Juniper® Validated Design

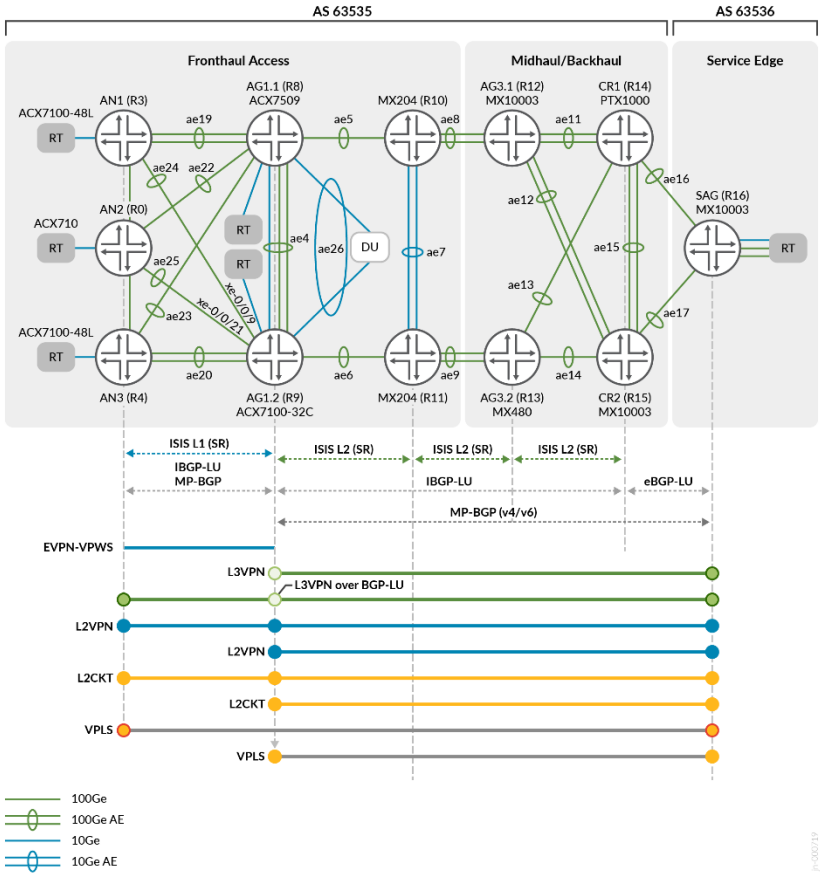
JVD Test Report Brief: 5G Fronthaul Network Using Seamless MPLS Segment Routing

Introduction

This test report brief outlines the series of testing for the 5G Fronthaul network reference design using Seamless Segment Routing with Multiprotocol Label Switching (SR-MPLS), utilizing the next-generation ACX7000 series. Following are the qualified roles:

- ACX7100-48L as cell site Access Node (AN)
- ACX7100-32C and ACX7509 as hub site Pre-Aggregation (AG1.1/AG1.2)
- MX204 as Aggregation (AG2)
- MX10003 and MX480 as Aggregation (AG3)
- PTX1000 and MX10003 as core routers (CR)
- MX10003 as a Services Aggregation Gateway (SAG) router

Test Topology



Platforms Tested

Role	Platform	OS
Access node 2 (AN2)	ACX710	Junos OS 22.3R1
Access node 1 (AN1 (DUT))	ACX7100-48L	Junos OS Evolved 22.3R1
Access node 3 (AN3)	ACX7100-48L	Junos OS Evolved 22.3R1
Aggregation node 1.1 (AG1.1 (DUT))	ACX7509	Junos OS Evolved 22.3R1
Aggregation node 1.2 (AG1.2 (DUT))	ACX7100-32C	Junos OS Evolved 22.3R1
Aggregation node 2.1 (AG2.1)	MX204	Junos OS 22.3R1
Aggregation node 2.2 (AG2.2)	MX204	Junos OS 22.3R1
Aggregation node 3.1 (AG3.1)	MX10003	Junos OS 22.3R1
Aggregation node 3.2 (AG3.2)	MX480	Junos OS 22.3R1
Core router 1 (CR1)	PTX1000	Junos OS 22.3R1
Core router 2 (CR2)	MX10003	Junos OS 22.3R1
Service aggregation node (SAG)	MX10003	Junos OS 22.3R1

Version Qualification History

This JVD has been qualified in Junos OS Release 22.3R1 and Junos OS Evolved Release 22.3R1.

Scale and Services Details

Validated key performance indexes (KPI) are multi-dimensional and reflect our observations in customer networks or reasonably represent solution capabilities. These numbers do not indicate the maximum scale and performance of individual tested devices. For uni-dimensional data on individual SKUs, contact your Juniper Networks representative.

The Juniper JVD team continuously strives to enhance solution capabilities. Consequently, solution KPIs may change without prior notice. Always refer to the latest JVD test report for up-to-date solution KPIs. For the latest comprehensive test report, contact your Juniper Networks representative.

Table 1: Access Nodes Validated Scale Parameters

AN/CSR ACX7100-48L Scale		
Parameter	**ACX7100-48L AN3**	**ACX7100-48L AN1**
AE groups	2	2
AE member links	~2	~2
VLANs	2115	2000

AN/CSR ACX7100-48L Scale		
Parameter	**ACX7100-48L AN3**	**ACX7100-48L AN1**
ISIS adjcency IPv4	13	3
IBGP v4 sessions	2	2
EBGP sessions	200	200
IGP routes	20000	20000
BGP routes	300000	300000
EVPN-VPWS MH	0	101
EVPN-VPWS SH	1000	1000
EVPN-ELAN	0	0
L2 circuit sessions	200	200
L2 VPN sessions	200	200
L3 VPN instances (OSPF)	100	100
L3 VPN instances (BGP)	100	100
VPLS sessions	200	200
MAC scale – VPLS	10600	10600
CFM UP MEP	1200	1200
CFM keepalive interval	1 Sec	1 Sec
BFD sessions single hop	3	3

Table 2: Aggregation Nodes Validated Scale Parameters

AGI/HSR Scale		
Parameter	**ACX7100-32C AG1.2**	**ACX7509 AG1.1**
AE groups	6	6
AE member links	2	2
VLANs	7300	7300
ISIS adjacency IPv4	5	5
IBGP v4 sessions	6	6

AGI/HSR Scale		
Parameter	**ACX7100-32C AG1.2**	**ACX7509 AG1.1**
EBGP sessions	201	201
IGP routes	10100	10100
BGP RIB	~80000	~80000
EVPN-VPWS MH	101	101
EVPN-VPWS SH	1000	1000
L3VPN Bridge Domain (Midhaul)	500	500
L3VPN EVPN-ELAN (Midhaul)	500	500
L2 circuit sessions	1000	1000
L2 VPN sessions	1000	1000
L3 VPN instances (OSPF)	100	100
L3 VPN instances (BGP)	100	100
VPLS sessions	1000	1000
MAC scale – VPLS	102000	22000
CFM UP MEP	1000	1000
CFM keepalive interval	1 Sec	1 Sec
BFD sessions single hop	5	5

Performance Data

Table 3: Aggregated Number of Flows Validated Simultaneously in the Topology

Stream Block	Aggregate Number of Flows	Aggregate FPS	Packet Sizes Tested
IPv4 (Global)	4	4000	512
EVPN-VPWS MH	14	107400	512/1000
EVPN-VPWS SH	4	4000	512
L2CKT	52	30400	512/1000
VPLS	42	23600	512/1000

Stream Block	Aggregate Number of Flows	Aggregate FPS	Packet Sizes Tested
L2VPN	40	24600	512/1000
L3VPN	52	52000	512

High Level Features Tested

Summary of the key features and functions under test:

- VPN services, including L3VPN, EVPN-VPWS, EVPN-FXC, EVPN-ELAN, BGP-VPLS, L2 circuit, and L2VPN over SR-MPLS transport architecture.
- TI-LFA redundancy mechanisms over Segment Routing with Seamless MPLS/BGP-LU.
- Network resiliency, traffic restoration, and measured convergence time for ACX7100-48L (AN3), ACX7100-32C (AG1.2), and ACX7509 (AG1.1) with adjacent link/node failures for all traffic types.
- Solution resilience of Layer 2/Layer 3 flows from specified DUTs, including:
  - Access Node (AN) to Pre-Aggregation AG1 (O-RU to O-DU)
  - Pre-Aggregation AG1 (including O-DU) to Services Gateway (SAG)
  - Access Node (AN) to SAG (EPC)
- Network stability for major 4G/5G traffic flows at scale with each VPN service type over Seamless MPLS during normal and stress conditions.

Known Limitations

Due to global convergence involved, the restoration time of ~2 seconds might be seen for EVPN traffic, if one of the member links in the aggregated Ethernet (AE) bundle between AG1 and DU is disabled/enabled.

Event Testing

- Link failures/failover scenarios across all the nodes within the network for traffic convergence validations.
- Node Reboot to evaluate the impact in the network.
- Restart critical Junos OS processes (Routing Protocol Process and Chassis Process).
- Traffic recovery was validated post all failure scenarios.
- Field scenarios such as service interface down/up triggers to evaluate the impact of these events in the network.

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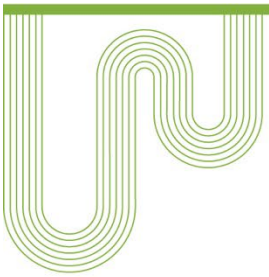

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