Networking Overview

J.P. Morgan 19th Annual Tech/Auto Forum
January 12, 2021
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This presentation contains forward-looking statements, including statements as to our priorities and goals, business strategy, performance and market opportunities, and products and technology development, that are based on our current expectations and beliefs of the management of Broadcom, as well as assumptions made by, and information currently available to, such management, current market trends and market conditions and involve risks and uncertainties, many of which are outside the Company’s and management’s control, and which may cause actual results to differ materially from those statements. Many of the foregoing risks and uncertainties are, and will be, exacerbated by the COVID-19 pandemic and any worsening of the global business and economic environment as a result.

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How Broadcom Became a Global Technology Leader
Category-Leading Franchises: 8 in 2009 → 25 Today

Revenue
($ in Billions)

16X Growth

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<th>FY09</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
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R&D
($ in Billions)

25X Growth

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<th>FY09</th>
<th>FY10</th>
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<th>FY12</th>
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<td>$4.7</td>
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84X Growth in Operating Profit from 2009 → 2020
Heritage of Innovation

One of the industry's broadest IP portfolios with ~23,000 patents
Connecting Everything® Across the Ecosystem

99.9% of All Internet Traffic Crosses at Least One Broadcom Chip

Source: Broadcom Internal Estimate

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99.9% of All Internet Traffic Crosses at Least One Broadcom Chip
Category-Leading Franchises in Diverse End Markets

- Broadband
- Server
- Storage
- Wireless
- Networking (~25%)
- Switching
- Compute Offload
- Physical Layer
- Routing

Semiconductor Solutions

Infrastructure Software
Core Switch Products

Ram Velaga
Senior Vice President and General Manager, Switch Products
Connecting Everything®
Different Networks, Different Needs

Enterprise
- Medium bandwidth
- User mobility → policy & security
- Heterogeneous mix of devices
- Wired / wireless access

Service Provider
- High bandwidth
- Hyper shared infrastructure
- Oversubscribed
- Long-distance interconnects

Hyperscale Data Center
- Hyper bandwidth
- East-west traffic dominates
- Latency sensitive

Source: Dell'Oro
Anatomy of a Switch / Router

High-Performance Switch Silicon

Network Operating System

Platform Hardware

Optical Transceivers

Powered by Broadcom Silicon
Broadcom Builds the Right Tools for Each Network

Optimized Silicon for Different Network Needs
Three Product Lines Serving All Networks ...

- **Tomahawk**: Highest Bandwidth for Hyperscale Data Center
  - 25.6T Bandwidth

- **Trident**: Feature-Rich, Programmable for Cloud Edge and Enterprise
  - 12.8T Bandwidth

- **Jericho**: Scale-out, Programmable, Deep Buffered for Service Provider
  - 1.0T Bandwidth

**Versatility**

**Extensibility**
… with Consistent Programming Interface

Layer 2 APIs  Layer 3 APIs  QOS APIs  Telemetry APIs  Port APIs

Broadcom Software Development Kit (SDK) with Open APIs

Single SDK Accelerates Development and Time to Market
Purpose-Built Silicon ➔ Unmatched Efficiency

14.4Tbps Routing Line Card with Integrated Security

21 Chips vs. Two Chips

* 18x 800GE external MACSec devices
Purpose-Built Silicon ➔ Performance Leadership

- **640G** (Trident)
  - 64 x 10G
  - 2011
- **1.28T** (Trident2)
  - 32 x 40G
- **3.2T** (Tomahawk)
  - 32 x 100G
- **6.4T** (Tomahawk2)
  - 64 x 100G
- **12.8T** (Tomahawk3)
  - 128 x 100G
- **25.6T** (Tomahawk4)
  - 256 x 100G
  - 2020

40X Bandwidth Increase per Switching Element
Outpacing Moore’s Law
Doubling Bandwidth Delivers 6x Performance Improvement

12.8Tbps Other Silicon

12.8Tbps Other Silicon

12.8Tbps Other Silicon

12.8Tbps Other Silicon

6.4Tbps

25.6Tbps

25.6Tbps

Tomahawk4

25.6Tbps
Purpose-Built Silicon ➔ Simplifies Hardware and Software …

Image Source: Facebook, OCP

75%+ Reduction in System Power and Cost
... Democratizing Networking

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<td>apstra</td>
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<td>Nuage Networks</td>
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<th>Operating System</th>
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<td>Arista</td>
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<td>Infoblox</td>
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<th>Hardware Platform</th>
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<td>Accton</td>
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<td>H3C</td>
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Operating at Scale: 6-8 New Chips Per Year

Deep Networking Knowledge

50/100G SerDes, PCIe, External Memory Interfaces, DSP, ADC/DAC, Signal Integrity
Standard Cells, Memories, PLL, Advanced Packaging, Chip-Chip Interconnect
Advanced Process Nodes (7nm, 5nm, 3nm)

Robust Ecosystem

Accelerated Time
to Revenue

Superior Quality

Proven Methodology & Process

Broadcom Silicon Platform
World’s Largest Networking Silicon

- Monolithic 7nm Implementation
- 30+ Billion Transistors
- 512 X 56G PAM4 SerDes
- 256 X 100G PAM4 SerDes*

* Also available
End-to-End Portfolio

Fronthaul Gateway

Cell Site Router

Metro Access
Silicon Photonics Platform Solutions

Alexis Björlin, Ph.D.
Senior Vice President and General Manager, Optical Systems
The Present and Future of Data Infrastructure

$100B Annual Capex Spend by Cloud with 15% CAGR\(^1\)

19.5 Zettabytes of Cloud Data Movement\(^2\)

Per hyperscale datacenter
> > 100k Servers
> > 10k Switches
> > 1M Optical Interconnects

Source:
1. 650 Group, Cloud Total Market and Forecast Report
3. Left: Digital Realty's Loudoun Three campus in Ashburn, Virginia. Photo courtesy of Digital Realty
4. Right: Google’s Council Bluffs, Iowa Data Center. Photo courtesy of Google
Datacenter Scale-out Requires Massive Fabric Connectivity

>25% annual growth for intra-datacenter traffic*

Compute and storage resources pooled within datacenter and across regional zones

Requires long-reach, low-latency interconnects

Fabric increasing as % spend and power consumption of infrastructure

Optical Interconnect Dominates Fabric Silicon Spend

High-Performance Switch Silicon

Optical Transceivers

Current Customer Spend*

10x $

Switch

Optics

Opportunity for Step Function Improvement in Optical Connectivity

* Source: LightCounting, Dell'Oro, 650 Group and Broadcom internal estimates
## Broadcom’s Unmatched Integration Capability Meets This Need

<table>
<thead>
<tr>
<th>Switch Silicon</th>
<th>Mixed Signal IC</th>
<th>Optical Devices &amp; Fabs</th>
<th>Advanced Packaging &amp; Test</th>
<th>Silicon Photonics</th>
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| • Core switch, SerDes and DSP in leading node  
• Sustained generational differentiation | • Power and performance optimized in both SiGe and CMOS | • 50M lasers/year from internal fabs  
• High-volume optical manufacturing  
• High-power, multi-wavelength sources | • Wafer-level test  
• TSV  
• 2.5D/3D integration | • High-density PIC design  
• Modulators and PDs in silicon  
• Low-loss SOI waveguides |

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**Industry-Leading Economics, Volume, Power Efficiency at Scale**
Broadcom’s Purpose-Built Silicon Photonics Platform …

Industry’s Highest Power Efficiency
- Direct drive from switch to photonics enables interconnect power <1 pJ/bit
- System thermal management handling > than 100 W/cm²

Industry’s Highest Bandwidth Density
- 500 Gbps/mm die edge
- 64 single mode fiber attached to a single die

Designed for Reliability and Operational Efficiency
- Remote, pluggable laser source
- No electrical connectors
... Delivers Disruptive System Value ...

- **30%** Power Consumption Savings
- **50%** Improvement in Rack Density and Integration Time
- **$40%** Lower Optics Cost/Bit
… with Multiple Use Cases Across the Broadcom Portfolio

**Thebit:** 800G DR8 integrated transceiver
- Optimized performance;
- lower cost

**Bailly:** Switch with optical I/O
- 30% lower power
- 40% lower cost/bit

**Janssen:**
- Silicon Photonics platform for optical I/O
- scale-up/out interconnect
Broadcom’s Disruptive Silicon + Photonics Platform …

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... Expands our SAM by $3B+*  

*Source: Data estimates from a combination of market research (650 Group, LightCounting, Dell’Oro) and Broadcom internal estimates