



## Company Background: IP Infusion Inc.

Intelligent Network Software for Enhanced IP Services

**IP Infusion** is at the forefront of dynamic changes in the way the Internet is designed, supported, used and perceived by its component markets. These IP (Internet Protocol) markets include voice, video, security, mobility, and storage applications that were traditionally based on non-IP, proprietary protocols. In order to successfully deliver and support these applications and services, a number of changes must occur both in the Internet technology itself, as well the process by which devices that support this technology are designed and implemented. In order to deliver communications applications and equipment to market in a timely manner, the use of standard based components rather than custom designed components is critical. This includes the use of off-the-shelf network processing technology and embedded operating systems. Even with these components, traditional IP cannot deliver the traffic engineering and quality of service necessary to provision these new applications.

**IP Infusion** is empowering communications equipment manufacturers, service providers, and telecommunications and enterprise customers to both deliver these new applications by providing a set of routing and switching solutions that integrate with embedded operating systems and network processors, and to deliver the traffic engineering and quality of service features that are required. In addition, a set of management solutions is provided to enable these applications to be easily managed using today's management systems.

The market is ready to accept these new applications, and **IP Infusion** is leading the

way in providing the key infrastructure that will allow these applications to be successfully designed and deployed using the Internet. A number of both large and small companies are using **IP Infusion's** intelligent network software to deliver the enhanced IP services that are needed for the next generation of Internet applications.

### New Communications Applications

A broad range of new communications applications based on the IP protocol are now being developed. These include voice over IP (VoIP), virtual private networking (VPN), storage area networking (SAN), content delivery and management, wireless and mobile networking, security, performance and conformance testers, photonic networking, home networking, and new enterprise network solutions. Many of these new applications will run at the edge or access points of the network. In the past, most edge equipment simply aggregated access networks. With the new applications, the edge will play a more pivotal role and will provide additional revenue opportunities for equipment vendors, service providers, and telecommunications customers.

The question is how can these new applications be embedded into communication equipment without the costly design, development, testing, and deployment cycles that have plagued equipment manufacturers. The answer is that these new communications applications mirror the similar shift that occurred in the computer systems market.

## **Computing and Communications Systems Trends: An Analogy**

In the 1980s and 1990s, computer systems migrated rapidly from a centralized model to a distributed one. One of the first implications of this decentralization was that a greater number of intelligent systems would be needed. The only way that a greater number of systems could be built at lower costs was for standard based components to be used. The market saw the widespread acceptance of the x86 and Pentium CPU. Even today, in terms of market share, this CPU is the undisputed leader of the computer systems industry. In this same way, Windows and Unix/Linux became the standard based operating system of the majority of systems shipped worldwide. As networking and the Internet grew, standard based network protocols such as TCP/IP, NFS, and CIFS became powerful tools for the development of network-based applications. The key to building large numbers of intelligent, low-cost, distributed systems was the use of standard based components.

We see a clear analogy in the communications systems market today. In the recent past, most of the intelligence in communications systems (like the days of the mainframe) was locked in core routing systems. In the past few years though, there has been a rapid migration of intelligence from the core to the edge of the network. We believe that this decentralization of communications equipment will continue to the access points and eventually to the consumer devices themselves. Standard-based communications components and systems will be critical to the successful delivery of this new decentralized model.

Most of the intelligent communications systems of the past were based on custom designed ASICs. There is already a shift in the market from custom designed ASICs to network processing technology. According to Cahners In-Stat, Sept. 2001, the market

for network processors is expected to grow from approximately \$200M in 2001 to nearly \$7B by 2005. Even more impressive are the key players, which are building network processor solutions.

There are also a number of other players as well. Each of the vendors has its advantages and disadvantages. It may well be that in the network processor market no one vendor dominates the market, as in the computer system market. Only time will tell, but it is certainly clear that network processors will be the standard based component for the communications systems industry over at least the next decade.

Similar to the computer systems move to standard based operating systems, we see a similar move in the communications systems industry. Again, as with network processors, there is not one operating systems vendor that dominates this market, but it is clear that VxWorks, Embedded Linux, OSE, QNX, and others are positioned as the standard based communications operating system of the future.

As TCP/IP, NFS, and CIFS dominated the network application market, routing and switching applications are driving the market for intelligent communications systems now and into the future. As communications systems become more decentralized and intelligent, these routing and switching solutions are needed in a greater number of devices. In addition, the new applications need these routing and switching solutions to provide failover, high availability, load balancing, traffic engineering, and quality of service. These solutions include MPLS, OSPF, BGP, IS-IS, RIP, Multicast, and Diffserv and are the key software building blocks for the new communications applications that are coming to market.

### **New Communications Challenges**

The advent of standard based components and software in the computer system market provided only the first step in the

evolutionary process. These components needed to be integrated and managed. In the communications market, this will be more difficult than the computer system market. The reason is that each communication system is composed of not just a CPU and operating system; but a CPU, multiple NPU's (network processors), multiple co-processors, and an operating system. This is a much more difficult integration and management process.

Additionally, communication systems may be single points of failure for multiple access points. This puts the added pressure of supporting high availability features such as multiple CPU's in a single communications "box." In the computer system world, an individual can, in many cases, just add additional hosts to add redundancy. The Internet Protocol does not make it easy to ensure high availability. Further solutions for IP high availability and virtualization must be provided.

Standards in the IP world are changing daily. How does a communications systems vendor stay abreast of the new traffic engineering, switching, bandwidth reservation, and quality of service standards?

Finally, communications systems need to be rigorously tested. This is an expensive and time-consuming operation. And with all of these challenges, there is the extra challenge of delivering a product to market quickly.

**IP Infusion's** ZebOS® Advanced Routing Suite (ARS) provides the total system integration, testing, and management of routing and switching software to enable systems developers, service providers, telecommunications, and enterprise customers to deliver enhanced IP services to market quickly, without the cost normally associated with complex system development.

## **Intelligent, Integrated Network Software**

**IP Infusion's** ZebOS® Advanced Routing Suite is a scalable, robust, and standards-based Layer 2 and Layer 3 carrier-class routing and switching software solution that allows OEMs to rapidly add networking capabilities to their new and existing lines of communication products. Its modular, platform-independent architecture enables OEMs to pick from amongst an impressive array of protocols and solutions to add to their equipment.

The ZebOS family of products provides the only fully integrated IPv4, IPv6, and Multicast routing, MPLS, and Layer 2 switching software on the market, which includes MPLS traffic engineering and Layer 2 and 3 MPLS-VPN solutions. In addition, they provide unique virtual routing and redundancy features that enable the Internet Protocol to be used to deliver critical applications that must maintain high availability. It supports industry standard and best-of-breed operating systems, control, and dataplane processors. Although ARS is a control plane network software solution, it has been architected to take advantage of separate dataplane processors (NPUs and ASICs) to support highly modular and scalable communications equipment.

So that it can be used optimally in enterprise, core, edge, and access equipment, the ZebOS architecture is modular and scalable. Each of the protocols is a module that integrates with our centralized management system, the Network Services Module (NSM). The NSM provides route table management, distribution, and conversion services; interfaces with the protocol modules; and provides high availability, redundancy, and virtualization support. In addition, the NSM supports features like Mobile IP home agent discovery.

**IP Infusion** provides the latest RFC standard support and implements stable

draft standards so that the company is on the leading edge of the protocol support challenge.

With our unique Platform Abstraction Layer (PAL), we can interface to a variety of operating systems, including: VxWorks, Linux, MontaVista, BSD, and others. Also, we can integrate with standard SNMP management agents and support an industry standard CLI.

Perhaps the most distinctive feature in our product set is our NPapi. The NPapi is a set of API's that allow the ZebOS software to integrate with various merchant silicon, network processors, and ASICs.

Most importantly, the ZebOS family of products has been extensively performance and conformance tested both internally and at a variety of external test sites, including the University of New Hampshire Interoperability Lab (UNHIOL) and the 6BONE IPv6 testbed in Japan.

**IP Infusion's** products provide the key software infrastructure, integration, and management for communications systems developers to build the value-added IP services applications of the future. Communications systems developers now have the ability to choose from amongst a range of standard components, such as CPUs, NPUs, co-processors, and operating systems, to design and build their systems. This provides them flexibility, will allow them to control costs and to deliver quality products to market in a timely manner.

## Company

**IP Infusion's** technology had its beginnings in 1995 when the company's co-founder and CTO Kunihiro Ishiguro was working at a large Japanese ISP (a joint venture between Marubeni and British Telecom) that was building Japan's Internet backbone using standard high-speed routers. During this time, Ishiguro decided to develop a platform-independent BGP route reflector that could easily be ported to multiple platforms.

In 1996, Ishiguro joined co-founder and Vice President Yoshinari Yoshikawa at Digital Magic Labs in Japan with the intention of developing platform-independent software for OSPF, BGP, and RIP for both IPv4 and IPv6. After building a large community of users of the software, Ishiguro and Yoshikawa recognized the tremendous potential this technology had for use in the market and decided to create a company. With help from initial investments from Bill Tai and T. Peter Thomas of IVP, as well as Michio Fujimura of IT-Farm, Yoshikawa and Ishiguro founded **IP Infusion** as a US company in 1999, with headquarters in Silicon Valley.

On March 8, 2006 **IP Infusion** became a wholly-owned, independent subsidiary of ACCESS Co., Ltd., a leading Japanese Software company.

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