IP STRATEGY AND VISION
IPD PRODUCT OVERVIEW AND EVOLUTION

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ALCATEL-LUCENT’S IP MARKET MOMENTUM

19% EVOLVED PACKET CORE (GLOBAL)
24% IP EDGE ROUTING (GLOBAL)

#1
26% IP EDGE (EMEA)
36% IP EDGE (CALA)
22% MOBILE BACKHAUL

#2
410K+ SYSTEMS SHIPPED
650+ SERVICE PROVIDERS
450+ INDUSTRIES
130+ COUNTRIES

Sources: 4Q13 Infonetics, FY2013 Dell’Oro
ALCATEL-LUCENT’S IP PORTFOLIO OVERVIEW

SPs   MNOs   Cable/MSOs   XLE   Transportation   Utilities   Government   Oil & Gas

IP CORE   IP EDGE   IP AGGREGATION   ACCESS & AGG’N

SERVICE ROUTING
NETWORKING THE CLOUD AND CLOUDIFYING THE NETWORK

NFV

CLOUD

SDN

NETWORK
THE SHIFT TO A NEW ERA

1993-1998
- MULTI-PROTOCOL ROUTING
- Enterprise networking
- All protocols
- All interfaces

1998-2003
- INTERNET ROUTING
- IP for internet service
- Hardware fastpath
- BGP-centric

2003-2012
- SERVICE ROUTING
- IP for all services
- Network processors
- HA/ISSU
- Service-centric

2013-Future
- CLOUD-OPTIMIZED ROUTING AND TRANSPORT
- SDN & NFV
- System/network level
- (Re)thinking
- (Re)innovate

THE SHIFT TO A NEW ERA
THE EVOLUTION OF SERVICE ROUTING
CLOUD-OPTIMIZED IP NETWORKS

IP SERVICES (NFV)

NFV

SDN

NETWORK FABRIC

NETWORK
CLOUD-OPTIMIZED NETWORKS

- Cost effective scalability
- Flexible, versatile, programmable
- Enables convergence
- IP-Optical Integration
7950 XRS MOMENTUM
CORE ROUTING FOR 100G AND BEYOND

Scalable
• 16 Tb/s per rack, multi-chassis evolution
• Distributed multi-core processing
• High-density 10, 40, 100 GE and beyond

Versatile
• IP/MPLS core, L2/3 VPN services, DC-GW, ...
• All elements upgradable and future-ready
• Adapts to changing needs and applications

Efficient
• Drastically reduced resource footprint
• Energy and thermally efficient design
• Operation simplification with uniform SROS/FP3

<table>
<thead>
<tr>
<th>7950 XRS-40</th>
<th>7950 XRS-20</th>
<th>7950 XRS-16c</th>
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<tbody>
<tr>
<td>32 Tb/s</td>
<td>16 Tb/s</td>
<td>6.4 Tb/s</td>
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<tr>
<td>40 slots</td>
<td>20 slots</td>
<td>16 slots</td>
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30+ 7950 XRS DEPLOYMENTS
ALCATEL-LUCENT 7750 SERVICE ROUTER FAMILY

<table>
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<tr>
<th></th>
<th>7750 SR-12e</th>
<th>7750 SR-12</th>
<th>7750 SR-7</th>
<th>7750 SR-c12</th>
<th>7750 SR-c4</th>
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<tbody>
<tr>
<td>Bandwidth</td>
<td>7.2 Tb/s</td>
<td>4 Tb/s</td>
<td>2 Tb/s</td>
<td>90 Gb/s</td>
<td>90 Gb/s</td>
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<tr>
<td>Per slot</td>
<td>400G</td>
<td>200G</td>
<td>200G</td>
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BROADBAND NETWORK GATEWAY

BUSINESS VPN, CLOUD GATEWAY, DATACENTER INTERCONNECT

MOBILE BACKHAUL, MOBILE GATEWAY & SECURITY GATEWAY

WLAN GATEWAY

EMBEDDED APPS: AA, CGNAT, ...
CLOUD-OPTIMIZED NETWORKING
NETWORK FUNCTIONS VIRTUALIZATION (NFV)

- Automation
- Elasticity
- Homogenization of physical infrastructure
NETWORK FUNCTIONS VIRTUALIZATION (NFV)

THE PROMISE
1. Rapid service innovation & expansion
2. Elastically scale and utilize network resources more efficiently
3. Lower operating costs through homogenized physical infrastructure

THE CHALLENGE
1. Maintaining/exceeding stringent SLAs and real-time performance?
2. Operating across a mix of traditional and cloud-based infrastructure?
3. Delivering event-driven, flexible scaling?
4. Operating in an open environment?
PARALLEL EVOLUTION PATH FOR THE IP SERVICES EDGE
COMMON SR OS, FLEXIBILITY IN DEPLOYMENT

VIRTUALIZATION, COTS, CLOUD

PURPOSE-BUILT HARDWARE, INTEGRATED

FULLY INTEGRATED NFV SOLUTIONS OR STAND-ALONE - THE CHOICE IS YOURS
VIRTUALIZED EVOLVED PACKET CORE

PoC
Available now

Field Trial
2H2014

Deployment
2015 timeframe

70+
IP Mobile Core Customers Worldwide

#2
LTE EPC vendor worldwide

5+
vEPC PoCs underway worldwide

SDN Policy & Control
NFV Management and Orchestration

vEPC
vEPC
vSGW
vMME
vPCRF
vPGW

Virtual Routing & Switching
Hypervisor
Native OS
Generic Hardware
VIRTUALIZED ROUTE REFECTOR (VRR)

RRs on dedicated routers

-vRR on generic x86 compute

Virtualization

• Hardware constraints limit RR scale
• Stranded capacity limits resource efficiency
• Platform testing limits RR deployment speed

vRRs on generic x86 compute

• Virtualized compute enables massive vRR scale
• Virtualized compute enables high resource efficiency
• Generic CPU accelerates vRR deployment speed

INCREASED RR FLEXIBILITY AND SCALE VIA VIRTUALIZATION
ISA APPLICATIONS

APPLICATION ASSURANCE

BROADBAND SERVICE APPS

SECURITY APPS

WLAN GATEWAY

Integrated and Virtualized

MS-ISA/MS-ISM

FLEXIBILITY TO POSITION VALUE-ADD APPLICATIONS WHERE THEY PROVIDE LOWEST TCO
VIRTUAL PE ARCHITECTURE
DISTRIBUTED MODEL

- Distributed model creates a virtual 7750 SR composed of multiple virtual machines running on 1 or more different servers
- Distributed virtualized SR model decouples control and data planes outside of a physical chassis
  - Separate VMs for control and data
  - Redundant control planes
  - Data-center fabric interconnection between VMs/servers
  - Separate fabric VLANs for control and data
- Available now using vSR-OS Simulator
- Data path optimization for vPE (2H/2015)
  - Optimization of control-plane/data-plane communication
  - Optimization of data path forwarding
CLOUD-OPTIMIZED NETWORKING
SOFTWARE DEFINED NETWORKING (SDN)

- Automation and Simplified Provisioning through network abstraction
- Optimizing network efficiency through real-time centralized visibility and control
- Enabling new SDN based services
SOFTWARE DEFINED NETWORKING USE CASES

• For the datacenter
  - Automate and orchestrate datacenter network connectivity
• For services
  - Automated, application-driven provisioning
  - Simplified deployment of user-defined services via service-chaining
  - Enable new service models, e.g. SD VPN services
• For the WAN
  - Optimize resource utilization through external visibility and control
SDN AUTOMATION IN THE DATACENTER AND DATACENTER-GATEWAY

7x50 DATACENTER GATEWAY

SR-OS 12.0 integrates 7x50 into Nuage architecture
- Cloud automation extended to DC-GW / WAN PE
- Hardware based VXLAN SDP support
- DC to WAN control plane federation via BGP-EVPN
SERVICE CHAINING AUTOMATION

• Drivers
  - Simplify access to virtualized appliances
  - Quick upsell of value-add services (time to market)
  - Self serve model
  - Elasticity based on service utilization
  - Offload application enablement function from routers

• Use cases
  - Per-subscriber steering from residential edge
  - Steering from business PE/CPE to value added services
  - Steering from mobile packet core on Gi-LAN

FULLY INTEGRATED SERVICE CHAINING SOLUTION AND 7x50 STEERING EDGE
SDN CONTROL OF THE 7X50 NETWORKING FABRIC

• OPENFLOW
  - OpenFlow on 7x50 provides for granular placement/steering of workflows at the network edge (SR-OS R12.0)
  - Hybrid switch architecture: router retains IP/MPLS & Segment Routing (SR-OS 13.0) control plane for scale and robustness (responsiveness, self-healing)

• Path Computation Element
  - PCEP: SR-OS 13.0

• NETCONF/YANG
  - Initial Netconf support since SR-OS 11.0r6
  - YANG models for configuration in SR-OS 13.0
IN SUMMARY
EVOLUTION TO CLOUD-OPTIMIZED IP NETWORKS

• Platform evolution for more scale, efficiency & convergence
• 7750 SR-a brings SR-OS & FP3 in aggregation optimized platform

• Introducing first SR-OS virtualized applications - vEPC, vRR, vISA
• Flexibility to deploy in the cloud or integrated on purpose built HW

• Enabling SDN controlled network fabric
• DC-GW automation, Hybrid OpenFlow Switch, Service Chaining edge