Qwest
Spirit of Service™

Qwest: a .NET web services case study

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ISS Microsoft Infrastructure Solutions

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About Qwest

- 2002 Revenues: $15 billion
- Services offered
  - Digital Subscriber Line (DSL)
  - Wireless communications
  - Broadband communications
    Local and long-distance telephony
  - Hosting services
    - Web hosting
    - Application hosting
    - Network hosting

Qwest 2002 Landscape

- No Core .NET Web Services infrastructure
- Ad-hoc .NET application roll-out
- Very capable IT & application development staff
- Thorough knowledge of IT administration and architectural best practices
- Existing infrastructure used alternate web services technology.
- Increasing interest in using .NET tools for application development
- Membership in Web Services Interoperability Organization, WS-I.

Qwest 2002 Needs

- Align IT strategy with Web Services and develop an infrastructure that supports both ASP.NET Web Services and ASP.NET Web Applications.
- Infrastructure must interoperate with Qwest's existing Web Services infrastructure.
- Embrace Microsoft® Visual Studio .NET as a strategic development tool.
- Design and implement a scalable, available, and manageable infrastructure for deployment of .NET Web Services in a shared environment.
- Standardize infrastructure hardware on just one or two platforms.

ASP.NET

- Next-generation application environment provided by Microsoft for the implementation of Web Applications and Web Services
- Microsoft Visual Studio .NET
  - Integrated Development Environment (IDE) for the development of ASP.NET Web Services and ASP.NET Web Applications
  - Visual Basic
  - Visual C#
  - Visual C++
  - Visual J#
  - 16+ other languages
- Facilitates development of application components that interoperate with other technologies and environments

ASP.NET Technologies

- Common Language Runtime
  - Execution environment for ASP.NET Web Applications and ASP.NET Web Services
  - Web Application or Web Service is compiled by Visual Studio .NET to an Intermediate Language called Microsoft Intermediate Language (MSIL).
  - When executed on a HP Industry Standard Server, MSIL code gets just-in-time compiled (JIT compiled) to x86 platform code.
  - MSIL code executes within the Common Language Runtime.
  - Any Web Service or Web Application gets compiled to the same MSIL code, regardless of the language of development
  - All applications work together elegantly, independent of the developer's language choice.

ASP.NET Technologies

- Common Class Library system
  - Provides a unified class hierarchy framework for the definition of objects within each .NET application
  - One can implement a class in one language and then directly integrate that class into a project written in another language with no special language interfacing required.
    - Coder preference drives language choice.
    - Coders get to work in their most productive language.
    - No loss in application integration capabilities.

ASP.NET Technologies

- Web Services
  - Simple Object Access Protocol (SOAP)
  - Web Services Definition Language (WSDL)
  - Allows, for example, an application resident on a UNIX® platform to consume the functionality presented by an ASP.NET Web Service as long as the UNIX application properly implements the SOAP and WSDL protocols.
  - Web Services Extensions (WS-E)
    - WS-Security
    - WS-Routing
    - WS-Attachments

ASP.NET Technology: hp Documentation

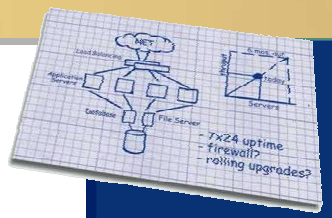
- *ASP.NET Web Services Solutions Guide*: http://activeanswers.compaq.com/ActiveAnswers/Render/1,1027,5438-6-100-225-1,00.htm
- *Microsoft .NET Web Services Solutions Guide*: http://activeanswers.compaq.com/ActiveAnswers/Render/1,1027,5384-6-100-225-1,00.htm

Putting It Together

- ASP.NET provides an elegant developer framework.
- Developers can adopt ASP.NET and quickly build useful applications.
- Applications can integrate with other platforms via SOAP, WSDL, and WS-E.

- Still, applications need a playground.
- Playground must be
  - Scalable
  - Available
  - Manageable Secure

hp Dynamic Internet Solutions Architecture (DISA)



Clients

Business Applications

Integration & Services

Operations & Management

Security

Access & Acceleration Resources

Web & Application Resources

Data Resources

Firewalls, Load Balancers, Cache, SSL, VPN

Web & Application Servers

Database, Storage (NAS & SAN)

A DISA Key Principle

ProLiant DL760

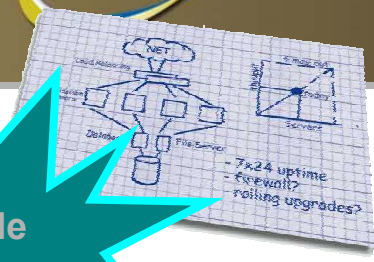
ProLiant DL740

ProLiant DL580 G2

Scale Up (one machine)
4P & 8P ProLiant servers
Windows .NET 2003

Microsoft Windows Server 2003

Scalable and Highly Available



Scale Up:
Database and ERP Servers

Scalability - As system throughput increases
Availability - Fault tolerance

Microsoft Windows Server 2003

Scale Out (many machines)
DISA architecture,
Windows .NET 2003 and
Microsoft's Application Center 2000

Scale Out: Web and Application Servers

One server or one cluster

ProLiant DL380 G3

ProLiant DL380 G3

ProLiant DL360 G3

ProLiant BL10e

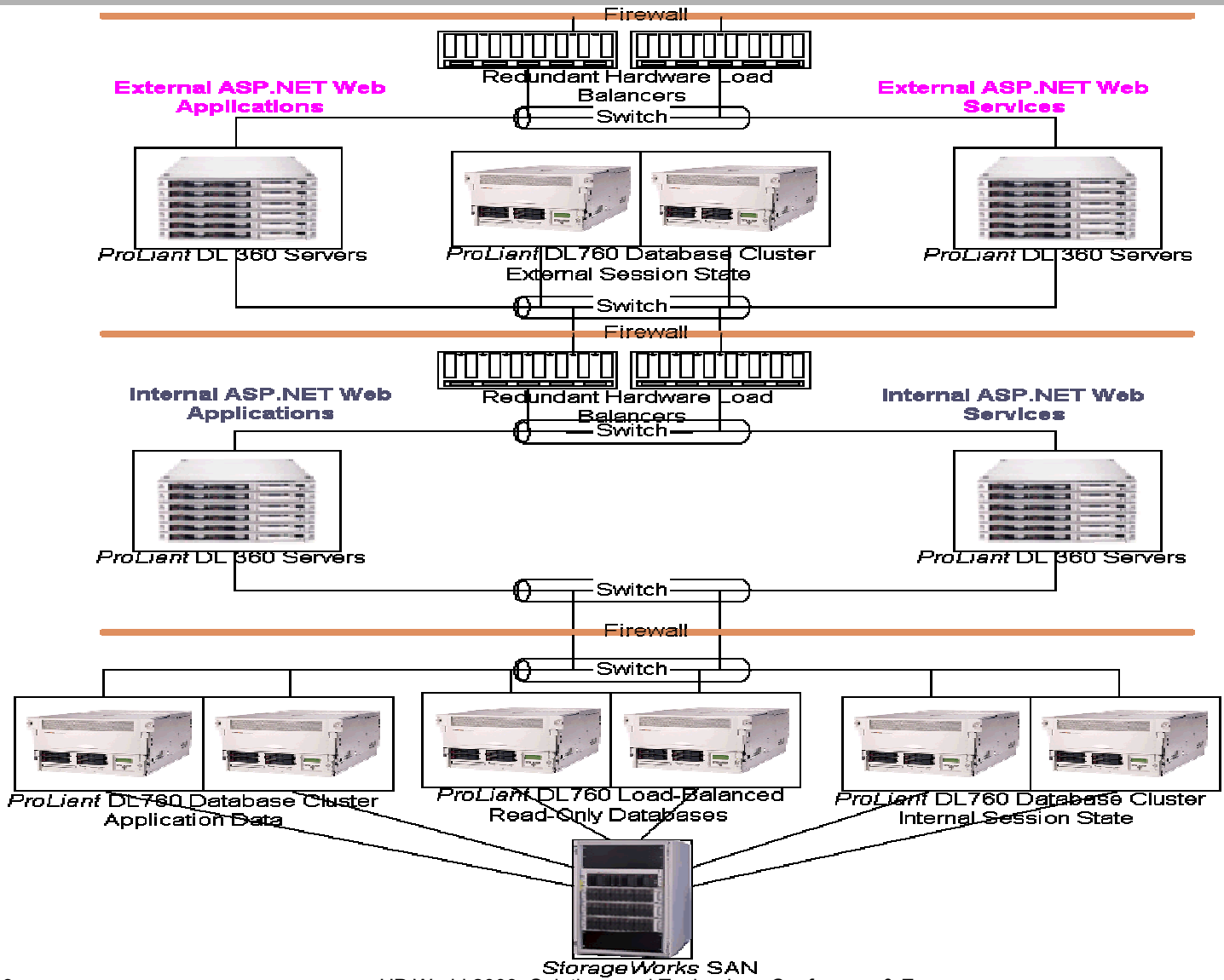
ProLiant BL20p

Server Farm

Qwest Application of DISA

- Qwest divided the DISA Web and Application Resources tier into a pair of network segments, each separated by a firewall.
- Build an architecture that would be both scalable and secure, with added security for internal business logic.
- Separate pools of servers on which ASP.NET Web Applications would execute from pools of servers on which ASP.NET Web Services would execute.
- Additional firewalls were placed both in front of the externally facing Web and Application Resources servers and in front of the Data Resources servers.

Qwest Application of DISA



Qwest Hardware Choices

- ProLiant DL360 servers for server farms
  - ASP.NET Web Applications
  - ASP.NET Web Services
- ProLiant DL760 servers for database
  - SQL Server 2000, Enterprise Edition
  - Read-only databases, load-balanced with Network Load Balancing
  - Read-Write databases, clustered with Microsoft cluster server
  - Session state databases, clustered with Microsoft cluster server
- StorageWorks Modular Array SAN for storage
  - Dependable, flexible storage management
  - Ability to grow storage requirements as needed over time

Integration

- Once Qwest implemented and tested its ASP.NET architecture, it had to deploy that architecture to address both of the following issues:
  - Other applications and end users could interact with the various ASP.NET Web Applications and ASP.NET Web Services deployed on the architecture.
  - Qwest system administrators could effectively administer the various ASP.NET Web Applications and ASP.NET Web Services, including deployment of the Applications and Web Services, management of the running Applications and Web Services, and retiring unsupported and unused versions of the Applications and Web Services.

Application Integration

- Qwest did not implement its ASP.NET architecture just so it could claim that its technology was robust and secure.
- Real goal was to present and sell Web Services and Web Applications to internal and external customers.
- The architecture had to support needed integration points with other server and end user applications in order for Qwest to justify its investment in ASP.NET technology.

Application Integration

- ASP.NET technology was designed to conform to standard protocols and data encoding formats.
- ASP.NET Web Applications appear to end users as any other application that uses web standards:
  - HTTP
  - HTML
  - XML
- ASP.NET Web Services implement technology that is relatively new:
  - SOAP
  - WSDL
  - WS-E

Web Services Integration

- ASP.NET Web Services are typically consumed by other server applications that support HTTP, XML, SOAP, and WSDL.
- Web Services therefore integrate seamlessly with existing technologies.
- Only issue:
  - Connect the new Qwest ASP.NET architecture with the customers for that architecture and to write the Web Services and Web Applications.

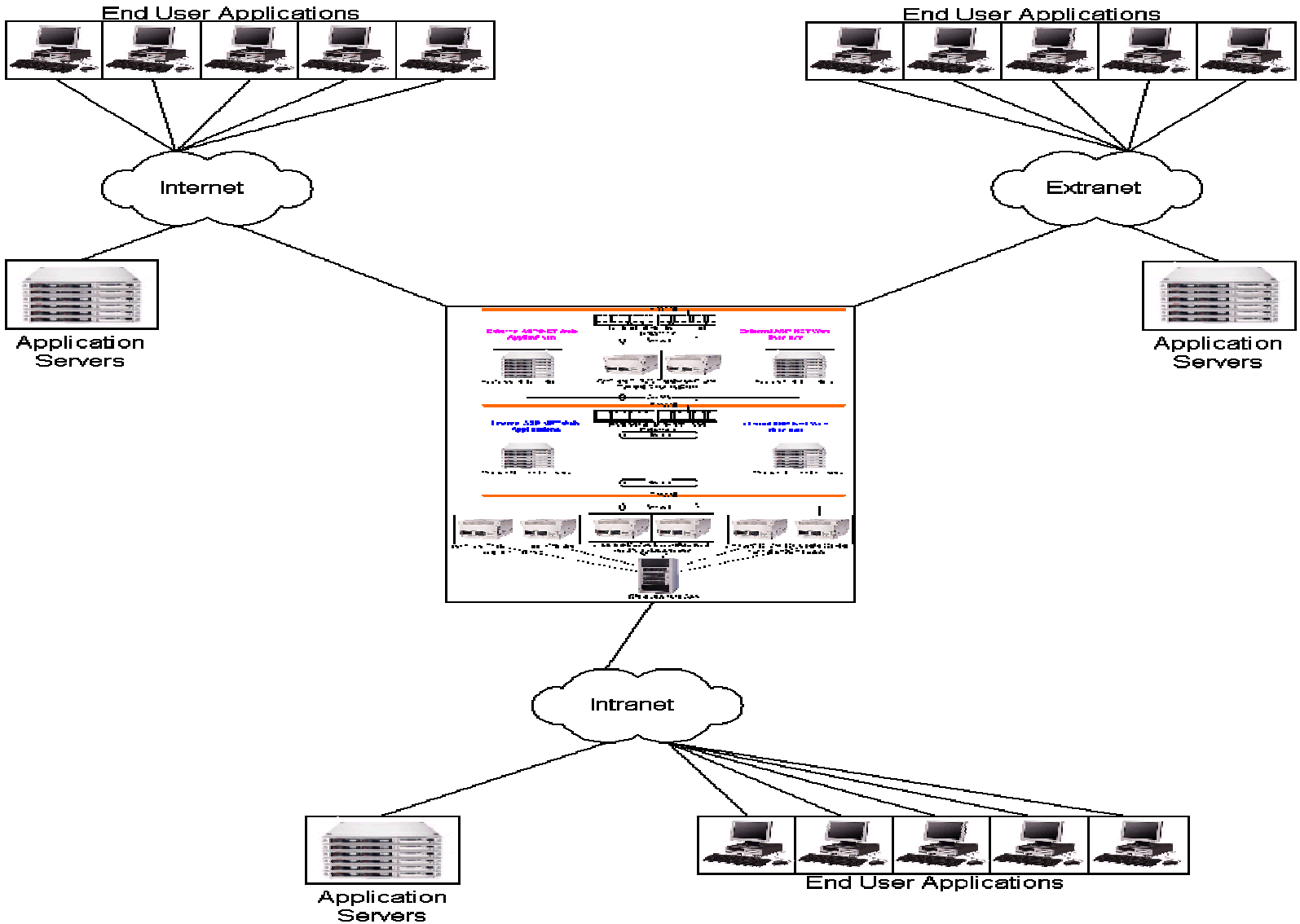
Gains from Architectural Integration

- Qwest's development teams can now develop the software that allows them to provide these services to their customers.
- Qwest's networking teams can integrate new application software into existing networking infrastructure as it is developed, with minimal or no changes to the infrastructure.
  - This includes several ASP.NET Web Services and ASP.NET Web Applications that Qwest had already developed.

Gains from Architectural Integration

- The end result is that clients of these Web Applications and Web Services need only connect via one of three industry standard connection mechanisms:
  - Internet
  - Extranets
  - Internal intranets.

Architectural Integration



Application Deployment and Administration

- Microsoft Application Center 2000 is strategic.
  - Provides ability to package, deploy, and replicate Microsoft Internet Information Services (IIS) applications and IIS metabase settings.
  - Both ASP.NET Web Services and ASP.NET Web Applications are, to the system administrator, nothing more complex than IIS applications (yet another industry standard exploited by the technology).
  - These Web Applications and Web Services are subject to the configuration settings provided by the system administrator using the Internet Service Manager tool that is provided alongside IIS.
  - These configuration settings are stored in the IIS metabase, and as such, they can be packaged, deployed, and replicated across a server farm by Application Center.

Application Deployment and Administration

- Application Center can quickly become the most strategically important administration tool available to the system administrator.
- This occurred in the Qwest project.
- Microsoft Application Center 2000 allows the system administrator to deploy and configure each new Web Application or Web Service on a deployment or testing server just once.
- Once sufficient testing has been conducted to allow the Web Application or Web Service to be moved into production, Application Center can package all of the components of that Web Application or Web Service into a logical container that it manages.

Application Deployment and Administration

- These components can include all of the following:
  - The IIS virtual directory, which constitutes the physical location of the Web Service or Web Application on the IIS server.
  - The virtual directory's current, tested configuration settings.
  - Any necessary Windows registry keys.
  - All files necessary for the Web Application or Web Service.
- Once these are brought together into a logical package on the deployment server, they can be rolled out, or published, to the entire server farm on which they will be deployed in production.

Testing at Microsoft Partner Solutions Center

- The initial testing of the .NET architecture took place at a facility on Microsoft's Redmond, WA campus called the Microsoft Partner Solution Center (MPSC).
- Detailed information on the MPSC is available at http://www.microsoft.com/serviceproviders/MPSC/default.asp.
- The MPSC provides a unique multi-vendor environment where network service providers can rapidly build and test secure, end-to-end network solutions to meet their needs.
- The MPSC leverages the combined expertise of Microsoft resources, as well as those of original equipment manufacturers (OEMs), network equipment providers (NEPs), independent software providers (ISVs), independent hardware providers (IHVs), access providers, systems integrators (SIs), and solution providers (SPs), to create solutions that network service providers can quickly roll out to consumers.

MPSC Testing Specifics

- External ASP.NET Web Services and ASP.NET Web Applications servers
- Internal ASP.NET Web Services and ASP.NET Web Applications servers
- All three databases identified in the Qwest ASP.NET Architectural diagram in Figure 2, above
- Load balancing integration in front of both the external and internal ASP.NET Web Services and ASP.NET Web Applications servers
- Firewall integration
- Active Directory integration
- Overall testing where thousands of individual requests touched every segment of the architecture

Specific Tests

- Proper firewall protocol and port rules for the firewalls enabled at each segment of the architecture
- Active Directory group policy and security templates used in the DMZ that host the external ASP.NET Web Application and ASP.NET Web Service servers
- Specific ASP.NET web.config configurations for use of ASP.NET applications and services in a server farm environment
- Load balancing of ASP.NET Web Services and Applications using the latest hardware load balancing technologies
- Microsoft Cluster Services (MSCS) configurations for shared ASP.NET Session State, Read Only, and Read Write databases deployed in a Storage Area Network (SAN) environment.

Recap

- Qwest is leading the industry in the implementation of ASP.NET Web Services and ASP.NET Web Applications.
- This technical case study provides a technical overview of Qwest's implementation of ASP.NET technologies, documenting in turn some of the technical aspects of Qwest's strategic embrace of ASP.NET.
- HP provided guidance to Qwest, but this guidance was in turn led by Qwest's vision to build an industry-leading paradigm for ASP.NET technology.
- DISA provided a set of guidelines to Qwest for its implementation of ASP.NET technology.

Recap

- Qwest applied DISA guidelines to produce an industry standard architecture that meets the advanced requirements of the ASP.NET Web Services and ASP.NET Web Applications it will deploy there.
- Furthermore, the core of the ASP.NET technology is based on World Wide Web Consortium standards, which further reduced the risk run by Qwest when they implemented this solution.
- The transport and data encoding technologies are based on the standard HTTP protocol and the standard HTML and XML data-encoding protocols.
- The new technology incorporated into ASP.NET Web Services and ASP.NET Web Applications is based on the equally standard SOAP and WSDL protocols.

Recap

- The development tool itself is the very mature version 7 of Microsoft's widely accepted Visual Studio suite of development tools: Visual Studio .NET.
- Thus, the risk to Qwest in approaching ASP.NET as a "new" technology was heavily mitigated by the fact that this technology is neatly couched in a large and mature collection of standard and industry standard protocols, formats, architectures, and development tools. This necessarily implies a low risk for adopting the technologies.

Recap

- Qwest also reduced its risk by assembling a highly skilled and professional team comprised of top talent from Qwest, HP, and Microsoft.
- Qwest brought in expert application developers, expert IT security and network professionals, expert IT administrators, and expert knowledge of the business for which it is building and deploying ASP.NET Web Services and ASP.NET Web Applications.
- Microsoft brought in its best-in-class .NET Framework and its expert software and technical operations consultants.
- HP brought in the rock-solid reliability of HP industry standard ProLiant servers for application and database services, the proven reliability, scalability and performance of the Dynamic Internet Solutions Architecture, as well as expert IT architects and integration consultants.

hp ActiveAnswers: Microsoft .NET Web Services Solutions

hp ActiveAnswers: Microsoft Application Center Solutions

Microsoft Application Center

» ActiveAnswers

- » home
- » solutions
- » tools
- » site map

member services

- » new user
- » what's new
- » update profile
- » logoff
- » ActiveAnswers tour

Application Center 2000 is part of the family of Microsoft® .NET Enterprise Servers. Using robust HP ProLiant platforms and Microsoft Application Center 2000 enables you to easily build manageable, scalable e-commerce solutions that achieve mission-critical availability, necessary in today's business environment.

HP is working closely with Microsoft on testing the Application Center 2000 product. We will publish a complete set of tested pre-configured hardware and software solutions based on Application Center 2000 as we work to characterize the new release in the coming months.

»Solution Overview

Highlights

»Performance Characterization of Application Center 2000 on HP ProLiant Servers

»HP and Microsoft E-Commerce Solutions Partner Brochure

»Checklist for Installing Microsoft Application Center 2000 on ProLiant Servers

Available Information

Please Select...

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Best Practices
Installation
Performance
Product Information

Links

- SOAP: http://www.w3.org/TR/SOAP/
- WSDL: http://www.w3.org/TR/wsdl
- Web Services in general: http://www.w3.org/2002/ws/
- HP Case Study, Qwest: http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,5593-6-100-225-1,00.htm
- Microsoft Case Study, Qwest: http://www.microsoft.com/resources/casestudies/CaseStudy.asp?CaseStudyID=13955

Links

- Microsoft Application Center Solutions Area of ActiveAnswers: http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,4103-6-100-225-1,00.htm.
- An *Overview of Microsoft Application Center 2000 in a DISA Environment* is available on ActiveAnswers at http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,4762-6-100-225-1,00.htm.
- Microsoft also provides information on Application Center 2000 at http://www.microsoft.com/applicationcenter/.

Links

- Microsoft .NET Web Services Solutions Area of ActiveAnswers: http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,5381-6-100-225-1,00.htm.
- Performance Characterization of an ASP.NET Web Service on ProLiant Servers: http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,5490-6-100-225-1,00.htm.
- ASP.NET Web Services Solutions Guide: http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,5438-6-100-225-1,00.htm.

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