Organizations today are seeking ways to improve business processes, agility, security, and productivity. To help achieve these goals, Cisco offers a technology vision as well as segment-specific architectures for building an infrastructure that will meet these needs today and tomorrow.

This vision is the Intelligent Information Network (IIN), a strategy that addresses the evolving role of the network within your business and directly addresses your desire to align IT resources with business priorities. The resulting network delivers active participation, process optimization, service delivery, and application responsiveness, which results in better IT awareness.

An intelligent network builds on an existing infrastructure foundation and turns the traditional IT “cost center” into a strategic tool that helps enable sophisticated IT functionality such as virtualization, telepresence, application integration, and optimization that streamlines IT processes. Regardless of the size and type of your business, Cisco provides architecture roadmaps to help you build a more resilient, adaptive, and intelligent network.

Cisco's approach is to eliminate the "gaps" between the different components and infrastructure layers to reduce complexity and system integration costs. The result is an intelligent network that is:

- **Integrated:** Infrastructure modules that work together without the need for expensive, extensive modifications and customization.
- **Adaptive:** Can better manage key operations, based on policies such as self-configuration, self-provisioning, self-defending, and self-healing processes.
- **Resilient:** Your network—and your business—stays up despite outages, malicious attacks, and failures. The power of this approach is that security, wireless/mobility, IP Communications, new application-oriented solutions, and more become business facilitators that extend the value of your investments.

Intelligent Information Networking is Cisco’s vision for the future of networking. It is a compelling vision, but all too often it is difficult to communicate to customers because it is presented as a vision, without any connection to real-world examples or experience.

Cisco IT, one of the more advanced enterprise IT organizations in the world, has already experienced most of the benefits of the Intelligent Information Network, and has enormous amounts of real-world experience with both the benefits, as well as the difficulties and lessons learned from deploying IIN in a real-world enterprise environment. Much of this experience is already documented in case studies, PowerPoint presentations and VoDs.
SLIDE 2 – CISCO’S 3-5 YEAR TECHNOLOGY VISION

Integrated Transport – The Intelligent Movement of Data / Voice / Video across a System of Networks

Everything migrates into a single consolidated IP network – wired and wireless connections, voice and video and data connections, and storage and content networking. Consolidating all services onto a single network not only saves infrastructure cabling, equipment, and management costs, but more importantly for IIN it makes shared virtual services, and instantaneous command and control of services possible.

Integrated Services – Virtualized Networking Resources

Use intelligent networking equipment to create virtual pooled resources within the network. Specialized tools can provide virtual local network attached storage from the data center, and can accelerate file and web traffic to maximize the transport capability of the WAN to support these virtual storage services without increasing WAN costs. Storage switches support Storage Area networks capable of carving out virtual data center storage SANs from a single shared storage resource pool, and server switches can support stacks of inexpensive servers in a grid computing environment, carving out virtual processors and OS resources from a single shared processing resource pool.

Integrated Applications – Application-Aware Network and Services

Install intelligent, application-aware network components that can:

● Deliver centralized communications services (instead of delivering them from within each application) for fast creation, change and control of new applications services, and can also

● Sense the needs of applications for changes in resources, and can control the immediate delivery and de-allocation of these resources to applications and users.

This requires the previous two steps:

● Convergence of networks, and networked applications onto a single IP network, and

● Shared pooled network, storage, and processing resources to allocate to applications and users and de-allocate back to their shared pools as necessary.

● This provides a world of new, flexible business solutions that can be created and controlled with maximum availability of resources while minimizing physical resource cost.

SLIDE 3 – PHASE 1: INTEGRATED SYSTEMS

The IIN picture sounds impressive, but how real is it and what has been done in Cisco to achieve the IIN goal?

Well, the first message is that IIN is real, and that Cisco IT has already been realizing the IIN vision for the last 5 years. IIN is a path, a guide to help IT organizations build a highly resilient and flexible and adaptive infrastructure. This flexibility allows IT to align its resources to support new and changing business priorities.

Inside Cisco, our Data Center strategy has three phases: consolidation or convergence, virtualization, and automation, and we are well down the road on the first two. The third phase of IIN expands beyond the Data Center, requiring collaboration between the networking, the Data Center, and the application development teams.

So Phase 1 of IIN is all about network convergence, right?

Yes, the first step in IIN is convergence, that is, bringing all resources into one fabric. These new flexible services bring together all earlier, disjointed services into a single network environment, bringing people together with each other, and with their application support tools in new ways and new places. People share information using computer screens, voice and video, whenever and wherever convenient.
However, the first step in IIN is actually bigger than just network convergence. Inside Cisco IT, convergence means simplifying the infrastructure along two paths, convergence of transport and convergence of technology. From experience, we know that complex infrastructures cost more to maintain and are more difficult to change to support the business needs. Simplifying infrastructures can reduce total cost of ownership, allowing IT investment to focus on enabling business innovation.

At Cisco, we have converged our data, voice, wireless, video and remote access network into a single IP network. We’ve been running this converged network, with occasional upgrades, for over 4 years. In that time, new tools have been developed that allow us to turn our laptops into secure portable offices that support telephony systems, voice and video messaging. Applications are starting to deliver new ways to communicate and collaborate with each other. Wireless and remote access services allows us to reach out to people and information systems from anywhere in the world. At the same time, our Data Center teams have been focusing on converging other technologies too. We have standardized server technology, operating systems, storage systems, and web and application environments. This standardization, or convergence, allows us to operate a highly available infrastructure, with improved cost of ownership.

Combining these two types of convergence is a great way to tie the IIN message with the broader Data Center strategy and make IIN real for our customers. It certainly is real for us.

SLIDE 4 – PHASE 1: INTEGRATED SYSTEMS, CONVERGENCE OF TECHNOLOGY

- Single stack reduces complexity, making it cheaper to operate, easier to change, easier to build applications and respond to the business needs.
- Lays foundation for virtualization. Can’t virtualize across heterogeneous technologies with any kind of effectiveness.

Convergence Paths:

- **Storage/Database**: We’ve been a pretty hard-core Oracle shop from way back, but it’s a constant struggle to keep application groups from introducing other technologies by way of “packaged applications” that can only run with a specific DB. It takes discipline to drive them to convert apps that use MS SQL Server or IBM DB2 to Oracle…but we do. And this allows our DBA department to specialize in operations and performance mgmt on Oracle DBs.
- **Servers**: we used to use Compaq, HP and Sun, with some random x86 servers thrown in. We have since consolidated into a standard set of server configurations, a mix of run, with blade servers being explored.
- **OS**: we used a few flavours of UNIX, primarily Sun Solaris and HP-UX, with versions of Linux and BSD UNIX thrown in for good measure…we have since standardized on [??LINUX version??]. On the MS side, we support [WHICH ONE], and require rigorous patching processes to be put in place for all managed servers.
- **In the web server space**, we’ve been pretty consistent, but IIS and Netscape have both had footprints of various size. We have since reduced this down to all web servers being Apache, which supports our choice of App server.
- **App Servers** have been the hardest to consolidate, as many third party software offerings come “only supporting app server X”. Examples are BEA WebLogic, IBM Websphere, MS BizTalk, etc. In the end, we have 3 primary application platforms for building Web Apps (which 95% of new apps are), each of them centrally deployed and managed:
  - PERL CGI: this support tens of thousands of legacy scripts. One of the most important apps in infrastructure (EMAN) still has a huge amount of Perl scripts.
  - Java: we run an Apache/Tomcat app server for lightweight applications, selected early on for it’s adherence to open standards. We are migrating this to IBM WebSphere in response to the overwhelming need by 3rd party apps to support one of the “big 3” app servers.
  - Oracle: for oracle-applications (our standard ERP systems) we use the oracle application server, due to its integration with the DB and App space.
Note: each of these three systems have a clear decision tree for which one a developer needs. And extreme pressure is kept on this space to insure that applications can be run in a service-oriented manner.

SLIDE 5 – PHASE 1: INTEGRATED SYSTEMS, CONVERGENCE OF TRANSPORT

Full Time line
1999:  Cisco IT began merging Wireless with wired IP LAN access.
   • Increased productivity, employees more mobile.
2000:  Cisco IT began converging Voice and Data Networks to a single IP voice / data network.
   • Reduced management, new site deployment costs, new services.
2000:  Remote Access VPNs brings employees and work together anywhere in the world.
   • More increased productivity, more mobility.
2003:  Storage Area Networking converges high speed storage over Data Center network (Fiber Channel over IP, iSCSI).
2005-2006:  ECT VPN deployed for home VPN access with converged routing, switching, IPC, wireless, VPN, security, NAC.
2006 - 2007:  Still to come:  Server networks (Infiniband), Building Systems like lighting, safety, and HVAC (current on their own network), are networks that will ultimately become part of the converged network.

Integrated Transport Examples from Cisco IT

   • Wireless and Wired access are consolidated using Access Points, wireless routers and wireless management tools, for greater user mobility (case studies at http://www.cisco.com/web/about/ciscoitatwork/case_studies/wireless.html).
   • Voice and Data networks are consolidated using CallManager, IP Phones, and dozens of other IP voice products, for cost savings and for new mixed voice-and-data applications (e.g. IPCC, Extension Mobility, Unity Voicemail, IP Communicator, Video Telephony Advantage, MeetingPlace 5.3 (and above), and IP voice applications) (see the IP Telephony case studies at http://www.cisco.com/web/about/ciscoitatwork/case_studies/ipcommunications.html).
   • Remote access networks and internal networks are consolidated using VPN software and VPN-enabled IOS routers.
   • Everything consolidates onto an IP network, which often must be physically re-designed from current client-server architectures to a new architecture that optimize peer-to-peer, any to any connectivity (Case study on US Architecture in planning; Case study on Europe MPLS VPN network at http://www.cisco.com/web/about/ciscoitatwork/case_studies/routing_dl8.html).
   • Storage and Data networks are consolidated, using MDS storage switches with FCIP and iSCSI connections, to reduce management costs and to support improved utilization of storage resources by consolidating them into larger SAN pools (case studies at http://www.cisco.com/web/about/ciscoitatwork/case_studies/storage_networking.html).
   • ISR routers (3700, 3800) consolidate multiple services (routing, switching, voice, wireless, security and VPN) into a single box to support faster and more flexible service deployment, and reduced capital and management costs.
   • Still to come:  Server networks (Infiniband), Building Systems like lighting, safety, and HVAC (current on their own network), are networks that will ultimately become part of the converged network.
SLIDE 6 – PHASE 1: RESULTS TO DATE

We’ve gone a long way down this track, and have results from both converging transport, and converging the other technology in the data center.

- Simplified infrastructure: Through many consolidations, we reduced the number of technologies supported in our data center across many parts of the stack. Having fewer technologies, such as a single DB technology and a single application server technology reduces the number of combinations of technologies that developers have to learn, QA has to test, and infrastructure has to support/manage. It also increases our buying power by consolidating purchasing, which increases volume discounts and increases our profile with the vendors for support and feature requests.
- By creating a simpler infrastructure, you can introduce changes more easily, as QA is shorter and changes are less likely to interact with many different solutions in unknown ways. This ability to introduce system changes quicker and cheaper improves IT’s ability to implement business change, which improves business flexibility.
- Also, reducing the complexity makes it easier to create highly available data centers, reducing downtime and costs associated with high-availability. Getting to our design goal of Active-Active (no “backup data center” but two shared/redundant ones) is much easier with fewer technologies to support.
- We don’t have any really hard-and-fast overall numbers on this reduction of complexity issue, but consider this one example. Prior to a convergence/standardization exercise, Cisco IT was had more than 50 independent “Portal” projects leveraging multiple portal technologies. Each project was also building their own frameworks as well, using at least 2 developers for at least 2 months as well as other costs for development. Post convergence, we were able to reduce the amount per portal project by 40% (~170k each) [source: portal services framework team, 2003]. It also reduced the length of projects by up to two months, so IT was more responsive to the business. This story is one example of convergence in the technology space, and can be repeated with each convergence.
- And finally, there is the strategic imperative…getting the data center “service ready”. Our overall goal is to dynamically allocate physical resources to applications as needed; this is incredibly complicated with heterogeneous technology. In fact, in the storage space, where virtualization is most mature, cross vendor virtualization came years after single vendor offerings (coming on the market in late 2005). The fact is, consolidation in the data center is the first step that virtually every DC manager will be striving for as they move towards Service Orientation.

SLIDE 7 – PHASE 2: INTEGRATED SERVICES

How real is virtualization, and what is Cisco really doing with it?

The second step of IIN is virtualization: virtualization of file location, storage resource location, and server resource location. The end goal is applications and content that can be added into a Data Center, or distributed across an entire network, without having to add new storage or server resources to handle them. A virtualized Data Center or network will respond to each new load by allocating them automatically across physical resources in the Data Center or network -- these resources are used only when needed and then are returned to a virtual resource pool for re-use.

Cisco IT has already been using virtualized services for years, in the form of Content Networking and Content Switching. Our content networking solution brought the speed of the Data Center to branch offices; and used Content Switching Modules or CSMs in the Data Center to create large virtual servers out of several smaller servers for our external network (Cisco.com), and for our internal network (Cisco Employee Connection). We have been creating larger shared pools of storage by connecting our smaller Storage Area Networks into data-center-spanning SANs, and even trans-continental SANs.

This work with virtual storage has led Cisco IT to test some new Cisco tools in the lab. These tools let us build high-speed server and storage networks in the Data Center. By building these networks around large pools of servers and storage, we have been building virtual server pools, and virtual storage pools that can allocate resources to new applications within minutes. When we need to add new
functionality, Data Center administrators can push this to the Data Center easily -- it can immediately and automatically respond to provision new processing. Virtualization means a Data Center that you don’t need to touch anymore, for example, Cisco will no longer need many administrators to rack new equipment, test new equipment, perform reboots or backups and resets. We won’t have to wait for new servers and storage to be racked and configured to have applications up and running; it can be done practically instantaneously as all resources are simple to set-up, change or remove. Virtualization allows the Data Center to be managed without physical presence and without having to allocate new resources to new applications.

In addition, we’re working with tools that vastly accelerate files and applications across a wide area network, making it easier to place content wherever it’s most convenient and least expensive.

**SLIDE 8 – PHASE 2: VIRTUALIZATION**

**TIMELINE**

- **2004**: Cisco IT installs Content Engines (ACNS) to create virtual data center storage and print services at remote sites.
- **2004**: Cisco IT installs CSM to create virtual Cisco.com and virtual CEC servers from multiple individual servers.
- **2005**: Cisco IT began consolidating Storage silos into shared Storage pools, and carving out virtual storage resources using VSANs.
  - Higher storage utilization, easier management.
- **2006**: Deployment of SFS Infiniband switches (Toppin) with VFrame software tools supports grid computing.
- **2007**: Storage (SAN and NAS) and Servers (grid computing) are now pooled virtual services made available to applications as needed.
  - Optimized utilization, lower costs, faster deployment, easier management.

**Integrated Services Examples from Cisco IT**

- Storage, servers, Network Attached Storage (NAS), web traffic and content, and eventually processing resources will all be part of virtualized pools of shared storage, network, and processing resources which can be optimally allocated among applications across the network. All this is done with reduced impact on network bandwidth requirements (and thus reduced need for costly WAN upgrades).
- Cisco IT began by providing a virtual data center storage service at each remote site, accelerating WAN transport of information, using content engines and ACNS software products (http://www.cisco.com/web/about/ciscoitatwork/case_studies/content_networking.html).
- Cisco IT created virtual web servers based on multiple physical services by intelligently load-balancing traffic with the Content Switching Module (case study in progress).
- Cisco IT has already transitioned to a SAN environment, and within each business function storage resources are shared within a separate SAN for greater utilization and faster resource deployment. However, Cisco IT is still in the process of consolidating individual SANs into a few shared Storage pools, to create virtual storage resources which can be allocated to different applications across business functions as needed.
- Cisco IT is currently (Sept. 2005) testing Wide Area File Services, based on our Actona acquisition, to perform file transfer acceleration across the WAN, making it possible to provide virtual Network Attached Storage to remote sites while consolidating most storage resources in the Data Center. We are also testing Application Velocity-based services (from our Fineground acquisition) to provide web-traffic acceleration across the WAN. Both services reduce the WAN load created by locating virtual services in the data center instead of next to the end users.
- Cisco IT is also (Sept. 2005) testing SFS Infiniband server switches with new VFrame software versions to support grid computing, the ability to pool large numbers of inexpensive servers into larger shared virtual servers, capable of changing size or OS within seconds.
By 2007 Cisco IT expects to have completed pooling of all storage resources within each data center, and to some degree across data centers as well; and to have completed building virtual processing resources for our major web servers. Business ERP servers will follow.

**SLIDE 9 – PHASE II EXAMPLE: STORAGE VIRTUALIZATION, FROM DIRECT ACCESS STORAGE (DAS).**

In 2002, each Cisco Business Unit required its own servers, each of which had its own set of Direct Access Storage. This required a significant amount of storage to be dedicated to each server, which could not be shared by other applications in other servers. Dedicating this storage per server resulted in low overall storage utilization; and while storage costs were dropping over time, the amount of storage used in Cisco was growing so fast that Cisco’s overall costs of storage was increasing dramatically.

**SLIDE 10 – PHASE II EXAMPLE: STORAGE VIRTUALIZATION, TO STORAGE AREA NETWORKS (SANS)**

In 2004 Cisco IT migrated its Direct Access Storage to Storage Area Networking, allowing Cisco IT to share storage resources within each Business Unit. This increased storage utilization within each Business Unit, but Cisco IT realized that sharing storage across multiple Business Units within a data center would increase utilization much further. Still, each Business Unit needed to keep its data completely separate for a variety of reasons.

**SLIDE 11 – PHASE II EXAMPLE: STORAGE VIRTUALIZATION, TO VIRTUAL SANS (VSANS)**

Cisco IT is currently in the process of consolidating storage in each data center, across Business Unit organizations, while still keeping each Business Unit storage completely separate using Virtual SANs. And when any Business Unit application needs additional storage, it is easy to add extra storage resources from the pooled SAN storage available to all applications.

**SLIDE 12 – PHASE II: RESULTS TO DATE**

The main benefit to virtualization comes from two factors, efficiency and utilization:

- **Efficiency**: the ratio of spend on operations vs. spend on assets. The more you spend (as a pct) on assets, the more efficient your investment. By converging, then virtualizing servers, you are able to manage more servers with fewer people. For example, Cisco has increased the number of virtual servers while keeping headcount flat. While we have reduced the physical servers and associated costs, we still feel that the ratio of servers is significant if compared to non-virtualized mgmt.

- **Utilization**: the ration of used vs. unused allocated resources. This is the biggest benefit for Cisco. By virtualizing servers, we are able to increase the pct utilization of physical resources up to 60% (from 4-8% typical) and storage in for our virtualized servers is approaching 75% average utilization. For just virtualised SAN’s and NAS, we are getting almost 50% utilization (up from 24% before SANs). This has very obvious cost avoidance savings, as each new server would cost us ~$10K over the cost of a virtualized environment.

In addition, we’ve found these additional benefits to virtualization.

- Content positioned where cheapest and most effective, regardless of where used…this results in reduced storage costs (using lowest cost storage and higher utilization rates)

- Virtual storage and server pools allocate resources to new apps in minutes…resulting in improved flexibility to the business (Infra stack in 1-5 days vs. 3-5 weeks without…further automation is possible to reduce overall time to market for business change…specifically: as of Jan ’06, 85% of all new virtual stacks can be created in less than 5 days, 60% in less than 1 day)

- Voicemail services are accessed consistently, regardless of user / mailbox location, clustering and vitalizing access to provide global access in a consistent manner simplifies access and improves employee productivity. They can get voice services anywhere they can get network, and voicemail access by dialling any of the global access numbers…or via the web from a standard URL, regardless of the physical location of their mailbox service.

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• Administrators can easily push new functionality to the Data Center -- it can immediately and automatically provision new processing...high availability is a key benefit to virtualization...that is, load can be migrated to other boxes in a cluster, or to another cluster to allow for no-downtime hardware upgrades. In addition, because all the virtual services have central management, you can make system-wide changes without touching every server...at worst, this can be done across all applications and services in a cluster.

• Virtualized Data Centers can be managed without physical presence and the need to allocate new resources to new apps, reducing time, increasing flexibility and improving manageability.

SLIDE 13 – PHASE 3: INTEGRATED APPLICATIONS

Integrated Applications Examples from Cisco IT:

• Application-aware networking and services will start with the Application-Oriented Networking (AON) product. This server on a network blade / module will deliver centralized communications services from a virtually centralized location within the network (instead of delivering them from within each application) for instant change and control of these security, management, reliability, and transport services.

• Cisco IT began testing AON in the lab in October 2004, and will begin a limited deployment of AON within the data center in October 2005. Full production deployment is planned for early 2006.

• Initial deployment of AON will offload a large number of middleware communications functions from dozens of web applications within Cisco IT, which currently perform these functions within each application, using code that had been custom-built into that application at the time of its creation. Offloading these communications functions onto a network-based switch blade in the data center will reduce processing requirements at each application server; better, it will reduce the cost and complexity of developing these functions for all future applications; and even better, it will provide a central place to control and change all communications functions across dozens or hundreds of applications quickly and easily.

• AON is also being tested to support intelligent routing and network handling of information requests based on the nature of the information request and the capabilities of the network at any locations, e.g. to transport large yet important files over larger WAN links with higher priority, or to route more valuable customer requests for service to special servers

• Future products still under consideration will provide users and applications with the ability to request network, service, storage, and processing resources, which can be supplied, managed, tracked, and billed immediately and automatically by the network. These resources will initially be traditional data center resources; but work is already underway to include manufacturing and inventory resources, as well as physical workplace resources and home information and recreation resources.

SLIDE 14 – PHASE 3: APPLICATION ENHANCEMENT

• 2005: Cisco IT piloting AON for virtual middleware application support

• 2006: Deployment of AON to perform proxy web services (SSL Termination, XML Encrypt/Decrypt, Protocol Translation, Service Versioning) for Cisco.com, CEC, other web service sites. WAAS.
  - Reduce development and support costs; reduce application server and storage load; easier to apply and manage security policies across standard proxy functions

• 2006: Deployment of WAFS (Actona) and Application Velocity (Fineground) supports virtual NAS storage and web data transport from data center

• 2006 - 2007: AON deployed throughout data center to perform transformation and mapping (Content Based Routing & Inspection, SSL Termination, Logging, Digital Signature Verification, Certificate Validation, XML Encrypt/Decrypt, Protocol Translation, Service Versioning) between end user and back end systems / packages / databases
• Significantly reduce development and support cost; minimize server and storage resource requirements; simplify web services architecture
• 2007 - 2008: AON deployed at key WAN network hubs to provide intelligent file movement across the WAN

Integrated Applications Examples from Cisco IT:
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• Future products still under consideration will provide users and applications with the ability to request network, service, storage, and processing resources, which can be supplied, managed, tracked, and billed immediately and automatically by the network. These resources will initially be traditional data center resources; but work is already underway to include manufacturing and inventory resources, as well as physical workplace resources and home information and recreation resources.

SLIDE 15 – PHASE 3: APPLICATION ORIENTED NETWORKING
• Normally, application developers need to write the code for several application utilities related to security, intelligent messaging, event management, optimization, and more of these functions into their applications, as required by the business client. This costs development time and effort for each application, and adds processing cycles and storage requirements on each server every time the application runs. This also requires each application to use a lot more processing time and RAM to support all of these utilities. In addition, managing these utilities is extremely difficult, since changing the requirements for any of these utilities (like requiring a new version of SSL encryption) would require each of hundreds of applications to be re-written.
• Note that the various communications functions, between client apps and server apps, and among server apps (listed in the two blocks, above), all pass through the Data Center network. Today, these functions are handled by custom code embedded within the client apps and the server apps.
SLIDE 16 – PHASE 3: APPLICATION ORIENTED NETWORKING

- Much of this cost and complexity can be avoided with the installation of Cisco AON modules in the data center—the common AON application utilities are managed via policies on a single set of AON modules in the network, instead of in each of potentially hundreds of applications. This can significantly reduce the size of the application, and reduce the time and effort required to write those applications in the first place. It can also reduce the amount of processing effort and RAM required by each application, allowing more applications to run on the same number of servers, saving data center space and other data center resources. In addition, centralizing these functions on AON modules makes it much easier to centrally manage and upgrade functions like encryption, authentication, or event logging.

- Note that since the various communications functions, between client apps and server apps, and among server apps (listed in the two blocks, above), all pass through the Data Center network, they can be offloaded from the server application code and onto a network device, the AON blade. Since the AON blade is now performing these functions, the actual size of the server applications can be significantly smaller. This results in code that is more compact, easier to develop and debug, and easier to maintain. It also results in IT being able to put more applications on the same processors, saving money on processors, on OS licenses, and on Data Center space and power.

SLIDE 17 – PHASE 3: RESULTS TO DATE

- Cisco AON technology played a critical role in the development and rapid deployment of this new application. Application developers can use any one of possible functions in the form of prewritten application functions by using XML tags in the application. One line of XML code in the application replaces dozens-or even hundreds-of lines of code in the application, and much of the development work as well. "This first application made use of SSL termination, certificate validation, user authentication and logging, schema validation, XML transformation between the client application and the back-end database, and content inspection for security," says Hicham Tout, Cisco IT AON engineer. "We were able to reduce the server memory needs for this application from 1800 MB to less than 100 MB, and the processing load on the server was also significantly reduced."

- "Being able to rely on the AON module to supply these utility functions to our application saved us 120 hours of writing and debugging time," says Sujata Joshi, Cisco IT project manager for HR. "We were planning on 240 hours of development effort, but we cut our time in half using the Cisco AON module rather than coding the functions ourselves. And much of that time was spent learning the AON technology for the first time-if we were to do a similar application again, we could cut our overall time by two thirds."

- Significantly reducing the load on server memory and processing brings with it more than just greater server efficiency. It allows the enterprise to run more applications on the same number of servers, lowering costs and preserving space in the data center. It reduces power and refrigeration requirements, as well as the need for more software licenses-and more components to manage and troubleshoot. Using the Cisco AON module to handle functions that would normally reside in multiple layers of servers (for example, in the partner-dedicated servers and the internal enterprise servers) reduces the number of hops in the internal network, and simplifies the network architecture required.

- Significantly reducing application development time means more than just saving money. It also brings the ability to automate more functions, more quickly, and allows the company to retire old code more easily.

- Centrally managing dozens of communications functions rather than applying them from custom code written directly into each application provides a completely new capability. It allows enterprise managers to change or update application functions-for example, to upgrade to new encryption standards-across the entire application platform by making a single change to the Cisco AON module.

- Cisco IT gained two extra advantages from this deployment of Cisco AON technology: flexibility and clarity in the business application environment. "With AON it is easier to put infrastructure services into the network, where it can be separate from what is in the business application services," says Paul Aoun, Advanced Services Technical Architect. "This de-coupling of infrastructure services into one layer, and business applications services into another layer, allows Cisco IT to keep a flexible business applications environment. Changes to the business services layer are not impacted by changes to the infrastructure services layer now provided by AON. This
separation of service layers also simplifies the environment, giving Cisco IT a clearer understanding of their current applications environment, and the ability to make sure that each layer was performing to its peak potential."

● With the benefits of application-oriented networking established, the company is poised to add even more application intelligence into the network in future. "Proving the AON module's success within IT does more than showcase our leading-edge application networking gear," says Chris Wiborg, program manager for the Cisco Application Oriented Networking Business Unit. "It moves Cisco IT forward into the third and final goal of the Intelligent Information Network-building a network that is truly application-aware."

● Moving forward, Cisco IT will use application-oriented networking functions to support most of its future application development. The team is currently working on sales, manufacturing, and Internet commerce applications supported by Cisco AON technology.

SLIDE 18 – SUMMARY OF IIN BENEFITS FOR CISCO

● Faster and less expensive development, and more rapid deployment of new applications.

● Reduced processing power / RAM needed per application, which translates to more applications per server, which translates to less data center space and power and AC required. It also translates to fewer OS licenses needed, fewer OS patches and upgrades.

● Centrally managing communications functions rather than applying them from custom code written directly into each application allows enterprise managers to change or update application functions at one time (rather than requiring each application to be rewritten one at a time).

● De-coupling of infrastructure services into one layer, and business applications services into another layer, allows Cisco IT to keep a flexible business applications environment. Changes to the business services layer are not impacted by changes to the infrastructure services layer now provided by AON.

SLIDE 19 – INTELLIGENT INFORMATION NETWORK, SOUND BITE SUMMARY

Intelligent Information Networking (IIN) is Cisco’s vision for the future of networking. It describes a network that is aware of the changing service and resource needs of each application and user. Based on those changing needs, the IIN can instantly and flexibly provide services from a virtual pool of shared resources. The IIN achieves three goals simultaneously: firstly, ensuring all applications and users get the communications services and resources they need -- only when they need it; secondly, minimizing resource waste and cost with unused resources being put back in the virtual pool, and thirdly, centralized control of the network, communications services and resources allow administrators to instantly apply policies and services whenever needed.

The complete vision of IIN at Cisco is currently being realized. At Cisco today:

● Our Enterprise Class Telecommuter VPN solution converges data, voice and security for home access users.

● Virtualized Storage Area Networking improves utilizations and manageability.

● Collaboration tools are made possible by converged voice and data; some examples being our deployment of Cisco IP Contact Centers, Unity voicemail, MeetingPlace and Video Telephony Advantage.

In the future:

● Consolidated wired, wireless, mobility and security tools will reside in simple manageable platforms,

● Virtual Storage and server resources will be available to applications on an ‘as-needed’ basis from large shared resource pools, and

● Application-aware network offloads will simplify data center environments and empower flexible communication among users and applications.

Through Integrated Systems, Integrated Services and Integrated Applications more value can be obtained from the network foundation, infrastructure, applications and services. Using one infrastructure lessens network complexity resulting in reduced CapEx and OpEx with
better operational manageability. Integrated voice, video and collaborative applications enhance the productivity of business interactions and security is improved when embedded in the system and not bolted on.

**SLIDE 20 – PRESENTATION END**

No notes.
This publication describes how Cisco has implemented and benefited from the deployment of its own products. Many factors have contributed to the architecture, results and benefits described; Cisco does not guarantee comparable results elsewhere.

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