Mainstream Networking Embraces XML

Why XML Networking is Suddenly So Interesting

A Tarari Whitepaper

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Key Messages

- XML-enabled Networking market is an emerging market which has begun the transition from cutting edge to broad market adoption in the past year.
- The value proposition of XML-enabled Networking is based on the key needs of offloading, security and intelligence.
- Recent movements in the networking landscape show that a critical mass of mainstream networking vendors have begun to embrace XML-enabled networking as critical to core strategic objectives.

The Intelligent Network and XML

The appearance of new concepts and new types of devices have signaled an important shift in the networking industry: the movement to the "Intelligent Network". In the intelligent network, devices perform new processing services that operate at a higher, message-format aware level and offload and provide additional value to the enterprise application environment. These new services are predominately enabled by the use of XML as a message format; XML's open and standardized format allows intelligent handling of messages to an extent that was not possible before. The increasing use of XML in the network, driven by the adoption of Web Services and other developments, is therefore strongly related in the emergence of intelligent networking, increasing the pace of this paradigm and market shift.

"Intelligent network" is a general term that has been used in the networking industry for some number of years. More recently, "Application-oriented Network" (AON) and XML-enabled Network, terms which highlight the intelligent network's relation to application offload and XML, has been used by some vendors.

Market Growth

Venture-funded XML pure-play companies addressed the XML-enabled network in the market inception phase beginning approximately 4 years ago and have brought it from negligible revenue opportunity to the present consolidation phase. Some of the pioneers have been absorbed by larger entities interested by an established market, some have dropped out, and some show signs of longer term independent viability. Cisco announced the maturing of this market with the unveiling of its AON group in June of 2005, declaring that: "The overall advanced application market, which includes integration, messaging, application acceleration, security, Web services and others, could reach US$7 billion in the next four years, according to Gartner research." Part of this market comes from replacement technology for the current generation of network switches, routers,

load balancers, firewalls, and management devices and part comes from the continued growth of the use of the internet for commerce and the internet's unstoppable worldwide expansion. Gartner also estimates that by 2008 40% of all enterprises will have deployed XML-enabled network appliances.[1]

A Quickening Market Pace

Product announcements, partnership announcments and acquisitions have come at quickening pace throughout 2005.

- **Early 2005 – Juniper Networks Inc. announced a marketing partnership with XML Network appliance-maker DataPower Technology, Inc.**
- **Early 2005 – Nortel Networks announced a marketing partnership with XML network appliance-maker DataPower Technology, Inc.**
- **May 2, 2005 – Avaya Inc. announced that its Converged Communications Server uses XML-capable software and Web services**
- **May 11, 2005 – Juniper Networks Inc. announced the acquisition of WAN acceleration company Peribit Networks and Web acceleration company Redline Networks**
- **June 21, 2005 – Cisco Systems Inc. announced the Application-Oriented Network (AON) on its Catalyst 6500 switch and other platforms**
- **August 18, 2005 – Intel Corporation announced the acquisition of XML network appliance-maker Sarvega Inc.**
- **October 18, 2005 – IBM Corporation announced the acquisition of XML network appliance-maker DataPower Technology, Inc.**
- **November 15, 2005 – Citrix Systems, Inc. announced the acquisition of network appliance-maker Teros, Inc., whose application security devices feature basic XML capabilities**

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[1] Source: Talk given by Roy Schulte, Gartner Application Integration & Web Services Summit, December 7, 2005, "Is There an XML Appliance In Your Future SOA and Integration Infrastructure?"

Value Proposition of the XML-enabled Network

XML both burdens the network and enables new kinds of efficiencies and, consequently, the possibility of new services. The XML-enabled Network device therefore brings value by virtue of handling increased traffic load without degradation and in the services it provides which make the enterprise more secure and more efficient. These twin drivers of customer demand are illustrated in Figure 1.

- **Greater volume and complexity of XML traffic places higher demands on the network simply to deliver messages in a timely manner**
- **The potential added value and promise enabled by use of XML-encoded messages is driving expectations for more services.**

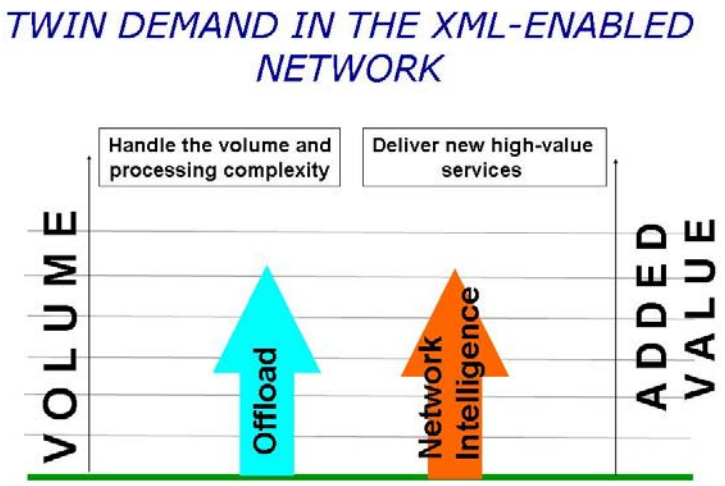


Figure 1 - Twin Demand

The combined dynamic is similar to that seen in the shift from analog to digital telephone infrastructure. Not only did digital infrastructure cope better than analog with rising volume but it also opened up an entire panorama of services beyond simply carrying voice.

To understand the movement by high-profile networking equipment manufacturers towards XML networking, we explore three constituent elements of the value proposition for XML Network Services: Offloading, Intelligence, and Security.

Offloading

Statistics from ZapThink, LLC, summarized in Figure 2 - Growth in XML Traffic, show the pattern of growth of XML traffic as a percentage of LAN traffic. In a few years' time over half of the packets will be moving XML messages and documents.

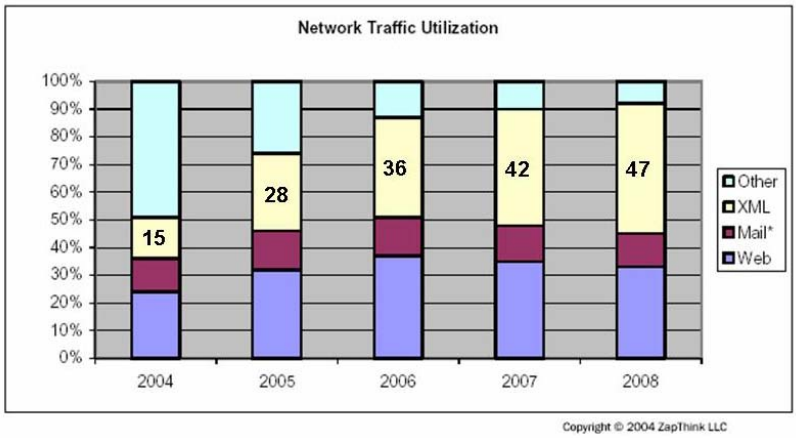


Figure 2 - Growth in XML Traffic

Changes in the XML networking landscape show that big players believe in the continued growth of XML and know that they need a plan for dealing with the added volume and compute-intensiveness of the traffic. *The growing body of XML-based Web Services has become the plan of choice, the transactional infrastructure for the Internet.*

Web Services distinguishes between two different roles of a node in a message exchange: intermediary and end-point. The intermediary is a kind of network-device in that it may be called on to perform standardized processing on the message as requested by SOAP headers. The endpoint receives the payload of the message but, like the intermediary, can also be required to perform standard processing required by the SOAP headers. Thus, XML-conversant network nodes, whether endpoints or intermediaries, can be called on to

perform some or even all of the following steps to consume or transit each message:

- **receive**
- **decrypt**
- **validate**
- **parse**
- **transform**
- **apply processing logic**
- **serialize**
- **canonicalize**
- **sign**
- **encrypt**
- **transmit**

When these operations are performed in the XML-enabled network device they ultimately offload the endpoint which processes the payload. In the Web Services intermediary reliability, security, authentication are message handling services which improve efficiency in the endpoints. At the edge of the LAN or within the LAN as an acceleration node the XML-enabled appliance can be directly tasked with compute-intensive tasks which the application server would otherwise have to perform.

Offloading this increment in workload from application servers to network devices is an important benefit of the application-oriented network. To offload XML processing is to enable the transactional infrastructure.

These operations are performed at the message level – above and beyond processing that continues to be performed at the packet level. (Most models for the XML-enabled network presuppose an overlay architecture. It is possible, however, that some aspects of the message-oriented processing may lead to fundamental changes in the OSI stack. This fascinating discussion is, however, beyond the scope of this paper.) Network equipment has, to date, handled increasing volume through the development of algorithms and specialized hardware designed for the limited requirements of packet processing. These highly specialized network computing devices are simply not capable of handling

XML message level operations with the same efficiency. There is an imperative to develop new device designs which can both handle packets efficiently and perform message-level operations required for XML traffic in the network.

Intelligence

The XML-enabled network device has the ability to offer new services which take advantage of its ability to inspect every message going in to or out of the enterprise network. These services can enable enterprises to make better utilization of computing resources, to do business with greater speed and efficiency, and to make better business decisions. Many of these services can replace complex and expensive business intelligence middleware, providing one of the stronger cost justifications for the XML-enabled network. The XML-enabled network, by putting basic event-driven business intelligence within the means of smaller enterprises and workgroups, will enlarge the size of the market addressed by business intelligence services and increase the overall level of business operational efficiency.

This XML-enabled network device, in graduating from moving packets to understanding XML documents and messages in the packets, from thinking at the network-level to thinking at the application-level, provides a central point from which business-critical questions can be asked. Enabled by agreement on standards within the Web Services framework and standard message formats in XML, the answers are found by applying inspection rules to the content of messages passing through the edge network device. The inspection may be both on inbound and outbound traffic. On inbound traffic the types of messages can be quantitatively measured, content-based load-balancing can be applied, content-based security policies can be enforced, and service level differentiation of messages can be applied. On outbound traffic outgoing activity can again be quantitatively measured, response performance metrics can be taken, and corporate security and communication policies can be enforced. Here is a sampling of the kinds of business-questions an XML-enabled network device can answer:

- **To whose computer / handheld / telephone should this message go? Not go?**
- **When is a response due? To whom should it go?**

- **Is this message safe? Is it malformed?**
- **Should this message be permitted to leave the building? To enter the building?**
- **Did the message arrive at its internal destination? At its external destination?**
- **In what format should this message from the manufacturing system arrive at the accounting system?**
- **To what protocol should this message from a partner company be converted?**
- **Is there an exploitable trend in this week's online orders?**

Security

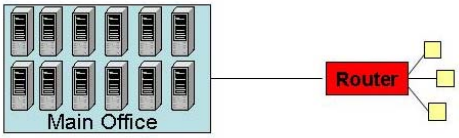
Packet-based content inspection for network security is a obligatory part of today's network infrastructure: firewalls, VPN gateways, and anti-virus, anti-spam, and intrusion detection systems are standard network devices. These operations will remain an essential part of network security irrespective of the kind of traffic the network carries. XML traffic, however, introduces some new insertion vectors for malicious traffic and malware. These application-level threats exploit vulnerabilities of the XML application infrastructure or specific-properties of XML format to carry attacks. For example, XML-specific denial of service attacks, XDoS, may be based on typical XML parsing strategies to cause resource exhaustion or buffer overflow. XML gives new ways to hide code-injection attacks. Given the volume growth of XML traffic, traditional approaches to network security require an update to deal with these new threats.

Web Services specifies XML-specific ways to provide user and service-request authentication and message-level security. This functionality is being added to devices which today manage only SSL connections. Sophisticated and very computational intensive XML Security gateways provide the next generation replacement of such devices.

Functional Differentiation and Deployment of the XML-enabled Network Device

The XML-enabled network device is appearing in the periphery, edge, and core of the network with each deployment model having different functionality and economics. With deployment essentially everywhere in the network the model is one of a universally more intelligent network, although "management intelligence" still radiates out from the core, with more distant nodes exhibiting more limited capabilities in security, data consolidation, and communication.

1. Periphery: Remote Office or B2B Spoke (e.g., router, branch office vpn)



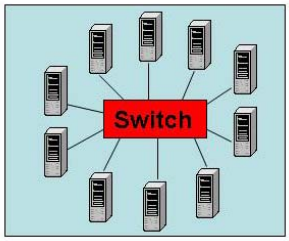
The branch office connected to a central facility is a good use case for this model. The device may enhance security with XML-specific protection and do lightweight intelligent routing to branch nodes. In the area of business intelligence the device may do filtering and consolidation of business event data to reduce traffic and analytic load on the central office BI system. These are low cost devices at workgroup price levels.

2. Enterprise Edge (e.g., enterprise firewall, Web Services intermediary, application load balancer)

Perimeter defense is one common use case for this model. The XML-enabled device may replace higher-end firewalls performing full content packet scanning, active intrusion prevention, anti-DoS, anti-virus, and anti-spam. XML-specific XDoS protection, and XML-based authentication may augment such capabilities. As a Web Services intermediary such as device may facilitate B2B exchanges and perform complex message-level security operations and XML language transformations. The device may classify, route, and gather business

intelligence usage profiles on traffic. Such a device may have a substantial cost-justification in offload of compute-intensive tasks for the enterprise network. It is this category of device that Gartner estimates that 40% of all enterprises will use within the next four years. This is a mid-range priced device.

3. Enterprise Core (e.g., switch)



Deployed in the enterprise datacenter, the XML-enabled device adds application-level intelligence at the closest point to the network interface. The XML device will most likely be a blade within the switch chassis. Putting XML intelligence into the switch provides an ideal point for policy enforcement – all traffic has to pass through the switch. The XML-enabled networking module in the switch may offer rule-based filtering and policy enforcement and business intelligence capabilities in addition to any other XML-network specific capabilities. The incremental cost of adding an XML module to a switch should be moderate on an enterprise scale but, of course, the brunt of the cost is carried in the switch chassis and infrastructure.

The Pioneers: Early Technology Directions

The technologies which are core to XML-enabled networking were pioneered by a number of start-ups with strong XML pedigrees and the foresight to recognize that XML would change the network. It is useful to understand the positioning of these companies as the evolution of XML-enabled networking has been wrapped around the strategic lines they set down. The companies we will analyze are Sarvega, DataPower and Tarari.

The Pioneers: Strategic Axes

In pioneering XML-enabled networking three basic decisions characterized the solutions offered by Sarvega, DataPower and Tarari: use of hardware, degree of portability, granularity of functionality. Viewing these design decisions as discrete axes, we can trace for each vendor a unique strategic vector.

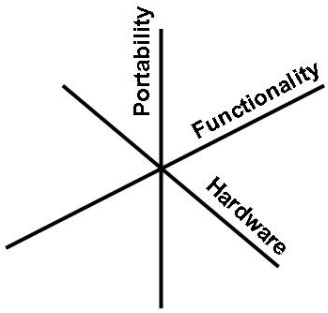


Figure 3 - Design Axes

- **Portability**

Is the XML networking approach bound to a particular computing platform?

- **Functionality**

Functionality is generally about granularity. A very coarse-grained approach would apply an XML policy-driven transformation (XSLT but perhaps also XML Security and other message manipulation), taking XML as input and delivering XML as output. A fine grained approach exposes an in-memory model and API for arbitrary manipulation of XML messages. Another aspect of functionality is coverage of XML and Web Services standards.

- **Hardware**

Has the approach mastered the performance problem of XML through the use of purpose-built XML silicon?

Table 1 - Vendor Comparison summarizes the progress of three particular XML networking vendors – Sarvega, DataPower and Tarari – along each of these design axes.

	Sarvega	**DataPower**	**Tarari**
Portability	High Software only and appliance offerings	Low Acceleration locked in box	Medium - High PCI card is portable among systems and software-only engines
Functionality	XML Security, XSLT Event model API not exposed but could support low-level integration	XSLT, XML Security XML-to-XML, XSLT-centric suggests high-level integration	XML Routing, Schema Val, XSLT In-memory model allows low-level integration
Hardware	Not at all	Appliance-level	Chip and PCI-X cards

Table 1 - Vendor Comparison

1. **Sarvega**

   Sarvega, after a brief effort at a hardware-centric approach, opted for the most portable approach to XML-enabled networking, emphasizing a pure software product with highly optimized algorithms. Sarvega emphasizes complex XML Security and XSLT transformation; there are also claims of supporting XML content-based routing but little market validation in this area. Sarvega has emphasized its low-level XML processing model but actually has not exposed that model to end users as an API.

2. **DataPower**

   DataPower has consistently maintained that acceptable XML performance can only be obtained with hardware acceleration. Although the actual contents of the DataPower box is a tightly guarded secret, it is clear that optimizations take place at the server level and that the DataPower solution is not portable. Like Sarvega, DataPower approached functionality from the top down, offering XSLT acceleration

and XML Security with a very XSLT-centric approach to everything it does.

3. **Tarari**

   Tarari approached XML-enabled networking from the component-level, offering both software and silicon chips which initially accelerated low-level XML processing, exposed through an API and an in-memory XML data model. Use of a standard PCI-X bus interface does make the Tarari installable in almost any server and for those servers without a PCI slot Tarari's software engines can be installed. Tarari initially emphasized the strength of its XML processing model for a very XML-networking-centric task, XML content-based routing but has since gone up the functionality stack with Schema Validation, XSLT, and XML Security.

Major Companies Position Themselves in the XML Market

With a quickening space, major companies have launched products and made acquisitions which give insight into their strategic imperatives and the role that XML in the network will play in their core businesses. Cisco announced a family of XML-enabled networking developed by its new AON division and two XML networking pioneers were acquired: Sarvega by Intel and DataPower by IBM.

Cisco Unveils AON (June 2005)

Cisco took the lead among network device manufacturers by aggressively launching itself into XML-enabled intelligent networking with the unveiling of its AON (Application-Oriented Networking) Business Unit and the announcement of a family of new products. The initial presentation of AON was made by Cisco CEO John Chambers himself, followed by a bevy of partner announcements, workshops, and white papers during Cisco Networkers in Las Vegas. Chambers demonstrated how intelligent networking would enables new classes of applications, devices and services, ultimately having a profound effect of how people communicate, work, and deal with everyday tasks. AON ecosystem partnerships were announced with the likes of IBM WebSphere, SAP, and Tibco.

Cisco's AON is a new class of network-embedded products. In the enterprise core or data center, AON is a module in the Catalyst 6500 Multi-Service Switch; in branch offices, it is in the 2600, 2800, 3700 and 3800 Routers and will be integrated into other products.

One of the key capabilities of the AON device is the ability to do application-aware XML content-based routing. The AON device also performs more standard XML appliance operations such as authentication, XML security, Schema Validation, and message transformation with XSLT. Cisco further differentiated itself from less network-centric appliance offerings and Web Services middleware by emphasizing their use of XML and cryptographic chip-level hardware acceleration. Use of hardware acceleration in the first generation product, while atypical for XML appliance vendors was natural for a company with long experience in building line-rate networking devices using task-specific chips.

Intel Buys Sarvega (August 2005)

Intel, without a lot of fanfare and without disclosing a whole lot about its ultimate intentions, acquired a company apparently having little to do with the design of general purpose processors, XML networking pure-play Sarvega. While the move is certainly a significant statement about the importance of XML traffic running on Intel processors, we can only speculate about the specific strategic objectives of Intel.

We surmise that it must have been of particular importance to Intel that Sarvega was a portable solution highly optimized to run on general purpose processors such as Intel's. There is no question that Intel considers XML an important part of the workload running on its processors. Just as Sun's Jon Bosak once said that the purpose of XML was to give Java something to do, XML gives Intel processors something to do and that something has been increasingly an object of concern to Intel customers. It is also evident that Intel is aware of the bottleneck in XML processing, a bottleneck which will become more acute as XML traffic volume increases.

The interesting question is whether Intel bought Sarvega in order just to get smarter about XML to build better chips or if Intel's primary interest is actually in Sarvega software. The former could make sense; certainly we have seen solutions to application-specific problems such as floating point and multi-media acceleration making their way into general processors and the same might be true for XML. On the other hand, in the case of XML it is very hard to separate the acceleration strategy from the software stack which exposes XML operations to its user. The software must be tailored to take advantage of the acceleration features of the underlying processor. Perhaps Intel really does plan to get into the software business, optimizing the Sarvega stack to take maximum advantage of what the processors do now and might do in the future.

This seems like a difficult path but the potential reward is attractive – lock-in to the Intel processor for anyone that wants the single ubiquitous data format to be processed efficiently.

An aggressive move by Intel into the XML space would most likely be extremely beneficial for Cisco's AON initiative. While more efficient processing of XML in

the enterprise might lessen the need for offload Cisco main thrust is on adding intelligent, network-centric services. It is possible that processing the XML payload on the application server may turn out to be a greater bottleneck which could slow the adoption curve of XML and Web Services in the enterprise and decrease demand for XML network devices. But if XML runs efficiently on the app server it is guaranteed that there will be a huge volume of XML in the network.

IBM Buys DataPower (October 2005)

IBM has one of the largest, if not the largest, XML research team on the planet. In DataPower's sweet spot around XSLT they have top talent. So what does DataPower have that IBM needs?

There are, of course, many opinions in a large company like IBM with a lot of talented people. But at least some at IBM have concluded that software optimization alone will not yield adequate improvement in performance to sustain a full scale conversion of the transactional infrastructure to XML Web Services. DataPower's offload strategy for XSLT processing is one approach that can make an IBM Web Services infrastructure viable over this scaling up of Web Services. And if this is a necessary component for Web Services deployment, the market for XML appliances is about to go from "boutique" to very large – a positive feedback loop where IBM, offering both the offload device and environment being offloaded, has a complete solution where sales of one continually amplifies the other.

The purchase may also be seen as a reaction to Cisco AON. While there is, as with the Intel XML activities, a certain synergistic relationship between growth of the Web Services infrastructure and XML network web services, IBM will not be ready to cede much to Cisco. In the same sense that AJAX and Google are seen as long term threats to Microsoft as less and less of what matters happens at the OS level, Cisco foray into the application environment is seen by some to trivialize the services provided by IBM middleware.

XML in the Core Business Strategy of Cisco, Intel, and IBM

The growth of an XML in the network is a key strategic driver for the core businesses of Cisco, Intel and IBM.

- Cisco's plans to upgrade customers to the next generation of networking devices with valuable XML-based networking services
- Intel's plans to lock customers into their processor family with superior XML performance
- IBM's plans to grow their server market with XML appliances and allow applications on the application server to overcome performance problems so that they can keep that business happy as well

Conclusion – The XML-enabled Network Has Arrived

Cisco's AON move into intelligent networking means that key networking equipment vendors will follow in their tracks. A new intelligent networking infrastructure will become ubiquitous, and the line between the application and the network will be redrawn. While specific elements of the Cisco initiative may succeed or fail we don't see any possibility of the market not going down this path. We've argued that all major vendors have an interest in seeing the XML-enabled network succeed, though each has competitive interests to balance and seeks a larger piece of the pie for themselves. And we have only but mentioned one other area with strong interests in the XML-enabled network – VoIP – arguably the single most important new source of internet-based applications. The decision was made, actually, when the landslide to adoption of XML began – XML doesn't just give Java something to do, it gives everyone something to do, including the network. Business problems that could not be solved, business processes that could not be rendered more efficient, are solved and rendered more efficient by having XML-enabled devices in the network. It is what it is there for.

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