Border Gateway Protocol (BGP-4)

EION Open IP Environment BGP-4 module is a portable software module that implements IP route generation per industry standard(s).

Overview

EION Open IP Environment is a portable real-time software suite that IP-enables new and traditional network elements providing high performance interoperability across multiple platforms and products. Open IP Environment is based on a single, open, modular and scalable framework that allows system integrators and developers to incorporate services such as routing, Quality of Service (QoS), security, IP accounting and policy management into any type of device. Open IP Environment is platform and real-time operating system (RTOS) independent and can work on any type of device ranging from high end optical core switches to personal digital assistants (PDAs).

Framework Overview

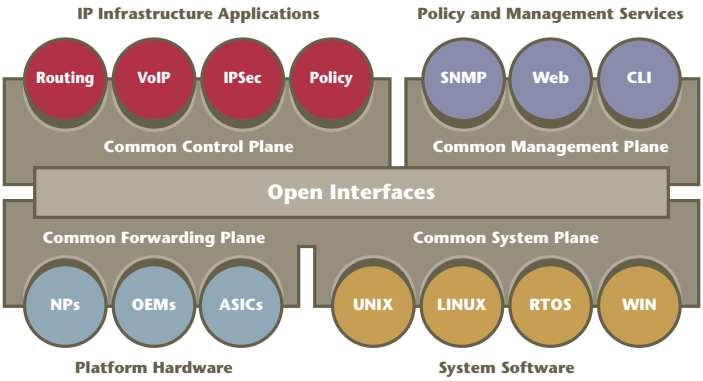
EION Open IP Environment framework consists of four planes: Common Control Plane, Common System Plane, Common Forwarding Plane and Common Management Plane. Each of these planes contains a set of components that are built to use well-defined interfaces.

Open IP Environment BGP-4 module resides within the Common Control Plane to deliver high performance and interoperable routing. The Common Control Plane supports the Open IP Environment Internet Protocol (IP) infrastructure protocols and enables a mix and match approach for adding support for networking protocols and/or services. The control plane holds together the Routing Protocol Applications (RPAs) and delivers network functionality for providing interchangeable access for all IP-based modules such as IPv4, RIP, IS-IS and OSPF.

BGP-4 Overview

All entities (routers or hosts) which participate in routing, store information about all destinations in the system. This information is typically stored in a routing table. Each routing table entry consists of the address of the first corresponding router on the route to the destination.

BGP-4 is an inter-Autonomous System (AS) routing protocol. An autonomous system is a set of routers under a single technical administration that uses an interior gateway protocol and common metrics to route packets within the AS. BGP is an exterior gateway protocol that is used to route packets to other autonomous systems. The primary function of BGP is to exchange network reachability information with other BGP systems. The Open IP Environment BGP-4 software module implements IP route generation in accordance with industry standards.



BGP-4 Enhancements for an Improved Network Performance

EION Open IP Environment BGP-4 module has been enhanced from the previous BGP-4 module release. These enhancements improve network stability and performance.

The first enhancement made is the incorporation of a newly integrated change to support a stateful implementation of BGP-4. This eliminates the need to send unnecessary withdrawals to originating peers and minimizes the risk of Internet routing instability. It maintains state information about what updates have been propagated.

The second enhancement provides a new hash function that has been integrated with Open IP Environment BGP module. This functionality allows all possible routes to be stored in one data structure RIB-IN to enable high performance hash table lookup. The new hash function generates 32 bit keys, resulting in an increased number of hash bins, which reduce the search space for each collision. The increase of hash bin size has decreased execution time for Hash table lookup by 40 percent.

Open IP Environment BGP-4 has been designed to support more than 1 million routes based on this value added enhance- ment to further reduce the execution time and provide high-performance, scalable solutions to your network.

BGP-4 Interactions

EION Open IP Environment BGP-4 module has been specifically designed to deliver time to market advantages through the built-in control-plane interaction with other Open IP Environment modules, such as the TCP/IP stack, RTM, and RPS.

BGP-4 and RTM

The Route Table Manager (RTM) maintains the BGP routes (BGP will register with RTM in order to add/delete/replace stored routes) and is responsible for the process of redistributing BGP routes to other RPAs. The RTM receives information from the Open IP Environment BGP-4 module and sends the "best" routes to the forwarding engine located within the forwarding plane.

BGP-4 and RPS

BGP-4 also interacts with the Open IP Environment Routing Policy Server for policy retrieval and evaluation.

BGP-4 and other RPAs

The BGP-4 module uses the TCP/IP stack provided by the IPv4 module to send and receive protocol data units (PDUs) via message queues from other BGP peers. However, the modularity and portability of the Open IP Environment BGP-4 module permits interaction with third party RPAs through the RTM and well-defined application programming interfaces (APIs).

In addition, the BGP-4 module uses the Open IP Environment's Common System Plane functions such as timers, message queues and thread manager libraries. BGP-4 has also been designed to interact with a third party or Open IP Environment Forwarding Engine by using its APIs to forward protocol data units (PDUs) seamlessly and efficiently across any type of device.

For more details about other Open IP Environment modules and planes, please refer to the relevant product briefs.

BGP-4 Features

EION Open IP Environment BGP-4 module demonstrates the following key features:

- BGP-4 OSPF Interaction
- Route Reflection
- Community Attributes
- Community Attributes in Multi-Home Routing
- Protection of BGP Session via the TCP MD5 Signature Option
- Route Flap Damping
- BSD/Sockets style TCP Interface
- Efficient data organization and lookup
- Poison Reverse Support
- Equal Cost Multiple Path (ECMP) E-BGP
- E-BGP Multihop
- Message Tracing on BGP Connection
- Stateful implementation
- Scalable to 1 million routes
- Ported using a number of compilers to Endian types, CISC and RISC processors and a number of operating systems.

For a complete list of Open IP Environment BGP-4 RFC support, please refer to the last page of this product brief.

BGP-4 Management Support

EION Open IP Environment BGP-4 module implements management via SNMP MIB RFC 1657. All objects are defined in a high-level description file to allow easy integration with Open IP Environment or third party SNMP agents.

In addition, BGP-4 implements management via EION Command Line Interface (CLI). EION CLI is packaged with industry standard commands which can be easily integrated into the customer's specific device. Please refer to the EION Command Line Interface Product Brief for more information.

BGP-4 Module Implementation

EION Open IP Environment BGP-4 module is implemented in the "C" programming language and can be run as a single thread or as multiple threads. This module has been configured to periodically relinquish control, permitting the utilization of the CPU for other activities in the system.

Through the publication of APIs, the Open IP Environment BGP-4 module boasts a design that facilities ease of portability and modularity by providing an architecture that allows you to implement BGP-4 within the Open IP Environment framework, or alternatively to adapt the BGP-4 module to your specific environment.

Ease of Portability

EION Open IP Environment provides a set of interoperable modules that are available for use in both established and "greenfield" products. The customer has the choice to pick and choose Open IP Environment modules to incorporate into the customer's established products, preserving the investment in prior development. The customer also has the option to use modules within the Open IP Environment framework to develop a new software base to address going-forward opportunities. It is also possible to compile the software for a variety of target processors. Therefore, protocol composition can be statically changed by modifying the configuration to suit your needs.

Established products typically have a well-developed architecture and an existing suite of applications, and these products will be looking to Open IP Environment for additional capabilities. The portable and modular Open IP Environment components can be integrated into an existing execution environment to work within an existing code base, with minimal modifications to the customer's environment.

Greenfield products typically require a full suite of applications plus the Open IP Environment framework to provide an appropriate execution environment. The Open IP Environment framework and modules are well-positioned to address such greenfield opportunities.

Benefits

In a market that demands ever-increasing IP support, it is difficult to maintain sufficient in-house expertise in every area. EION Open IP Environment framework and BGP-4 module solve this problem by:

- Allowing OEMs to focus on their real value added solutions, not underlying infrastructure
- Reducing the length of time to market via ease of integration of key components such as BGP-4
- Enabling the freedom to choose among different software and hardware platforms
- Enabling ease of portability to traditional and new network enabled devices
- Enabling accelerated development of highly customized IP-enabled products via well documented APIs
- Enabling a pick and choose approach to Open IP Environment modules via a flexible open framework addressing various devices and applications from PDAs to carrier grade optical switches
- Delivering components of the framework that are scalable, modular, and portable that consistently demonstrate high performance attributes
- Delivering standards-based interfaces and common programming languages such as C, C++ and Java to developers, enhancing overall productivity with a small learning curve.
- Delivering configured and managed modules that use one or several of the following management capabilities:
  - EION Command Line Interface
  - Simple Network Management Protocol (SNMP)
  - Web-based management.

EION Open IP Environment BGP-4 Feature Summary

RFC and Draft Support

- RFC 1657 MIB
- RFC 1745 BGP OSPF Interaction
- RFC 1771 BGP-4
- RFC 1965 Confederations
- RFC 1966 Route Reflection
- RFC 1997 Community Attributes
- RFC 1998 Community Attributes in Multi-Home Routing
- RFC 2385 Protection of BGP Session via the TCP MD5 Signature Option
- RFC 2439 Route Flap Damping
- RFC 2842 Capabilities

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