



Distance Vector Multicast Routing Protocol (DVMRP)

EION Open IP Environment Distance Vector Multicast Routing Protocol (DVMRP) module is a portable implementation of a distributed Multicast Routing Protocol. The module dynamically generates IP Multicast delivery trees and enables forwarding of multicast packets along these multicast tree branches.

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).

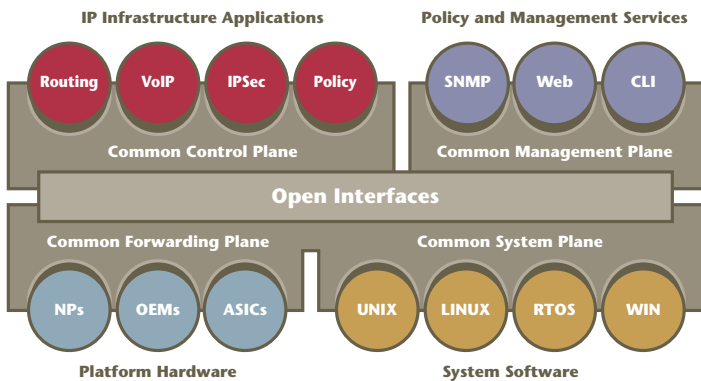
Open IP Environment DVMRP module resides in the Common Control Plane and works in conjunction with Multicast Routing Table Manager (M-RTM) that populates source/group routes with appropriate interfaces. DVMRP's implementation uses the Reverse Path Multicasting (RPM) algorithm to generate an IP Multicast delivery tree where multicast packets are forwarded along these multicast tree branches. DVMRP provides support for dynamic learning of host membership information from Internet Group Management Protocol (IGMP) Version 2.0, which runs as part of the M-RTM thread.

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.

DVMRP Overview

The module uses the Reverse Path Multicasting (RPM) technique to build per-source-group multicast delivery trees for efficient datagram delivery to a group of hosts and members of a multicast group. Datagrams follow multicast delivery trees from a source to all, replicating the packet only at necessary branches in the delivery tree. The trees are calculated and updated dynamically to track the membership of individual groups.



DVMRP can be summarized as a “broadcast and prune” multicast routing protocol. This version of the multicast protocol (version 3) implements the “prune” and “graft” capability. It builds per-source broadcast trees based upon routing exchanges, then dynamically creates per-source-group multicast delivery trees by pruning the source’s truncated broadcast tree. New sections of the tree can also be added dynamically as new members join the multicast group by grafting the new sections onto the delivery trees. Cache entries contain a list of neighbors. These neighbors send prune requests to the interface and the prune request is executed. However, this prune request is executed only when all dependent routers have been pruned first.

DVMRP maintains its own Reverse Path Forwarding (RPF) routing table for each DVMRP reachable source network. Attached to each entry is a list of downstream dependent neighbor routers, which is used for leaf/branch determination.

When a datagram arrives on an interface, the reverse path to the source of the datagram is determined by examining a DVMRP routing table of known source networks. If the datagram arrives on an interface that would be used to transmit datagrams back to the

source, then it is forwarded to the appropriate list of downstream interfaces. Otherwise, it is not on the optimal delivery tree and is discarded. By performing this RPF check, duplicate packets can be filtered when loops exist in the network topology.

DVMRP Interactions

EION Open IP Environment DVMRP provides routing information to the forwarding engine by sending datagrams towards destination networks. It also interacts with M-RTM to update the shared multicast cache table. It will query the IGMP protocol, which resides inside the M-RTM to determine if there are IGMP members on a particular interface. The M-RTM maintains a table of IGMP host members on each interface. When IGMP membership changes on an interface, M-RTM will send a message to the interface owner of the change. The target multicast RPA, DVMRP, will then modify its internal routing tables as needed.

The population of source/group routes is sent to the Open IP Environment Forwarding Engine based on the multicast cache entry, which is searched during multicast forwarding. That forwarding cache contains source, group routes with distribution tree information. DVMRP seamlessly integrates with the Open IP Environment or third party multicast forwarding engine.

Within the Open IP Environment, the DVMRP module can be configured to use the Open IP Environment’s Common System Plane functions such as timers, message queues, memory manager and thread manager libraries. This module also uses the services of the Common Management Plane by developing appropriate management code in order to integrate with management services such as SNMP, EION Command Line Interface and/or web-based management.

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

DVMRP Features

EION Open IP Environment DVMRP module demonstrates the following key features:

- Provides routing information to IP for forwarding multicast datagrams towards destination networks.
- Implements the Reverse Path Multicasting algorithm to calculate the shortest path back to the source that generates the multicast traffic.
- Implements efficient techniques like Pruning and Grafting to reduce unnecessary data traffic.
- Implements the Poison Reverse technique to create an optimal multicast delivery tree along which datagrams are forwarded.
- In multi-access networks if more than two DVMRP Routers are present, an implicit Router election decides the forwarder of the multicast packets on the network.
- Supports Graceful Shutdown by informing the Neighbors, whenever the protocol is disabled.
- Routes advertised are split and sent across the whole Route update interval to avoid flooding.
- Most frequently used routes are cached, resulting in efficient forwarding of Multicast datagrams.
- Provides support for dynamic learning of host membership information from M-RTM embedded IGMP functionality.

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

DVMRP SNMP Support

EION Open IP Environment DVMRP module implements management via SNMP as specified in the DVMRP MIB per draft dated 4-97.

All objects are defined in a high-level description file to allow easy integration with Open IP Environment or third party SNMP agents.

DVMRP Module Implementation

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

Through the publication of application programming interfaces (APIs), the Open IP Environment DVMRP module has been designed for ease of portability and

modularity. Open IP Environment provides an architecture to allow you to implement DVMRP within the Open IP Environment framework, or alternatively to adapt the DVMRP 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 DVMRP 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 DVMRP
- 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 DVMRP Feature Summary

RFC and Draft Support

- RFC 2236 Internet Group Management Protocol version 2 (IGMPv2)
- draft-ietf-idmr-dvmrp-v3-3 (97) "Implementation of DVMRP Version 3 protocol for Interdomain Multicast Routing"
- draft-ietf-idmr-multicast-routmib-05.txt "IPv4 Multicast Routing MIB"
- draft--idmr-dvmrp-mib-04 "Distance Vector Multicast Routing Protocol MIB"

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