



**Broadcom Ships Jericho2:**

**Driving the Merchant Silicon Revolution  
in Carrier Networks**

**Under Embargo**

Confidential Until 6am PDT, March 6 2018



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# The Most Powerful, Scalable Switch-Router Silicon on the Planet



**Chipset Solution Scaling > 200 Tb/s in a Single Chassis**



**Elastic Pipe™ Ground Breaking Packet Processor**



**Distributed and Robust Packet Buffer with Optional HBM Expansion**



**Redefining Router Economics, Power and Form Factor**



**NOW SHIPPING**

**Jericho2**

**10 Tb/s Device  
208 x 50G SerDes**

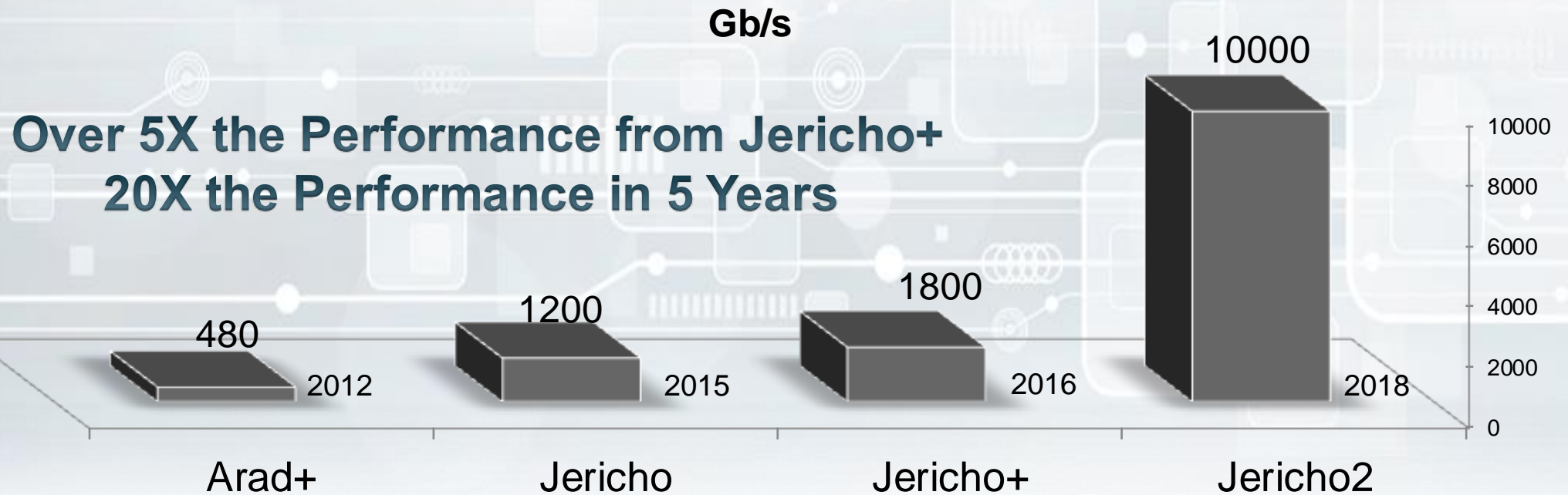


**NOW SHIPPING**

**Ramon**

**192x 50G SerDes**

# Merchant Silicon Outpacing Moore's Law



# Introducing StrataDNX™ 2018

## Switch-Router



- Up to 10Tb/s switching capacity per device
- Elastic Pipe™
  - Flexible binding of a centralized database to any stage of the pipe
  - Extending Jericho2 pipe via a pool of additional general purpose stages
- 10GE, 25GE, 40GE, 50GE, 100GE, **200GE**, **400GE** interfaces
- Carrier grade Hierarchical Traffic Manager
- In package, scalable packet buffer memory using HBM
- Over 2M IPv4 on chip (1M IPv6), Over 12M using external memory device

400GE

200GE

## *Now sampling to customers*



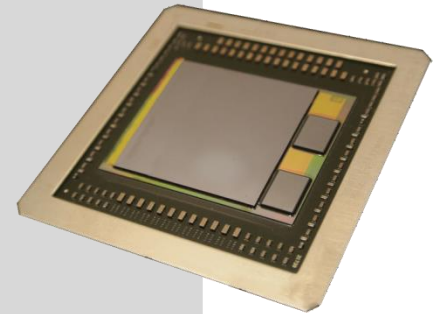
## Interconnect Fabric

- Switch fabric supporting up to 9.6Tb/s per device
- Supports over 200Tb/s in a single modular system
- One generation of backward and forward Compatibility
- The most power efficient switch in the Industry
- 50Gb/s PAM-4 SerDes

# Jericho 2 : Purpose-Built for Next-Gen Routing Requirements

## Traffic Management with 8GB of High Bandwidth Memory

- Eliminates packet drops
- In-package, low power and high performance deep packet buffering
- Seamless expansion from on chip buffer to HBM
  - Packet queueing utilizing on-chip buffer
  - Congested flows handled via HBM

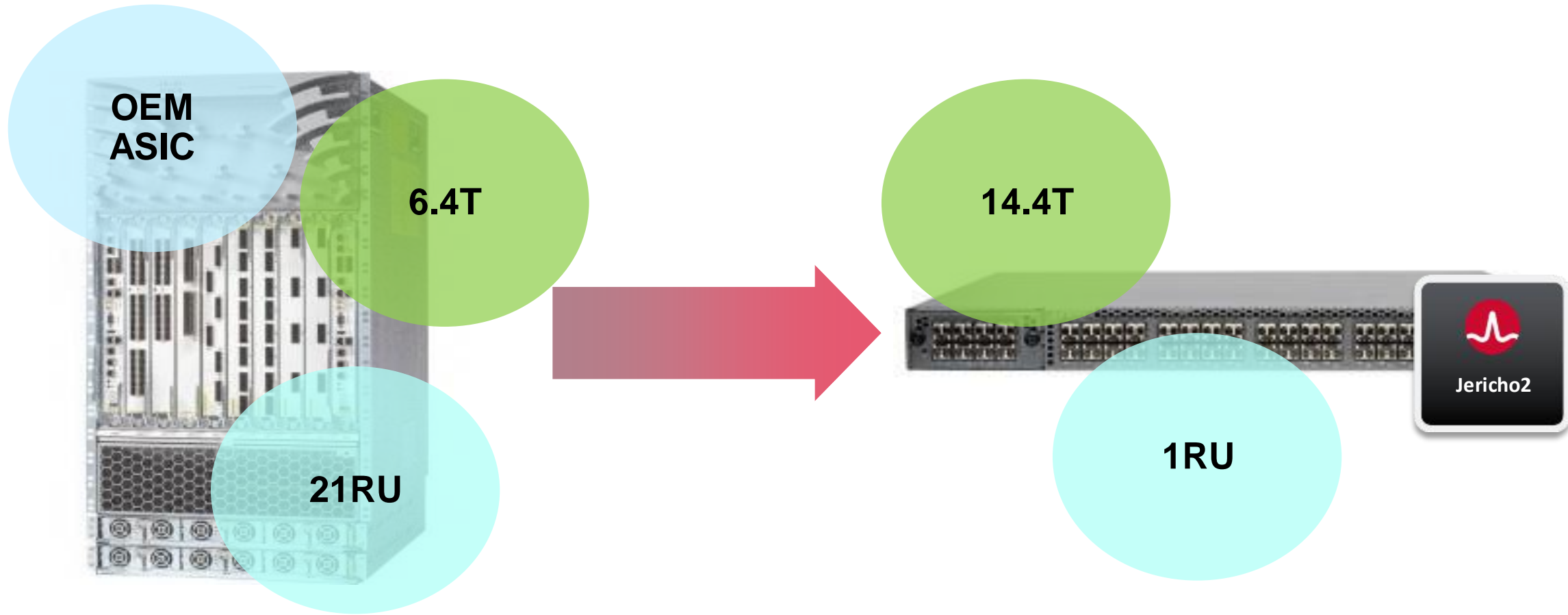


## Elastic Pipe™

- Extending Jericho2 pipe via a pool of additional general purpose stages
- Future proof and programmable pipe with elastic extension
- Flexible binding of a centralized database to any stage of the pipe



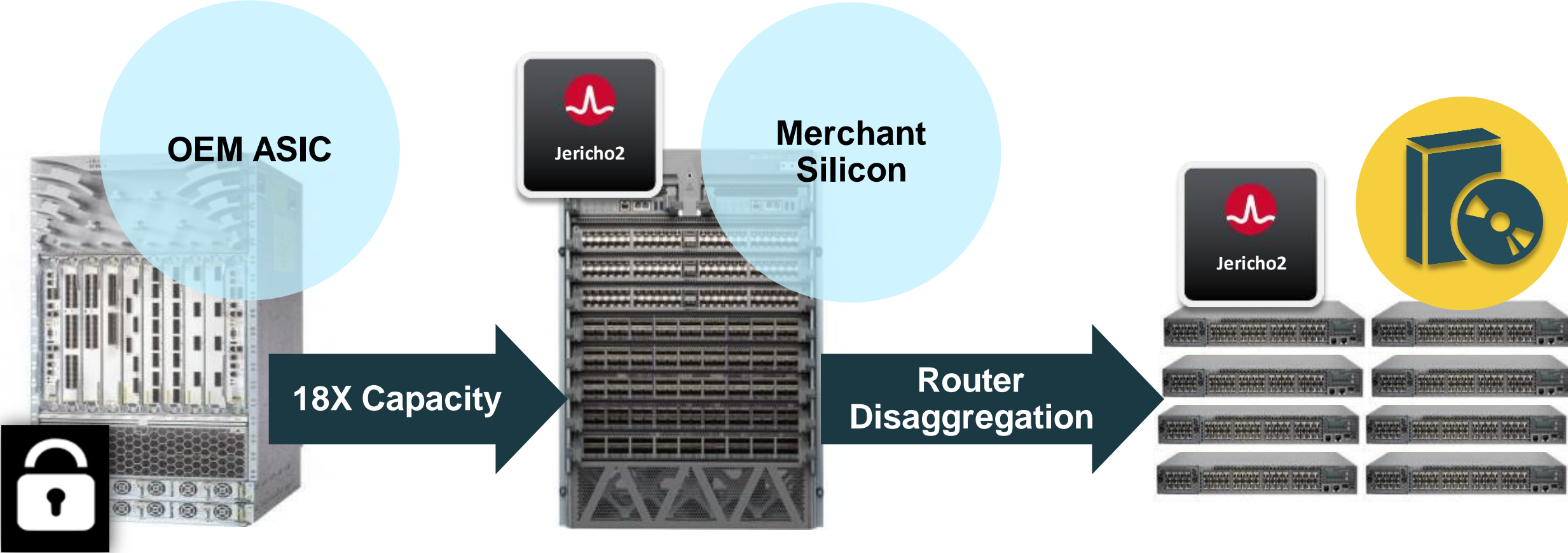
# Jericho2: Quantum Leap in Router Power & Cost Efficiency



**Redefining Router Economics, Power and Form Factor**



# Democratizing the Most Complex Area of Networking



Enabling Whitebox and Disaggregated Economics

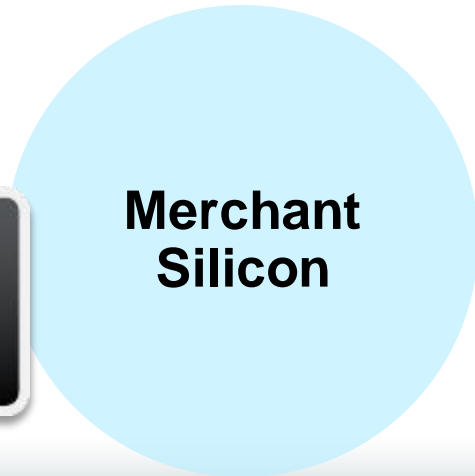


# Jericho2: Unparalleled Router Economics at 100GE/400GE



36x400GE

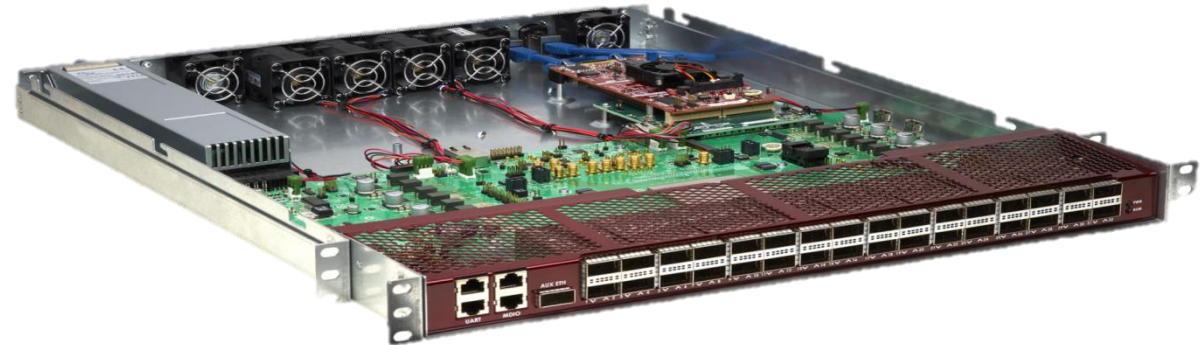
Jericho2/Ramon Based



36x400GE

Jericho2/Ramon Based

**<\$1K per 400GE Router Port\***



**Jericho2 ODM Router Systems Available Q4 2018 at Market-Disrupting Prices**

\* Excluding optics

# The Router Merchant Silicon Revolution Has Already Started

SP Aggregation

SP Core

SP DC

## WHITE BOX / WHITE BOX SYSTEMS AT&T Teams with Broadcom on Hardware



NEWS WIRE  
FEED  
LIGHT READING  
2/18/2017

COMMENT (0)

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DALLAS — AT&T and Broadcom are working together to build a strategic program focused on driving innovation of network hardware, such as switching, routing, broadband access and customer premises equipment.

"By collaborating directly with Broadcom, AT&T is driving a roadmap that will help enable innovation," said John Donovan, chief strategy officer and group president, Technology and Operations. "We continue to form relationships with disruptive suppliers as we build a software-centric network and drive the industry to software-defined networking (SDN)."

Working directly with companies like Broadcom offers AT&T access to guide requirements at the chipset level.

"This represents a significant milestone toward accelerating innovation in the industry," said Hock Tan, president and CEO, Broadcom. "Both companies are committed to sustained collaboration on product and chipset roadmaps, engineering services and advanced functionality."

Article Stock Quotes (1) Comments (14)  
Apr 4, 2016 9:54 AM EDT  
Cisco (CSCO) Counters Arista N  
Find out which companies are... before the news hits the Street with StreetInsider.com's Dividend Insider Elite. Sign-up for a FREE trial here.

CSCO Heat Sheet	Get Alerts
Price: \$37.73	-0%
Rating Summary:	25 Buy, 20 Hold, 1 Sell
Rating Trend:	1.0%
Today's Overall Ratings:	Up: 11   Down: 11   New: 13%
Track CSKO Now!	

UBS analyst, Steve Mikunovich, commented on back and forth rumors between Cisco (NASDAQ: CSCO) and Arista (NASDAQ: ARST) last week claimed to be the first vendor to ship a new switch, the 7500R, based on Broadcom's Jericho silicon. However, Cisco told UBS that it has been shipping the NCS 5000 router with Jericho silicon since November targeting similar interconnection (DCI) market in which full-featured routers are used but not always required. Jericho is a fabric-based router features rather than its predecessors. It embeds more routing switches than its predecessors. It enables segment routing using its TAM while Cisco appears more willing to work with public cloud providers to enable similar solutions. Both...



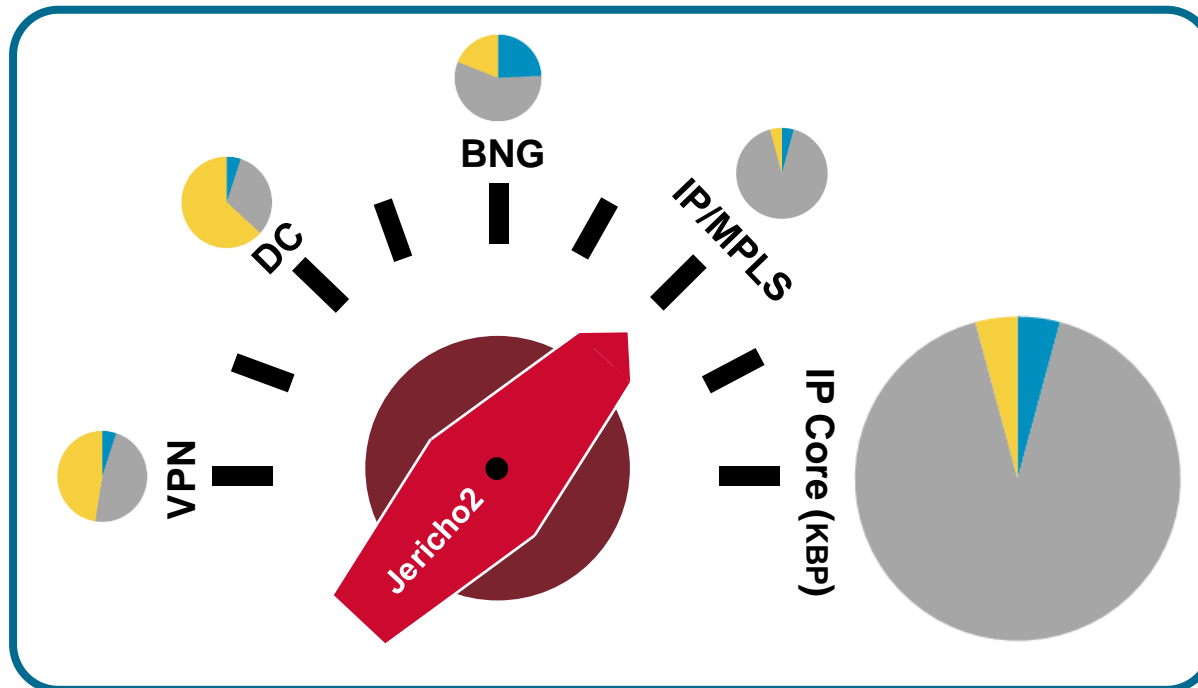
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**Arista takes on Cisco, Juniper at routing**  
New 'Jericho' switches and FlexRoute software aimed at replacing Internet routers

By Jim Duffy  
Managing Editor, Network World | MAR 29, 2016 3:00 AM PT

- ✓ IPv6 SR
- ✓ 400GE SAT
- ✓ VxLAN-EVPN
- ✓ BIER Multicast
- ✓ SAT
- ✓ PBR
- ✓ PIC
- ✓ PPPoE
- ✓ MPLS-SR
- ✓ MPLS-EVPN
- ✓ MCAST SM/SSM
- ✓ Carrier-Grade Statistics
- ✓ Low-Latency Protection
- ✓ Routing in/out of tunnels
- ✓ Expandable ACLs and DBs
- ✓ Hardware Accelerated OAM
- ✓ IPv4/IPv6 complete internet FIB

# Elastic Pipe™ , Modular Databases

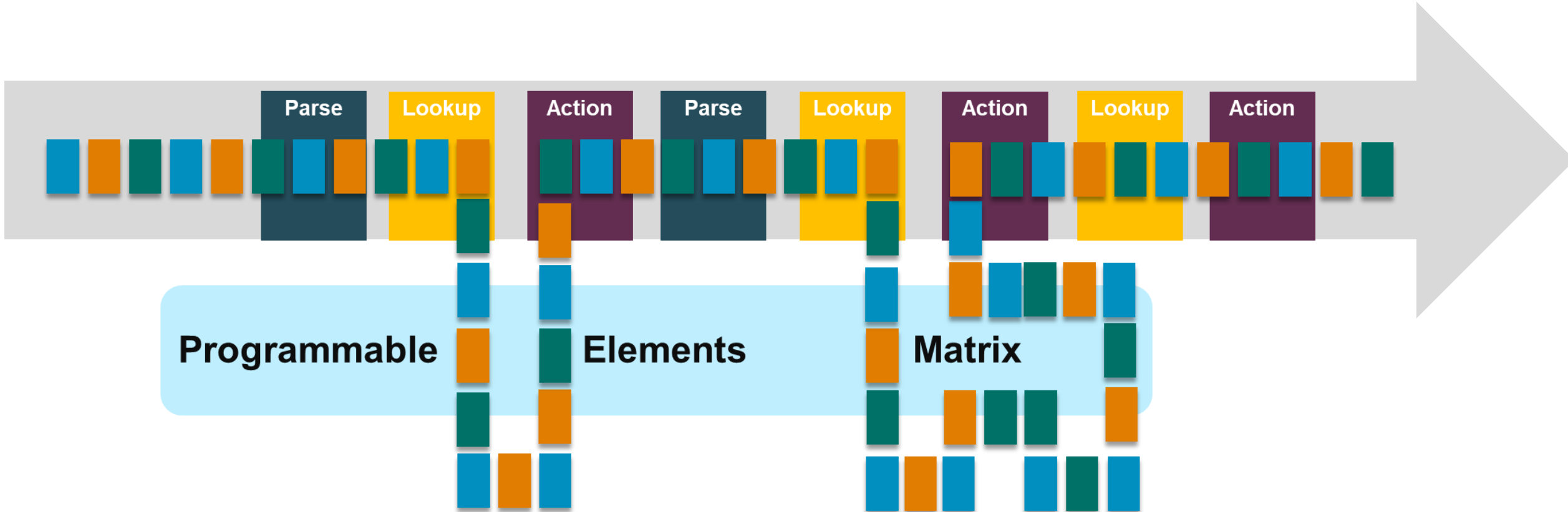
- Different networking segments require different database scales
- Jericho2 adjusts database sizing based on profiles
- Elastic pipe™ enables flexible binding of a centralized database to any pipe stage
- Scale expandable through an external lookup device (KBP)





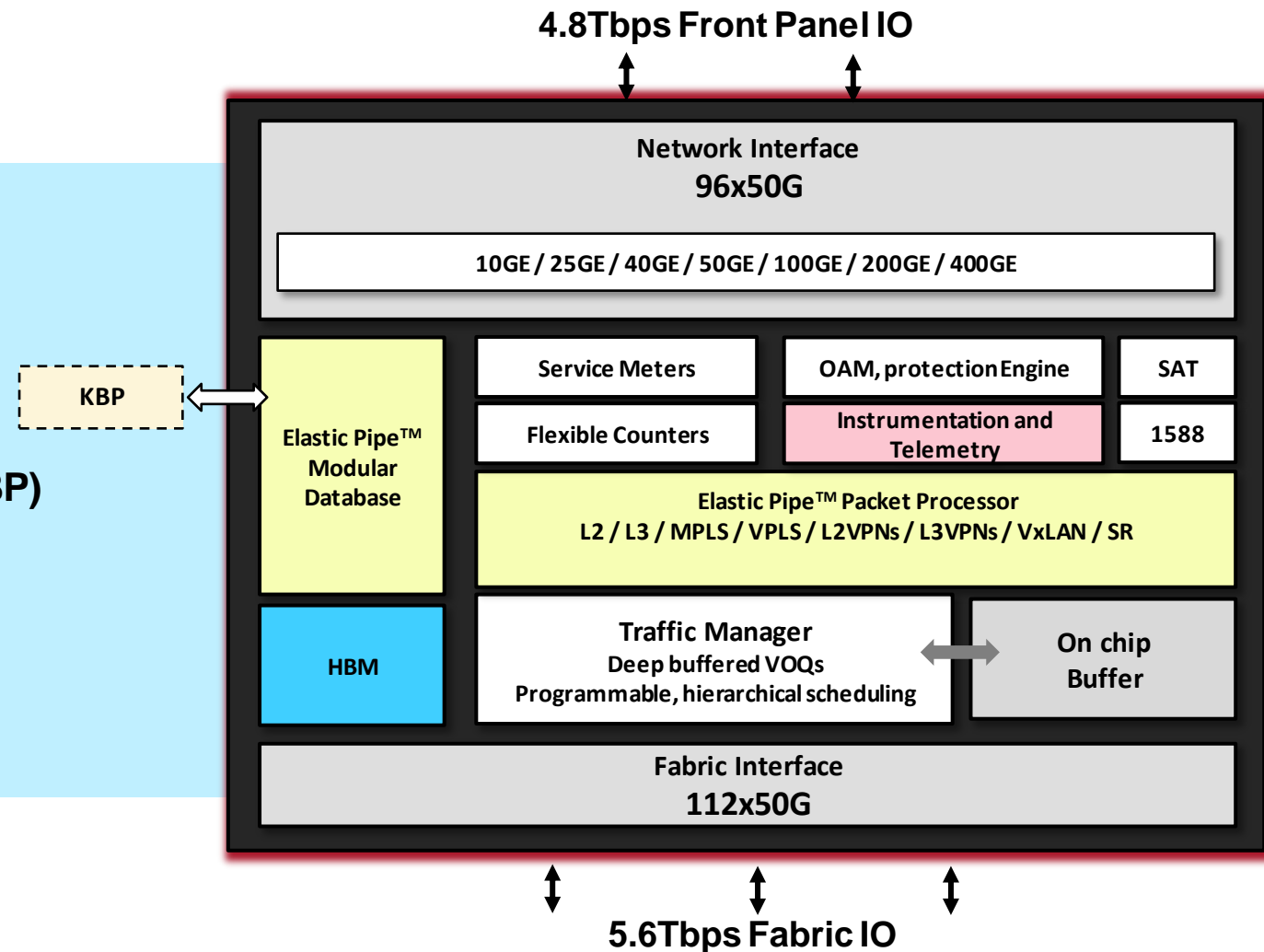
# Elastic Pipe™, Future Proof Switch-Router

- DNX packet processor is composed of programmable pipe stages
- Jericho2 enables pipe extension via a pool of programmable elements
- Elastic pipe™ - creating a new pipe by adding stages



# BCM88690 DNX “Jericho2”

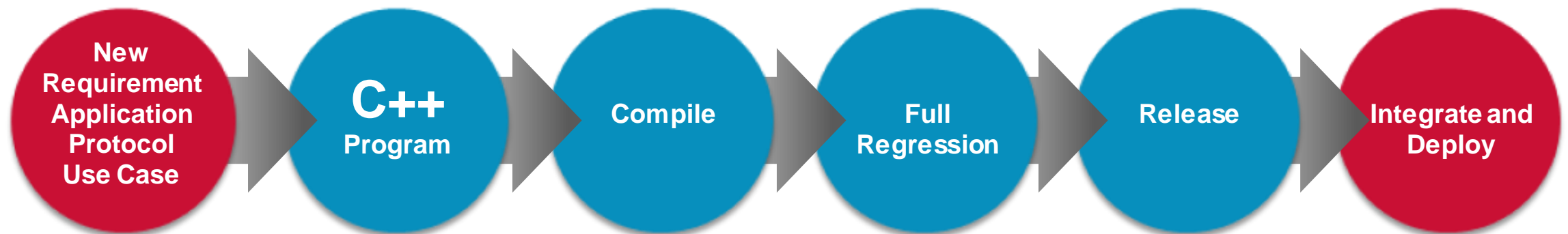
- 10Tb/s line card performance
  - 208 50G PAM-4 SerDes
- Deep buffering using HBM
- Elastic Pipe™ with external table expansion (KBP)
- Hierarchical Traffic Management
- Network Instrumentation and Telemetry
  - Hardware accelerator



Available Now For Qualified Customers

# Jericho2 Programmability

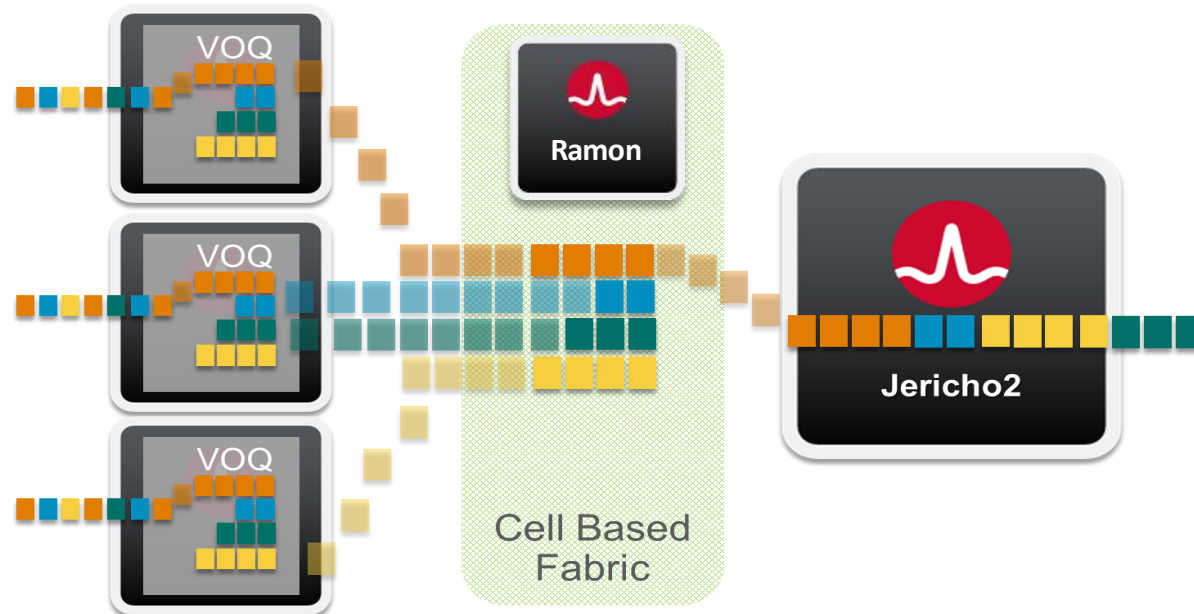
- Jericho2's Elastic Pipe™ takes programmability a step further
  - Evolution of the StrataDNX field proven programmable pipe
- Addressing ever-changing switch-router requirements
  - allowing OEMs and service providers to protect their investment
- The Elastic Pipe™ allows a fast turn-around for Protocol upgrades
  - C++ programming and integration into the fully tested Broadcom SDK
- Factory programmable datapath via high-level C++ language
  - C++ development environment for qualified customers





# Industry-Best Silicon for Chassis

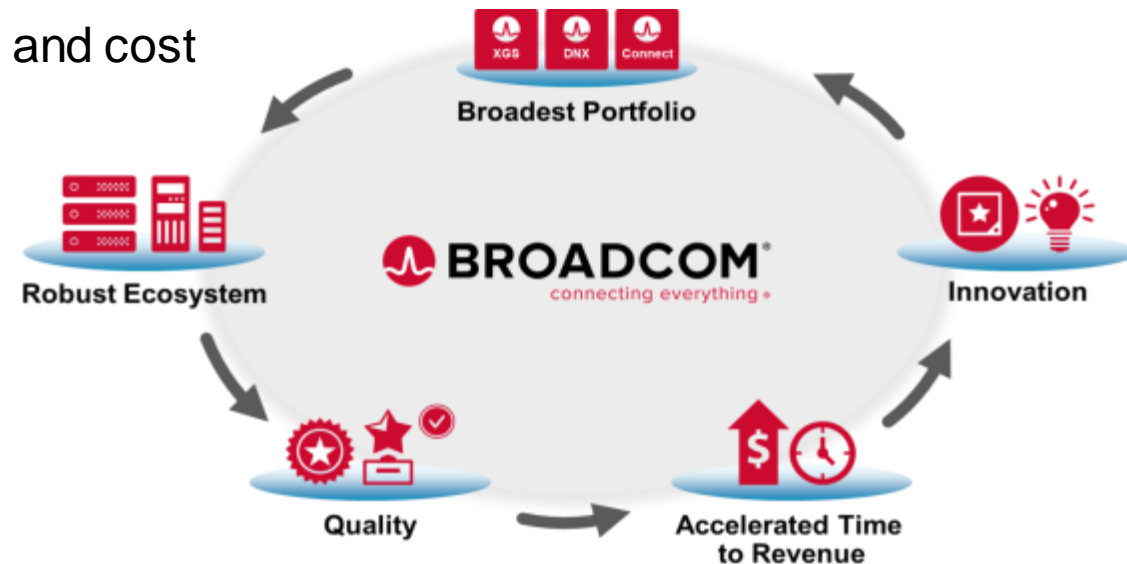
- Incast prevention
  - Credit based virtual output queues
- Easy migration to the next bandwidth standard e.g. 100GE to 400GE
  - Eliminating speed mismatch using cell based fabric
- HBM and OCB only (On Chip Buffer) device flavors



**Largest Effective OCB  
in the Industry**

# Summary – Jericho2 Excels the Router Checklist

- ✓ Large scale, carrier grade, expandable IP-MPLS forwarding
- ✓ High bandwidth, High density
- ✓ Hundreds of milliseconds of deep buffering
- ✓ Tens of thousands of subscriber sessions; Scheduling and Policing per session
- ✓ Elastic Pipe, delivering Advanced Packet processing, Programmability, and investment protection
- ✓ Carrier Grade Functionality, Diagnostics, OAM, SAT and Instrumentation
- ✓ High integration, changing the router economics for power and cost





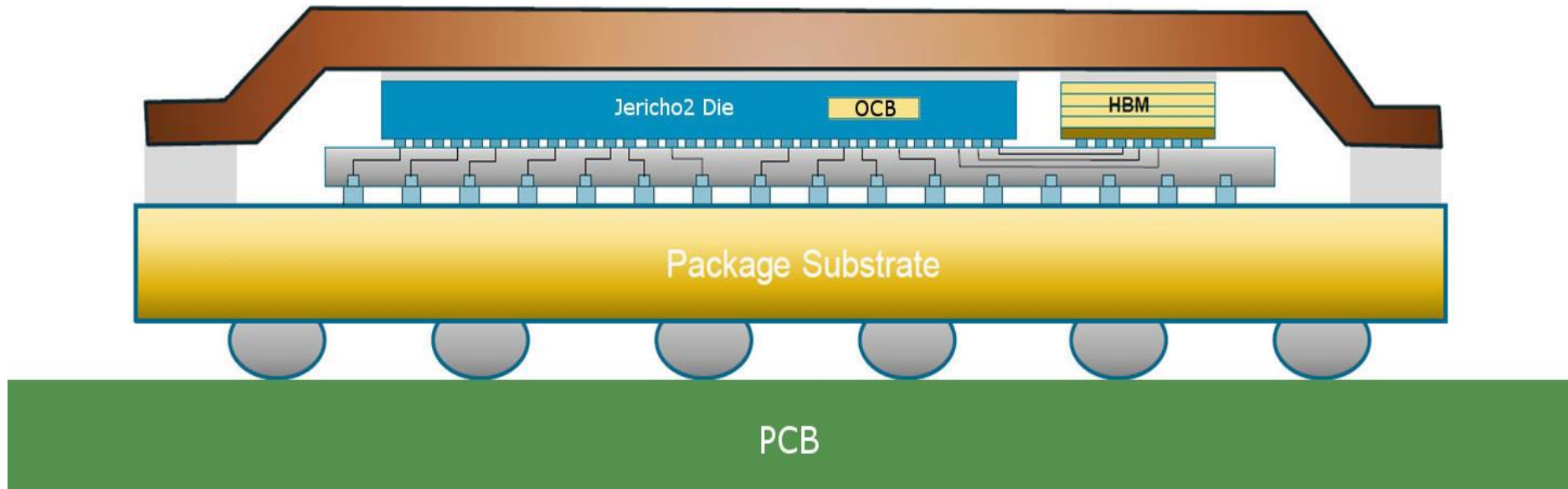
**Thank You!**





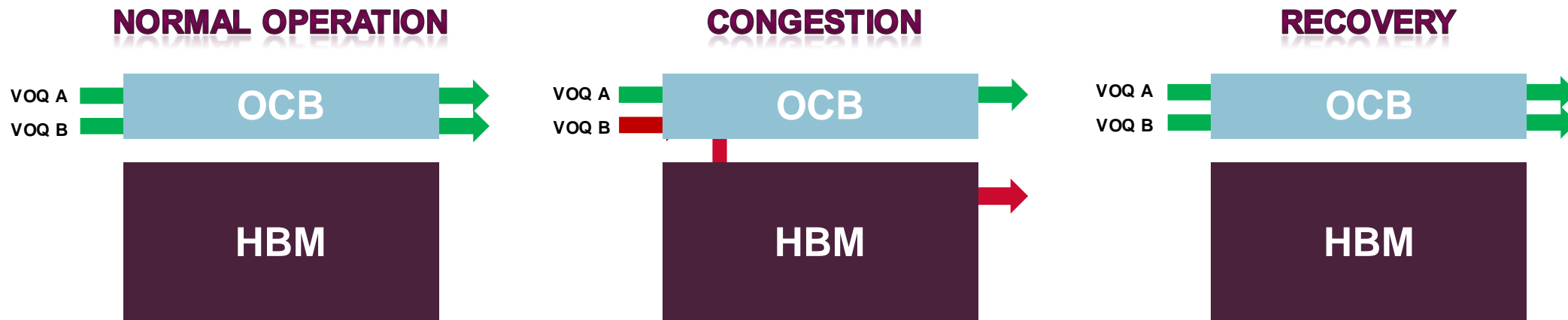
# Distributed Buffer Scaling

- Flexible packet buffer behavior. On Chip Buffer and HBM
- Low latency, OCB-based under normal conditions
- Seamless migration to HBM memory for congested flows



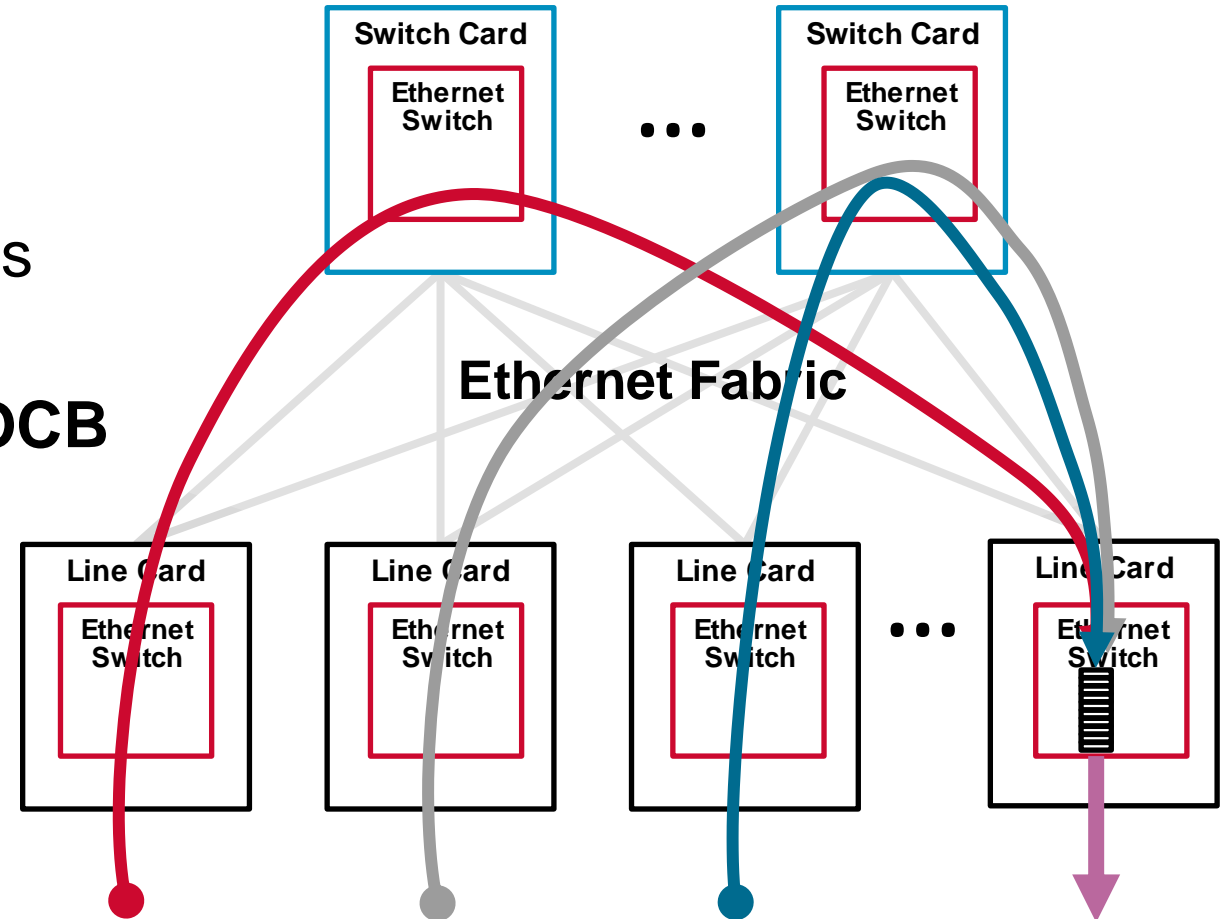
# Seamless Packet Buffer Optimization to any Network Scenario

- DBS enables the use of JR2 across various network scenarios
- DBS optimizes flow completion time
  - Memory assignment per VOQ (OCB/HBM)
  - Seamless expansion to HBM and back based on congestion levels – **No packet drops!**
- No packet buffer tuning
- Robust and future proof
  - Ready for future protocols buffering requirements



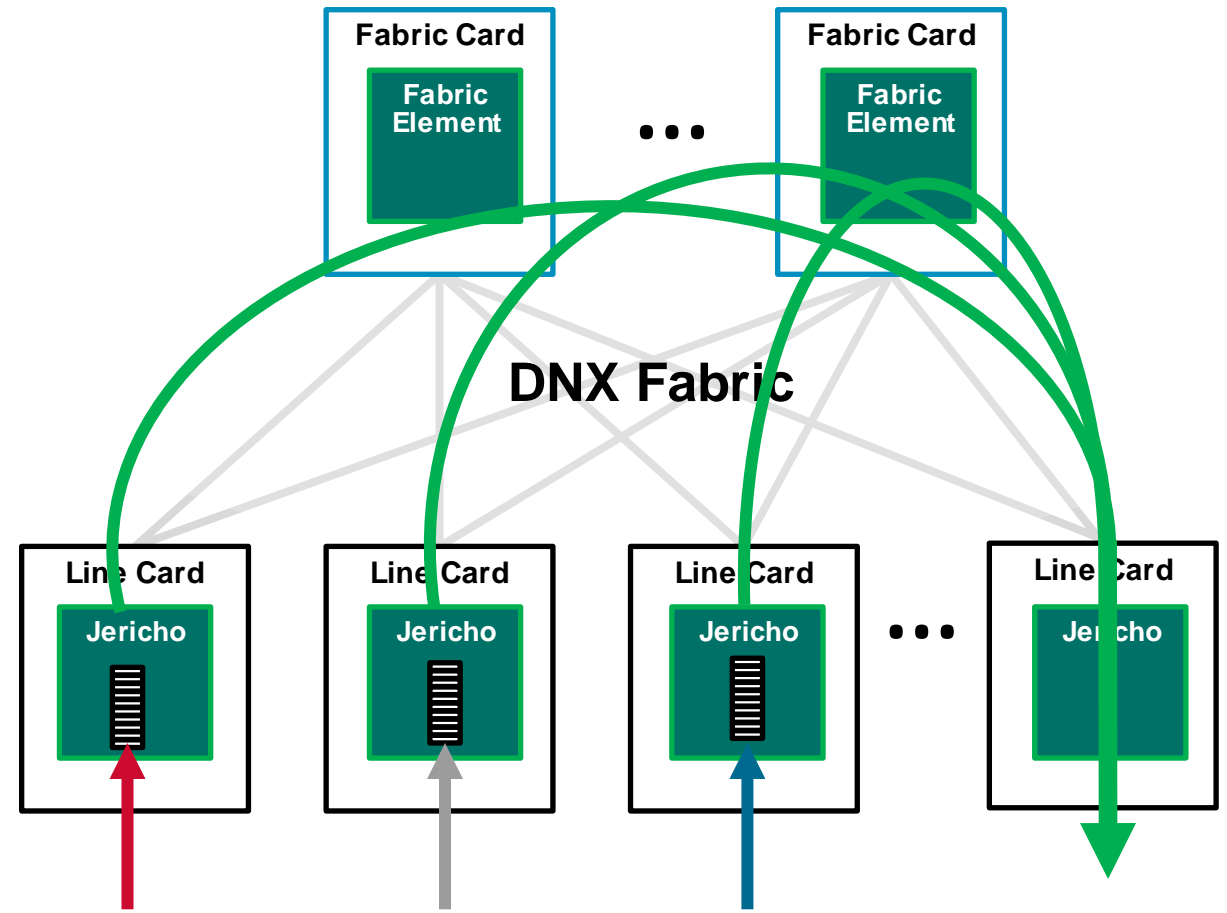
# Ethernet Fabric Drops on Incast

- Ingress traffic pushed to egress
- Egress buffer derives max burst size
- Egress buffer might overflow (drops)
- Effective buffer size is equal to the egress buffer size of the egress chip
- **Entire Incast traffic reaches a single OCB**



# DNX Fabric, Incast Prevention

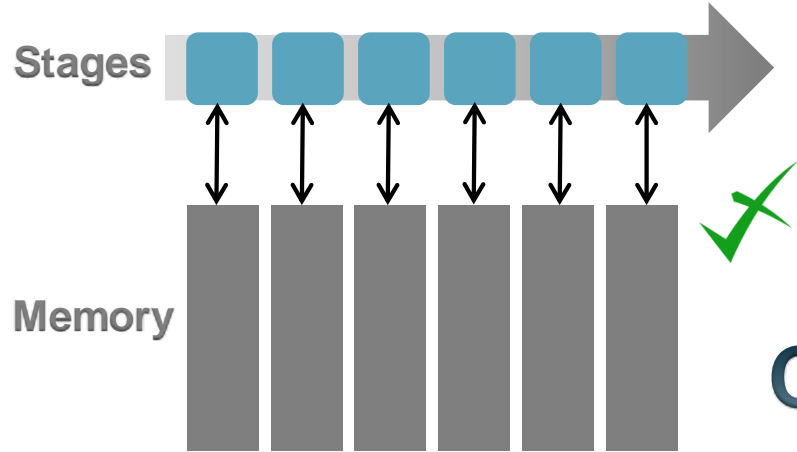
- Ingress traffic stored in VOQ
  - No congestion
- Egress port pulls the stored traffic
- Egress buffer never fills up
- **Effective buffer size is equal to the sum of ingress devices VOQs**
- **Incast traffic distributed between all ingress devices**



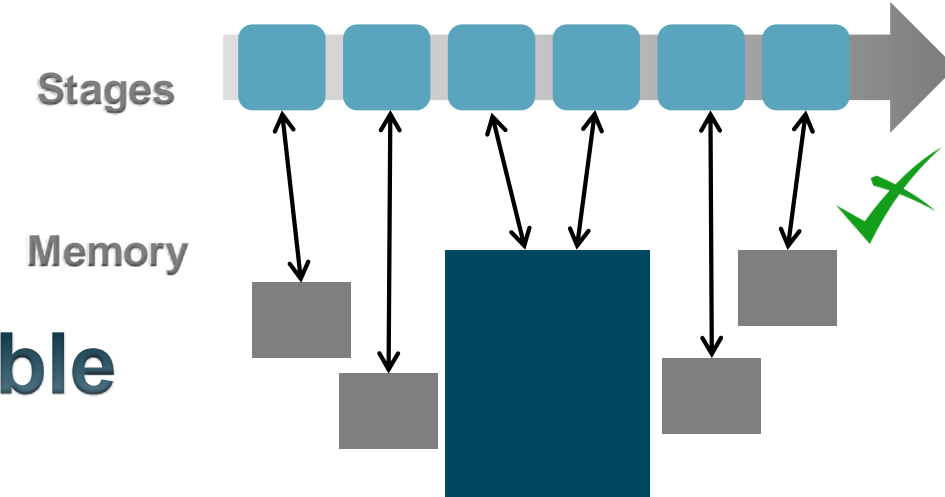


# Pipe Architecture Comparison

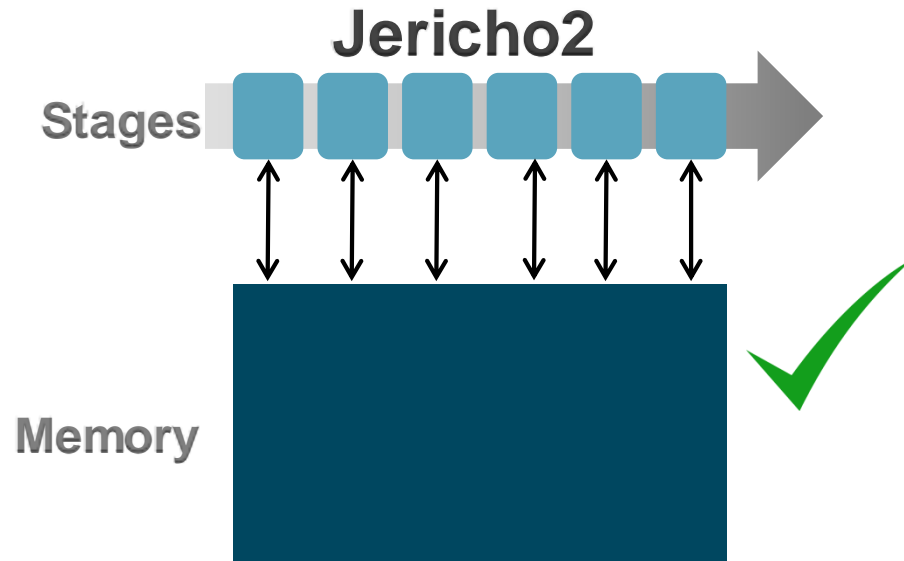
Not Centralized, Fungible



Partly Fungible, Partly Centralized



Centralized & Fungible



# Jericho2 Solutions



Data Center

DC Core



Spine / Leaf



Top of Rack

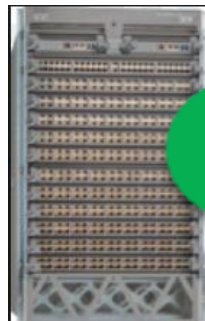


DCI



Service Provider

SP Cloud



Core/Agg Router



Edge/Agg Router

