



## Introduction

Broadcom® provides semiconductor and software solutions for a wide range of applications. One of the areas where Broadcom has a leading position for many years is in Ethernet Switch technology. The semiconductor and software solutions for Ethernet switching, cover a wide range of applications and finding your way among all the option is not always easy. In this expertise brief some background is given on the different switch solutions and how AimValley can support you on this.

## Ethernet Switch Components

To build a complete Ethernet switch, the following key components are required.

- **Switch silicon**, processes and forwards Ethernet packets between the ports of a switch. This is a very complex function, as the packets need to be processed at wire speed. Well known vendors of switch silicon are Broadcom, Marvell®, Microsemi® and Realtek® and for some applications FPGA-based solutions are possible. Some devices are limited to Ethernet switching (Layer 2/L2), other devices are suitable for IP routing (Layer 3/L3).
- **Ethernet PHYs**, sending and receiving Ethernet frames on the Ethernet cable, handling the physical layer of the transmission. Depending on the type of Ethernet connection, a different PHY is required, for example: the CAT5E cabling which uses 4 pairs of wires requires a different PHY than Single Pair Ethernet (SPE), which uses as the name suggests, a single pair of wires. Some switch silicon has built-in PHYs.
- **Power over Ethernet Power Supply (PoE)**. Some Ethernet switches cannot only process Ethernet packets received on the Ethernet cable but can also power remote equipment using the same cable, for example: a PoE switch can provide power to a remote security camera using the same cable as used for receiving the video stream.
- **Management processor**. Most Ethernet switches can be configured by the user or an operator using a management interface, such as a graphical interface or command line interface. Some switches also need to support specific protocols which are implemented in software as wire speed processing is not needed for these protocols. Hence a processor is needed to support this function. Some switch silicon already include a processor, in most cases ARM based. For other switch silicon an external processor is required.

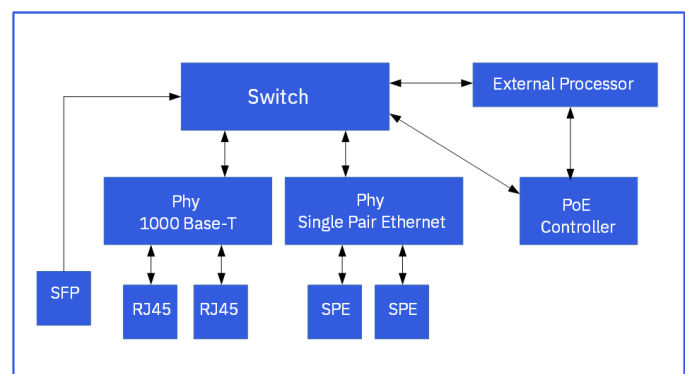


Figure 1: Block Diagram Ethernet Switch

### Broadcom Switch Silicon

Broadcom® has three families of generic Ethernet switch silicon, each focused on a specific application area:

- RoboSwitch™
- StrataXGS™
- StrataDNX®

The **RoboSwitch family** is targeting lower-end switches, supporting mainly Fast Ethernet and Gigabit Ethernet, but some devices support up to 10G inter-face speeds for up-links. Total switching capacity ranges from 2 to 39 Gb/s. Some devices have built-in PHYs and processors to allow a cost effective solution with few external components. Some devices also support a limited set of TSN features.

For relatively simple applications and switches focusing on FE and GbE, the RoboSwitch family is the default choice. When for more advanced applications, such as Time Sensitive Networking, support is required, another family or vendor might be a better choice.

#### Management

Using RoboOS, a software package, for web based management of this family only.

#### Device Names

RoboSwitch, RoboSwitch2, Avenger.

#### Number Format

BCM53nn, BCMnmm.

The **StrataDNX family** is the highest end family, supporting flexibility and programmability and a switching capacity from 120 Gb/s to 14.4 Tb/s and up to 144 external interfaces of 50Gb/s.

Note that these 50Gb/s interfaces are typically combined to create a higher speed optical Ethernet interface, for example: by using a QSFP-DD optical module, 8 of these 50 Gb/s are combined to create a 400Gb/s optical interface.

Access to support and software for this family is restricted by Broadcom as the devices are targeted to a selected set of high end customers.

#### Management

For some devices can be done using Broadcom Open Network Switch APIs (OpenNSA), Broadcom's BroadView™ or OpenFlow Data Plane Abstraction (OF-DPA).

#### Device Names

Qumran and Jericho

#### Number Format

BCM88nnn

The **StrataXGS family** has similar switching capacity as the DNX family, ranging from 160 Gb/s to 25.6 Tb/s but is more focusing on high integration compared to DNX.

This family has a lot of different devices. A lower-end device is the Foxhound for L2 switches with up to 24 interfaces of 1Gb/s, 10Gbs and 25Gbs interfaces.

The Tomahawk devices are the high-end members, supporting up to 256 interfaces of 100 Gb/s and consuming 450 Watt!

#### Management

Usually done using the Broadcom SDK or with Broadcom's FASTPATH®, selected devices are supported by Broadcom's Software Development Kit Logical Table (SDKLT), Broadcom Open Network Switch APIs (OpenNSA), Broadcom's BroadView or OpenFlow Data Plane Abstraction (OF-DPA).

#### Device Names

Tomahawk, Trident, Maverick, Firebolt, Hurricane, Monterey, Metrolite, Saber, Greyhound, Wolfhound, ElkHound, Bloodhound and Quartz.

#### Number Format

BCM53nnn for L2 and L3-lite devices  
BCM56nnn for full L3 devices.

### Broadcom Software

In the previous paragraph several software packages are mentioned which are used to configure and monitor the Broadcom silicon and in some cases add a full software stack with protocols to support Ethernet switching and IP routing.

A number of those packages, i.e. SDKLT, OpenNSA, BroadView and OF-DPA are developed to be used in open source initiatives such as OpenDaylight and OpenStack. Some versions of it are available as open source, but often contain parts which are released as binaries. Several of those packages are not maintained actively.

In reality those packages are mainly interesting for large equipment manufacturers and customers of such equipment and are not generally available.

For smaller customers the Broadcom SDK and RoboOS are the more obvious choice and are available to customers who are accepted by Broadcom and have signed a Software License Agreement (SLA).

Note that Broadcom is only accepting customers which generate sufficient business in such programs, probably to avoid spending too much time on support without enough silicon revenue in return.

Broadcom's FASTPATH is a Linux based software stack which can be used to quickly develop a L2 or L3 system based on Broadcom silicon. It is available for a selected set of Broadcom evaluation boards and needs to be ported to and tested on the actual hardware before it can be shipped to the field.

A dedicated Broadcom team is supporting customers who have purchased FASTPATH. The benefit of FASTPATH is a short time to market with a large feature set. Drawback are the license and maintenance costs and the lock-in to Broadcom silicon.

### AimValley Expertise

AimValley is an expert in Ethernet Switch development and specifically in Broadcom based development using both RoboSwitch and StrataXGS silicon.

A few examples of projects successfully completed are:

- Carrier Class Ethernet switch in 19inch form factor with hot standby switch matrix and pluggable interface units, based on StrataXGS and AimOS software.
- Ethernet switch for defense market based on StrataXGS and FASTPATH software.
- Backplane with active Ethernet switching based on RoboSwitch2 and AimOS Robo.
- Avionics Ethernet Switches
- Ethernet Vehicle Gateway Switch

Unique to AimValley is the in-house developed AimOS, a software stack which can be used to quickly develop a L2 or L3 system based on any vendor's silicon. AimValley has a license agreement with Broadcom for the RoboOS and StrataXGS SDK allowing a quick start of your project without the need to worry about license agreements.

We also have the hardware expertise required to develop custom Ethernet switches ranging from 4 port, 10 Mbit/s Single Pair Ethernet switches to 800 Gb/s FPGA based Ethernet analyzer cards.

We are a reliable partner for Broadcom based development with a proven track record since 2003.

### ***A seamless fit and a compatible match!***

*Customer Feedback – Avionics Switch*



# Broadcom® Switch Technology Expertise Brief

**Delivering Solutions for a Connected World**



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### AimOS Feature List

#### AimOS Benefits

- Source code available with perpetual license.
- Low cost for L2+ applications.
- One time start fee
- No per unit royalty
- Affordable yearly maintenance
- Field proven, also on AimValley's products
- Customization by customer, AimValley or jointly
- No silicon vendor lock-in

Add-in the same team all the support you need

- Hardware Development
- FPGA Development
- Systems Engineering
- Systems Verification Test
- Compliance Testing
- Factory Introduction
- Life-cycle Management

#### AimOS standard edition features

- User Management
- Command Line Interface (CLI)
- Web UI
- Rest API
- L2 FDB Management
- Event Logging
- RSYSLOG
- Port Management
- Static IP Routing (L3)
- DHCP server
- Self Test
- System Inventory
- Port Monitoring: one-to-one and many-to-one
- Port based access control (EAPOL v2)
- Ingress and Egress Rate Limiting
- Remote monitoring (RMON, RFC2819)
- CPU Storm Control
- 802.3ad Link Aggregation
- Rapid Spanning Tree Protocol (RSTP)
- VLAN Management
- Configuration Management

#### AimOS add-on features

These features can be added to a custom version.

- QoS, based upon IEEE 802.1P priority, VLAN-ID, DSCP
- IGMP snooping, v1/v2/Querier/Fast Leave
- MLD RFC3810, RFC2710
- IEEE1588v2 (1/2-step BC and TC)
- SNMP v1/v2/v3
- MRP

#### BCM9556160 demo features

- User Management
- CLI
- L2 FDB Management
- Event Logging
- Port Management
- DHCP server
- 802.1x Port-based Access Control
- Ingress and Egress Rate Limiting
- CPU Storm Control
- VLAN Management
- Configuration Management
- QoS, based on IEEE 801.2P priority, VLAN-ID, DSCP

AimOS, shortens time-to-market for Ethernet switch development

#### Why AimValley?

AimValley is a reliable provider of packet switching technology since 2003, delivering solutions for:

- High speed data processing applications
- Complex FPGA-based accelerated systems
- High speed, low power hardware equipment
- Robust embedded software
- Early adopter of Acceleration Technology

AimValley understands the full complexities as well as the subtle nuances of designing great edge solutions. We excel in building complex systems that are part of your product in the fields of Industry 4.0, Big Data, Healthcare and Transportation markets. Our combined skills represent all the important aspects required for the development of end-to-end systems.

Our customers enjoy the benefits of working with a strong team with over 2000 years engineering experience. AimValley is a trusted partner of Tier 1 customers in Telecom and Industrial markets and has shipped more than 100 000 products. Contact us for a complete development, an architecture study for your next product or for fixing issues in your current products.

#### Quality Focus

- Outstanding track record of on-time delivery
- Best in Class Designs – Time, Budget & Quality
- ISO9001, ISO140001, EcoVadis Platinum CSR