



Broadcom Delivers High Performance Data Plane Programmability with new Trident 3 Generation of 10/25/100G Ethernet Switches

June 14, 2017

Robust FlexGS™ packet switching architecture scales from hundreds of Gbps to multiple Tbps, enabling in-field upgrade to extend the asset life of data center, campus, and service provider networks

SAN JOSE, Calif. and SINGAPORE, June 14, 2017 (GLOBE NEWSWIRE) -- Broadcom Limited (NASDAQ:AVGO), today announced immediate availability of the first members of its breakthrough [Trident 3 family of programmable switches](#) for data center, enterprise, and service provider networks transitioning to high density 10/25/100G Ethernet. Manufactured in 16nm and building on the widely deployed StrataXGS® Trident and Tomahawk® switch products, the new StrataXGS Trident 3 switch series offers fully programmable, line-rate switching solutions ranging from hundreds of Gbps to multiple Tbps, complete with large reconfigurable on-chip databases, best-in-class load balancing, and rich embedded instrumentation for network visibility.

A photo accompanying this announcement is available at <http://www.globenewswire.com/NewsRoom/AttachmentNg/a7df7ca3-c27f-45ea-b447-512f894ff972>

Key benefits of the new StrataXGS Trident 3 switch family include:

- Market-leading StrataXGS Trident switch architecture revolutionized to support fully programmable packet processing, while achieving significant cost and power efficiency advantages over alternatives
- Programmable support for new protocol parsing, processing, and editing for Service Function Chaining, Network Virtualization, and Software-Defined Forwarding
- Programmable support for new switch instrumentation capabilities such as in-band and out-of-band network telemetry
- Fully verified, feature-rich Trident 3 programming images and flexible software APIs enabling complete functional compatibility to StrataXGS Trident 2 and Trident 2+ based networks, maximizing customer investment protection and providing fastest time to network deployment
- 3.2Tbps and 2.0Tbps devices sampling now; part of complete Trident 3 portfolio extending from several Tbps down to 200Gbps of switching, leveraging a single, unified software development effort and programming flow
- Industry's broadest line of cost-and power-optimized programmable switches, providing end-to-end network feature consistency across enterprise, data center, and provider edge, as well as in-network upgradeability for maximum asset life



The Broadcom Trident 3 is an ethernet switch with new levels of data plane programmability

"The innovation in our StrataXGS Trident 3 Series is in delivering a fully programmable switching pipeline while maintaining backwards compatibility to the existing install base of StrataXGS Trident and Trident 2 based networks," said Ram Velaga, senior vice president and general manager, Switch Products at Broadcom. "Rather than a blank slate, our customers want a scalable, bulletproof network data plane that is reprogrammable to address future requirements, while continuing to aggressively drive down Ethernet cost and power. With Trident 3, we've uniquely delivered that solution. Our customers can leverage a single development to yield a complete line of programmable switching platforms, with the same rich feature set extending all the way from the service provider edge, to the data center, converged campus core, and wiring closet."

The FlexGS™ architecture in Trident 3 comprises of new programmable parsing, lookup, and editing engines with associated reconfigurable databases. The engines are dimensioned and arrayed to maximize parallelism, performance, functional capacity and area/power efficiency to best address the diverse and concurrent needs of today's evolving networks.

The pipeline can be programmed to handle software-defined network virtualization and service chaining protocols, including VXLAN, GPE, NSH, Geneve, MPLS, MPLS over GRE, MPLS over UDP, GUE, Identifier Locator Addressing (ILA) and PPPoE, among others. The architecture also supports programmable telemetry, including the insertion/processing of in-band telemetry headers (and associated packet metadata such as traffic identifiers and timestamps) as well as out-of-band network visibility (such as per-packet/per-flow attribute histograms and new ERSPAN like protocols). Programmability can be used in conjunction with Trident 3 native traffic engineering functions such as configurable ECMP and dynamic, state-based load balancing and multipathing.

"Broadcom's approach to programmable switching in the Trident 3 line distinctly enables the implementation of new and diverse packet processing use cases with a pipeline that boasts optimal silicon power and area, deterministic PPS performance, and bandwidth scalability even greater than its more purpose-built predecessor," said Bob Wheeler, principal analyst at The Linley Group. "With multiple, optimized Trident 3 products ranging from 25/100GbE data center leaf-spine to multigigabit campus distribution, network operators can deploy new software-defined visibility, overlay, and forwarding capabilities uniformly across their infrastructure in a highly responsive and efficient manner."

Broadcom's FlexGS Programmability provides the ability to introduce completely new switching and instrumentation features via field-upgrade.

Network OEMs, ISVs, and operators can hence take advantage of Trident 3's programmability, while leveraging the rich and robust switching feature set developed and deployed over multiple generations of configurable StrataXGS switch devices.

FlexXGS Programmable Architecture Key Features

- Fully Programmable Packet-Processing Pipelines: parsers, editors and lookup/action engines
- Support for next-generation overlay protocols, including NSH, VXLAN-GPE, VXLAN-IPv6, Geneve, MPLS-over-GRE/UDP, ILA, GUE, and more
- Programmability enables new overlay processing and instrumentation features delivered via in-network software upgrade
- Large, parallelized, and shared match-action databases for maximum table efficiency and per-packet lookup capacity
- Flexible programming models: script based programming flow for power users, in addition to fully-verified, turnkey switch program images for fastest time-to-market
- Unified software development model across devices with flexible APIs, offering quick and seamless leverage of programmable capabilities

StrataXGS Trident 3 Switch Series Key Features

- High density 1/2.5/5/10/25/40/50/100GbE port connectivity using best-in-class integrated 10/25Gbps NRZ SerDes
- Example single-chip platforms and line cards include spine and converged campus core (32x100GbE), 25/100GbE Top-of-Rack (48x25GbE + 8x100GbE) and 10/100GbE Top-of-Rack (48x10GbE + 6x100GbE)
- 32MB on-chip, 100% fully shared packet buffer delivers up to 8X higher network burst absorption and congestion avoidance compared to previous generations
- Large, programmable on-chip forwarding databases for L2 switching, L3 routing, label switching, and overlay forwarding
- 3X increased ACL scale to support evolving policy/security requirements
- PCIe Gen3 x4 host CPU interface with on-chip accelerators improves control-plane update and boot performance by up to 5X
- Programmable support for enhanced network telemetry, including per-packet timestamping, Flow Tracker, microburst detection, latency/drop monitor, Active-probe-based in-band network telemetry, and in-band OAM processing; integrated with open-source BroadView v2 telemetry agent and analytics software
- Dynamic, State-Based Flow Distribution provides systematic and adaptive reduction in link congestion and traffic imbalances in large-scale Layer3/ECMP leaf-spine networks
- Adaptive Routing for dynamic traffic engineering in non-Clos topologies
- Full feature compatibility with previous generation Trident 2 and Trident 2+ devices

Availability

Broadcom is now sampling the first two members of the [StrataXGS Trident 3 family](#): BCM56870 (3.2 Tbps) and BCM56873 (2.0 Tbps).

Industry Quotes

Networking Original Equipment Manufacturers (OEMs):

Jeff Hirschman, Vice President, Hardware Engineering, Arista Networks:

"Broadcom's Trident family of silicon powers the highly successful Arista 7050 Series platforms and we are pleased with the new capabilities of Broadcom's Trident 3 offering, enabling highly programmable switching and routing achievements for networking."

Gavin Cato, Senior Vice President of Development Engineering, Dell Networking:

"This is a vibrant time for network innovation. Dell EMC and Broadcom are at the forefront of delivering on this promise with best-in-class open networking solutions to expand the vision and reach of scale-out, converged and highly automated infrastructure. The StrataXGS Trident 3 Series is an important part of our customer-driven mission to simplify operational complexity, and maximize programmatic control of cloud-scale networks."

Eric Broockman, CTO and EVP of Engineering, Extreme Networks:

"As a long-standing technology partner of Broadcom, Extreme Networks is committed to delivering the industry's most comprehensive, feature-rich, turnkey networking solutions serving the multi-faceted needs of modern IT enterprises. We recognize the massive transformative potential of the StrataXGS Trident 3 Series in unifying the feature consistency, network visibility, and software-driven control of the end-to-end enterprise network -- from campus access/distribution to converged core to DCI. Trident 3-based platforms will form an important part of Extreme's world class switching portfolio, enabling unprecedented 100GbE economics in the enterprise and end-to-end in-field upgrades of critical new switch functionality."

Michael Xie, Founder, President, and Chief Technology Officer, Fortinet Inc.:

"Enterprise networks are continually evolving to meet the increasing demands of today's digital economy. Effectively protecting all of this traffic requires high-performance and highly reliable security solutions like Fortinet's industry-leading enterprise and cloud firewalls which leverage Broadcom's StrataXGS silicon. The Trident 3 Series enables us to integrate 25GE and 100GE interconnects into our enterprise firewall solutions to provide our customers with superior power efficiency, flexible traffic management, and meet traffic demands now and into the future."

Liu Yili, Vice President and Head of Datacenter Research Department, H3C Technologies:

"H3C Technologies, building on its leading-edge portfolio of enterprise and data center networking solutions, is uniquely positioned to leverage the breakthrough programmable switch architecture of Broadcom's Trident 3. Our rich experience with StrataXGS and StrataDNX merchant silicon allows H3C to support the most reliable, flexible, and production-ready solutions for end-user applications, and to be the first to drive advanced network virtualization, monitoring, and traffic engineering capabilities into large scale deployment. H3C and its customers will greatly benefit from Broadcom's"

innovative approach in Trident 3."

Yu Li, General Manager, Data Center Network Product Line, Huawei Technologies:

"Our multi-generational collaboration with Broadcom, using StrataXGS and StrataDNX switches, has helped Huawei establish its position as a global networking equipment leader for enterprises and service providers. And our continued success relies on silicon technology that enables Huawei's product differentiation, quality, reliability, and engineering excellence. The Trident 3 platform provides such valuable technology by delivering expanded, backwards-compatible switching behavior that can be reprogrammed to rapidly implement new SDN and network visibility requirements, with the full production readiness and solution robustness expected by our customers."

Bethany Mayer, President and CEO, Ixia Solutions Group, Keysight Technologies:

"In this IT era of software-defined-everything, network visibility must be operationalized and adapted to new requirements at a lightning-fast pace. Ixia's network packet brokering solutions depend on Broadcom StrataXGS switching for ultra-high-bandwidth connectivity and no-compromise packet processing performance. The Trident 3 series architecture arms us with a versatile silicon platform for customizing our 10/25/40/50/100GbE monitoring solutions, with unprecedented deployment velocity."

Liu Zhongdong, President and CEO, Ruijie Networks:

"Broadcom and Ruijie Networks are helping to drive the current network transformation happening in China - from power-constrained, inflexible, limited-performance solutions to nimble, high-performance, merchant-silicon based equipment. Setting a new industry standard for data plane programmability, the StrataXGS Trident 3 family will trigger a new wave of switching solutions for the China market that will bring 25GbE and 100GbE into the mainstream, extending the life of networking infrastructure with ISSU-delivered functional upgrades and unparalleled power efficiency. We have worked closely with Broadcom to develop a rich portfolio of switches based on Trident, Tomahawk, and Jericho products, and we are excited to embark together on this ambitious journey armed with the ingenuity and versatility of the Trident 3 generation."

David Chen, Vice General Manager, Ethernet Switching, ZTE Corporation:

"The introduction of fully programmable packet processing in the Trident 3 switching architecture is noteworthy as it extends the lifespan and feature capacity of the industry's most recognized merchant switch silicon solution. ZTE's growing portfolio of high-performance Ethernet solutions will benefit from the extensive L2, L3, MPLS, and overlay processing flexibility in Trident 3 and drive the adoption of software-defined, economical, low-power 100GbE connectivity in the data center market."

Network Operators and End Users:

Truman Boyes, Head of Networks, CTO Office, Bloomberg LP

"At Bloomberg, we feel that programmable packet-processing pipelines allow for rapid time-to-market solutions and support next-generation encapsulation technologies. We believe that in-band network telemetry and the active monitoring of latency, loss, and behavior are the keys to operating a high performance network. Broadcom's focus on open telemetry technologies, such as In-band OAM, will allow operators to build and deploy more intelligent mission-critical networks."

Dr. Li Han, Director of Network Research Institute, China Mobile Communications Corporation:

"China Mobile believes in the value of merchant switch silicon and emerging software-defined technologies that enable the service provider cloud to be more operationally agile. We applaud Broadcom for investing in a programmable switch architecture for Trident 3 that delivers leading-edge network telemetry capabilities and the ability to implement new protocol processing paradigms. We believe it will be an important product for advancing the next generation of cloud and mobile services in China."

Dr. Shen Chengbin, Director of Infrastructure Networks, Shanghai Research Institute, China Telecom:

"Networking silicon that can marry software-driven programmability with robust, guaranteed functionality and efficient hardware implementation are particularly attractive to telecom operators, so that we can deploy a more flexible carrier network without compromising on economics, reliability, or time-to-market. Broadcom Trident 3 switches fulfill this promise and their programmable architecture provides insurance that fast-evolving network requirements can be met without continuously investing in long equipment upgrade cycles. From central office NFV to mobile core to data center, telecom infrastructure can benefit from the innovation and attention to quality and efficiency that Broadcom has achieved in Trident 3."

Wang Guangquan, Director of Network Research Institute, China Unicom:

"The migration of Asia operators to higher-speed 25GbE, 50GbE, and 100GbE networks relies on technologies that can reduce power consumption, capital expense and operational burden. By enabling new capabilities such as Service Function Chaining and in-band telemetry in an aggressive cost and power envelope, the Broadcom Trident 3 switch family can deliver tremendous efficiencies to China Unicom's network infrastructure."

Wen Temitim, Chief Network Scientist, Stackpath:

"Stackpath's vision for delivering intelligent, secure web-scale services is predicated on network infrastructure developing a faster loop between real time visibility data and programmatic control of its various resources. The Trident 3 switching series provides a powerful toolset for detailed, per-packet monitoring of network performance and traffic anomalies, future-proofed to address the evolving needs of a fully secured cloud. We can count on Broadcom and its impressive ecosystem of equipment/software providers to deliver fundamentally enabling technologies for the next generation of secure cloud services."

Wade Shao, Deputy Director, Network Architecture Center, Tencent:

"Tencent's network needs to provide high-quality services to businesses and be programmable to accommodate massive scale requirements and new applications. Broadcom's new Trident 3 platform allows for rolling out required network features quickly and responding to network anomalies and failures with a global view and real-time deep insights."

Original Design Manufacturers (ODMs):

CC Lee, President, Accton Technology Corporation:

"Accton has had the privilege of continuously cooperating with Broadcom to introduce innovative networking technologies to the industry. Not long ago, the StrataXGS Trident-II ushered in the era of open, scale-out networks based on merchant switch silicon, and we helped enable this transition - through existing OEM partners as well as Edgecore Networks - at massive scale in data centers and network service providers worldwide. Now, with the Trident 3 generation, we see the opportunity for mass-market adoption of 25/100GbE based leaf-spine interconnect leveraging a fully programmable switch data plane. We are excited to work with Broadcom to deliver more agile, performant, and efficient switching solutions to the

industry based on Trident 3."

Jeff Chen, CEO, Delta Networks Inc.:

"The introduction of the StrataXGS Trident 3 programmable switch architecture is an important milestone for DNI and for the overall industry. As Broadcom's premier networking ODM provider, our focus is to deliver on the numerous benefits of this family -- including in-system upgradeability, excellent cost/performance and superior power efficiency, unified, flexible switch features scaling from Gigabit Ethernet all the way to high-density 100GbE. It is our honor to participate in this revolutionary product development and expect great mutual success through our cooperation."

Mike Yang, Senior Vice-President, Quanta Computer Inc. and President, Quanta Cloud Technology:

"By collaborating with silicon solution leaders such as Broadcom, QCT has helped transform cloud data centers to maximize technology integration and innovation in the large-scale deployment of servers, storage, and networking. We are focused on bringing to market a number of platform solutions leveraging the superior Ethernet switching capabilities of Broadcom's Trident 3 switch family. Our common customers will be able to build on the robust feature set they have deployed over generations of StrataXGS based QCT switches, with the added protection of intercepting new network protocols and telemetry functions using the programmable architecture of Trident 3."

Network Software Vendors:

Prashant Gandhi, Chief Product Officer, Big Switch Networks:

"As Big Switch advances our next-generation data center networking solutions to cloud-native applications, software-defined data centers and software-defined security & monitoring, access to advanced switch ASIC functions become paramount to delivering network innovations while operating in an agile, efficient and scalable manner. Broadcom's Trident 3 ASIC will enable us to build high performance SDN fabric solutions for enterprise, service providers, cloud and SAAS customers with many new capabilities such as deep fabric analytics, efficient leaf-spine flow distribution, service chaining for L4-7 services, network function virtualization and cybersecurity features."

JR Rivers, Co-Founder and Chief Technology Officer, Cumulus Networks:

"Broadcom fundamentally enabled the Open Networking ecosystem and their continuous innovations in switching silicon are advancing the state-of-the-art in terms of cost efficiency, power, performance, and functionality. The FlexXGS architecture brings a broad set of programmability to the popular Trident family, setting new expectations for field adaptable switching equipment. Cumulus Networks is collaborating with Broadcom to realize the industry's most capable and high-quality open networking solutions based on Trident 3 and Cumulus Linux."

Atsushi Ogata, President & CEO, IP Infusion:

"IP Infusion looks forward to adding support for Broadcom's Trident 3 switch series to the OcNOS network operating system, which currently supports multiple generations of StrataXGS silicon. OcNOS will leverage the FlexXGS programmable architecture to enable advanced networking features for service provider and next generation data center applications, and will also take advantage of Trident 3's programmability to support rich features for SDN and NFV."

Kumar Srikantan, President and CEO, Pluribus Networks:

"The architectural approach and tradeoffs made in switch ASICs have a profound impact on the efficiency, agility, resiliency and performance of software-defined cloud fabrics. Pluribus Networks has brought to market disruptive and highly scalable networking software solutions, including our Adaptive Cloud Fabric built on the popular NetVisor OS, by designing to Broadcom switch ASICs that deliver on all dimensions of importance to network operators. With the new Trident 3 family, our SDN and monitoring solutions can take advantage of a highly flexible switch data plane, with excellent system power, cost, buffering, visibility, and resiliency characteristics at multi-terabit performance."

Jason Forrester, Founder and CEO, Snaproute:

"We are excited to be collaborating with Broadcom and to integrate with a wide range of network devices built on Broadcom's StrataXGS Trident 3 family. The programmable, API-driven nature of our FlexSwitch network operating system makes it uniquely suited to delivering network data-plane and control-plane innovation enabled by this new generation of switch chips."

About Broadcom Limited

Broadcom Limited (NASDAQ:AVGO) is a leading designer, developer and global supplier of a broad range of analog and digital semiconductor connectivity solutions. Broadcom Limited's extensive product portfolio serves four primary end markets: wired infrastructure, wireless communications, enterprise storage and industrial & other. Applications for our products in these end markets include: data center networking, home connectivity, broadband access, telecommunications equipment, smartphones and base stations, data center servers and storage, factory automation, power generation and alternative energy systems, and displays. For more information, go to www.broadcom.com.

Broadcom, the pulse logo, Connecting everything, StrataXGS, Tomahawk, and FlexXGS are among the trademarks of Broadcom. The term "Broadcom" refers to Broadcom Limited and/or its subsidiaries.

Press Contact:

David Szabados

Corporate Communications

david.szabados@broadcom.com

Telephone: 1-408-433-7848



Broadcom Limited