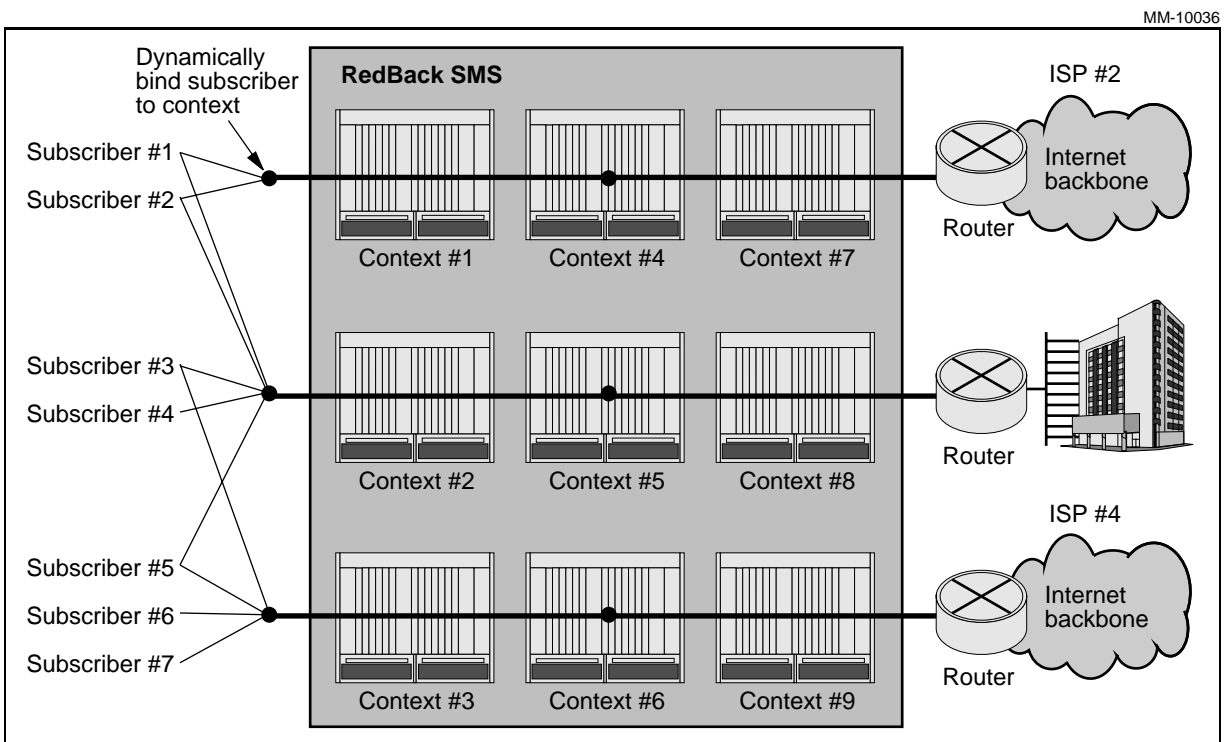
## Contexts and virtual private networks

RedBack SMS 1000 supports multiple contexts which are virtual machines within one SMS node and are used to provide a separate administrative domain for security, accounting, and management (see Figure 1-2). A context effectively creates a virtual router for each service provider and each context provides:

- a unique routing entity
- independent address spaces
- independent routing tables
- secure management contexts
- support for multiple L2TP tunnels
- support of multiple RADIUS databases

Each context is like a virtual RedBack SMS 1000 node which provides the ability to route to multiple destinations. Since independent service providers are assigned their own contexts, users can use DSL sessions to connect to different locations in much the same way as a dial-up session. Each context also supports tunnelling which provides a secure environment and allows multiple service providers to share the same context.

**Figure 1-2**  
RedBack SMS 1000 contexts



## Tunnelling and multiple service providers

RedBack SMS 1000 supports LAC (L2TP access concentrator) and LNS (L2TP network server) functionality which supports multiple secure sessions and allows multiple service providers to share the same context.

## Ports and physical connectors

The RedBack SMS 1000 defines a port as the connector or physical point for connecting network cables to network I/O modules. The RedBack AOS creates one internal “port” construct per external network connector. Ports are managed with the port command. Ports can be brought in and out of service with the [no] shutdown command, which is available under port configuration. Complete specification of the port command, and all port sub-mode commands, can be found in the *RedBack Access Operating System (AOS) Command Reference Guide*.

**Note:** The 10 / 100 Ethernet port (RJ-45) located on the SMS CE module has a special purpose. This port is intended only to provide out-of-band network-management access to the RedBack system, and is therefore referred to as “the management port.” The RedBack AOS does not support forwarding of data between the management port and other general purpose network I/O ports.

## Circuit and Ethernet ports

Some network media, like ATM and Frame Relay, are connection-oriented, meaning that a connection must be established before data can flow between end-points on the given media. These connections are referred to as virtual channels or virtual circuits on ATM and Frame Relay ports.

The Ethernet network media is connectionless and does not require the establishment of a connection in order for data to flow. No (virtual) circuit commands are required or supported.

For each Ethernet port:

- there is only one logical interface per Ethernet port
- the encapsulation is always “Ethernet” or “PPPOE”
- protocols available on the port are determined indirectly through bindings

Command line interface (CLI) commands are provided to configure and manage ATM, Frame Relay, and Ethernet ports.

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## Binding associations

Bindings are complimentary to the multiple network context and virtual machine concepts. Bindings are what form the necessary association, linkage, or coupling between ports, circuits, or tunnels, and the bridging, routing, and switching protocols configured for a given context or virtual machine. Higher-layer protocols are defined in interface profile constructs. Correct operation of bindings and the higher-layer protocols are dependent on circuit or Ethernet port encapsulation. Bindings must be deleted and recreated in order to change encapsulations.

Static binding is used to bind circuits and Ethernet ports to higher-layer protocols directly through an interface profile or indirectly through subscriber records. Indirect static binding through subscriber records (probably located on a remote RADIUS server) can be used for any circuit with any encapsulation type. Indirect binding through subscriber records can also be dynamic in that the same circuit can be bound to different higher-layer protocols or services at different times. In order to use dynamic binding, the circuit must use PPP encapsulation. Dynamic binding is an essential component to the context selection feature and is used to bind subscriber authentications to different contexts and services.

Two circuits can be bound together, using the **bind bypass** command, without protocol translation if they are of the same type and use the same type of encapsulation.

## Interface profiles and protocols

Each SMS virtual machine, created by each context construct, has its own set of virtual interfaces. The interface profiles define these virtual interfaces.

Interface profiles are a powerful configuration construct used to define multiple (virtual) higher-layer protocol interface/instances, called a “multi-protocol interface profile.” Each set of higher-layer protocols defined in a given profile operate independently of each other. Internally, each interface/instance defined in such a profile is allocated its own unique interface (or equivalent) structure to facilitate independent operation. When a circuit is bound to a multi-protocol interface profile, several internal bindings are actually created; one for each higher-layer protocol interface/instance defined in the profile.

In order for a higher-layer protocol to become operational, circuits must be bound to an interface profile in which the protocol is defined. In the specific case of PPP encapsulation, operation of each higher-layer protocol is dependent on the completion of a full PPP Link Control Protocol negotiation, plus completion of the appropriate Network Control Protocol (such as, IPCP for IP).

Details for the IP series of interface sub-mode commands used to define operational parameters for IP interfaces (such as, addresses, masks, MTU, address resolution mechanisms, and so on) are given in the *Access Operating System (AOS) Command Reference Guide*. Only one IP address may be defined per interface profile.

## Encapsulation and PPP

Circuits must have an encapsulation configured with them. Only those encapsulations which make sense for a given circuit on a given type of port/media may be configured for that circuit. The encapsulations supported and CLI keywords defined for them are listed in the *Access Operating System (AOS) Command Reference Guide*. Ethernet encapsulation is automatically established for (the automatically generated circuit on) Ethernet ports, and is not explicitly available as an encapsulation type at the CLI. AOS supports many types of encapsulation, including RFC1483 bridging, RFC1483 routing, and RFC1490.

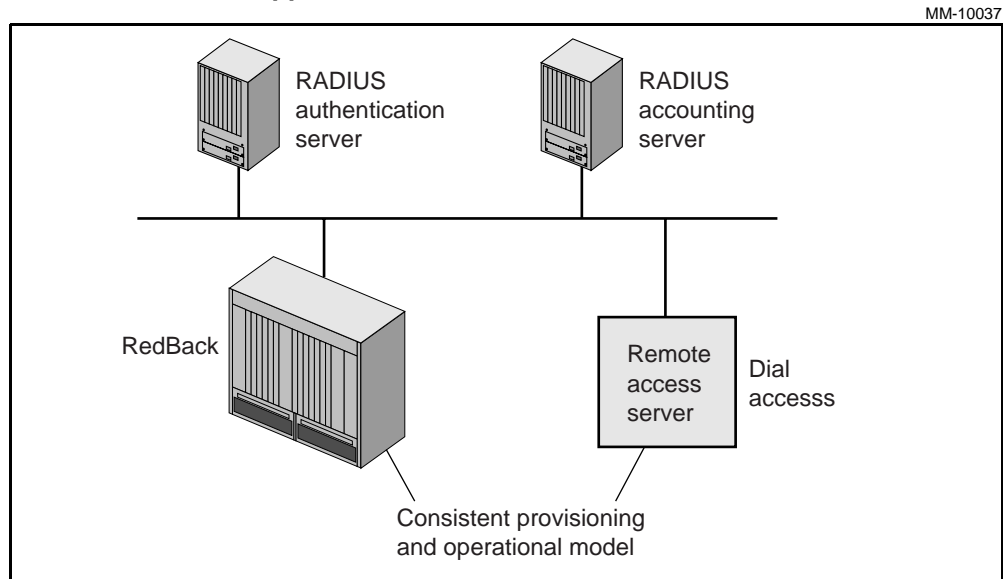
The Point-to-Point protocol (PPP) supports encapsulation extensions which includes, among other things, the ability to authenticate the entity at the remote end of the circuit.

## RADIUS authentication and billing

RedBack SMS 1000 provides automated authentication and accounting, scalability in operations and deployment, and supports (see Figure 1-3):

- authentication, authorization, and accounting
- billing via RADIUS messages
- usage information on a per circuit basis
- RADIUS for PPP connections
- local authentication
- local proxy
- one record per subscriber

**Figure 1-3**  
**RedBack RADIUS support**



## Subscriber records

Subscriber records define the authentication and services available for a given subscriber. They contain information, such as IP addresses, necessary to bind a subscriber to the correct interface profile, and therefore, to the correct network context and services.

Subscriber records can be configured for local authentication only or they may be located remotely on RADIUS servers. The use of RADIUS is signaled by the presence of an **aaa authentication subscriber radius** command within a given context construct. The **aaa** command and **subscriber** commands are only available in a context sub-mode.

## System management

The RedBack SMS 1000 control engine (CE) module is responsible for initialization and controlling operations of the entire RedBack SMS 1000 system. All the software necessary to manage the operation of connections (for example, ATM virtual circuit and PPP sessions), protocols (for example, bridging or IP), management interfaces (CLI and SNMP), authentication (PAP, CHAP, and RADIUS), and the FLASH file system all execute on the CE module. The CE is also tasked with managing operation of the slave forwarding engine (FE).

The forwarding engine (FE) is tasked with forwarding data-traffic flows traversing the RedBack system according to paths prescribed by the CE. Software device drivers to manage operations of the ports on network I/O adapters execute on the FE processor module. The FE relies on the CE to provide all the information needed for proper data forwarding operation.

Software executing on the CE gains knowledge of network operating parameters and accordingly adjusts the contents of the slave FE's tables. This knowledge is gained partly through configuration and partly through the dynamic operation of one or more protocols.

System troubleshooting is supported by local and remote event logging controlled by the RedBack access operating system (AOS) logging and show logging commands.

## **System configuration**

The default configuration for each RedBack SMS 1000 node is stored in FLASH memory on the control engine (CE) module and is loaded when the RedBack SMS 1000 node is booted up.

To make changes to the default configuration, a console connection must be established on the RS-232 port on the CE module. Configuration changes are made through the command line interface (CLI). Different configurations can be stored for future use as the default configuration internally on FLASH memory in the CE module or externally on FLASH memory cards.

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## Features and specifications

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This section lists the main RedBack SMS 1000 features and specifications:

- RedBack SMS 1000 equipment conformance and certifications
- RedBack SMS 1000 equipment enclosure specification
- RedBack SMS 1000 feature highlights

### **RedBack SMS 1000 equipment conformance and certifications**

RedBack SMS 1000 equipment conformance and certifications include:

- FCC part 15, class A
- Low Voltage Directive 73 / 72 / EEC
- Low Voltage Directive Amendment 93 / 68 / EEC
- EMC Directive 89 / 336 / EEC
- UL file number is E179981
- Approved and certified by TUV Rheinland; file number E9872048.03
- Tested to IEC 950 / EN 60950: 1992, A1, A2: 1993, A3:1995, A4: 1997 and EN 60825-1: 1994, A11: 1996
- UL1950 with D3 Deviations
- CSA 22.2 #950 with D3 Deviations
- UL 94- V1 Flammability for PC Boards
- EN 41003
- Markings for FCC class A compliance, CE mark, UL listing, TUV marking

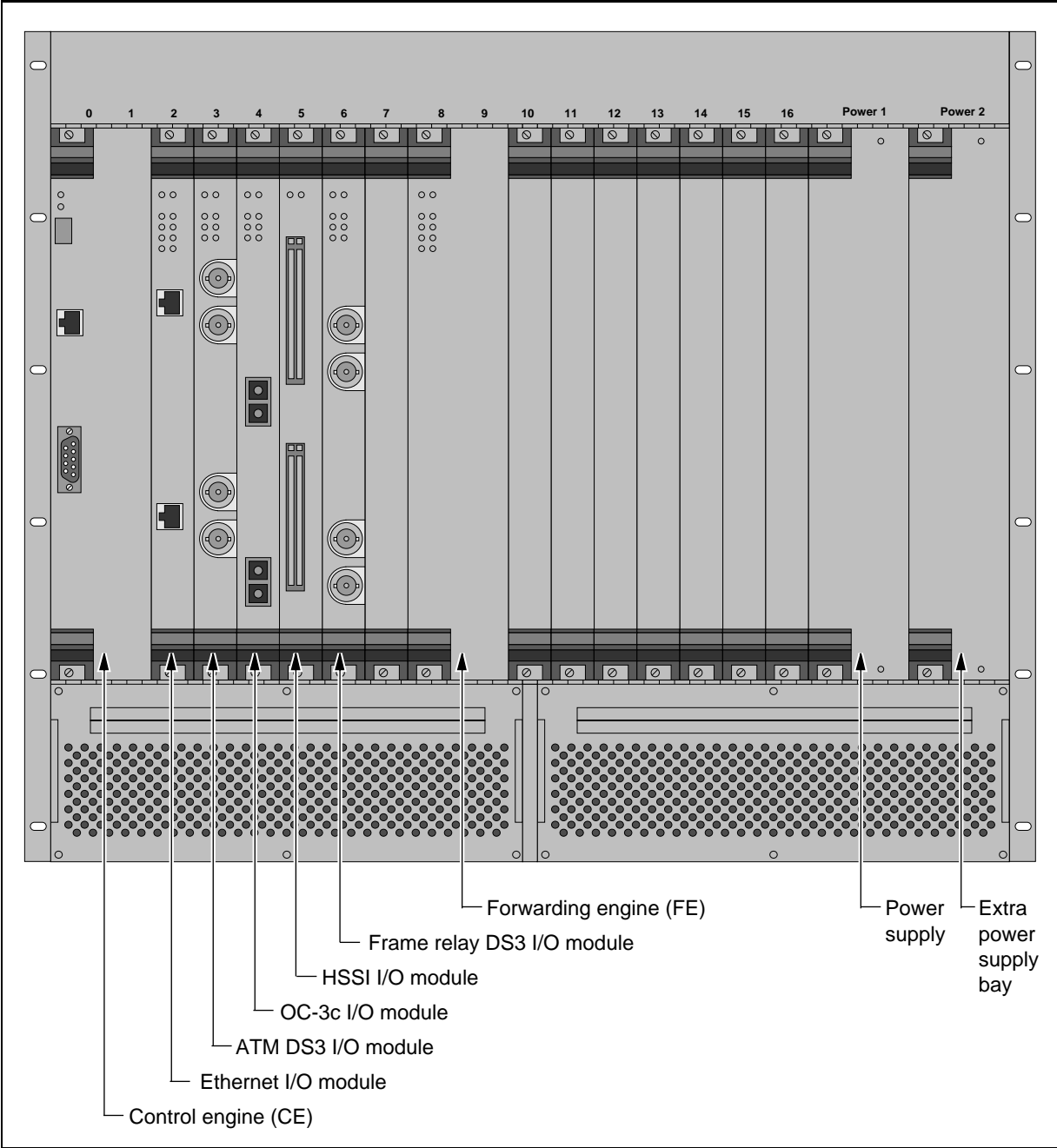
## **RedBack SMS 1000 equipment enclosure specification**

The RedBack equipment is housed in a custom, industrial, compact PCI chassis (see Figure 2-1), 15.75-inch high x 17-inch wide x 12-inch deep, weighing 30 lbs, with the following characteristics:

- redundant ac or dc power modules: ac-supply, auto-ranging 100 to 240 volt, 50-60 Hz, input 700 watts, output 400 watts; dc supply, -36 to -58 volts, 400 watts (ac and dc power modules can not be used in the same chassis)
- operating temperature of 0 to 40°C; storage temperature of -25°C to 70°C; maximum operating relative humidity of 85% (non-condensing,); maximum non-operating relative humidity of 95%; maximum operating altitude of 10,000 ft
- 2 x 1 Gb/s backplane capacity (400 Mb/s throughput)
- support for hot swapping and insertion of all modules
- a dedicated control engine (CE) module) to perform all management and control functions and scalable to handle thousands of subscribers (slots 0 and 1)
- an independent dedicated forwarding engine (FE) module to perform all buffering, packet processing, and forwarding of all normal user data between I/O modules (slots 8 and 9)
- support for six I/O modules for all physical connectivity and cell-to-packet conversion (slots 2 to 7)
- management Ethernet and console port (on the CE module)

Figure 2-1  
RedBack SMS 1000 chassis

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## RedBack SMS 1000 feature highlights

The main features supported by the RedBack SMS 1000 are:

- Control engine (CE) module: performs all control, system configuration, and connection management tasks and initiates the default system boot from FLASH memory on the CE; the module includes both a 10 /100 Ethernet port and an RS-232 serial console port
- Forwarding engine (FE) module: performs all packet forwarding between I/O modules
- I/O modules: up to 6 in any combination of 2 port ATM OC-3c / STS3c UNI (cell-based); 2 port ATM DS3 / E3 UNI (cell based); 2 port DS3 Clear Channel Frame Relay (packet based); 2 port HSSI (serial interface); 2 port 10/100 Base-T Ethernet (LAN interface)
- LAN protocols: Ethernet
- WAN protocols: HDLC, PPP, ATM PVC, Frame Relay
- PPP over ATM
- PPP over Ethernet (PPPOE) support: allows multiple hosts on a shared Ethernet connection to open PPP sessions to multiple destinations
- Encapsulation: Ethernet, 1483, 1490
- Packet forwarding: Routed, bridged, tunnelled
- IP routing protocols: Static, RIP, RIPv2
- Dynamic address management: DHCP Relay, IPCP
- Subscriber security: PAP, CHAP, and secured ARP (using RADIUS)
- Network management: CLI support (password protected access by a Telnet session initiated from the element management system or from a local craft terminal), all configuration data is stored in CE FLASH memory or on a remote server; SNMP v1 and v2c (for fault and performance management)
- RADIUS support: multiple client instances and proxy; redundant server selection (multiple servers, retransmit count); support for configuration of RFC 1483 / 1490 circuits; per subscriber accounting and statistics
- Bandwidth management: per VC traffic shaping
- ATM QoS support: CBR, VBR- rt, VBR- nrt, UBR
- Multiple contexts: support for up to 20 (FE1 or FE2) contexts with own addresses, name spaces, separate routing tables, RADIUS instances, and accounting data; configuration of optional context alias and a default context
- Dynamic service and provider selection (for example, using RADIUS)
- Tunnelling support: LAC (L2TP access concentrator) and LNS (L2TP network server) over UDP/IP

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# Planning and engineering

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This chapter defines the planning and engineering process for using a RedBack SMS 1000. The process involves determining:

1. Network characteristics
2. End user characteristics
3. Service provider characteristics
4. Network architecture
5. Bandwidth requirements
6. Uplink technology from FID
7. Number and type of FID uplinks
8. Scaling limits
9. Number of nodes needed
10. ATM switch scaling

## Network characteristics

This step involves determining the:

- types of market areas (small, medium, large, very large)
- number of market areas per market type (current and forecasted)
- number of wire centres per market area (current and forecasted)
- number of wire centres (current and forecasted)
- number of high speed access end users per wire centre & market area per market type (current and forecasted)
- number of service providers per market area (current and forecasted)
- type of high-speed access system (for example, 1-Meg Modem, ADSL)
- number of users per unit system (for example, 1-Meg Modem FID, ADSL DSLAM)
- uplink technology (for example, OC3 ATM, DS3 ATM)

## End user characteristics

This step involves determining the:

- service applications to be used: internet access, corporate access, videoconferencing, audio, video
- degree of end user loading:
  - Degree 1: some users will have just completed downloading (not generating any traffic)
  - Degree 2: others will be getting ready to download (not generating any traffic)
  - Degree 3: others will have just issued a download request (only generating upstream traffic)
  - Degree 4: remaining users will be downloading (generating downstream traffic). The downstream data rate will range from the system maximum assuming no Internet congestion, service provider network congestion or bottlenecks in the network providers backbone network (for example, 960 kb/s) to some lower value due to congestion

### End user loading based on average end user data rates

This involves considering:

- The average end user data rate is an average across all end users on the system, that is active and non- active users (includes all the various degrees mentioned above).
- The average bandwidth is much lower than the link rate for web browsing because file downloads are separated by:
  - short intervals due to user reaction time (for example, look at a page and find the desired link)
  - long intervals when users do another activity (for example, coffee break, answer phone).
- The short idle periods are present for web browsing, while the long will also be present between applications (for example, between videoconferencing and web browsing).
- With high speed access (for example, 1-Meg Modem, the active periods are much shorter than the short idle periods (for example, the 0.13 seconds to download an average file size of 16 kBytes, vs. 7 seconds (based on industry research) for the short idle period).
- The average end user data rates (for web browsing) presented below assumes only the short intervals (that is, every user is active at the computer), which is extremely conservative. However, other applications may lead to higher usage during a busy hour
  - typical average end user downstream data rates: 30 kb/s, 60 kb/s, 90 kb/s

- typical average end user upstream data rates: 5 kb/s, 10 kb/s, 15 kb/s
- A good, yet conservative, average end user downstream data rate to use, based on Nortel Networks deployment experience, is 30kb/s

**End user loading based on simultaneous sessions**

This involves considering the:

- percentage of simultaneous downloading and uploading sessions (end users) per site
- simultaneous downstream bandwidth (without protocol overheads) per site
- average downstream bandwidth (without protocol overheads) per simultaneous end user session
- average downstream bandwidth (without protocol overheads) per end user
- simultaneous upstream bandwidth (without protocol overheads) per site
- average upstream bandwidth (without protocol overheads) per simultaneous end user session
- average upstream bandwidth (without protocol overheads) per end user

**Service provider characteristics**

This involves determining the:

- Number of simultaneous end users
- Physical links to service providers
- Transport method
- Number of service providers per context

Table 3-1 lists the parameter values to be used when determining service provider characteristics.

**Table 3-1  
Parameter values**

Characteristic	Value
Service provider side protocol overhead factor:	
• PPP terminated	1.31
• PPP Tunnelled with L2TP over IP	1.43
• PPP Tunnelled with L2TP over AAL5	1.35
Bandwidth per physical link	
• OC3 bandwidth (Mb/s)	128.5
• DS3 bandwidth (Mb/s)	34.7

### Number of simultaneous end users

For each service provider at each RedBack SMS 1000 site, determine the:

- number of end users to be supported
- number of simultaneous end users = [(Number of end users) x (% Simultaneous end user sessions)]

### Physical links to service providers

Determine the number of direct connect physical links required from each RedBack SMS 1000 site to each service provider using one of the following method:

- Average data rates
- Simultaneous bandwidth

#### Average data rates

Number of physical links = [(Number of end users per service provider per RedBack SMS 1000 site) x (Average end user downstream data rate) x (Service provider side protocol overhead factor)] / [Bandwidth per physical link]

For parameter values, see Table 3-1 on page 3-3.

#### Simultaneous bandwidth

Number of physical links = [(Simultaneous downstream bandwidth) x (Service provider side protocol overhead factor)] / [Bandwidth per physical link]

For parameter values, see Table 3-1 on page 3-3.

### Transport method

Determine the transport method to be used between RedBack SMS 1000 sites and service providers:

- **PPP terminated:**
  - IP (Ethernet, 1483, or 1490) used to route user data traffic between RedBack SMS 1000 sites and service provider servers (no tunnelling is used)
- **PPP tunnelled with L2TP:**
  - L2TP Tunnelled with 1483 Routed used to carry user data traffic between RedBack SMS 1000 sites and service provider servers
  - two options: L2TP over IP and L2TP over ATM AAL5
  - preferred transport method because multiple service providers can be supported for each context

**Note:** In both transport methods, PPP encapsulation with 1483 Bridged is used to carry user data traffic between RedBack SMS 1000 sites and end users.

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### Number of service providers per context

Determine the number of service providers to be supported at each RedBack SMS 1000 site; consider the following:

- PPP Terminated architecture supports one service provider per context
- PPP Tunnelled architecture with L2TP tunnelling supports multiple service providers per context, separate L2TP tunnels are used for each service provider, thus the number of service providers supported per context is based on the number of tunnels supported
- PPP Tunnelled architecture is preferred over PPP Terminated, since it makes better use of the available contexts, it is recommended to provision multiple service providers in a single context in order to conserve on the number of contexts needed
- The maximum context limit is 20 (FE1 or FE2)
  - PPP Terminated architecture, able to support 20 (FE1 or FE2) separate service providers or 20 (FE1 or FE2) separate contexts where some service providers may have multiple contexts based on tiers of service
  - PPP Tunnelled architecture, able to support 20 (FE1 or FE2) contexts with multiple service providers per context
- If the number of contexts required exceeds the RedBack SMS 1000 context limit special engineering and provisioning would be needed
  - only subsets of the total number of contexts and service providers would be provisioned in each RedBack SMS 1000
  - end users would not have access to all the contexts
  - end users may need to be moved to a specific RedBack SMS 1000 in order to achieve the desired range of service selections

### Network architecture

Determine the type of architecture to be deployed:

- Centralized
- Distributed

#### Centralized

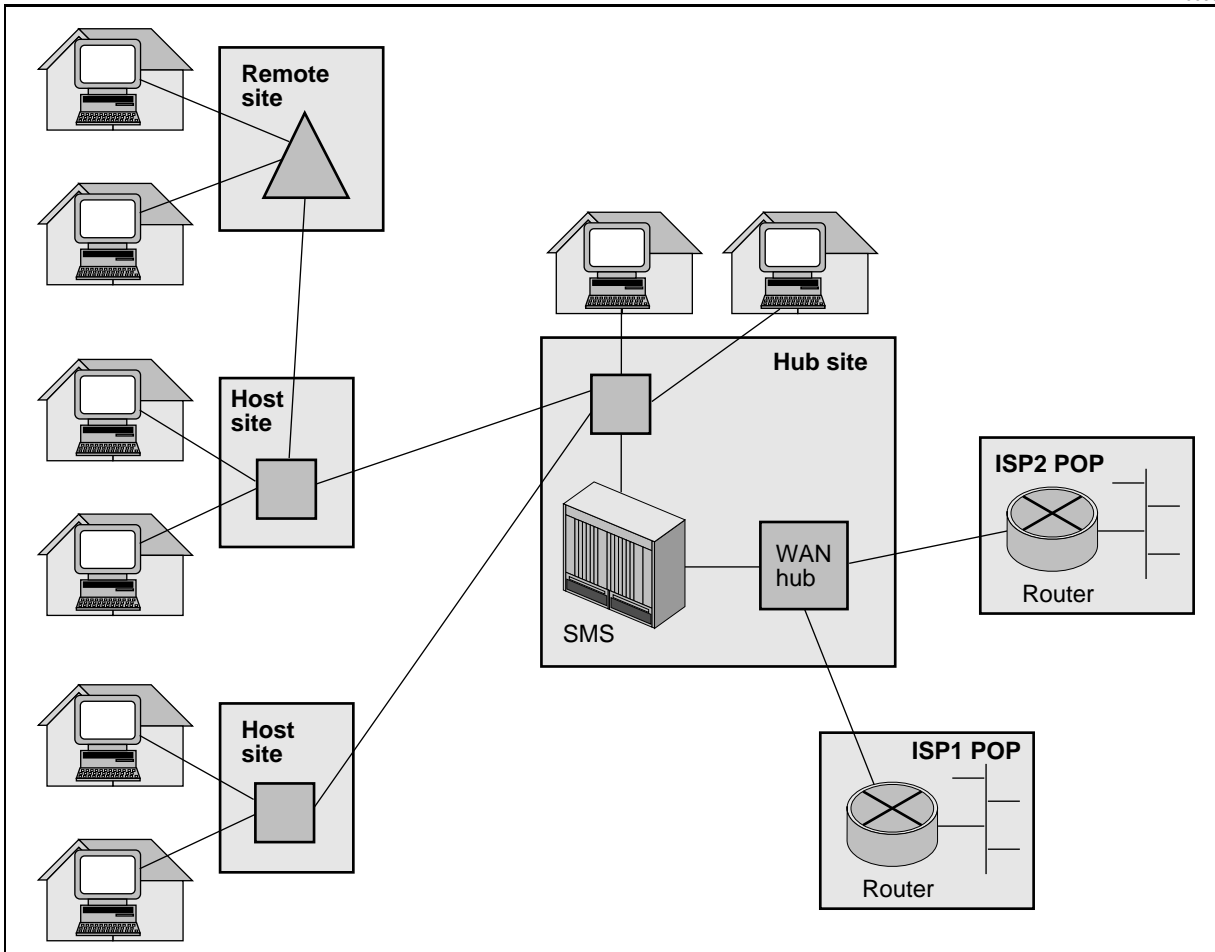
Centralized for the entire network or per market type and market area:

- achieves better SMS site utilization
- SMS site for each market type and area

This is the recommended architecture and is significantly more cost effective in terms of product cost (hardware and software), installation, and operations. See Figure 3-1.

Figure 3-1  
Centralized network architecture

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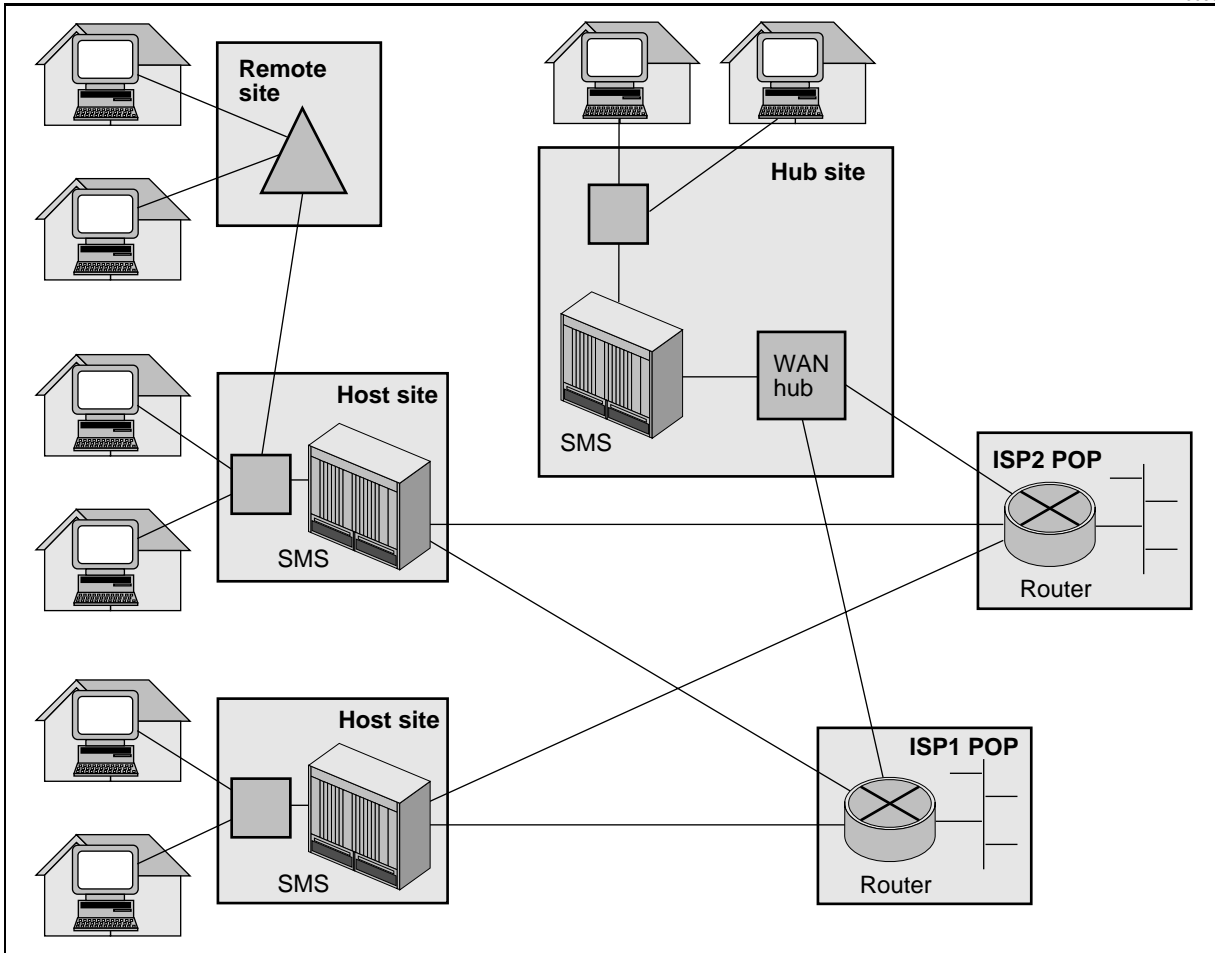
### Distributed

RedBack SMS 1000 sites are distributed in each wire centre for each market type and market area (see Figure 3-2):

- generally lower RedBack SMS 1000 site utilization
- RedBack SMS 1000 site for each wire centre

**Figure 3-2**  
Distributed network architecture

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### Bandwidth requirements

The required bandwidth for each RedBack SMS 1000 site involves determining the:

- Downstream bandwidth
- Upstream bandwidth

### Downstream bandwidth

The downstream bandwidth requirements for each RedBack SMS 1000 site can be determined by one of the following methods:

- the simultaneous downstream bandwidth per market area or wire centre
- [number of end users per market area or wire centre] x [average downstream data rate per user]

### Upstream bandwidth

The upstream bandwidth requirements for each RedBack SMS 1000 site can be determined by one of the following methods:

- the simultaneous upstream bandwidth per market area or wire centre
- [number of end users per market area or wire centre] x [average upstream data rate per user]

### Uplink technology from FID

Determine which uplink technology will be used for each SMS site:

- **OC3 ATM:** 1 ATM OC3 link supports a data rate of 128.5 Mb/s (data rate discounted to ensure frame loss < 1%)
- **DS3 ATM:** 1 ATM DS3 link supports a data rate of 34.7 Mb/s (data rate discounted to ensure frame loss < 1%)

### Number and type of FID uplinks

Determine the number and type of FID uplinks required for each SMS site:

- number of OC3 ATM links based on the number of FID uplinks
- number of DS3 ATM links based on the number of FID uplinks

### Scaling limits

Determine the size of each SMS site. Consider the following:

- Each RedBack SMS 1000 chassis supports:
  - 1 Control Engine card
  - 1 Forwarding Engine card
  - up to 6 2-port OC-3 or 2-port DS3 ATM cards
  - Bus capacity = 800Mb/s (400Mb/s into Forwarding Engine and 400Mb/s out from Forwarding Engine)
- 1 ATM OC3 port supports a data rate of 128.5 Mb/s (data rate discounted to ensure frame loss < 1%)
- 1 ATM DS3 port supports a data rate of 34.7 Mb/s (data rate discounted to ensure frame loss < 1%)
- 20 (FE1 or FE2) contexts supported

- Forwarding Engine (FE1) supports:
  - up to 8,000 configured PVCs
  - 4,000 active (simultaneous) if PPP Terminated
  - 100,000 packets per second with a maximum throughput of 400 Mb/s
- Forwarding Engine (FE2) supports:
  - up to 48,000 configured PVCs
  - 8,000 active (simultaneous) if PPP Terminated
  - 24,000 active (simultaneous) if Tunnelled with L2TP over IP or ATM AAL5 (more simultaneous sessions can be supported with Tunnelled since Terminated needs more processing for terminating PPP sessions and for IP routing)
  - more than 1,000 tunnels, with multiple sessions per tunnel
  - 130,000 packets per second with a maximum throughput of 520 Mb/s

### Number of nodes needed

Determine the number of SMS nodes based on each of the following:

- Configured PVCs required
- Simultaneous sessions required
- Ports required
- Bus bandwidth required
- Forwarding engine packets required
- Total SMS nodes required

### Configured PVCs required

Determine the number of SMS nodes required to handle the number of configured PVCs to be supported at each SMS site:

- Number of SMS nodes = [(Number of FIDs per SMS site) x 2] / [48000]
- 1 PVC required for data traffic
- 1 PVC required for management traffic

### Simultaneous sessions required

Determine the number of SMS nodes required to handle the number of simultaneous sessions to be supported at each SMS site:

- Number of SMS nodes = [Number of simultaneous sessions per SMS site] / [Simultaneous Sessions Limit per SMS node]
- PPP Terminated Simultaneous Sessions Limit = 8000
- PPP Tunnelled with L2TP Simultaneous Sessions Limit = 24000

### Ports required

Determine the number of SMS nodes based on the number of ports required at each SMS site:

- Number of SMS nodes = [(Number of FID uplinks) + (Number of service provider links)] / [12]
- For number of FID uplinks, see “Number and type of FID uplinks” on page 3-8
- For number of service provider links, see “Physical links to service providers” on page 3-4

### Bus bandwidth required

Determine the number of SMS nodes based on the bus bandwidth required at each SMS site calculated using one of the following:

- End user average data rate
- Simultaneous bandwidth

#### End user average data rate

Determine the number of SMS nodes based on the end user average data rates required at each SMS site:

- Number of SMS nodes = [(Number of end users) x (Average end user downstream data rate) x (Bus protocol overhead factor)] + [(Number of end user) x (Average end user upstream data rate) x (Bus protocol overhead factor)] / [Bus bandwidth]
- PPP Terminated: bus protocol overhead factor = [1.22 (user side) + 1.16 (network side)] = 2.38
- PPP Tunnelled with L2TP over IP: bus protocol overhead factor = [1.22 (user side) + 1.27 (network side)] = 2.49
- PPP Tunnelled with L2TP over AAL5: bus protocol overhead factor = [1.22 (user side) + 1.21 (network side)] = 2.43
- Bus bandwidth = 800 Mb/s

#### Simultaneous bandwidth

Determine the number of SMS nodes based on the simultaneous bandwidth required at each SMS site:

- Number of SMS nodes = [(Simultaneous downstream bandwidth) x (Bus protocol overhead factor)] + [(Simultaneous upstream bandwidth) x (Bus protocol overhead factor)] / [Bus bandwidth]
- PPP Terminated: bus protocol overhead factor = [1.22 (user side) + 1.16 (network side)] = 2.38
- PPP Tunnelled with L2TP over IP: bus protocol overhead factor = [1.22 (user side) + 1.27 (network side)] = 2.49

- PPP Tunnelled with L2TP over AAL5: bus protocol overhead factor = [1.22 (user side) + 1.21 (network side)] = 2.43
- Bus bandwidth = 800 Mb/s

### **Forwarding engine packets required**

Determine the number of SMS nodes based on the number of packets per second to be forwarded at each SMS site using one of the following methods:

- End user average bandwidth
- Simultaneous bandwidth

#### **End user average bandwidth**

- Number of SMS nodes = [(Number of end users) x (Average end user downstream bandwidth)] + [(Number of end users) x (Average end user upstream bandwidth)] / [ 8 / 440 / 130]
- Packet (frame) size = 440 bytes
- Packet processing limit = 130 kpps

#### **Simultaneous bandwidth**

- Number of SMS nodes = [(Simultaneous downstream bandwidth) + (Simultaneous upstream bandwidth)] / [ 8 / 440 / 130]
- Packet (frame) size = 440 bytes
- Packet processing limit = 130 kpps

### **Total SMS nodes required**

Determine the number of SMS nodes required by considering the following:

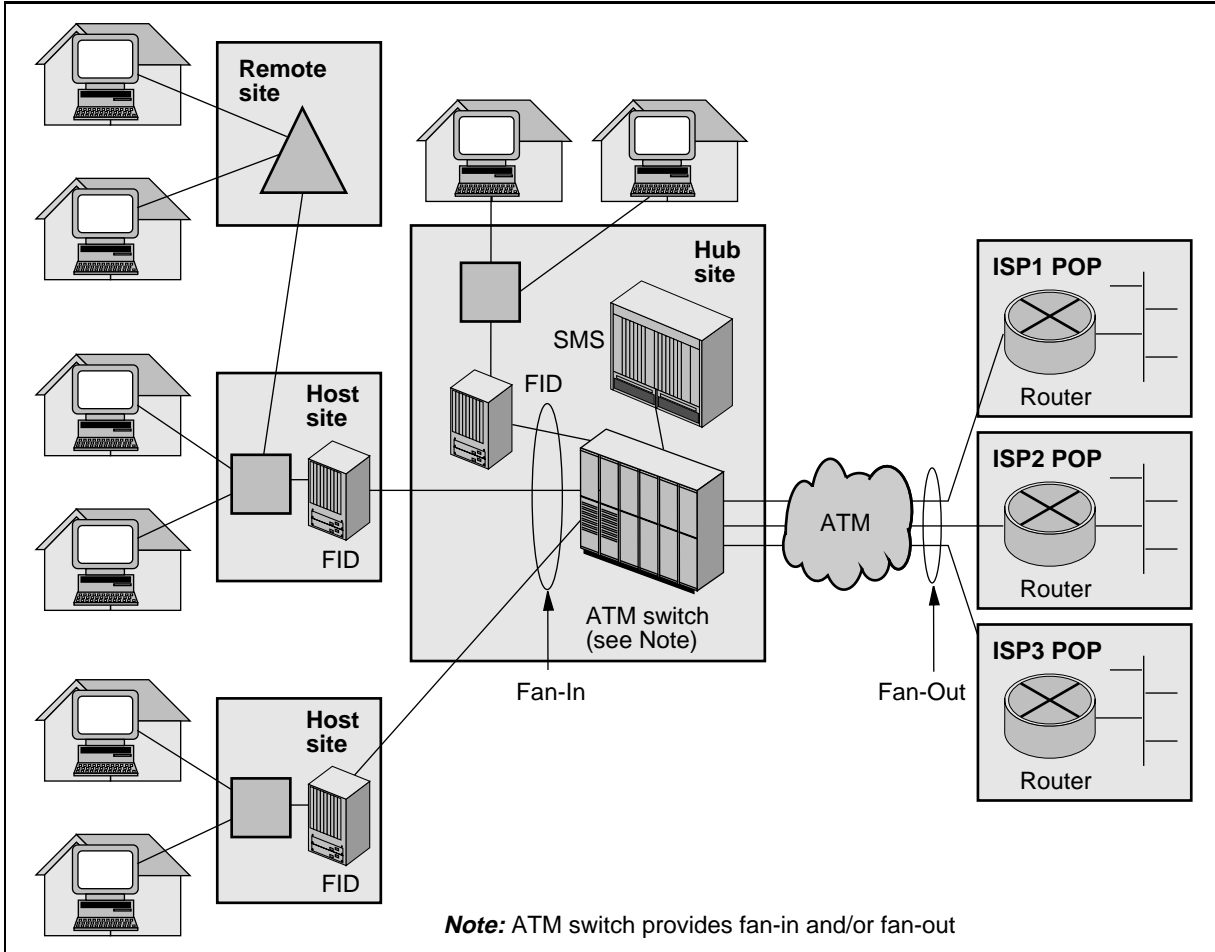
- Number of SMS nodes = [(Configured PVCs required) + (Simultaneous sessions required) + (Ports required) + (Bus bandwidth required) + (Forwarding engine packets required)]
- Deployment of the # of SMSs determined here would create a single point of failure for the network, especially since the SMS does not have redundant CE or FE
  - investigation is underway concerning the use of 802.1Q Tagging with multiple layer 2 switches
  - load sharing can also be used, whereby an ISPs users can be spread across multiple SMSs, to reduce the impact of a single SMS failure
  - redundant CE (Control Engine) will be available with the SMS 2000, and each I/ O module will contain a FE (Forwarding Engine)

### ATM switch scaling

If the main constraint for the SMS site scaling in a specific application is the port limitation, then consider using ATM switches to provide SMS site fan-in and fan-out. See Figure 3-3.

**Figure 3-3**  
Using an ATM switch to improve SMS site fan-in and fan-out

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**Note 1:** Fan-in: An ATM switch can be used to concentrate ingress ATM links from FIDs into fewer links, thereby requiring fewer ports on an SMS node.

**Note 2:** Fan-out: An ATM switch can be used to concentrate the egress ATM links from an SMS site to service providers into fewer links, the ATM switch/ network would provide the fan-out to service providers.

If ATM switches are used to reduce SMS site port requirements, use the following steps to determine the number of SMS nodes needed per SMS site:

- ATM switch fan-in from FIDs

- ATM switch fan-out to service providers
- ATM switch port limitation

### **ATM switch fan-in from FIDs**

Determine the number of physical links to the SMS site from the ATM switch fan-in from FIDs using one of the following methods:

- Average downstream data rate
- Simultaneous downstream bandwidth

#### **Average downstream data rate**

- Number of physical links = [(Number of End Users per SMS site) x (Average end user downstream data rate) x (User side protocol overhead factor)] / [Bandwidth per physical link]
- User side protocol overhead
  - PPP Terminated = 1.38
  - PPP Tunnelled = 1.38
- Bandwidth per physical link
  - OC3 = 128.5 Mb/ s
  - DS3 = 34.7 Mb/ s

#### **Simultaneous downstream bandwidth**

- Number of physical links = [(Simultaneous downstream bandwidth {without protocol overheads}) x (User side protocol overhead factor)] / [Bandwidth per physical link]
- If simultaneous downstream bandwidth includes overhead and is viewed from the service provider side then we must divide by the service provider side protocol overhead or if viewed from user side then we do not need to multiply by the user side protocol overhead
- User side protocol overhead
  - PPP Terminated = 1.38
  - PPP Tunnelled = 1.38
- Bandwidth per physical link
  - OC3 = 128.5 Mb/s
  - DS3 = 34.7 Mb/s

### **ATM switch fan-out to service providers**

Determine the number of physical links from service providers to the ATM switch fan-out to the SMS site using one of the following methods:

- Average downstream data rate
- Simultaneous downstream bandwidth

### **Average downstream data rate**

- Number of physical links = [(Number of end users per SMS site) x (Average end user downstream data rate) x (Service provider side protocol overhead factor)] / [Bandwidth per physical link]
- Service provider side protocol overhead
  - PPP Terminated = 1.31
  - PPP Tunnelled with L2TP = 1.43
- Bandwidth per physical link
  - OC3 = 128.5 Mb/ s
  - DS3 = 34.7 Mb/ s

### **Simultaneous downstream bandwidth**

- Number of physical links = [(Simultaneous downstream bandwidth) x (Service provider side protocol overhead factor)] / [Bandwidth per physical link]
- If simultaneous downstream bandwidth includes overhead and is viewed from the end user side then we must divide by the end user side protocol overhead or if viewed from service provider side then we do not need to multiply by the service provider side protocol overhead
- Service provider side protocol overhead
  - PPP Terminated = 1.31
  - PPP Tunnelled = 1.43
- Bandwidth per physical link
  - OC3 = 128.5 Mb/s
  - DS3 = 34.7 Mb/s

### **ATM switch port limitation**

Determine the number of SMS nodes based on the number of ports required at each SMS site:

- Number of SMS nodes = [(Number of uplinks from ATM switch) + (Number of physical links to ATM switch for service providers)] / [12]
- 6 I/O module slots for each SMS node
- DS3 and OC3 ATM modules have two ports each

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# Installing and configuring

---

This section outlines how to install and configure a RedBack SMS 1000 node.

## Installing a RedBack SMS 1000 node

The following steps outline how to install a RedBack SMS 1000 node:

1. Prepare site for installing RedBack SMS 1000 equipment:
  - a. install each node in an air conditioned and well ventilated environment
  - b. ambient temperature at the site should be between 0°C and 40°C
  - c. minimum clearance of at least 4 inches in the front and rear of chassis
2. Unpack the RedBack SMS 1000 node equipment
3. Mount the SMS 1000 node chassis
4. Install the required power supplies and cables
5. Install the control engine (CE) module in slots 0 and 1 of the chassis
6. Install the forwarding engine (FE) module in slots 8 and 9 of the chassis
7. Install the required I/O modules in slots 2 through 7 of the chassis
8. Install blank panels in empty chassis slots to ensure correct air flow
9. Attach a terminal device to the CE module serial port or Ethernet port
10. Connect the ac or dc power
11. Power up the SMS 1000 node and observe the boot sequence. The system will boot and load the system software using the default system image and configuration stored in the CE module FLASH memory. After a successful boot up you should see the following prompt on the console:

(c) Redback Networks 1997-1998

**Note:** Follow all standard safety and ESD protection procedures.

For full installation details, refer to the *RedBack SMS Hardware Guide*.

## Configuring a RedBack SMS 1000 node

Configuring a RedBack SMS 1000 node involves three main steps:

- Accessing the CLI configuration mode
- Configuring an administrator account
- Configuring operator accounts
- Creating a system configuration

For full configuration details, refer to the *RedBack SMS Configuration Guide*.

### Accessing the CLI configuration mode

All RedBack SMS 1000 configuration must be done using CLI (command line interface) commands entered through a terminal attached to the RS-232 serial port on a CE module or via a Telnet session routed to the Ethernet port on a CE module.

The CLI is comprised of a number of modes which specify an environment where a group of related commands are valid. When initiating a session, the CLI is always set to the operator (non-privileged) mode by default. In the operator mode, the system can not be modified. In order to configure the system, the administrator (privileged) mode must be entered; the operator **enable** command is used to do this; for example, enter **enable** after the Redback operator system prompt:

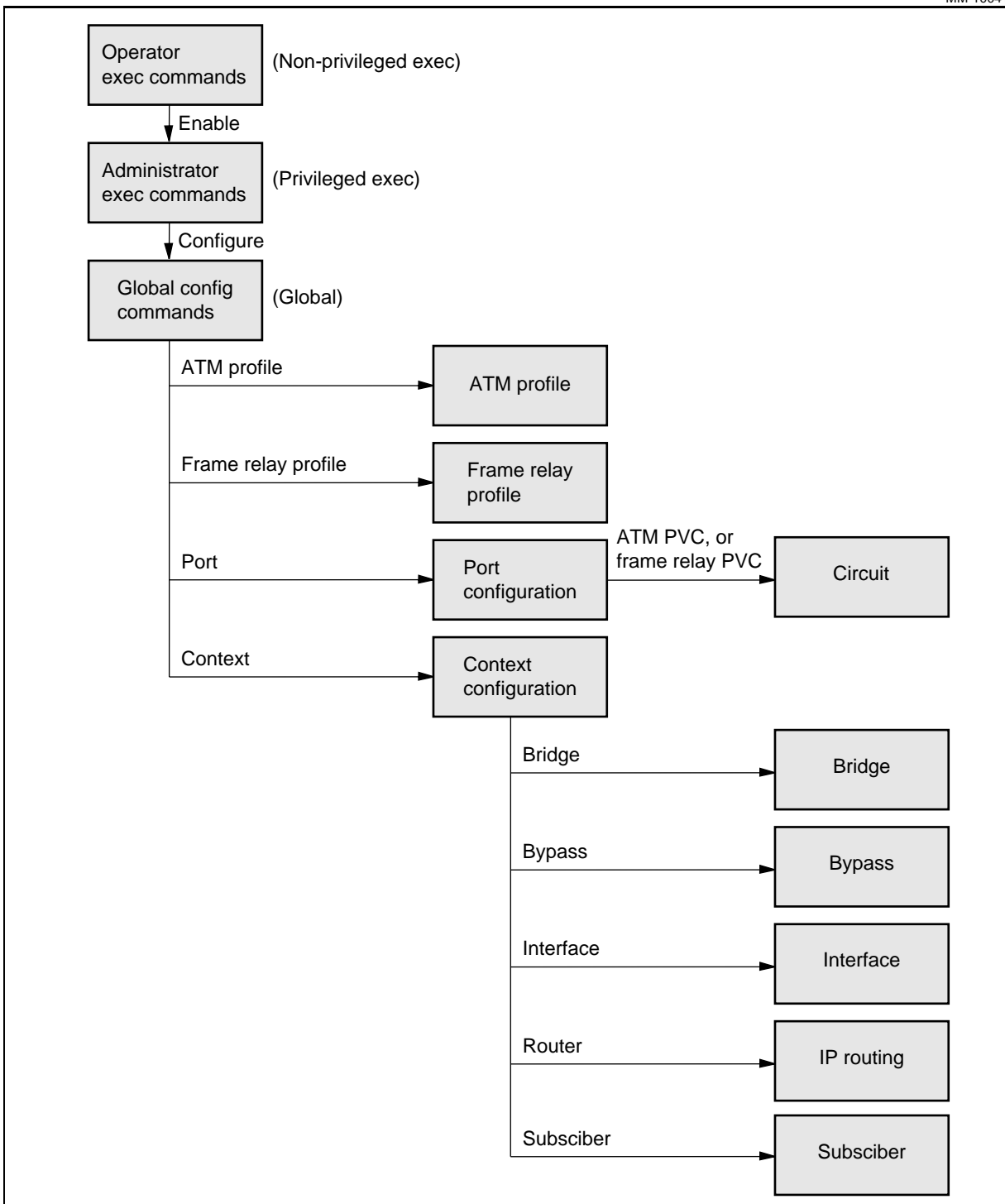
```
[local] Redback> enable  
[local] Redback#
```

Once within the administrator mode, all system commands are available. To return to the operator mode, enter **no enable** after the system prompt. All other modes are sub-modes of the configuration mode (see Figure 4-1). To exit the configuration mode, enter the **end** command. To return to the a higher level configuration sub-mode or close an active session use the **exit** command.

**Note:** Until valid administrator user names and passwords are configured, the administrator mode can only be accessed from the console attached to the RS-232 port on the CE module.

**Figure 4-1**  
**CLI modes**

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### Configuring an administrator account

Prior to configuring the system, the console is not secured and a session can be initiated by simply pressing the **return** key. To secure the console and automatically enable Telnet, one or more administrator accounts must be configured. In the following example, an administrator account with the user name of “root” is created and a password of “foobar” is assigned to the account.

```
[local]Redback(config)#context local
```

```
[local]Redback(config-ctx)#administrator root password foobar
```

The next time a session is initiated via Telnet or the console, the system will prompt for a user name and password. The user must enter “root@local” and “foobar” at the appropriate prompts in order to gain access. Note that the user name is always of the structured form user@context for Telnet sessions. This instructs the system as to which context to use for authentication. It may be of the form user@context for a console login but the context name is optional—if a context name is not supplied, the “local” context is assumed.

### Configuring operator accounts

Operator accounts may also be created. The login procedure for an operator is the same as that for an administrator. However, operator accounts cannot access any privileged mode commands (primarily, the enable command is not accessible). Operator accounts are particularly useful for personnel who need to verify the state of the system but who are not authorized to make changes. The following example creates an operator account “tac” with a password of “TopSecret”.

```
[local]Redback(config)#context local
```

```
[local]Redback(config-ctx)#operator tac password TopSecret
```

When connecting to the system by the console or a Telnet session, the password entered is not echoed. In addition, passwords are stored in the configuration file with strong encryption.

If a password is forgotten, the particular account configuration record must be deleted and a new one entered.

### Creating a system configuration

The following steps outline how to create a basic system configuration:

1. Configure global parameters
2. Configure interfaces, ports, and routing protocols
3. Configure ATM PVCs
4. Configure PPP over Ethernet
5. Configure subscribers and PPP
6. Configure RADIUS
7. Configure DHCP support
8. Configure bridges
9. Configure multiple contexts
10. Configure traffic contracts
11. Configure AAA features
12. Configure access control lists
13. Saving the configuration to CE FLASH memory

**Note 1:** By default, the system software image is stored in *redback.bin* and configuration data is stored in *redback.cfg* within CE FLASH memory.

**Note 2:** By default, the system boots using the *redback.bin* and *redback.cfg* CE FLASH memory files; to interrupt the default system boot, press any key and then specify the local filename and the host and file to boot from.

**Note 3:** For configuration problems, refer to the *DANS RedBack SMS 1000 Troubleshooting Guide*.



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## List of terms

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<b>802</b>	802 refers to the IEEE 802 series of LAN standards: <ul style="list-style-type: none"><li>• 802.2 is the Data Link standard for use with 802.3, 802.4, and 802.5; it specifies how the basic data connection should be set up over the cable</li><li>• 802.3 defines the Ethernet physical layer standard that includes specification of physical cables and the method of transmitting data and controlling access to cables</li><li>• 802.4 defines the physical Token Bus standard for the Token Ring passing access method on a bus topology LAN</li><li>• 802.5 defines the physical layer IBM Token Ring standard for the Token Ring passing method on a ring topology LAN</li><li>• 802.6 is the standard that defines MANs, an SMDS-based, short-packet ATM transmission method</li></ul>
<b>1483</b>	RFC 1483 Multiprotocol Encapsulation over ATM Adaptation Layer 5; see RFC
<b>1490</b>	RFC 1490 Multiprotocol Interconnect Over Frame Relay; see RFC
<b>100Base-T</b>	RedBack SMS supports 100 Mb/s Ethernet using twisted-pair cables of up to 10 metres to interconnect equipment using RJ-45 connectors
<b>10Base-T</b>	RedBack SMS supports 10 Mb/s Ethernet using twisted-pair cables of up to 100 metres to interconnect equipment using RJ-45 connectors
<b>1MM</b>	A IMM (1-Meg modem) is subscriber customer premise equipment (CPE) that connects to a telephone line, an extension telephone, and a personal computer
<b>1MMS</b>	1-Meg modem system
<b>AAA</b>	The RedBack SMS AOS supports AAA (authentication, authorization, and accounting) configuration of RADIUS servers
<b>AAL5</b>	ATM Adaptation Layer 5; also see ATM
<b>ADSL</b>	ADSL (asymmetrical digital subscriber line) is a standard allowing digital broadband (over 6 M/s) signals and plain old telephone service to be transmitted up to 12,000 feet over a twisted copper pair.
<b>AOS</b>	AOS (access operating system) is the RedBack SMS operating system

<b>ARP</b>	address resolution protocol
<b>asynchronous transmission</b>	Data transmission one character at a time to a receiving device, with intervals of varying lengths between transmittals, with start bits at the beginning and stop bits at the end of each character, to control the transmission. In xDSL and in most dial up modem communications, asynchronous transmission is often found in Internet access and remote office applications. Also see synchronous transmission.
<b>ATM</b>	ATM (asynchronous transfer mode) is a protocol that packs digital information into 53-byte cells (5 byte header and 48 bytes of payload) that are switched throughout a network over virtual circuits. Standardized by the ITU-T in 1988 to create a Broadband Integrated Services Digital Network (B-ISDN). Its ability to accommodate multiple types of media (voice, video, data) make it a very useful for full service networks based on ADSL and VDSL.
<b>B-ISDN</b>	Broadband ISDN standard for digital transmission speeds from 34 Mb/s to 622 Mb/s.
<b>baseband</b>	Baseband refers to any network that uses a single-carrier frequency. Only a single form of data transmission is used. The digital data is applied directly to the transmission media without the intervention of a modulating device. Ethernet is a baseband network.
<b>binding</b>	Within RedBack SMS, binding refer to the action of forming associations, linkages, or coupling between ports, circuits, or tunnels and the bridging, routing, and switching protocols configured within a specific context. Also see contexts.
<b>BOOTP</b>	BOOTP (bootstrap protocol) is a protocol used by nodes, when booted, to learn about its own IP address and/or the IP address of the server it must contact to download the load it should boot.
<b>bridging</b>	Bridging refers to connections between network segments. A bridge connects two networks at the OSI Data Link Layer (Media Access Control). Once bridging is achieved, the bridge makes the interconnected networks look like a single network. There are two types of bridging: Spanning Tree and Source Routing (for Token Ring networks). Bridges can connect networks using different protocols and they do not interpret data they carry; they do control network traffic and security and filter when required.
<b>broadband</b>	Broadband (also referred to as wideband) can be used to describe any network that multiplexes multiple network carrier frequencies onto a single transmission media, such as a copper or fiber optic cable. This permits multiple networks to share the same media because they operate at different frequencies and do not interfere with each other.
<b>bus topology</b>	A bus topology is a network layout scheme which all devices are connected in a line to a single cable. A bus network has two distinct ends. All devices attached to a bus network have equal access to it and can see all messages. Each device selects its own messages.
<b>CBR</b>	constant bit rate

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<b>CE</b>	The RedBack SMS CE (control engine) module performs all control, system configuration, and connection management tasks
<b>CHAP</b>	CHAP (challenge-handshake authentication protocol) is used to verify a user's name and password for PPP Internet connections
<b>circuit switching</b>	A switching system that establishes a dedicated physical communications connection between end points, through the network, for the duration of the communications session; this is most often contrasted with packet switching in data communications transmissions. Also see Packet Switching.
<b>circuit-switched network</b>	Network that establishes a physical circuit temporarily on demand (typically when a telephone or other connected device goes "off hook", and keeps that circuit reserved for the user until it receives a disconnect signal.
<b>CLI</b>	CLI (command line interpreter) is the primary user interface to the RedBack SMS. The CLI can be accessed from a console port or a Telnet session; the CLI is used to perform all configuration tasks. It can also be used to monitor the system.
<b>CO</b>	A CO (central office) is a circuit switch that terminates all the local access lines in a particular geographic serving area; a physical building where the local switching equipment is found. xDSL lines running from a subscriber's home connect at their serving central office.
<b>compression</b>	The act of sampling and reducing a signal for the purposes of saving storage or transmission capacity; MPEG1 and MPEG2 are two key encoding and compression algorithms that enable full motion video over smaller bandwidth circuits, such as those offered by ADSL, SDSL, and HDSL.
<b>connection oriented</b>	A term applied to network architectures and services which require the establishment of an end-to-end, predefined circuit prior to the start of a communications session. Frame relay circuits are examples of connection-oriented sessions. See connectionless.
<b>connectionless</b>	A term applied to network architectures and services which do not involve the establishment of an end-to-end, predefined circuit prior to the start of a communications session. Cells or packets are sent into the connectionless network, and are sent to their destination based on addresses contained within their headers. The Internet and SMDS are two examples of connectionless networks. See connection oriented.
<b>context</b>	Each physical RedBack SMS node supports multiple contexts which enable a virtual private network (VPN) to be set up for for multiple service providers; each context provides a separate administrative domain for security, accounting, and management for each service provider.
<b>CPE</b>	customer premises equipment
<b>CSA</b>	Canadian Standards Association
<b>DANS</b>	Data Access Network Solutions

## 5-4 List of terms

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<b>DBIC</b>	DBIC (data-enhanced BIC) is a bus interface card enhanced to accommodate data traffic. Each DBIC has a 10Base-T interface.
<b>DHCP</b>	DHCP (dynamic host configuration protocol) is the protocol used to dynamically assign and unassign an IP address to a host. This is an extension to BOOTP. DHCP servers will also accept and respond to BOOTP requests.
<b>DLC</b>	data line card
<b>DMS</b>	digital multiplex system
<b>DMT</b>	Discrete multi-tone modulation. A wave modulation scheme that discretely divides the available frequencies into 256 sub-channels or tones to avoid high-frequency signal loss caused by noise on copper lines.
<b>downstream</b>	In xDSL, the communications from the network towards the customer premises.
<b>DS1</b>	digital signal, level 1 (1.544 Mb/s)
<b>DS3</b>	digital signal, level 3 (44.7 Mb/s)
<b>DSL</b>	Digital subscriber line. A local loop access technology that calls for modems on either end of copper twisted-pair wire to deliver data, voice, and video information over a dedicated digital network.
<b>DSLAM</b>	A DSLAM (digital subscriber line access multiplexer) is a device located in the central office or DLC which terminates incoming DSL lines, directs voice traffic to the PSTN and concentrates data traffic to the service provider's WAN connections.
<b>EEC</b>	European Economic Community
<b>EMC</b>	electromagnetic compatibility
<b>encapsulation</b>	Encapsulation is the process of sending data encoded in one protocol format across a network operating a different protocol; also known as protocol tunneling
<b>FCC</b>	U.S.A. Federal Communications Commission
<b>FE</b>	The RedBack SMS FE (function engine) module performs all packet forwarding between I/O modules.
<b>FID</b>	fan-in device
<b>Frame Relay</b>	Frame Relay is a high-speed packet-switched data communications service, similar to X.25. It originates from ISDN and is designed to provide high-speed frame or packet transmission with minimum delay and efficient use of T3/E3 or lower bandwidth. Frame Relay is a leading contender for LAN-to-LAN interconnect services, and is well suited to the bursty demands of LAN environments.
<b>FTP</b>	FTP (file transfer protocol) is a software protocol that operates over the Internet or other wide area networks. When called, it connects to a specified server or site that is set up to utilize FTP protocol. Files and information are retrieved by the connecting server.

<b>gateway</b>	A gateway is a network interconnect device that operates at OSI Layer 7. It supports a full stack of protocols, for example, ISO and TCP/IP) and can convert to lower-level layer protocols.
<b>Gb/s</b>	Gigabits per second
<b>GTS</b>	Global Technical Support provides support (Tier 2) within Nortel Networks; also see TAS
<b>HDLC</b>	high-level data link control
<b>HDSL</b>	HDSL (high bit rate digital subscriber line) is an xDSL technology in which modems on either end of two or more twisted-pair lines deliver symmetric T1 or E1 speeds. Currently, T1 requires two lines and E1 requires three.
<b>HSSI</b>	high-speed serial interface
<b>IAB</b>	Internet Activities Board is the technical body that sets policy and standards for TCP/IP and the Internet; its task forces are the IETF and IRTF.
<b>IEC</b>	International Electrotechnical Commission
<b>IEEE</b>	Institute of Electrical and Electronic Engineers
<b>IETF</b>	The Internet Engineering Task Force (IETF) is a committee concerned with the short-term and medium-term problems with TCP/IP and the Internet; its chairperson is a member of the IAB.
<b>Internet</b>	The Internet is a group of networks that are interconnected so that they appear to be one continuous network that can be addressed seamlessly at Network Layer 3 of the OSI model.
<b>IP</b>	Internet Protocol
<b>IPCP</b>	Internet Control Protocol
<b>IRTF</b>	The Internet Research Task Force (IRTF) is a technical group working on TCP/IP and Internet problems; the IRTF chairperson is a member of the IAB.
<b>ISDN</b>	integrated services digital network
<b>ISO</b>	The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies from over 90 countries whose work results in international agreements which are published as International Standards.
<b>ISP</b>	ISP (Internet service provider) is the telecommunications company providing subscriber access into the Internet.
<b>kb/s</b>	kilobits per second
<b>LAC</b>	LAC (L2TP access concentrator) protocol used to provide tunnelling over UDP/TP.
<b>LAN</b>	local area network

<b>latency</b>	A measure of the temporal delay. Typically, in xDSL, latency refers to the delay in time between the sending of a unit of data at one end of a connection, until the receipt of that unit at the destination.
<b>LC</b>	line card
<b>LCM</b>	line concentrating module
<b>LED</b>	light-emitting diode
<b>LMDS</b>	LMDS (local multipoint distribution system) is a one- or two-way wireless system designed to offer customers a variety of broadband services, such as video programming distribution; video teleconferencing; wireless local loop telephony; and high speed data transmission, such as internet access.
<b>LNS</b>	LNS (L2TP network server ) protocol used to provide tunnelling over UDP/TP.
<b>local loop</b>	A generic term for the connection between the customer's premises (home, office, whatever) and the provider's serving central office. Historically, this has been a wireline connection; however, wireless options are increasingly available for local loop capacity. Also colloquially referred to as "the last mile" (even though the actual distance can vary).
<b>MAC</b>	MAC (media access control). A MAC address is a unique OSI Data Link sub-layer address associated with a particular network device.
<b>MAN</b>	A MAN (metropolitan are network) is a data communication network typically covering the geographic area of a city; a communications network that is usually larger than a LAN but smaller than a WAN. Based on the IEEE 802.6 standard. Also see LAN and WAN.
<b>Mb/s</b>	Megabits per second
<b>MIB</b>	A MIB (management information base) is a database of network element identifiers and associated data that can be monitored and controlled through the SNMP.
<b>modulation</b>	The process in which the characteristics of one wave or signal are varied in accordance with another wave or signal. Modulation can alter frequency, phase, or amplitude characteristics.
<b>MPEG</b>	MPEG (motion picture experts group) is an industry organization whose goal is to develop standards and specifications for the encoding, transmission, and unencoding of video
<b>MUX</b>	A MUX (multiplexer) is a device that allows the transmission of multiple data streams over a common medium. Several communications paths or channels may be either permanently or dymanically established over the medium to accomplish this.
<b>nail up</b>	The process of dedicating a telecommunications circuit for a particular use; the physical or logical dedication of a line for a particular use.
<b>NMS</b>	Network Management System

<b>NOC</b>	network operations center
<b>OAM</b>	operation, administration, and maintenance
<b>OAMP</b>	also OAM&P; operations, administration, maintenance, and provisioning
<b>OC-3c</b>	optical carrier, level 3, concatenated
<b>OC-x</b>	OC-x (optical carrier) is base unit found in the SONET hierarchy; the "x" represents increments of 51.84 Mb/s (so, OC-1 is 51.84 Mb/s; OC-3 is 155 Mb/s, and OC-12 is 622 Mb/s). See Synchronous Optical Network.
<b>OSI</b>	Open Systems Interconnection (OSI) refers to the OSI basic reference architectural model that describes how communications can be achieved between different vendor systems. It is a logical structure for network operations standardized within ISO and contains 7 primary layers. It enables OSI-compliant equipment to communicate with other OSI-compliant equipment. The 7 layers, starting at the lowest are: Physical, Data Link, Network, Transport, Session, Presentation, and Application.
<b>packet</b>	A sub-unit of a data stream; a grouping of information that includes a header (containing information like address destination) and, in most cases, user data.
<b>packet switching</b>	A switching system that uses a physical communications connection only long enough to transit a data message; data messages are disassembled into packets and reassembled at the receiving end of the communication link; packets may travel over many diverse communications links to get to the common endpoint. This is most often contrasted with circuit switching in data communications, where all data messages transmitted during a session are transmitted over the same path for the duration of the session. Also see "circuit switching".
<b>packet-switched network</b>	Network that does not establish a dedicated path through the network for the duration of a session, opting instead to transmit data in units called packets in a connectionless manner; data streams are broken into packets at the front end of a transmission, sent over the best available network connection, and then reassembled in their original order at the destination endpoint.
<b>PAP</b>	password authentication protocol
<b>payload</b>	That portion of a frame or cell that carries user traffic. It is effectively what remains in the frame or cell if you take out all headers or trailers.
<b>ping</b>	Ping is a protocol function in TCP/IP that tests the ability of a computer to communicate with a remote computer by sending a query and receiving a confirmation response.
<b>POP</b>	POP (point of presence) is the location where a line from a long-distance carrier connects to the line of the local telephone company or to the user if the local company is not involved.
<b>POTS</b>	POTS (plain old telephone protocol) commonly refers to standard telephony, as in placing and receiving telephone calls.

<b>POTS splitter</b>	A device that separates an xDSL communications stream into its POTS and data components; for example, a standard POTS connection on a RJ-11 connector and an Ethernet or ATM connection on a RJ-45 connector.
<b>PPP</b>	PPP (point-to-point protocol) is the data-link protocol that provides dial-up access over serial lines by encapsulating protocols in specialized network control protocol packets; these packets can be used to replace a network adapter driver which allows remote users to log on to networks as if they were local users.
<b>PPPOE</b>	PPPOE (PPP over Ethernet)
<b>PSTN</b>	public switched telephone network
<b>PVC</b>	PVC (permanent virtual circuit) is a term found in frame relay and ATM networking in which a virtual connection between two fixed end-points is established through the network. See SVC.
<b>QAM</b>	QAM (quadrature amplitude modulation) is a bandwidth conservation process routinely used in modems, QAM enables two digital carrier signals to occupy the same transmission bandwidth.
<b>QoS</b>	Quality of Service
<b>RADIUS</b>	The RADIUS (remote authentication dial-in user service) protocol enables the building of a system that secures remote access to networks and network services. RADIUS is based on a client/server architecture. The RedBack SMS AOS can be configured to act as a RADIUS client.
<b>RADSL</b>	RADSL (rate adaptive digital subscriber line) is an emerging variation of CAP; it divides the transmission spectrum into discrete sub-channels and adjusts each signal transmission according to line quality. Also see CAP.
<b>RAM</b>	random access memory
<b>RFC</b>	RFC (Request for Comment) are documents that contain written information about TCP/IP and the Internet including its architecture, protocols, and history. RFC documents can be downloaded by anonymous/guest FTP from URL <b>ds.internic.net</b> using the <b>get rfc/rfcN.txt local_filename</b> command or by sending an email to <b>mailserv@ds.internic.net</b> with the command <b>send rfcN.txt</b> in it.
<b>ring topology</b>	A ring topology is a network layout scheme which forms a closed loop with devices attached to the ring. Every device is linked to two others, one on each side. All data is passed from node to node in only one direction. Response time is determined by the number of devices in the ring, more devices leads to slower responses.
<b>RIP</b>	The RIP (routing information protocol) is used by UNIX systems to exchange routing information
<b>RJ-45</b>	RJ-45 is a connector with eight conductors. The most common Ethernet connector using unshielded twisted-pair cables.

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<b>router</b>	A router is a network connection device operating at the OSI Network Layer that supports a specific Network Layer protocol and related stack, such as TCP/IP. Routers are used to link LANs together locally or remotely as part of a WAN.
<b>RS-232</b>	RS-232 is a popular standard used for asynchronous or serial communications over short distances (up to 50 ft) between a personal computer and a modem or ACSII terminal. Typically a DB-25 connector with unshielded twisted-pair cable is used.
<b>RSMS</b>	RedBack SMS
<b>S-HDSL</b>	S-HDSL (single pair high bit rate digital subscriber line). SDSL is essentially HDSL over a single twisted pair.
<b>SAM</b>	SAM (service access multiplexer) is a component of the DSLAM.
<b>SDH</b>	SDH (synchronous digital hierarchy) is the international standard for transmitting digital information over optical networks. Term used by ITU to refer to SONET.
<b>SDMT</b>	SDMT (synchronized DMT) is a multicarrier modulation scheme that adds time division duplexing on top of DMT systems and permits transmit and receive in discrete time slots. Proposed for use with VDSL.
<b>SDSL</b>	symmetric digital subscriber line
<b>signaling</b>	The process of sending a transmission over a physical medium for purposes of communication.
<b>SMDS</b>	switched multimegabit data service
<b>SMS</b>	subscriber management system
<b>SNMP</b>	SNMP (simple network management protocol) can be used to monitor the status of RedBack SMS nodes.
<b>SONET</b>	SONET (synchronous optical network) is the standard for transmitting digital information over optical networks. Fiber optic transmission rates range from 51.84 Mb/s to 13.22 Gb/s. It defines a physical interface, optical line rates known as Optical Carrier (OC) signals, frame formats and a OAM&P protocol. The base rate is known as OC-1 and runs at 51.84 Mb/s. Higher rates are a multiple of this such that OC-12 is equal to 622 Mb/s (12 times 51.84 Mb/s)
<b>STS1</b>	STS1 is an ATM Physical Layer implementation supporting 51 Mb/s
<b>STS3</b>	STS3 is an ATM Physical Layer implementation supporting 155 Mb/s
<b>SVC</b>	SVC (switched virtual circuit) is a term found in Frame Relay and ATM networking in which a virtual connection, with variable end-points, is established through an ATM network at the time the call is initiated; the SVC is de-established at the end of the call. Also see PVC.
<b>synchronous transmission</b>	Data transmission using synchronization bytes, instead of start/stop bits, to control the transmission. In xDSL, video streams are considered to be synchronous in nature. Also see asynchronous transmission.

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<b>T1</b>	The North American standard for high-speed digital data transmission through the telephone hierarchy at a transmission rate of 1.544 Mb/s (24.64 kb/s per channel with 8 kb/s for control information. Also called DS1. Equivalent to E1.
<b>T3</b>	The North American standard for high-speed digital data transmission through the telephone hierarchy at a transmission rate of 44.736 Mb/s (equivalent to 28 T1 circuits). Also called DS3. Equivalent to E3.
<b>TAS</b>	Technical Assistance Support provides direct support (Tier 1) to external customers; also see GTS
<b>TCP</b>	TCP (transmission control protocol) is the standard transport protocol that provides the full duplex stream service on which many application protocols depend. TCP allows a process on one machine to send a stream of data to a process on another machine. The software implementing TCP usually resides in the operating system and IP is used to transport data across the network.
<b>TCP/IP</b>	TCP/IP (transmission control protocol/Internet protocol) are a suite of protocols that build up to layer 4 of the ISO OSI model but with no direct correspondence layer for layer; three main protocols sit above TCP/IP: Telnet, FTP, and SMTP
<b>TFTP</b>	TFTP (trivial file transfer protocol) is the TCP/IP standard protocol for file transfer with minimal capability and overhead; TFTP depends on UDP
<b>trap</b>	Trap is an asynchronous message from the SNMP server agent to a network management application. In the xEMS context, this is how fault event data collection is triggered.
<b>tunnelling</b>	Tunnelling refers to the ability to support secure PPPOE sessions using LAC and LNS UDP/IP tunnelling which allows multiple service providers to share the same context. Also see context, LAC, LNS, PPPOE, and UDP/IP.
<b>TUV</b>	TUV (Technischer Überwachungs Verein) is the German standards authority
<b>UBR</b>	unspecified bit rate
<b>UDP/TP</b>	UDP (user datagram protocol)/TP is the TCP/IP transaction protocol for applications; for example, remote network management and name-service access.
<b>UDSL</b>	universal digital subscriber line
<b>UL</b>	Underwriters Laboratories
<b>UNI</b>	user-network interface
<b>UNIX</b>	UNIX is a widely-used proprietary client/server operating system
<b>upstream</b>	In xDSL, the communications from the customer site up into the telecommunications network.
<b>URL</b>	URL (uniform resource locator) is the standardized way of representing different documents, media and network services on the World Wide Web.
<b>VBR</b>	variable bit rate

<b>VC</b>	virtual channel
<b>VDSL</b>	VHDL (very high bit-rate digital subscriber line) is a technology in which modems enable access and communications over twisted-pair lines at a data rate from 1.54 Mb/s to 52 Mb/s. VDSL has a maximum operating range from 1,000 feet to 4,500 feet on 24-gauge wire.
<b>VF</b>	voice frequency
<b>VLAN</b>	virtual local area network
<b>VPN</b>	virtual private network
<b>WAN</b>	wide area network
<b>xDSL</b>	xDSL (x digital subscriber line) is a generic name for asymmetrical digital subscriber line equipments and services. Digital subscriber line technology provides high-speed digital bit stream over the same wires used for analog connection.
<b>xEMS</b>	xEMS (xDSL element management system) is the graphical user interface (GUI) on an HP OpenView workstation used to manage the LCM.
<b>xLC</b>	xDSL line card





Data Access Network Solutions (DANS)

# **RedBack**

## **SMS 1000**

### Planning Guide

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DANS-RSMS-012  
Final 01.01  
April 16, 1999  
Printed in Canada