Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 1 of 13)

Nokia 7750 SR-s Service Router

Release 22

The Nokia 7750 SR-s series of IP routers takes performance to new heights. It delivers the speed, capacity, flexible capability, network security and automation tools essential for IP networking in the 5G and cloud era. With continuous design innovation and proven investment protection, the 7750 SR-s helps build a sustainable IP network that can evolve with changing needs for years to come.
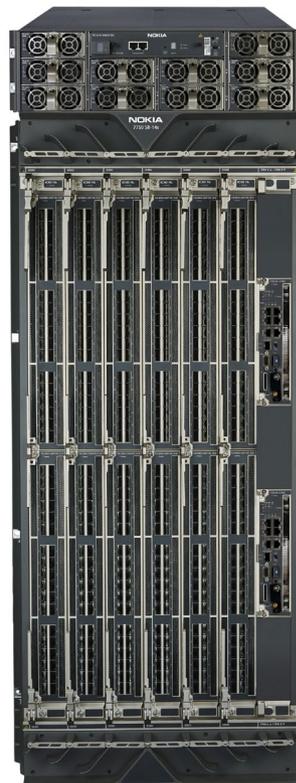
Overview

As networks experience unprecedented traffic growth and unpredictable demands, operators are on a quest to meet ever-increasing performance requirements while rolling out new services quickly over a secure, self-defending network.

Leveraging Nokia 3.0 Tb/s FP4 silicon, the 7750 SR-s addresses today's network imperatives, enabling operators to build a bigger, secure, automated and sustainable network with a superior return on investment.

With platforms scaling from 9.6 Tb/s half duplex (HD) to 288 Tb/s HD, the 7750 SR-s delivers performance certainty for demanding network roles with power efficiency. A mix of port speeds and types including QSFP-DD, QSFP28, SFP-DD and CFP2-DCO enable high-density 400GE, 200GE, 100GE, 50GE, 25GE and 10GE networking environments.

At the heart of the 7750 SR-s is the Nokia 3.0 Tb/s FP4 silicon. Leveraging a fully programmable network processor (NP) architecture, the systems are designed to be deterministic, enabling deployment certainty under all network operating conditions. Running the Nokia Service Routing Operating System (SR OS), the 7750 SR-s supports a full array of network functions and services.

7750 SR-14s

7750 SR-7s

7750 SR-2s

7750 SR-1s

Data sheet
Nokia 7750 SR-s Service Router

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc..

Exhibit IX.B.1.a - Attachment 1 (Page 2 of 13)

These industry-leading capabilities enable network designs without trade-offs among performance, capacity, scale and power consumption.

To protect against raising security threats, the 7750 SR-s takes a silicon-embedded approach to IP network security. Acting as a highly precise attack sensor and mitigation element, the 7750 SR-s makes the network part of the solution to help neutralize DDoS attacks — all without impacting router performance.

The Nokia 7750 SR product portfolio consists of the Nokia 7750 SR-s series, the Nokia 7750 SR series, the Nokia 7750 SR-a series and the Nokia 7750 SR-e series.

Features and benefits

Speed and capacity

There are four system versions in the 7750 SR-s product family. Platform form factors, speeds and capacities are outlined in the table below.

Table 1. 7750 SR-s platform overview

	7750 SR-1s	7750 SR-2s	7750 SR-7s	7750 SR-14s
Height / Depth	3RU / 687.8 mm	5RU / 813.5 mm	16 or 17RU / 858.5 mm	27 or 28RU / 858.5 mm
System Configuration	Fixed: 2.4T FD, 4.8T FD; Modular: 3T FD	2 slots, modular XMA-s / IOM-s	6 slots, modular XMA-s, IOM-s	12 slots, modular XMA-s, IOM-s
Fabric	Integrated	Integrated, control redundant	Fabric & control redundant	Fabric & control redundant
Capacity FD	Up to 4.8 Tb/s	9.6 Tb/s	28.8 Tb/s	57.6 Tb/s
Line-rate slot forwarding FD	4.8 Tb/s	4.8 Tb/s	4.8 Tb/s	4.8 Tb/s
Port density: 400G / 100G / 10G	12 / 48 / 360	24 / 96 / 720	216 / 864 / 2160	432 / 1728 / 4320
IA capacity FD	12 Tb/s	24 Tb/s	72 Tb/s	144 Tb/s
IA slot forwarding FD	12 Tb/s	12 Tb/s	12 Tb/s	12 Tb/s
Port density: 400G / 100G / 10G	24 / 120 / 360	48 / 240 / 720	288 / 1152 / 2160	576 / 2304 / 4320
Common parts			Switch Fabric Modules (SFMs) and fans	
	Power supply units (PSUs)			

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 3 of 13)

Designed to meet the requirements of critical IP networks, the 7750 SR-s supports high-density 10GE, 25GE, 50GE, 100GE and 400G interfaces and up to 1 Tb/s clear channel flows. All platforms support universal line cards and intelligent aggregation (IA) with support for any speed on any service on any port without restriction. Optical breakout options include 4x10GE, 10x10GE, 4x25GE, 2x100GE and 4x100GE.

These capabilities are all provided within the same product family, in platforms ranging from 2.4 Tb/s FD to 144 Tb/s FD. The design of 7750 SR-s systems and line cards enables operators to optimize for speed, capacity, connector mix and power, tuning each system to exact networking requirements. Please refer to the 7750 SR-s XMA-s and 7750 SR IOM-s datasheets for more details on line card variants.

Power

Sustainability

The power-efficient design of the 7750 SR-s increases the sustainability of IP networks through reduced emissions. Power density optimization, a best-in-class mechanical design for optimal cooling, and the silicon miniaturization and memory integration of FP4 drive power savings. Together, these design considerations reduce power consumption by 50 percent generation-over-generation. This power reduction is realized with full features while concurrently being fully buffered, both ingress and egress, with line rate memories everywhere. The memory architecture of Nokia silicon is designed to be deterministic under all network operating conditions. It delivers superior performing, non-line rate memory systems under every real-world condition without exception.

The system design of the 7750 SR-s dynamically scales power consumption based on licensing levels and connectors in use. With multiple license configurations, including intelligent aggregation and a choice of line card assembly options, operators have flexibility to design network locations with the right power consumption, performance, capacity and scale to achieve sustainability goals.

System efficiency

The mechanical design of the 7750 SR-s is focused on enabling operators to maximize the density and useability of coherent optics. Today's coherent optics, such as 400G ZR/ZR+, can consume power above 20 W and are a challenge to cool in data center focussed router designs. The design of the 7750 SR-s line cards and systems allows for a full set of coherent 400G ZR/ZR+ optics. The intent of coherent optics is to leverage full router density without losing ports and without sacrifice, and that is exactly what the 7750 SR-s design delivers.

Flexible capability

Network processor-based architecture

Every generation of FP silicon has been based on a network processor (NP) design. As an NP, FP4 offers the highest degree of flexibility and programmability in the industry. With a fully programmable data path, the data path is fully upgradable to new hardware-based performance standards with a simple software update. Fixed-function silicon with pre-defined upgradability pales in comparison.

The value of a fully upgradable data path has been shown over several generations of FP deployments where segment routing, ethernet virtual private network (EVPN) and 1588 edge timestamping have been activated in hardware without the need for site visits or hardware swaps on silicon delivered well before the standards were conceived. This is a true measure of programmability and investment protection. With uncertainty around future evolving network standards, an NP-based architecture delivers the lowest TCO compared to any other chipset architecture on the market.

Deterministic performance: tables, buffers and QoS

The NP architecture of FP4 has been designed to be fully deterministic across tables and buffering under all network loading conditions. Nokia-designed smart memories for tables and line rate buffer memories make this design possible, allowing high-scale routing with full access control lists (ACLs) and services with no performance

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 4 of 13)

trade-off. This enables certainty at full scale and under real-world network conditions from day 1 through year 10 and beyond. A line rate memory system will always outperform a non-line rate memory system under all network loading conditions without exception.

Full buffering for ingress and well as egress data combined with packet pre-classification and pre-buffering ensures superior performance for all critical flows. This guarantees the traffic that matters most regardless of port configuration, microbursting or network congestion. Our FP4 supports all necessary QoS features from simple to complex in a highly granular way. They support a full set of QoS with up to 8 queues per service, hardware-assisted H-QoS, and an industry-leading total number of queues and policers. QoS capabilities provide tremendous capability for broadband network gateway (BNG) and quad-play services but can equally be scaled to deliver optimized, lean performance.

Intelligent aggregation

Intelligent aggregation is a capability that allows the 7750 SR-s to cost-effectively aggregate port capacity beyond the forwarding capacity of a delivered line card. The 7750 SR-s enables up to 12 Tb/s FD of intelligent aggregation per system and line card and it does this in a deterministic way with full respect for QoS and packet priority.

Intelligent aggregation allows for guaranteed QoS with full pre-buffering and pre-classification in front of our packet processor when used in an aggregation configuration. This enables the 7750 SR-s to collapse full layers of pre-aggregation in front of systems or, if ports are constrained on an edge or core node, to expand the number of available ports without adding more line cards and continue to perform in a fully deterministic way under all network loading conditions. As a result, intelligent aggregation can be a significant driver of sustainability and both CAPEX and OPEX savings.

Pay-as-you-grow licensing

The flexible 7750 SR-s pay-as-you-grow hardware capacity and functions licensing model provide a choice of entry points for immediate requirements and the ability to scale in-place for evolving needs with software-only upgrades. Customers have the option to start with 100G and enable 400G later. Scalable throughput rates are equally available where performance can be dialled down proportional to power, to yield the right power, performance and port mix with the right economics.

In-service software right to use (RTU) licences can be activated on many pay-as-you grow license options ensuring that performance and port capacity need not be constrained by maintenance windows.

Comprehensive features

Nokia's feature-rich 64-bit SR OS addresses the full spectrum of IP routing requirements. With comprehensive QoS, IP/MPLS, segment routing and model-driven management features, the 7750 SR-s has the intelligent capabilities and tools to define and deliver the most stringent SLAs and end-user quality of experience (QoE).

The 7750 SR-s supports hundreds of thousands of IP flows and ACLs with high performance at scale even when multiple advanced features are enabled concurrently. It supports advanced push-based telemetry models to stream flow-level data and insights in near-real time for network automation and DDoS security.

The 7750 SR-s supports multi-dimensional table scaling where MPLS and ACLs scale and does not come at the cost of IPv4 or IPv6. Tables can all grow simultaneously and concurrently allowing the true potential of network designs to be unleashed without constraint.

Leveraging the Nokia SR OS, the 7750 SR-s supports value-added services and network functions through the 7750 SR Extended Services Appliance (ESA) including application assurance (AA), Layer 7 Stateful Firewall, network address translation (NAT) and gateways.

Platform versatility

Demanding network roles demand in-house silicon. The 7750 SR-s supports a full array of network functions and services. Leading SR OS capabilities combined with licensing and line card modularity provide complete configuration versatility to support multiple, demanding network roles with deterministic performance on a single platform on common silicon.

For service providers, the 7750 SR-s is deployed in mission-critical WAN, data center and aggregation networks to support IP edge, gateway and core functions for advanced residential, mobile and enterprise services, including:

- Broadband services: IP aggregation, peering edge and multi-access broadband network edge functions including broadband network gateway (BNG), security gateway (SeGW) and hybrid access gateway (HAG)

- Mobile services: IP aggregation, IP security gateway, WLAN gateway and multi-access edge in IP mobile anyhaul

- Enterprise VPN services: IP aggregation, provider edge (PE), internet access, and cloud and data center interconnect (DCI) services

- Core router: Internet/BGP peering, MPLS switching and backbone infrastructure

- Data center locations: Gateway and interconnect and internet/peering functions

For webscale operators looking to maximize application performance, the 7750 SR-s delivers massive scalability along with leading features for data center edge functions, including aggregation, gateway, interconnect and internet/peering. In the PoP it supports internet/peering edge and core router functions.

For enterprises, the 7750 SR-s provides high-performance IP routing, including connectivity to the data center, internet and WAN applications.

IP network security: DDoS mitigation

To identify and neutralize volumetric DDoS attacks automatically, the 7750 SR-s can be combined with Nokia Deepfield Defender software analytics. The solution is uniquely enabled by the massive filtering scale and performance headroom in FP silicon that allows the 7750 SR-s to act as highly precise attack sensor and mitigation element without compromising the performance of any function or service running on it.

Security policies are continuously monitored and tuned using SR OS telemetry from the 7750 SR-s. With automated workflows in Deepfield Defender, tens of thousands of ACL filters are updated in seconds to respond to changing security conditions without delay. The filters associated with DDoS mitigation are signature ACLs. These are ACLs beyond typical 5-tuple ACLs that only serve to complete DDoS attacks by impacting all traffic. Signature-based ACLs provide surgical payload level inspection capabilities at line rate to truly filter out DDoS traffic in a future-proof way.

Network automation

Model-driven management

To simplify and automate network operations, the 7750 SR-s enables model-driven network element management through the Nokia SR OS. YANG-based data modelling delivers the foundation for programmability, and model-driven interface support includes NETCONF, gRPC (gNMI and gNOI) and the model-driven CLI (MD-CLI). The Nokia Network Services Platform (NSP) also supports these interfaces using YANG models to customize automation for operational use cases.

SDN integration and automation

The 7750 SR-s and the programmability of the Nokia SR OS enable multivendor software-defined networking (SDN). Control integration is enabled through OpenFlow, Path Computation Element Protocol (PCEP), and model-driven network element management.

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 6 of 13)

In combination with the Nokia NSP, the 7750 SR-s can be deployed to introduce scalable and integrated SDN control across IP, MPLS, Ethernet and optical transport layers. The NSP delivers best-in-class SDN capabilities for multi-layer, cross-domain, multi-technology and coordinated management of IP and optical assets.

The NSP supports unified service automation and network optimization with comprehensive path computation capabilities to enable source-based routing and traffic steering with segment routing support, online traffic engineering and resource optimization, and elastic bandwidth services for dynamic cloud applications.

Cross-domain management

The 7750 SR-s is managed by the Nokia NSP, supporting automated network management, service assurance and resource optimization across IP and optical networks and orchestrated network slicing across transport and core domains.

Hardware overview

The 7750 SR-s is available in four system variants and supports a wide range of hardware assemblies. For value-added services and interface extension options, the 7750 SR ESA and 7210 SAS satellites are hardware options external to the 7750 SR-s. With reference to Table 2, this overview captures the function and capabilities of 7750 SR-s adapters, modules and systems. All equipment adapters and modules are hot swappable and field replaceable to maximize system uptime.

eXpandable Media Adapter-s (XMA-s)

The universal XMA-s contains the forwarding complex that performs typical functions such as IP/MPLS routing, packet lookups, traffic classification, processing and forwarding, service enablement, and QoS. The XMA-s also provides specific interface ports, physical media, and optical functions. The XMA-s is available in 1.2 Tb/s FD, 2.4 Tb/s FD, 3.6 Tb/s FD and 4.8 Tb/s FD variants with QSFP28 and QSFP-DD 400 connector options and supports several pay-as-you-grow licensable configurations.

Input/Output Module-s (IOM-s)

The IOM-s contains the forwarding complex that performs typical functions such as IP/MPLS routing, packet lookups, traffic classification, processing and forwarding, service enablement and QoS. Available in 1.5 Tb/s FD and 3.0 Tb/s variants, it equips up to two pluggable media dependent adapter-s (MDA-s) types and supports several pay-as-you-grow licensable configurations.

Media Dependent Adapter-s (MDA-s)

The MDA-s provides modular interface connectivity with QSFP-DD, QSFP28, SFP-DD and CFP2-DCO variants, physical media, and optical functions. Each supports up to 1.5 Tb/s FD in capacity, and up to two are installed in the IOM-s.

XMA Control Module-s (XCM-s)

Each XMA and IOM is equipped in an appropriate XCM. The XCM-s contains a slot-level control plane subsystem and fabric interface to interconnect to the SFM-s via the chassis. The XCM-s delivers up to 4.8 Tb/s FD capacity to each XMA-s.

Switch Fabric Module-s (SFM-s)

The SFM-s enables line-rate connectivity among all slots of a 7750 SR-7s and SR-14s system. SFM and XCM cards mate together via orthogonal direct cross-connect to eliminate the need for a backplane/midplane, providing upgradability beyond classic system designs. Fabrics are cell based, avoiding the head of line (HoL) blocking that comes with packet-based fabrics, and support graceful degradation. The SFM-s interconnects to the XCM-s.

Control Processor Module-s (CPM-s/CPM2-s)

A CPM provides configuration, management, security and control plane processing. It can be deployed in a simplex or redundant configuration in systems that allow for redundancy. Redundant CPM configurations allow for a hitless, stateful failover with full nonstop routing and nonstop services.

CPM Management Adapter (CMA-s/CMA2-s)

A CMA provides a pluggable interface for one or more CPMs to be equipped in a 7750 SR-7s or SR-14s.

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 7 of 13)

7750 SR-2s

The 7750 SR-2s is a two-slot, redundant system that scale from 1.2Tb/s FD to 9.6Tb/s FD. The system is designed to accept the same XMA and IOM line cards that are supported in the 7750 SR-7s and 7750 SR-14s.

7750 SR-1s: Fixed and modular variants

The 7750 SR-1s is available in two fixed form factor systems (2.4Tb/s FD and 4.8Tb/s FD) and a single modular form factor accepting two MDA-s pluggables with 3.0 Tb/s FD. All three systems support a simplex control plane.

Power

The 7750 SR-7s and SR-14s implement a building-block approach to power with a decoupled power subsystem design. LVDC, AC or HVDC power type is available via a clip-on power shelf that can be flexibly changed and spared independent of the main chassis. The SR-1s and SR-2 have an integrated power shelf. All 7750 SR-s systems share common LVDC and AC/HVDC power supply units (PSUs).

7750 SR Extended Services Appliance (ESA)

The Nokia 7750 SR ESA is mounted external to the 7750 SR system. It is used to extend the level of networking functionality and generalized processing for IP/MPLS routing applications for integrated services on the 7750 SR.

The 7750 SR forwards traffic from a selected port at speeds up to 100 Gb/s to connect to the Nokia 7750 SR ESA, relieving high-performance slots from needing to host service processing, value-added services and network functions. Service support includes AA, Layer 7 Stateful Firewall, CG-NAT, LNS, IPsec, IP tunneling and WiLAN gateway.

7210 Service Access Switch (SAS) satellites

Nokia 7210 SAS satellites provide flexibility and improve the cost efficiency of the 7750 SR-s. They offer GE, 10GE and SONET/SDH port extension through an external system to the 7750 SR-s. They can be collocated in the same 7750 SR-s rack or located remotely, within distance of pluggable optics. 7210 SAS satellites are logically integrated into the 7750 SR-s with one single IP address. Configuration is done on the 7750 SR-s and satellites utilize the 7750 SR-s QoS, buffering, multicast and rich service provisioning.

NOKIA

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 8 of 13)

Technical specifications

Table 2. Hardware specifications for 7750 SR-s systems

	7750 SR-1s	7750 SR-2s	7750 SR-7s	7750 SR-14s
System architecture	Centralized, with fixed and modular variants	Centralized; control redundant	Orthogonal direct cross-connect; redundant control and redundant fabric	Orthogonal direct cross-connect; redundant control and redundant fabric
System capacity (HD) (max)	9.6 Tb/s	19.2 Tb/s	57.6 Tb/s	115.2 Tb/s
Line-rate slot forwarding capacity (FD) (max)	4.8 Tb/s	4.8 Tb/s	4.8 Tb/s	4.8 Tb/s
IA system capacity (HD) (max)	24 Tb/s	48 Tb/s	144 Tb/s	288 Tb/s
IA slot forwarding capacity (FD) (max)	12 Tb/s	12 Tb/s	12 Tb/s	12 Tb/s
Line card slots	1	2	6	12
Line card adapters and modules (hot swappable)	Fixed: integrated with fixed connectors Modular: IOM-s/MDA-s	XMA-s, IOM-s/MDA-s	XMA-s, IOM-s/MDA-s	XMA-s, IOM-s/MDA-s
System modules (hot swappable)	Fixed: PSU, fan; Modular: MDA, PSU, fan	XMA, XCM, CPM, PSU, fan	XMA, IOM, MDA, XCM, SFM, CPM, PSU, fan	XMA, IOM, MDA, XCM, SFM, CPM, PSU, fan
Cooling	Front to back. Optional filter kit available.	Front to back. Optional filter kit available.	Front to back. Optional filter kit available.	Front to back. Optional filter kit available.

Dimensions	3RU, includes integrated power shelf
	• Height: 13.3 cm (5.25 in)
	• Width: 44.5 cm (17.5 in)
	• Depth: 68.78 cm (27.08 in)
		5RU, includes integrated power shelf
		• Height: 22.2 cm (8.75 in)
		• Width: 44.5 cm (17.5 in)
		• Depth: 81.35 cm (32.03 in)
			13RU + 3RU (LVDC) or 4RU (AC/HVDC) power shelf
			• Height:
			  – 16RU:71.04 cm (27.97 in)
			  – 17RU:75.34 cm (29.66 in)
			• Width: 44.5 cm (17.5 in)
			• Depth: 85.8 cm (33.8 in)
				24RU + 3RU (LVDC) or 4RU (AC/HVDC) power shelf
				• Height:
				  – 27RU:119.93 cm (47.22 in)
				  – 28RU: 124.23 cm (48.91 in)
				• Width: 44.5 cm (17.5 in)
				• Depth: 85.8 cm (33.8 in)

Weight	Fixed system (max) • Loaded: 50.3 kg (111 lb); excludes optics Modular system (max) • Loaded: 30.4 kg (67 lb)	Loaded: 102.06 kg (225 lb); excludes optics	Loaded: 215.3 kg (473.6 lb); excludes power shelf and optics	Loaded: 370.1 kg (815.7 lb); excludes power shelf and optics
Power	• LVDC: -48 V/-60 V, 80 A max per feed • HVDC: 260-400 V DC, 12 A max per source • AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed • N+N redundancy • Integrated 1RU power shelf	• LVDC: -48 V/-60 V, 80 A max per feed • HVDC: 260-400 V DC, 12 A max per source • AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed • N+N redundancy • Integrated 1RU power shelf	• LVDC: -48 V/-60 V, 80 A max per feed • HVDC: 260-400 V DC, 12 A max per source • AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed • N+N redundancy • Common power shelf with the SR-14s	• LVDC: -48 V/-60 V, 80 A max per feed • HVDC: 260-400 V DC, 12 A max per source • AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed • N+N redundancy • Common power shelf common with the SR-7s

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 9 of 13)

Table 3. Nokia 7750 SR-s maximum density

Ethernet speed | Connector	7750 SR-1s	7750 SR-2s	7750 SR-7s	7750 SR-14s
400G | QSFP-DD	12/24*	24/48*	216/288*	432/576*
100G | QSFP28	48/120*	96/240*	864/1152*	1728/2304*
10G | QSFP28 (via 10 x 10G breakout)	360	720	2160	4320
10G/25G/50G/100G | SFP-DD	32	64	192	384
100G/200G | CFP2-DCO	12	24	72	144
100G/200G/300G/400G | CFP2-DCO	8	16	48	96

* With intelligent aggregation

Feature and protocol support highlights

Feature and protocol support in the 7750 SR-s includes but is not limited to the following.

IP and MPLS routing features

- IP unicast routing:
  - Intermediate System-to-Intermediate System (IS-IS)
  - Open Shortest Path First (OSPF)
  - Routing Information Protocol (RIP)
  - Multiprotocol Border Gateway Protocol (MBGP)
  - Unicast Reverse Path Forwarding (uRPF)
  - Comprehensive control plane protection features for security
  - IPv4 and IPv6 feature parity
- IP multicast routing:
  - Internet Group Management Protocol (IGMP)
  - Multicast Listener Discovery (MLD)
  - Protocol Independent Multicast (PIM)
  - Multicast Source Discovery Protocol (MSDP)
  - Bit Indexed Explicit Replication (BIER)
  - IPv4 and IPv6 feature parity
- MPLS:
  - Label edge router (LER) and label switch router (LSR) functions with support for seamless MPLS designs
  - MPLS-Transport Profile (MPLS-TP)

- Label Distribution Protocol (LDP) and Resource Reservation Protocol (RSVP) for MPLS signalling and traffic engineering
- Includes GMPLS UNI, point-to-point (P2P) and point-to-multipoint (P2MP) label switched paths (LSPs) with multicast LDP (MLDP), P2MP RSVP and weighted Equal-Cost Multi-Path (ECMP)

Segment routing and SDN features

- Multiple instance IS-IS and OSPF segment routing support with shortest path tunnel, Segment Routing-Traffic Engineering (SR-TE) LSP, flexible algorithms and static and BGP SR policy
  - Implementation provides Loop Free Alternate (LFA), remote LFA and Topology-Independent LFA (TI-LFA) protection for all types of tunnels as well as end-to-end protection with primary/secondary paths for SR-TE tunnels and SR policies.
  - PCEP allows the delegation of the SR-TE LSP to the Nokia NSP or a third-party PCE function.
- Programmable forwarding tables via gRPC-based routing information base (RIB) API feature and MPLS forwarding policy
- Extensive set of capabilities using ACL logic to steer routes/flows toward various target types, such as IP next-hop, SR-TE/RSVP-TE/MPLS-TP LSP and Virtual Routing and Forwarding (VRF)
  - Applicable to a wide range of routing and service contexts, such as global routing table,

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 10 of 13)

Virtual Private Routed Network (VPRN), Virtual Private LAN Service (VPLS) and E-PIPE service

- Supports control interfaces such as OpenFlow, FlowSpec, CLI and NETCONF

- Multivendor SDN control integration through OpenFlow, PCEP, BGP Link-State (BGP-LS) and BGP SR policy support

- Collection of traffic statistics on an extensive set of constructs:

  - LDP

  - RSVP-TE and SR-TE LSPs

  - MPLS forwarding policies

  - SR policies

  - RIB API tunnel entries

  - Interior Gateway Protocol (IGP) SIDs

Layer 2 features

- Ethernet LAN (E-LAN): BGP-VPLS, Provide Backbone Bridging for VPLS (PBB-VPLS), EVPN and PBB-EVPN

- E-Line: BGP-Virtual Private Wire Service (BGP-VPWS), EVPN-VPWS and PBB-EVPN

- E-Tree: EVPN and PBB-EVPN

- DCI: EVPN Virtual eXtensible LAN (VXLAN) to VPLS/EVPN-MPLS/EVPN-VXLAN gateway functions

Layer 3 features

- IP-VPN

- Enhanced internet services

- EVPN for Layer 3 unicast and Optimized Inter-Subnet Multicast (OISM) services with Integrated Routing and Bridging (EVPN-IRB)

- Multicast VPN (MVPN), which includes inter-AS MVPN and Next Generation MVPN (NG-MVPN)

- EVPN and IP-VPN gateway interworking, including D-PATH attribute for loop protection in redundant gateways

- Seamless MPLS/SRv6 integration in the same IP-VRF for interworking or migration between MPLS and SRv6 transport technologies

System features

- Ethernet satellites: Port expansion through local or remote Nokia 7210 SAS-S series GE,10GE and 100GE satellite variants, offering 24/48 x GE ports or 64 x GE/10GE ports over 10GE and 100GE uplinks

- OAM: Extensive fault and performance monitoring. OAM includes:

  - Ethernet Connectivity Fault Management (CFM) (IEEE 802.1ag, ITU-T Y.1731)

  - Ethernet in the First Mile (EFM) (IEEE 802.3ah)

  - Bidirectional Forwarding Detection (BFD), including seamless BFD

  - cflowd

  - Two-Way Active Measurement Protocol (TWAMP and TWAMP Light/STAMP)

  - A full suite of MPLS and segment routing OAM tools

- Timing:

  - ITU-T Synchronous Ethernet (SyncE)

  - IEEE 1588v2 Precision Time Protocol (PTP)

  - Network Time Protocol (NTP)

  - BITS ports (T1, E1, 2M)

  - 1PPS

- QoS:

  - Flexible intelligent packet classification

  - Ingress and egress Hierarchical QoS (H-QoS) with multitiered shaping and two-tiered, class fair hierarchical policing

  - Advanced, scalable network and service QoS

  - End-to-end consistent QoS regardless of oversubscription or congestion

- High availability:

  - Nonstop routing[1]

  - Nonstop services[1]

  - ISSU[1]

  - Fast reroute for IP, RSVP, LDP and segment routing

---

1 Requires redundant CPM modules

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 11 of 13)

– Pseudowire redundancy

– ITU-T G.8031 and G.8032

– Weighted ECMP

– Weighted, mixed-speed link aggregation

Management features

- Model-driven configuration and state management through the MD-CLI, NETCONF and gRPC/gNMI using YANG models; streaming telemetry through gRPC/gNMI subscriptions; operations through NETCONF using YANG models and gNOI.

- Enhanced automation flexibility provides personalization and automation with Python 3

- Full SNMP management support including configuration, monitoring and traps

- Comprehensive network and node management through the Nokia NSP

- Zero Touch Provisioning (ZTP) automatically downloads the image and configuration from a server via out-of-band management port or in-band interfaces

Standards support[2]

Environmental specifications

- Operating temperature: 5°C to 40°C (41°F to 104°F)

- Operating relative humidity: 5% to 85% non-condensing

- Operating altitude: Up to 3960 m (13,000 ft); operating temperature range de-rated above 1,829 m (6,000 ft)

Safety

- AS/NZS 62368.1

- IEC/EN 60825-1

- IEC/EN 60825-2

- IEC/EN/UL/CSA 62368-1 Ed2

EMC emission

- AS/NZS CISPR 32 Class A

- BSMI CNS13438 Class A

- EN 55032 Class A

- FCC Part 15 Class A

- ICES-003 Class A

- IEC CISPR 32 Class A

- IEC/EN 61000-3-2 Power Line Harmonics

- IEC/EN 61000-3-3 Voltage Fluctuations and Flicker

- IEC/EN 61000-6-4

- KS C 9832 (2019) formerly KN 32

- VCCI Class A

EMC immunity

- BT GS-7

- EN 55035

- ETSI EN 300 132-1 AC Power Supply Interface

- ETSI EN 300 132-2 DC Power Supply Interface

- ETSI EN 300 132-3-1 HVDC Power Supply Interface

- ETSI EN 300 386

- ETSI ES 201 468

- IEC CISPR 35 (SR-1s and SR-2s)

- IEC/EN 61000-3-2 Power Line Harmonics

- IEC/EN 61000-3-3 Voltage Fluctuations and Flicker

- IEC/EN 61000-4-2 Electrostatic Discharge

- IEC/EN 61000-4-3 Radiated, RF, EM field immunity

- IEC/EN 61000-4-4 Electrical Fast Transients

- IEC/EN 61000-4-5 Surge Immunity

- IEC/EN 61000-4-6 Immunity to Conducted Disturbances

- IEC/EN 61000-4-11 Voltage Interruptions

---

2   System design intent is according to the listed standards.
    Refer to the product documentation for detailed compliance status.

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 12 of 13)

- IEC/EN 61000-6-2 Immunity for Industrial Environments
- ITU-T K.20
- ITU-T L.1200
- KS C 9835 (2019)

Environmental/NEBS

- ATIS 0600010
- ATIS-0600015
- ATIS-0600015.03
- ATIS-0600315.01.2015 HVDC Power Supply Interface
- ATT-TP-76200
- ETSI EN 300 019-2-1 Storage Tests, Class 1.2
- ETSI EN 300 019-2-2 Transportation Tests, Class 2.3
- ETSI EN 300 019-2-3 Operational Tests, Class 3.2
- ETSI EN 300 019-2-3 Earthquake
- ETSI 300 753 Acoustic Noise, Class 3.2 (excluding SR-7s & SR-14s)
- GR-63-CORE, Level 3
- GR-1089-CORE, Level 3
- TR No. 176002 1.1 (SR-7s and SR-14s)
- VZ.TPR.9205
- VZ.TPR.9305

Wireless

- ETSI EN 301 489-1
- ETSI EN 301 489-17 (Bluetooth)
- KS X 3124:2020
- KS X 3126:2020 (Bluetooth)

Directives, regional approvals and certifications

- Directive 2011/65/EU Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (Recast) Directive (including Commission Delegated Directive (EU) 2015/863)
- Directive 2012/19/EU Waste Electrical and Electronic Equipment (WEEE)
- Directive 2014/30/EU Electromagnetic Compatibility (EMC)
- Directive 2014/35/EU Low Voltage Directive (LVD)
- Directive 2014/53/EU Radio Equipment Directive (RED)
- BSMI Mark - Taiwan
- CE Mark - Common Europe
- CRoHS - China RoHS
- KC Mark - South Korea
- NEBS Level 3
- RCM Mark – Australia
- UKCA Mark - United Kingdom
- VCCI Mark – Japan

MEF certifications

For a list of Nokia CE 1.0-, CE 2.0- and CE 3.0-certified products, refer to the MEF certification registry

Refer to the 7750 SR-s product and release documentation for system details on dimensions, weights, hardware, safety standards, compliance agency certifications and protocol support.

Application For Issuance Of A Cable Franchise For The County Of Hawaii
Name Of Applicant: Hawaiian Telcom Services Company, Inc.

Exhibit IX.B.1.a - Attachment 1 (Page 13 of 13)

About Nokia

At Nokia, we create technology that helps the world act together.

As a trusted partner for critical networks, we are committed to innovation and technology leadership across mobile, fixed and cloud networks. We create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Adhering to the highest standards of integrity and security, we help build the capabilities needed for a more productive, sustainable and inclusive world.