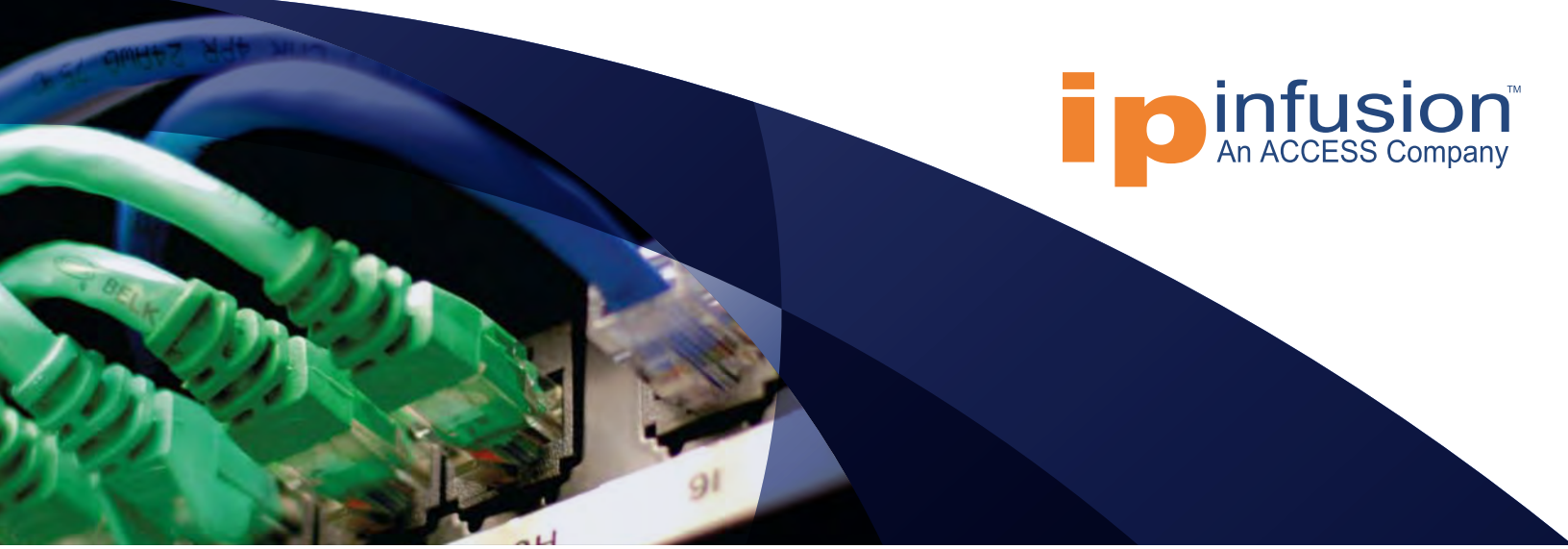

ip infusion™
An ACCESS Company

IP Infusion Brochure

ZebOS® Network Platform

Transporting You to Next Generation Networks

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The Market Opportunity for Equipment Manufacturers

Next-Generation Networks (NGNs) present tremendous market opportunities for manufacturers of a broad range of equipment types, including provider edge, metro access/aggregation, mobile backhaul equipment, data center switches and enterprise switches and routers. But along with these opportunities come substantial challenges:

- Delivering packet-based software on time to address requirements for NGN equipment
- Ensuring full compliance and interworking with a broad range of IPv4, IPv6, MPLS, Metro Ethernet and networking standards
- Addressing increasing scalability and uptime requirements of carrier-grade equipment
- Leveraging software investments across diverse hardware platforms and in the face of rapidly evolving market requirements

IP Infusion Inc., an ACCESS company, provides leading-edge solutions to these challenges. We specialize in helping equipment providers bring IP-based and Ethernet-based NGN equipment to market on time, with assured quality and reduced cost and risk. We have helped more than 170 companies over the past nine years accelerate time to market for advanced networking equipment and have a solid understanding of the issues equipment manufacturers must overcome in order to capture NGN opportunities. We are active participants in the Institute of Electrical and Electronics Engineers (IEEE), Internet Engineering Task Force (IETF) and Metro Ethernet Forum (MEF) standards bodies, as well as in interoperability and conformance testing at Isocore events and the University of New Hampshire, giving us in-depth knowledge of the standards requirements that impact equipment manufacturers.

Besides our comprehensive suite of robust, modular, standards-based software products, our IP Infusion professional services team is available to assist customers in every phase of development to assure the most efficient time to market advantage. IP Infusion works closely with customers in developing customized plans to help deploy NGN products as rapidly as possible

ZebOS by IP Infusion Inc.

ZebOS consists of three main components: the ZebOS Network Platform (ZAP), the ZebOS Advanced Integration Suite (AIS) and a comprehensive library of standards-based protocol modules grouped into application-specific ZebOS Network Platform Profiles. These components provide a complete suite of networking protocol software supporting Layer 2 (L2), Layer 3 (L3), unicast, multicast, Multi-Protocol Label Switching (MPLS) and Metro Ethernet standards. They support both Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6) networks as well as a number of transition technologies which enable seamless transport of IPv6 traffic over existing IPv4 networks. ZebOS is well-positioned not only to support core, edge and access routing and switching platforms in provider and enterprise networks, but also to act as the standard routing and switching platform for an entire range of future IPv6-enabled devices. These include Small Office Home Office (SOHO) gateways, wireless, access and security devices, as well as devices that support Virtual Private Network (VPN) and Voice-over-Internet Protocol (VoIP) technologies requiring high Quality of Service (QOS) and leading-edge bandwidth management.

All ZebOS components benefit from an industry-leading validation and testing program, including hundreds of tests run internally, as well as interoperability testing at industry events and conformance testing at independent laboratories.

ZebOS Network Platform

The ZebOS Network Platform includes the Network Services Module (NSM), which interfaces with the Hardware Abstraction Layer (HAL) and the Platform Abstraction Layer (PAL) to enable communication with the underlying operating system or network processor for forwarding table updates. The ZebOS Network Platform management interface software provides customers with ease of management, configuration and operation, offering a comprehensive set of tools to manage all routing and switching protocols.

The ZebOS Network Platform also offers a High Availability (HA) Solution which provides the control plane redundancy necessary to meet the demanding 99.999% or 99.9999%

ZebOS Feature	Value to Equipment Manufacturer
Industry's most comprehensive suite of IPv4 and IPv6 Layer 2 / Layer 3 MPLS and Metro Ethernet protocols	• Speeds time to market and time to quality for converged network equipment • Proactive investment in key technologies assures future feature agility for customers
Supports full interworking between Ethernet and IP/ MPLS networks	• Facilitates development of equipment which must interface with both Carrier Ethernet and IP/MPLS networks
Fully meets Isocore and University of NH InterOperability Laboratory certified standards	• Ensures flawless interoperability in enterprise- and carrier-grade networks
Pre-integrated with leading merchant silicon and operating systems	• Scales across a broad range of platforms, reducing cost and effort to support an entire product family
Pre-integrated high-availability (HA) middleware	• Addresses 99.999% / 99.9999% uptime requirements of carrier networks
Modular architecture with clean silicon/ OS/ middleware abstractions and minimal interdependency between protocols	• Prevents lock-in to a single silicon, OS or middleware supplier • Assures feature agility to meet evolving requirements
Proven scalability	• Addresses operators' demanding performance and scalability requirements

uptime requirements of carrier networks. Features include stateful switchover operations (SSO) for a variety of HA configurations (1+1, 1:1, m:n, or simplex); SSO using replication for ZebOS Spanning Tree Protocol (STP) and Link Aggregation Control Protocol (LACP); and SSO using replication of Routing Information Base (RIB) to support Non-Stop Routing (NSR). The ZebOS HA Solution comes pre-integrated with the ENEA Element middleware via a versatile Checkpoint Abstraction Layer (CAL). Management functionality is similarly abstracted through a Management Abstraction Layer (MAL). This pre-integrated platform provides industry-leading checkpointing and is primed to provide In-Service Software Upgrades (ISSU). The CAL can also be used to extend the environment to support other commercial or proprietary HA middleware solutions.

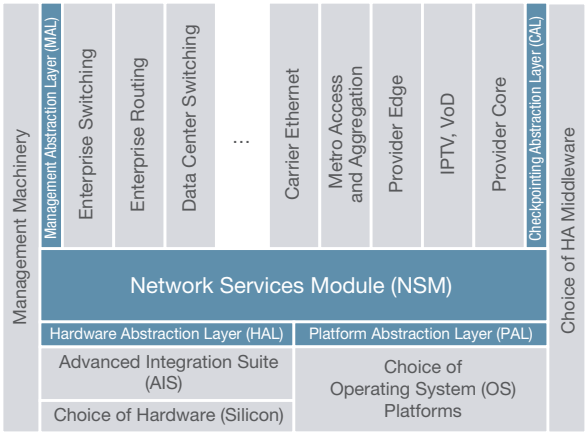
ZebOS Advanced Integration Suite (AIS)

The ZebOS Advanced Integration Suite (AIS) is an array of software modules and Hardware Integration Platforms (HIPs) - each designed and integrated with an industry-leading merchant silicon solution and operating system. The ZebOS AIS provides a comprehensive forwarding plane implementation supporting Layer 2, Layer 3 (both IPv4 and IPv6), multicast and MPLS/Traffic Engineering. When combined with the ZebOS Network Platform Layer 2, Layer 3, multicast and MPLS networking protocol modules for the control plane, the ZebOS AIS provides a full system solution for enterprise switching, Metro Ethernet, core, access, edge, mobile wireless and advanced IP services applications.

The ZebOS AIS HIPs are fully system tested with the ZebOS Network Platform protocol software on leading merchant silicon reference platforms. The well-defined and extensible API between the ZebOS Network Platform (control plane) and the ZebOS AIS (forwarding plane), called the Hardware Abstraction Layer (HAL), accommodates easy addition of custom features and applications and easy integration to virtually any silicon and operating system environment.

ZebOS Network Platform Profiles

The ZebOS Network Platform Profiles leverage the industry's most comprehensive suite of robust, standards-based IPv4 / IPv6, unicast, multicast, MPLS and Metro Ethernet protocol modules to create highly optimized solutions designed to accelerate time to market for specific application segments. Each individual protocol module takes full advantage of the services and clean APIs of the ZebOS Network Platform to eliminate specific hardware, OS and middleware dependencies. Each protocol in a module group is typically implemented as a distinct process to ensure robustness and to eliminate dependencies on other protocol modules.



ZebOS Network Platform Profiles

The following profiles are typical examples; it is possible to construct other variations focused on specific applications.

Enterprise Switching Profile

The Enterprise Switching Profile's focus is providing all the required Layer 2 software support for use within the enterprise. It includes Ethernet Media Access Control (MAC) bridging, STP, Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), Virtual LAN (VLAN) and hardware forwarding APIs, Internet Group Management Protocol (IGMP) Snooping, GARP Multicast Registration Protocol (GMRP), GARP VLAN Registration protocol (GVRP), Port and Protocol VLAN classification (802.1v), 802.1x Port Authentication and Link Aggregation (802.3ad).

This profile is useful in requirements that are well satisfied by Layer 2 only networks.

Enterprise Routing Profile

The Enterprise Routing Profile includes key routing protocols such as Routing Information Protocol (RIP) and Open Shortest Path First version 2 (OSPF) hybrid switching routing that enables synergistic interaction between the L2 and L3 protocols. This synergy helps design powerful enterprise network elements that can behave as L2 switch, L3 router or a combined L2 and L3 hybrid switch router that can take advantage of the fast path forwarding provided by today's advanced networking hardware. Typical routed networks provide a greater level of segregation that might be attractive in enterprise networks.

Carrier Ethernet Profile

The Carrier Ethernet Profile consists of modules from the Layer 2 and Metro Ethernet groups. The Profile focuses on providing Ethernet services - E-LINE, E-LAN and their virtual counterparts - in full compliance with Metro Ethernet Forum (MEF) standards 9, 10.1, 13 and 19. Even though Carrier Ethernet is primarily a Layer 2 definition and service, several alternatives exist for service providers in making the service available to their subscribers. For example, an Original Equipment Manufacturer (OEM) could combine the Layer 2 and the Metro Ethernet module groups to provide a low-cost Carrier Ethernet solution that is relatively simple because it contains only Layer 2 control protocols. Implementations such as VLAN tagging, Provider Bridging and Provider Backbone Bridging only make use of Layer 2 control plane protocols.

ZebOS Network Platform also scales to support a broad range of more sophisticated implementations. Ethernet over MPLS, for example, requires the use of Layer 3 control plane protocols such as Label Distribution Protocol (LDP).

Provider Edge Profile

The Provider Edge (PE) Profile, sometimes also called the network-facing provider edge (N-PE), consists of modules from a number of module groups: Layer 2, Layer 3 (IPv4 and IPv6), Multicast (IPv4), VR (IPv4), Metro Ethernet, MPLS (IPv4), HA Layer 2 and HA Layer 3. The Profile provides IP-layer services such as IP VPNs using virtual routers, IP VPNs using MPLS/BGP, IPv6 islands connected by an IPv4 core network and IPv6 VPNs through an IPv4 core. Provider Edge devices can also be called upon to provide Layer 1 and Layer 2 services that make use of the same Layer 3 control plane protocols as MPLS.

For example, an OEM could combine the Layer 2, Layer 3, IPv6/IPv4 Dual Stacking, Multicast and HA module groups to provide an effective PE solution that is able to serve well in the transition to IPv6.

(Note: A Provider Edge Profile that is focused on a pure IPv4 network is a simpler subset of the above example.)

IPTV/VoD Profile

By combining Multicast, Metro Ethernet, Layer 3 and MPLS module groups, an OEM can create a very effective Internet Protocol Television (IPTV) and/or Video-on-Demand (VoD) solution. IPTV functionality requires a very effective multicast support, whereas VoD requires high quality of service unicast capability. A set-top box targeted to the home is a good candidate for this functionality.

ZEBOS NETWORK PLATFORM MODULES AND MODULE GROUPS

Layer 2: Spanning Tree, Rapid Spanning Tree and Multiple Spanning Tree (STP/RSTP/MSTP) protocols with flow control, Broadcast storm recovery and port mirroring; Virtual LANs; Layer 2 VPNs; IGMP Snooping/Proxy; MLD Snooping/Proxy; Bridging, VLAN, Generic Attribute Registration Protocol (GARP), MRP, GMRP/ Mobile Mesh Routing Protocol (MMRP), GARP VLAN Registration Protocol (GVRP)/GVRP, Link Layer Discovery Protocol (LLDP), Connectivity Fault Management (CFM), Ethernet Operation, Administration and Maintenance (OAM); Per-VLAN Spanning Tree Protocols, Link Aggregation/ LACP and Port Authentication protocols.

Layer 3: OSPFv2/OSPFv3, Border Gateway Protocol – 4 (BGP-4)/BGP-4+, RIP/RIPng, Intermediate System to Intermediate System (IS-IS)/IS-ISv6 and CSPF routing and signaling protocols; Layer 3 VPNs.

Metro Ethernet: Provider Bridging, Provider Backbone Bridging and the Metro Ethernet Forum's User Network Interface (MEF-UNI).

User-facing Provider Edge (u-PE) and Provider Aggregation (PE-Agg): The modules in this group enable MPLS-based Layer 1 and Layer 2 services based on pseudo-wires. Ethernet Virtual private LAN service (VPLS), circuit emulation services, Asynchronous Transfer Mode (ATM) emulation over MPLS are all functions available in this group.

Multicast: IPv4/IPv6 versions of Protocol Independent Multicast - Sparse-Mode (PIM-SM), Protocol Independent Multicast - Dense Mode (PIM-DM), Protocol Independent Multicast - Source Specific Multicast (PIM-SSM), and Distance Vector Multicast Routing Protocol (DVMRP) multicast protocols; IGMPv1/IGMPv2/IGMPv3 and MLDv1/MLDv2 group multicast protocols; IP Multicast Management Information Bases (MIBs).

IPv6/IPv4 Dual Stacking: 6PE, 6VPE, Resource Reservation Protocol - Traffic Engineering (RSVP-TE) in dual stack environment.

High Availability Layer 2: Stateful switchover operations (SSO) for a variety of HA configurations (1+1, 1:1, m:n, or simplex); SSO using replication for ZebOS STP and LACP; and SSO using replication of Routing Information Base (RIB) to support Non-Stop Routing (NSR). In addition to the basic HA module, HA-specific STP and LACP modules are available as options.

Multiprotocol Label Switching: MPLS, RSVP-TE, LDP, BGP-VPN and Constrained Shortest Path First (CSPF); VPLS; DiffServ, and DiffServ-TE; Ethernet Pseudo-Wires.

Virtual Routing Options: Virtual Routing available for BGP-4, BGP-4+ (IPv6), OSPFv2, OSPFv3 (IPv6), RIPv1/v2, RIPng(IPv6), PIM-DM (IPv4/IPv6), PIM-SM (IPv4/IPv6), and PIM-SSM(IPv4/IPv6).

Virtual Router Redundancy Protocol (VRRP): Furnishes a virtual router comprised of two or more VRRP routers on the same subnet to prevent failure by providing at least one Standby virtual router if the Master virtual router fails. VRRP is designed to eliminate the single point of failure most common in a static default routed environment.

Management Interface Module: Integrated Management Interface (IMI), IMI Shell (IMISH), Simple Network Management Protocol (SNMP), Remote Monitor (RMon) and IPv6 Tunneling and Transition Tools.

Network Services Module: The base module that simultaneously and independently communicates with every ZebOS Network Platform routing and switching process and acts as the backbone of the ZebOS Network Platform.

Advanced Distributed Stacking/ Chassis Support

Modular, portable Layer 2/Layer 3, hybrid and adaptive packet handling supports:

- Distributed forward plane for maximum performance and scalability
- Layer 2/Layer 3 packet forwarding, switching and routing across the entire system
- Unified management view of stacked or chassis-based system on ports
- Master/slave instances needed to sustain a distributed forwarding plane
- Interconnection discovery, topology management and dynamic reconfiguration upon change events

Supported Merchant Silicon

- Broadcom Strata XGS model 5665, the model 56601 Ethernet Services Router and the Firebolt and EasyRider models, 56506
- Marvell Prestera-EX and Prestera-DX product lines
- Fujitsu AXEL-X

Supported Operating Systems

- VxWorks® 5.4 with Interpeak IPNET TCP/IP stack as an option
- MontaVista Professional Edition 3.1, 4.0
- Linux® 2.4.x and 2.6.x kernels
- VxWorks 6.3 and 6.4
- WindRiver Linux 1.4

Support and Professional Services

IP Infusion provides a comprehensive program of customer support and professional services. For more information, contact Sales, or visit our Support site at http://www.ipinfusion.com/support/support_home.html or email support@ipinfusion.com

PRODUCT PRICING AND AVAILABILITY

For more detailed information about our products, pricing and availability, contact an IP Infusion Sales Representative in your area.

- In the Western United States, call +1 (408) 794-1566 or email USWestSales@ipinfusion.com
- In the Eastern United States, call +1 (408) 794-1566 or email USEastSales@ipinfusion.com
- In Japan, call +81 (90) 4003-9046 or email JapanSales@ipinfusion.com
- In Korea, call +81 (90) 4003-9046 or email KoreaSales@ipinfusion.com
- In Taiwan, call +81 (90) 4003-9046 or email TaiwanSales@ipinfusion.com
- In India, call +86 (138) 1610-1250 or email IndiaSales@ipinfusion.com
- In China, call +86 (138) 1610-1250 or email ChinaSales@ipinfusion.com
- In EMEA countries, call +33 1 73 02 32 50 or email EmeaSales@ipinfusion.com

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About IP Infusion

IP Infusion delivers advanced software solutions that power communications equipment for packet-based Next Generation Networks (NGN). With a unique modular architecture and the industry's broadest suite of communication protocols, IP Infusion enhances product differentiation and market agility for many of the world's leading network equipment vendors. Incorporated in Delaware in October 1999, IP Infusion is headquartered in Sunnyvale, California, and is a wholly owned and independently-operated subsidiary of ACCESS Systems Americas, Inc., the wholly owned subsidiary of ACCESS CO., LTD., of Tokyo, Japan. For more information about IP Infusion, please visit www.ipinfusion.com.