Forwarding Engine (FE)

EION Open IP Environment Forwarding Engine is a portable software module that receives and forwards Protocol Data Units (PDUs) through network interfaces based on a forwarding table that provides the best route to the packet destination.

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

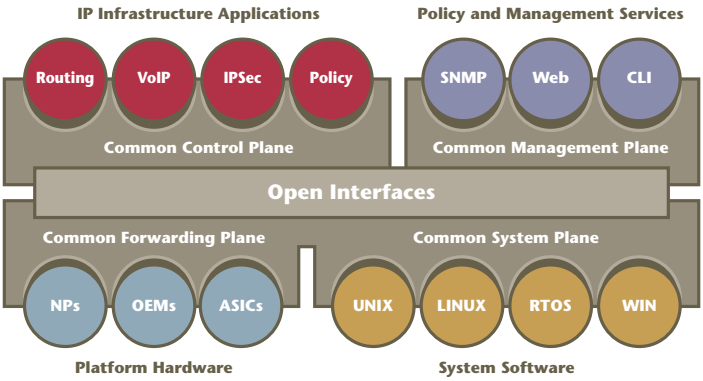
EION Open IP Environment framework consists of four planes: Common Control Plane, Common System Plane, Common Forwarding Plane and Common Management Plane. Each of these planes contains a set of components that are built to use well-defined interfaces.

These planes provide access to Open IP Environment modules and mask platform specific details.

Open IP Environment Forwarding Engine (FE) and Forwarding Plane Interface (FPI) modules together comprise the Open IP Environment Common Forwarding Plane. The FE receives and forwards IPv4 Protocol Data Units (PDUs) through network interfaces. The FPI hides FE implementation-specific details from the Open IP Environment protocol modules and applications.

Forwarding Engine Overview

EION Open IP Environment Forwarding Engine (FE) is a portable and modular software module that receives and forwards Protocol Data Units (PDUs) through network interfaces based on a forwarding table that provides the best route to the packet destination. The Open IP Environment FE supports IPv4 unicast and multicast routing as per RFC 1812, and supports the Virtual Router Redundancy Protocol (VRRP) and Intermediate System to Intermediate System (IS-IS) protocol.



The following Open IP Environment modules are implemented inside the FE: Internet Protocol (IPv4) fast path, Differentiated Services Quality of Service (DiffServ QoS), Network Address Translation/Port Address Translation (NAT/PAT) and Point-to-Point Protocol (PPP).

Open IP Environment Release 2.1 Forwarding Engine was specifically designed to run on a Pentium-200 MHz hardware platform, VxWorks real-time operating system and ZNYX Networks 4-port PCI Ethernet card. It can be used in this format or modified to create a customized forwarding engine. The Open IP Environment Forwarding Engine can be ported to any platform that provides packet capture and output facilities as well as input handlers and output drivers for Ethernet cards.

Forwarding Engine Interactions

The FE interacts with Open IP Environment Common Control Plane and Common Management Plane modules through the Forwarding Plane Interface (FPI). The FPI hides the Open IP Environment Forwarding Engine implementation details from all other Open IP Environment modules.

The FPI consists of a backend Application Programming Interface (API) and a front-end API. The FPI backend API provides a set of C functions that define the interface to the FE. The internal code for the backend API function varies according to the hardware and software platform the FE is implemented on.

The front-end API is an object-oriented API written in C++, which passes control data and PDUs between Open IP Environment modules and the FE via the FPI backend API. The internal code for the front-end API is not affected by changes to the FE implementation. This reduces the effort required to port Open IP Environment to different hardware and software platforms.

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

Forwarding Engine Module Features

EION Open IP Environment Forwarding Engine module is available in three different packages described below. Other product briefs offer more detailed information about VRRP, IS-IS, DiffServ QoS, NAT/PAT and PPP.

1. Basic Software Forwarding Engine provides the following key features:

- IPv4 packet per RFC 1812
- Unicast and multicast PDU routing
- Support for Virtual Router Redundancy Protocol (VRRP)
- Support for Intermediate System to Intermediate System (IS-IS) protocol
- An application programming interface (API) for interaction with other Open IP Environment modules
- Portability to any third-party platform that provides packet capture and output facilities as well as input handlers and output drivers for Ethernet cards
- Forwarding of OSI (IS-IS) packets
- Reusability as a template for creating new forwarding engines

2. Software Forwarding Engine with integrated DiffServ QoS provides the following key features:

- Differentiated Services Quality of Service (DiffServ QoS)
- All features described in the Basic Forwarding Engine

3. Software Forwarding Engine with NAT/PAT and PPP provides the following key features:

- Network Address Translation/Port Address Translation (NAT/PAT)
- Point-to-Point Protocol (PPP)
- IPv4 packet per RFC 1812
- Unicast PDU routing
- An application programming interface (API) for interaction with other Open IP Environment modules
- Portability to any third-party platform that provides packet capture and output facilities as well as input handlers and output drivers for Ethernet cards
- Reusability as a template for creating new forwarding engines

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

Forwarding Engine SNMP Support

EION Open IP Environment Release 2.1 Forwarding Engine QoS configuration and management is done using an embedded web server. IPv4 configuration is achieved by modifying the FE source code. However, all objects are defined in a high-level description file to allow easy integration with Open IP Environment and third party SNMP agents.

Forwarding Engine Implementation

EION Open IP Environment Forwarding Engine is implemented in the "C" programming language and runs as a single thread.

Through the publication of APIs, the Open IP Environment Forwarding Engine module has been designed for ease of portability and modularity. Open IP Environment provides an architecture to allow you to implement Forwarding Engine within the Open IP Environment framework, or alternatively to adapt the Forwarding Engine 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 FE 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 FE
- 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 FE Feature Summary

RFC and Draft Support

- RFC 1631 IP Network Address Translation (NAT/PAT)
- RFC 1661 Point-to-Point Protocol (PPP)
- RFC 1812 Requirements for IP Version 4 Routers
- RFC 2309 Recommendations on Queue Management and Congestion Avoidance in the Internet
- RFC 2338 Forwarding engine parts of the Virtual Router Redundancy Protocol (VRRP)
- RFC 2474 Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
- RFC 2475 Architecture for Differentiated Services
- RFC 2481 Proposal to add Explicit Congestion Notification (ECN) to IP
- RFC 2597 Assured Forwarding PHB Group
- RFC 2598 Expedited Forwarding PHB
- RFC 2697 Single Rate Three Color Marker
- RFC 2698 Two Rate Three Color Marker
- RFC 2859 Time Sliding Window Three Color Marker (TSWTCM)

EION Inc. Locations Worldwide

United States
EION Inc.
CT Corporation System
101 Federal Street
Boston, MA 02110
United States
Ph: 613-715-9067 x224
email: global_sales@eionsoft.com

Asia Pacific
EION Inc.
Room 1405, 14/F
China Merchants Building
No. 303 Des Voeux Road
Central, Sheung Wan
Hong Kong, SAR, China
Ph: +852 9314 3023
email: asia_sales@eionsoft.com

Canada
EION Inc.
945 Wellington Street
Ottawa, Ontario K1Y 2X5
Canada
Ph: 613-715-9067 x224
Fax: 613-722-0039
email: global_sales@eionsoft.com

Europe, Middle East & Africa
EION Inc.
Claridge House
29 Barnes High Street
London SW13 9LW
UK
Ph: +44 (0)20 8741 5377
email: europe_sales@eionsoft.com