7210 SAS and 7705 SAR product update

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AGENDA

• 7210 SAS Release 9.0 hardware update
• 7210 SAS-Sx/S Satellite overview
• 7210 SAS Release 9.0 software update
• 7705 SAR update
  - SW update
  - HW update
7210 SAS-K 12-port (2F4T6C)
IP/MPLS GE NID

- Non-ETR variant: 1RU, passively cooled, AC/DC power supply (single power supply)
- 3 variants – Standard/Non-ETR, ETR* and ETR with PoE/PoE+*
- In-house silicon for dataplane/forwarding processor - 5 Gb/s (FD) switching capacity
- IP/MPLS-capable with Traffic Engineering (TE), FRR, BGP Labeled route (BGP LU) and BFD support
- Cost effective option with scale designed for use in hierarchical/seamless MPLS networks
- Option to use Ethernet with G8032, LAG
- Security option – MACSec on ETR variant*
- Hierarchical service ingress and service egress QoS with deep buffers (~64MBytes)
- Best in class Ethernet and MPLS OAM tool set

*Preliminary picture
7210 SAS-K 12-port (2F4T6C)
Pushing IP/MPLS to the edge

- IP/MPLS demarcation device – cost effectively extend IP/MPLS to network edge, flexibility to use Ethernet
- Designed for hierarchical and seamless MPLS networks
- Per service differentiation with ingress and egress shaping and queuing with deep buffers
- End-to-End IP OAM using IP TWAMP-light, Ethernet CFM/Y.1731, Y.1564
- High-availability with IP/MPLS FRR
- Target application – Ethernet cell-site router, business service NID, access device for verticals and public sector
7210 SAS-R 100G IMM card

Faster speeds

- 1 x 100G CFP4 port per IMM (QSFP28 option*)
- Throughput – 100 Gb/s with 2 x SF/CPM and ~60 Gb/s with single SF/CPM
- Same IMM can be used on both SAS-R6 and SAS-R12 (SAS-R6 – up to 2 x 100G IMM)
- Network uplinks with MPLS LER and LSR functionality
- Target application – migration of access aggregation networks to 100G uplinks (using existing chassis)
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## 7210 SAS Product Snapshot

### MPLS Enabled Access & Aggregation & Satellite

<table>
<thead>
<tr>
<th>7210 SAS-Sx</th>
<th>7210 SAS-S / 7210 SAS-Sx</th>
<th>7210 SAS-Sx</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legacy Satellite (ETR)</strong></td>
<td><strong>1GE /10GE Satellite</strong></td>
<td><strong>10G/100GE Satellite (with ETR option)</strong></td>
</tr>
<tr>
<td>ch.OC3/STM1 &amp; ch.OC12/STM4</td>
<td>24-port: 128Gb/s (HD), 48-port: 196Gb/s (HD)</td>
<td>2.08Tb/s (HD)</td>
</tr>
<tr>
<td>1 Variant</td>
<td><strong>10 variants (-S) / 6 variants (-Sx)</strong></td>
<td>2 Variants</td>
</tr>
<tr>
<td><strong>NEW</strong></td>
<td><strong>NEW</strong></td>
<td><strong>NEW</strong></td>
</tr>
<tr>
<td>• 4 x ch.OC3/STM1, 1xch.OC12/STM4 &amp; 2 x GE Combo</td>
<td>• 46 SFP, 2 Combo, 4SFP+</td>
<td>• 64-port 10GE SFP+/SFP &amp; 4x100G CFP4</td>
</tr>
<tr>
<td></td>
<td>• 22 SFP, 2 Combo, 4SFP+</td>
<td>• 64-port 10GE SFP+/SFP &amp; 4x100G QSFP28</td>
</tr>
<tr>
<td></td>
<td>• 48 TX, 4 SFP+ (POE option)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 24 TX, 4 SFP+ (POE option)</td>
<td></td>
</tr>
<tr>
<td>1RU 7750 satellite</td>
<td>1RU stand-alone or as a 7x50 satellite</td>
<td>1.5RU stand-alone or as a 7x50 satellite</td>
</tr>
<tr>
<td>Legacy support without 7750 slot sacrifice</td>
<td>High GE fanout with optional PoE/PoE+</td>
<td>High Density 10GE with 100GE uplinks</td>
</tr>
</tbody>
</table>

**MPLS Enabled Access & Aggregation & Satellite**

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### 7210 SAS-Sx 1/10GE – Models/Variants

<table>
<thead>
<tr>
<th>7210 SAS-Sx Models</th>
<th>Fiber Ports 1GE SFP</th>
<th>Fixed Copper Ports RJ-45 10/100/1000 Mb/s</th>
<th>Combo Ports (SFP or Copper)</th>
<th>PoE /PoE+ Ports (Maximum Power)</th>
<th>10GE Ports SFP+</th>
</tr>
</thead>
<tbody>
<tr>
<td>7210 SAS-Sx 46F 2C 4SFP+</td>
<td>46</td>
<td>None</td>
<td>2</td>
<td>2 (60W)</td>
<td>4</td>
</tr>
<tr>
<td>7210 SAS-Sx 22F 2C 4SFP+</td>
<td>22</td>
<td>None</td>
<td>2</td>
<td>2 (60W)</td>
<td>4</td>
</tr>
<tr>
<td>7210 SAS-Sx 48T 4SFP+ *</td>
<td>None</td>
<td>48</td>
<td>None</td>
<td>None</td>
<td>4</td>
</tr>
<tr>
<td>7210 SAS-Sx 24T 4SFP+ *</td>
<td>None</td>
<td>24</td>
<td>None</td>
<td>None</td>
<td>4</td>
</tr>
<tr>
<td>7210 SAS-Sx 48Tp 4SFP+ (PoE) – AC only</td>
<td>None</td>
<td>48</td>
<td>None</td>
<td>48 PoE or 24 PoE+ or mix (720W)</td>
<td>4</td>
</tr>
<tr>
<td>7210 SAS-Sx 24Tp 4SFP+ (PoE) – AC only</td>
<td>None</td>
<td>24</td>
<td>None</td>
<td>24 PoE /PoE+ (720W)</td>
<td>4</td>
</tr>
</tbody>
</table>

* Target 8.0R9 (Oct 2016) / 9.0R1 (Sep 2016)
7210 SAS-S 1/10GE hardware overview

Greater port density

- 10 variants: 24/48-port variants with Fiber/SFP GE ports (AC/DC), Copper GE ports (AC/DC), Copper GE ports with PoE (AC)
  - 7210 SAS-S 48F4SFP+ (AC), 7210 SAS-S 48F4SFP+ (-48 VDC)
  - 7210 SAS-S 24F4SFP+ (AC), 7210 SAS-S 24F4SFP+ (-48 VDC)
  - 7210 SAS-S 48T4SFP+ (AC), 7210 SAS-S 48T4SFP+ (-48 VDC)
  - 7210 SAS-S 24T4SFP+ (AC), 7210 SAS-S 24T4SFP+ (-48 VDC)
  - 7210 SAS-S 48Tp4SFP+ (AC) PoE, 7210 SAS-S 24Tp4SFP+ (AC) PoE

- Designed for NEBS compliance – exception, front-to-back air flow without air filters
- Redundant power supply – one fixed integrated and one hot-swappable
- Timing – SyncE and PTP TC functionality only, without PPS interfaces
- No combo ports with PoE/PoE+ on fiber variant
- Software functionality and scale target to be similar to SAS-Sx

Cost effective satellite platform, similar service scale
7210 SAS-Sx 10/100GE variant with 64 SFP+, 4 CFP4

- 1.5RU, designed to be NEBS compliant
- 64 x 10GE SFP+ ports and 4 x 100GE CFP4 ports (QSFP28 option*)
- Front panel access for Ethernet interfaces
- Flexibility of using SFP+ ports as GE or 10GE
- Redundant, hot-swappable power supplies, option for remote power supply (RPS)
- Fans on the rear - side to back airflow with air filters on both sides
Target application – 10G access, aggregation

Option for residential, mobile backhaul, business networks

Operates in standalone mode or satellite mode
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Routed VPLS (RVPLS) with VPRN IPv4 Interface

- Allows operators to extend VPRN in mobile backhaul networks closer to the cell-site
- Routed VPLS (RVPLS) support extended to VPRNs (IPv4 family)
- Access SAPs and MP-BGP MPLS spoke
- Multicast support can be considered for future release
ITU-T has published G.8275.1 (07/2014) - “Precision time protocol telecom profile for phase/time synchronization with full timing support from the network”

Profile defines how to distribute high accuracy time for mobile base station applications of Advanced LTE (eMBMS, eICIC, CoMP) using both IEEE1588 and Synchronous Ethernet

Interoperable PTP over Ethernet encapsulation

- Uses well-defined multicast address
- Untagged packets are used
TWAMP-light

• TWAMP RFC 5357 is a Client – Server Model with functional blocks – control Client, session-sender, server and session-reflector
• 7210 supports the server & session reflector portion of RFC5357, in base router instance for IPv4
• Limited industry support for control-client and no per service measurements

• TWAMP-Light model needs only session sender (built-into OAM-PM) and session reflector
• Simplify operations – control channel is configured
  - Base router instance & per VPRN service for IPv4 support
  - Session reflector port configuration is required on peer
7705 SAR Portfolio Update
Route Target (RT) constraints
Update message with specific RTC routes

• Control routes to advertise
• Specify which routes to advertise via Route-Targets to a neighbor, else do not advertise
• Why? Scaling!
  - RIB memory
  - Control plane bandwidth
  - Automation of route-filtering
  - AFI = 1 (IPv4) and AFI = 2 (IPv6) with SAFI = 132 (route target constrains)

http://iana.org/assignments/safi-namesapce/safi-namespacs.xhtml & rfc-4684
Auto LSP

- Automatic signaling of RSVP-TE P2P LSPs to a set of destination routers
  - Based on LSP template
    - common parameters
  - Peer prefix policy
    - Access-list of “allowed” destination nodes
- 7705 SAR iLER initiated signaling without any external dependency
  - 5620 SAM integration
  - Configuration of access-list and lsp-template
  - Discovery of node signaled LSPs
- LSP template for common LSP and path level parameters or options

apply mesh-template
- Three LSPs originating from B
- E&F in exclude-list
Entropy label support

• Distribute MPLS service traffic among multiple parallel links
  - load-balancing
• Mobile traffic encapsulated in GTP header
  - Per flow identifier: teid
• Classic fields for load-balancing won’t work
  - src.ip=eNB, dst.ip=GW, udp/tcp port=fixed
• Hash on classic fields + teid
  - Already supported for IP ECMP under GRT/IP-VPN
• Hash to turn into a unique label, intermediate LSRs can use
  - No packet re-ordering by intermediate nodes
  - LSR load-balancing based on “hash” label
• Eth PW and VPLS services
• rfc-6790 The use of Entropy Labels in MPLS forwarding
IS-IS for IPv6

• The IS-IS protocol extended to support the IPv6 address family
• Native support – RFC 5308
  - 2 new TLV Types
    – IPv6 Reachability TLV [Type 236] [0xEC]
    – IPv6 Interface Address TLV [Type 232] [0xE8]
  - IPv6 Protocol Identifier
    – IPv6 NLPID 142 [0x8E]
    – This is carried in the existing protocols support TLV 129
• IPv4 and IPv6 topologies in a single IS-IS instance be congruent
  - Single SPF run for both protocols, so all area routers must support the same set of protocols (IPv4-only, IPv6-only, IPv4/IPv6)
Active/Active access and hybrid LAG

- Bandwidth explosion in MBH
  - Microwave cluster aggregation
  - Multi-spectrum band/multi-technology sites
  - CRAN
- FMC
  - L2 and L3 network boundaries dissolving
    - 10 GigE costs
    - L2 access with 1GE ports
- Both on modular SAR-8/SAR-18 but as well on pizzaboxes SAR-A, SAR-H, SAR-Hc, SAR-M, SAR-W, SAR-Wx and SAR-X
CRC Monitor

- Link up doesn’t equate to link quality
- Calculate CRC error-rate detected on an Ethernet port over a pre-configured window
  - Raise event/trap when thresholds crossed
    - Thresholds defined with two variable: $M \times 10^N$
      - $M$ = Multiplier
      - $N$ = Exponent
      - Example: $M=5$, $N=6$ sets the threshold at $5 \times 10^{-6}$
    - Configurable Signal Degrade (SD) Threshold
    - Configurable Signal Fail (SF) Threshold
    - Configurable Window (W), in seconds.
- CRC Error Rate is calculated as a sliding window average with error rates collected every seconds
Mirroring

• Debug connectivity, protocol, mismatch,... issues
• Local or remote destination
• Mirroring on Ethernet ports
  - Access, network or hybrid
  - Ingress or egress
  - Including LAG members
• Low priority arbitration
  - User-defined FC
  - Priority data traffic
• Truncation option to focus on headers
Network accounting records

- Forward and Drop counters on per queue and profile state basis
- Complements access side counters
- Accounting records in local file
  - Full set of counters on per interface basis
  - Polled periodically by 5620 SAM
    – Roll-over option
- Compare records with transport provider
  - Packet-Byte-Offset
GLONASS support in the SAR-8/18 GNSS Receiver MDA

• In addition to GPS, GLONASS support is added to the existing GNSS MDA in the SAR-8/18
• Higher GNSS availability with increased number of satellites
  - Selectable mode for GPS-only or GPS+GLONASS
• Provides frequency, time of day/phase, location (longitude, latitude, altitude)
• Enables integrated with IEEE1588v2 to support grand master for both frequency and time/phase
• Multi-GNSS antenna for simultaneous support of both GPS and GLONASS satellites
SAR-Ax hardware
Designed for small cell applications

- Temperature hardened, Fan-less
- Fanless
- Enhanced security, synchronization and timing
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