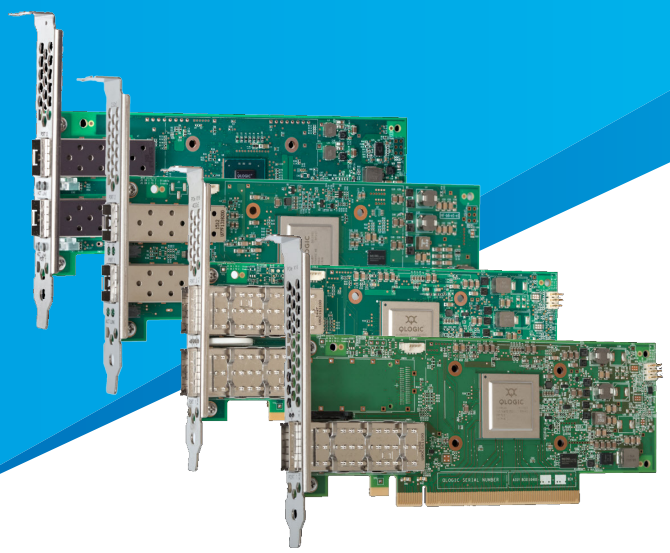
Establishing Adaptive Links with Cavium SmartAN™ Technology



- Simplifies establishing a link to a switch
- Streamlines deployment and management
- Delivers increased interoperability

EXECUTIVE SUMMARY

The number of speeds supported over network connections, and their associated cable types—optics and Direct Attached Copper (DAC) cables—has increased dramatically with the fast proliferation of Ethernet standards in recent years. Instead of having just 1Gb SFP and 10Gb SFP+ connections, now we have 25Gb SFP28 single connections, 40Gb QSFP+ single connections, 50Gb QSFP28 single/dual connections, 100Gb QSFP28 single connections, 4x10Gb QSFP+ fanout connections, and 4x25Gb QSFP28 fanout connections.

In addition, a link may have no Forward Error Correction (FEC) or Firecode (FC) FEC or Reed Solomon (RS) FEC enabled.

This increases the complexity when trying to establish a simple link between an adapter port and its associated switch port, which usually requires cooperation between both server and network administrators.

With Cavium SmartAN™, the administrators don't have to change the switch (port) settings or the server (adapter port) settings since it seeks the best available connection setting, based on the cable and switch configuration.

Cavium SmartAN technology is available on the Cavium FastlinQ® 41000 Series of 10/25GbE and 45000 Series 10GbE/25GbE/40GbE/50GbE/100GbE Adapters.

LINK UP ISSUES

The current in-market mixture of IEEE and/or consortium pre-standard, standards-compliant, and non-standard switches and cables presents a challenging problem when deploying 25GbE and faster link speed capable networks. Add to that auto-negotiation vs. fixed speed, optics vs. DAC, different FEC modes, cable length and quality, and module EEPROM data, and the problem grows exponentially.

The standards do not cover speed auto-negotiation between 10GbE and 25GbE, let alone between these and the multi-laned 40GbE, 50GbE and 100GbE.

This requires users to manually configure the speed on all ports—both the adapter and the switch—exactly the same, to ensure they can attain a link.

FastLinQ SmartAN

The Cavium solution provides a technology that automatically detects the peer switch capabilities, the inserted cable's type, and capabilities and links at the highest possible speed with the best feasible reliability.

This relieves users from fumbling with adapter and switch connection settings to secure a link. Instead, it provides them with a "plug and play" experience.

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HOW FastLinQ SmartAN WORKS

When an administrator first plugs a device (discrete optical module or Active Optical Cable assembly or DAC) into the Cavium FastLinQ adapter SFP/QSFP interface, the Cavium SmartAN technology reads the device type (discrete optics or AOC or DAC), what its speed rating is, special optics data (such as what FEC mode is required or if it is multi-speed capable), DAC CA-x type, and DAC length.

Armed with this information, the FastLinQ adapter attempts each possible mode (supported by that device) until it secures a link with the connected link partner (switch), without input from the end user. (See Table 1 and Table 2.)

As an option, the user can select the desired mode (Auto-Neg vs. Fixed Speed mode and Fixed Speed FEC mode) for special situations, using the server system BIOS Unified Extensible Firmware Interface (UEFI) Human Interface Infrastructure (HII) controls. (See Figure 1.)

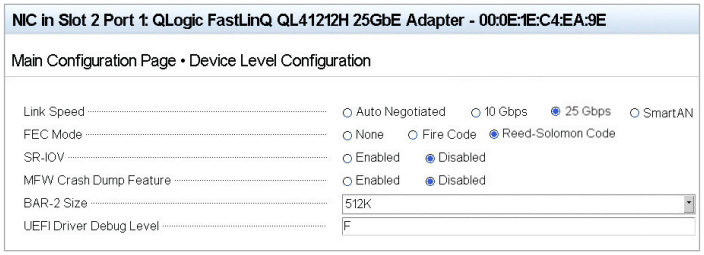

Figure 1. Cavium SmartAN/Auto-Neg/Fixed Speed & Fixed Speed FEC UEFI Controls

COMPETITIVE SOLUTIONS

Few competitive NIC products provide the breadth, functionality, and benefits found in Cavium FastLinQ SmartAN. FastLinQ SmartAN technology automatically selects the optimal FEC mode that would best suit the characteristics of the components connecting the NIC to the switch (cables or optics). If none is available, the link would not be brought up since it could compromise the integrity of the link and lead to uncorrectable errors. Competitive offerings do not have this level of intelligence in their solutions.

Table 1. Linking on QL412xx and QL452xx 25/10G NICs in Cavium SmartAN Mode to SFP+/SFP28 Interface

Switch Mode	Cable	Results Without SmartAN	Results With SmartAN
10GbE Switch	10GbE	✘ No Link*	✓ Link Up @ 10GbE
10GbE Switch	25GbE	✘ No Link*	✓ Link Up @ 10GbE
25GbE Switch	10GbE	✘ No Link*	✓ Link Up @ 10GbE
25GbE Switch	25GbE	✓ Link Up @ 25GbE	✓ Link Up @ 25GbE

* Manual server and switch admin action may be required to bring link up

Table 2. Linking on QL454xx 40G NIC and QL456xx 100G NIC in Cavium SmartAN Mode to QSFP+/QSFP28 Interface

Switch Mode	Cable	Results Without SmartAN	Results With SmartAN
40GbE Switch	40GbE	✘ No Link*	✓ Link Up @ 40GbE
40GbE Switch	100GbE	✘ No Link*	✓ Link Up @ 40GbE
100GbE Switch	40GbE	✘ No Link*	✓ Link Up @ 40GbE
100GbE Switch	100GbE	✓ Link Up @ 100GbE	✓ Link Up @ 100GbE

* Manual server and switch admin action may be required to bring link up

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KEY BENEFITS

Here are some of the ways Cavium FastLinQ SmartAN delivers value to an enterprise and/or MSP data center:

- Reduces setup effort
  - Provides seamless interconnection between 10GbE and 25GbE
  - Links the adapter at the same speed as the attached switch
- Reduces the need to reconfigure switches
  - Reduces the need to reconfigure the external Ethernet switch to match the adapter's settings
  - Works with any switch
  - Offers customers the freedom to use an Ethernet switch of their choice
- Simplifies deployment and management
  - Allows reuse of existing cabling and switches
  - Provides an easier pathway for upgrading from 10G to higher speeds
  - Allows reuse of DACs and optics

SUMMARY

Ethernet is experiencing a proliferation of speeds and cable types. Adding to this the different FEC modes greatly increases the complexity when trying to get a simple link between an adapter port and its associated switch port.

The SmartAN technology available on FastLinQ QL41000 Series 10/25GbE and QL45000 Series 10/25/40/50/100GbE NICs simplifies these connectivity issues with its automatic detection, configuration, and linking capabilities.

ABOUT CAVIUM

Cavium, Inc. (NASDAQ: CAVM), offers a broad portfolio of infrastructure solutions for compute, security, storage, switching, connectivity and baseband processing. Cavium's highly integrated multi-core SoC products deliver software compatible solutions across low to high performance points enabling secure and intelligent functionality in Enterprise, Data Center and Service Provider Equipment. Cavium processors and solutions are supported by an extensive ecosystem of operating systems, tools, application stacks, hardware reference designs and other products. Cavium is headquartered in San Jose, CA with design centers in California, Massachusetts, India, Israel, China and Taiwan.

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