Cisco ASR 9000 Series

Mobile Backhaul Profile (MBH)

November 2017

Contents

1. Profile Introduction

The Cisco® ASR 9000 Series is a true carrier-class solution. It features the modular, microkernel-based Cisco IOS® XR Software operating system, comprehensive system redundancy, and a full complement of network resiliency schemes. Cisco ASR 9000 Series Routers also offer the services and application-level intelligence you need for optimized video delivery and mobile aggregation. ASR9000 intelligently blends with the following technology/deployment solutions:

- Cable/MSO
- Carrier Ethernet
- Mobile backhaul
- Web OTT
- Multiservice edge
- DCI gateway
- Broadband gateway
- Large enterprise WAN

This document is intended as a reference for deployment profiles of Mobile Backhaul (MBH) with the primary role of aggregation node in mobile aggregation solutions. MBH aggregation node involves legacy technologies such as SONET/SDH with ATM, PPP, and MLP, apart from the Ethernet. From a solutions point of view, MBH aggregation node uses dual-stack L3 VPN, mVPN, AToM, L2 VPN, BGP PiC, dual homing, and a few others. Mobile aggregation deployment is targeted for services such as EVDO, 1xRTT, LTE, GSM/UMTS, and so on. This deployment guide discusses L3 VPN on multilink PPP-bundled T1s with CHOC12 SPAs in SIP-700 LC.

ASR9000 has incrementally offered solution and hardware elements along with higher scalability targets for the MBH market segment from 3.9.0. For hardware coverage, refer to the hardware matrix in Table 3.

This document addresses the question of multidimensional feature scalability and performance, along with network-level resiliency, data-plane throughput, and network-level QoS, typically deployed in a mobile aggregation solution. Information in this document helps to analyze ASR9000 performance for scalability verified as part of this deployment guide and provides guidance for higher scalability. As part of this profile verification, this document provides CPU and memory usage characterization, network-level resiliency and redundancy data, and ASR9000 reliability data under extensive stress and disruptions. A few of the key highlights are the following:

Cisco ASR 9000 Series Routers provide industry best resiliency performance for various failure scenarios across the mobile backhaul network with TE FRR, BGP PIC core and edge, IGP convergence, IC-SSO, VRRP, BFD, and a range of other features. Cisco ASR 9000 delivers no packet loss during RSP failover for all traffic flows. ASR9000 allows process restart ability, providing hitless operation for all major processes.

The scalability maximums for individual features are typically higher than what is specified in these individual profiles. These profiles are meant only to give a multidimensional view of how features perform and scale together. The Cisco ASR9000 team will continue to validate and evolve these profiles as part of the image qualification and test process prior to releasing each new major software release.

Table 1. MBH Profile Feature Summary

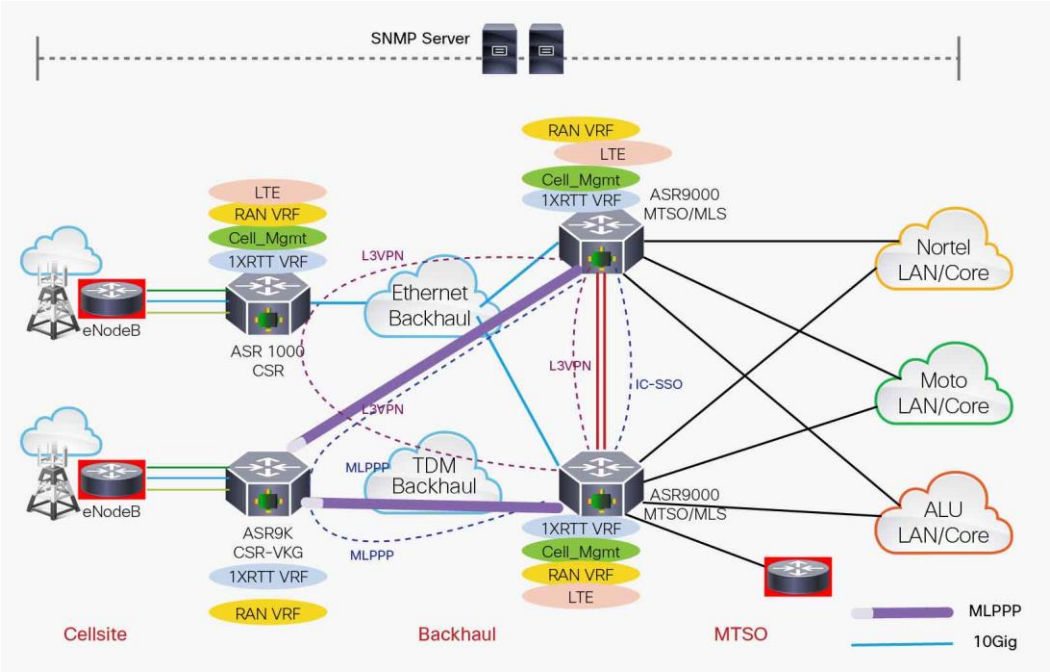
Deployment Areas	Features
Ethernet backhaul	BFD, VRRP, HSRP, IRB, HSRPv6, VRRPv6, QoS, L2 VPN, L3 VPN, CFM, Y1731
TDM backhaul	ML PPP, IC-SSO, PPP, IP-FRR, SSRP, MR-APS, PW grouping, CEMoMPLS
T-class synchronization	SyncE, 1558v2, NTP, satellite SyncE, PTP on RSP440, G8275.1
nV satellite	Ring, dual head, min-links, ARP sync, L2 fabric, dynamic ICL, bundle over bundle, multiple ICCP groups, 9000v and skywarp as satellite
Network management	SNMP, SSH, Syslog (IPv4), OAM, TACACS, RADIUS, Telemetry
High availability	RPFO, NSR, process restarts, LACP, MR-APS, FRR
Licensing	Mobile and OAM

2. Network Profile

This document covers TDM backhaul, Ethernet backhaul, and nV satellite deployments.

2.1 Topology Diagram

Figure 1. MBH High-Level Topology Overview



2.2 Hardware and Feature Specifications

This section of the guide details the 3D feature matrix where the hardware platforms are listed along with their Place-In-Network (PIN) and the relevant education vertical deployed.

2.2.1 Feature Support

Table 2 defines the 3D hardware, PIN, and features deployed. The scale of these configured features is the test environment.

Table 2. Feature Validation Summary with Releases from 53x/61x

Feature	Release
8x100 OTN: SyncE features	5.3.0
Sat: CFM/Y.1731 performance monitoring responder on nV satellite access ports	5.3.1
UDLD over bundle ICL	5.3.1
8x100G PTP support	5.3.1
ASR9K nV satellite Tomahawk support	5.3.1
Sat: ICL fabric port management	5.3.1
Sat: dual-head 2.0: min links	5.3.1
RADIUS over IPv6	5.3.1
Sat: access bundle with fabric redundancy (bundle on bundle)	5.3.2
Sat: 802.3ah loopback on bundled/nonbundled ICLs	5.3.2
Sat: multiple ICCP groups for dual-host nV sat	5.3.2
Sat: dual-head 2.0: IPv4 ARP sync	5.3.2
Sat: dynamic ICL 9000v	5.3.2
IEEE1588 port on RSP440	5.3.2
L2 mcast replication	6.1.3
G8275.1	6.1.3
L2tpv3ov4	6.1.3
Skywarp as satellite	6.1.3
PTP cluster 9001	6.1.3
Smart licensing	6.1.3

2.2.2 Hardware Profile

Table 3 defines the set of relevant hardware, servers, test equipment, and endpoints that are used to complete the end-to-end MBH profile deployment. This list of hardware, along with the relevant software versions and the role of these devices that complement the actual physical topology, is defined in Figure 1, earlier.

Table 3. Hardware Profile of Servers and Endpoints

Hardware	Software Versions	Description
ASR 9010	06.01.03	For aggregation and core functionality
ASR1000	13.9	CSR
C7600	12.9	CSR
Cisco ONS15454		As optical switch
ASR9000v		nV Satellite
ASR9001		As cluster

2.3 Test Environment

This section contains the description of the features and the relevant scales at which the features are deployed across the physical topology. Table 4 lists the scale for each respective feature.

Table 4. MBH Profile: Feature Scale Validated

Feature	Scale
Ethernet flow point (EFP: L2)	14K
L3 subinterface	4K
TDM/CEM	1700
OSPF	
Neighbors	500
Routes	2000
IRB (BVI)	172
PE-CE	Static, RIPv2, OSPF, eBGP
eBGP routes	100K
MP-BGP	50
Sessions	2500
iBGP routes	200K
PIM-SM	
IGMPv2	2.5K MC groups
Static joins	2.5 MC groups
MPLS-LDP	100
L3 VPN (v4 + v6)	200
VRRP/HSRP	50/250 (IPv4/IPv6)
L2 VPN	16K
xconnect	16K
MSPW	2500
TDM/CEM	1K
VPLS	
BD	1K
AC	2K
PW headend	500
QoS per LC	200 policy-map
Thor	
IPv4	250K routes
Serial interface/CEM/BVI	1344/1000/172
Multilink interfaces	672
IEEE 1588v2	
Slave session per LC at 128pps	250
Slave session per LC at 64pps	500
MPLS TE	4000/8K midpoint
MPLS-TP	50
1K BFD session per LC at 1 sec	
Y1731	
CFM/Y.1731 FM sessions	8K

Feature	Scale
MBH:Y.1731 PM/TWAMP	
nV satellite	
Ring topology (number of satellites)	7
DHCP	
Server	56K
Proxy	56K
Relay	64K
Snoop	12K
DHCPv6	
Proxy	32K
Server	32K
L2tpv3oV4	2K

3. Use Case Scenarios

3.1 Test Methodology

The use cases listed in Table 5 will be executed using the topology defined in Figure 1 along with the test environment, Table 4, already explained in this document.

With respect to the longevity for this profile setup, the CPU and memory usage would be monitored overnight as well as during the weekends along with any mem-leak checks. In order to test the robustness, certain negative events would be triggered during the use case testing.

3.2 Use Cases

Table 5 describes the use cases that were executed on the ASR9000 mobile backhaul profile. These use cases are divided into buckets of technology areas to see the complete coverage of the deployment scenarios.

Table 5. Use Case Scenarios

Number	Focus Area	Use Cases
Bootup and Management		
1	Bootup and management	Service providers should be able to upgrade/downgrade from 6.1.3 to any of the images. They will require monitoring capabilities, including remote logging, SNMP polling, traps, and secure transports such as SSH/SFTP for the image or file transfers. The following scenarios are validated in this profile: • Bootup (upgrade, downgrade, FPD, config backup/restore) • Logging (syslog) • SNMP • Telnet/SSH/SFTP/TFTP • TACACS authentication • Telemetry (model driven)
1.1	Image upgrade	Validated image upgrade on this profile from various images, including 4.3.4, 5.1.3, 5.2.4, 5.3.3, and 5.3.4. ASR9K upgrade from 32 bit to 64 bit.
	FPD upgrades	Validated FPD upgrades both auto/manual methods to make sure the FPDs get updated for the mentioned ASR9000 hardware.
	Syslog	Validated syslog for service provider informational logging and debugging
	Entity MIBs and traps	Validated entity and system MIB polling and traps as part of this profile validation
	SSH/SFTP/TFTP	Validated for secure transports, including SSH/SFTP for image transfers and device logins
	TACACS auth	Validated management login for SSH/Telnet with TACACS-based authentication

Number	Focus Area	Use Cases
Mobile Backhaul Solution		
2	Ethernet backhaul	In this profile Ethernet back solutions cases validated. • Ethernet backhaul solution: Cell site routers connected to preaggregation and aggregation via Ethernet transport. The following use cases are covered in this profile. • Traffic from the cell site routers carried over via L2 VPN with pw-stitching on the multilayer service routers. CFM used for Y1731 fault management and for SLA validations. • The traffic from the cell site routers carried over L3 VPN to multilayer service routers. • Cell site routers are dual-homed with aggregation routers or multilayer switches. VRRP/HSRP protocols are running from CSR to MLS for redundancy. • Various traffic from different cell sites carried over VRF.
3	TDM backhaul	In this profile TDM back solutions cases validated. This profile on the access OC3 and aggregation is with OC12 hardware. DS1-mapped ML PPP session is configured between ASR9K (DACS) and ASR9Ks (MLSs). IC-SSO is configured between ASR9Ks. Flow monitoring is done via netflow. The following cases are included in this scenario: • ML PPP with DS1 -> DS3 -> STS1 mapping • ML PPP with VT1.5 -> STS1 mapping • ML PPP with DS3 -> STS1 mapping • IC-SSO for PPP • IP-FRR in the context of IC-SSO
4	IEEE 1588v2 and SyncE solution	The preceding scenarios are covered with the following timing features: • IEEE 1588v2/G.8275.1 • IEEE 1588v2 hybrid mode • NTP interworking • Telecom profile • 1588 timing on LAG bundles • Satellite: SyncE
5	CeoPs backhaul with SIP-700	This scenario covers the following use cases: • CEM SAToP mode • CEM CESoP mode • PW grouping: MRAPS core link tracking • PW grouping: MRAPS integration with hot standby PW • PW grouping: 2-way PW for CEMoMPLS • PW grouping: hot standby PW for CEMoMPLS • PW grouping: PW grouping for multisegment PW
6	Backhaul with nV satellite solution	This profile validates the following nV satellite use cases: • Sat: dual-home architecture (ASR9k with ASR9000v/NCS5000) • Sat: L2 fabric architecture (ASR9k with ASR901/9000v) • Sat: fast fabric convergence (subsecond for L2 fabric, CFM, and link OAM) • nV L2 fabric QoS • Sat: dynamic ICL • Sat: L2 (BVI) multicast on satellite • Sat: dual-head 2.0: IGMP sync • **Sat:** L2 multicast replication
Convergence, HA, and Network Resiliency		
7	Process start	This profile verifies that during process restart, the Ethernet/TDM backhaul mentioned in numbers 1 through 7 is recovered with minimal system effect.
8	Link flap	This profile verifies that during link flap events (link down and link up), the Ethernet/TDM backhaul mentioned in numbers 1 through 7 is recovered with minimal system effect.
9	LC OIR	This profile verifies that during LC OIR (soft OIR or physical plug out and plug back in), the Ethernet/TDM backhaul mentioned in numbers 1 through 7 is recovered with minimal system effect.
10	RSP FO	This profile verifies that during redundant RSP/RP failover, the Ethernet/TDM backhaul mentioned in numbers 1 through 7 is recovered with minimal system effect.

Number	Focus Area	Use Cases
11	Node failure	This profile verifies that during node failure (soft reload or physical power off and power back on), t the Ethernet/TDM backhaul mentioned in numbers 1 through 7 is recovered with minimal system effect.
Smart Licensing		
12	Licensing	This profile validates call-home behavior on CM-based LCs for MOBILE-LIC and timing in both 32 bit and 64 bit.
System Health Monitoring		
13	Node health	Node health is monitored via frequent SNMP-based polling for CPU and memory for various processes. Memory leaks are observed using the PAM memory leak tool. Hardware diagnostics are run periodically during profile validation.

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Printed in USA C07-738902-01 11/17