



Building and Deploying Enterprise ArcGIS Server Solutions (Best Practices)

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Presentation Goals

- **See real world, Enterprise implementations of ArcGIS Server presented in a case study fashion**
- **Learn from the experience of ESRI Professional Services staff**
- **Take away some lessons learned that can be applied to your project(s)**

Presentation outline

- **Introduction**
- **Project Case Studies**
 - **Background**
 - **Technology Stack**
 - **Unique Challenges**
 - **Design and Architecture**
 - **Lessons Learned**
- **Summarize Project Experience**
- **Q & A**

What is Enterprise (practically)?

- **Integration with third-party services and applications**
- **Large volumes of data**
- **High availability**
- **High throughput**
- **Cross platform environment**

Common Enterprise GIS Implementations

- **High volume editing and dissemination**
- **Advanced spatial analysis supporting range of clients**
- **Spatial Data Infrastructure (SDI)**
- **Map production systems**

Case Studies

FedEx Express – Background

- **Company**

- 2+ million stops per day
- 60,000+ employees
- 2,000 Java developers

- **Business Problem**

- Implement a scalable work area design system that can also assist with and prescribe an on-the-road plan for efficient delivery and pickup operations
- Provide users with a highly capable and flexible interface for reporting on their execution of the on-the-road plan

FedEx Express – Background

- **J2EE as the standard server development platform**
 - Deployed to WebLogic Application Server
 - Secured by Oblix single-sign on
- **Cross platform environment**
 - Web / Application Servers: Redhat Linux
 - ArcGIS Servers (operation): Redhat Linux
 - ArcGIS Servers (caching): Windows 2003 Server
 - Database Servers: HP-UX
 - Citrix Servers: Windows 2003 Server

FedEx Express – Technology Stack

- **ESRI Technologies**

- ArcGIS Server Java 9.2
- ArcGIS Desktop 9.2
- ArcSDE 9.2

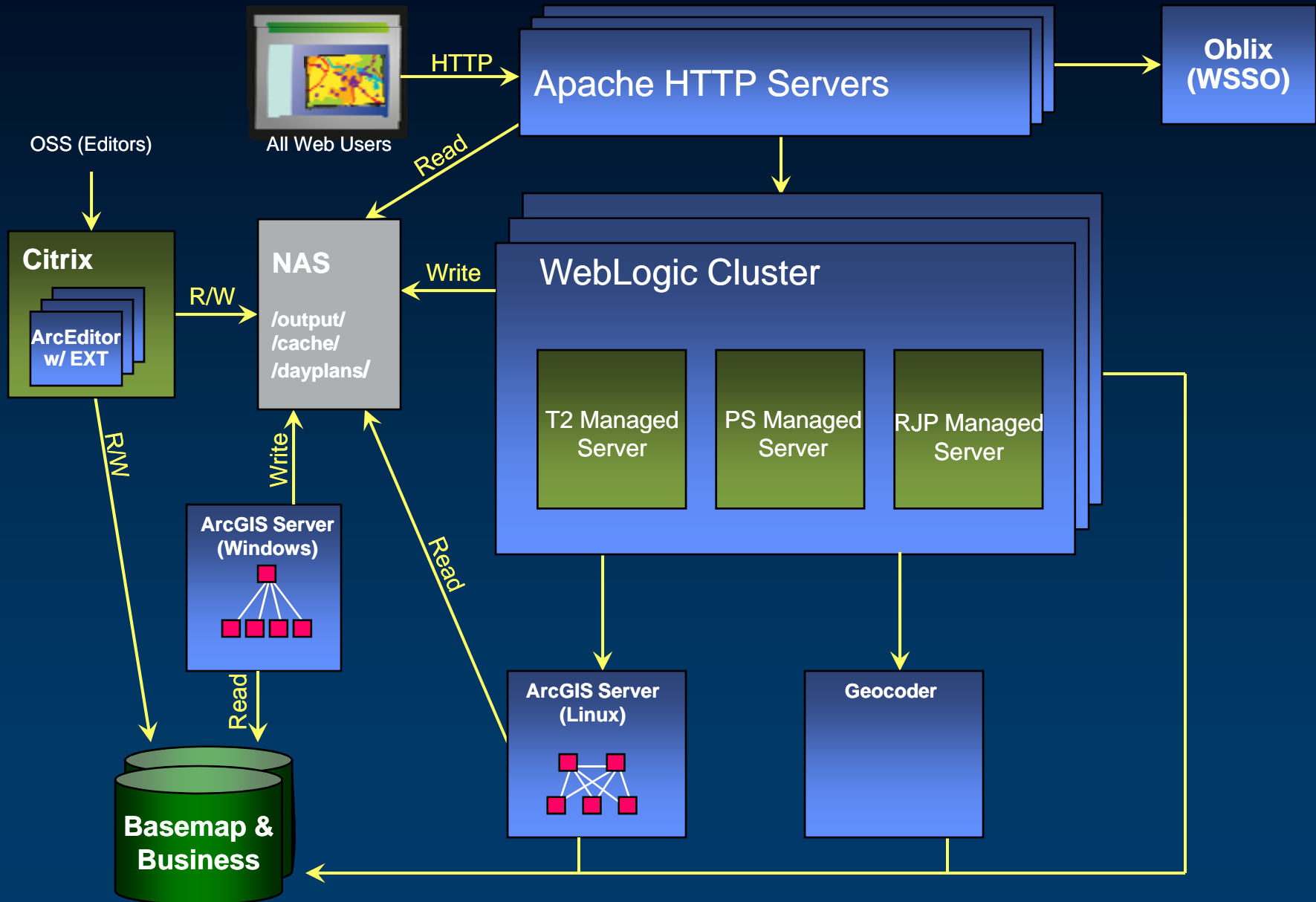
- **Other Technologies**

- Apache HTTP Server
- WebLogic Server 9.2
- Oracle 10gR2 RDBMS
- Oracle Identity Management (Oblix)
- Third-party Geocoder
- Appistry Enterprise Application Fabric

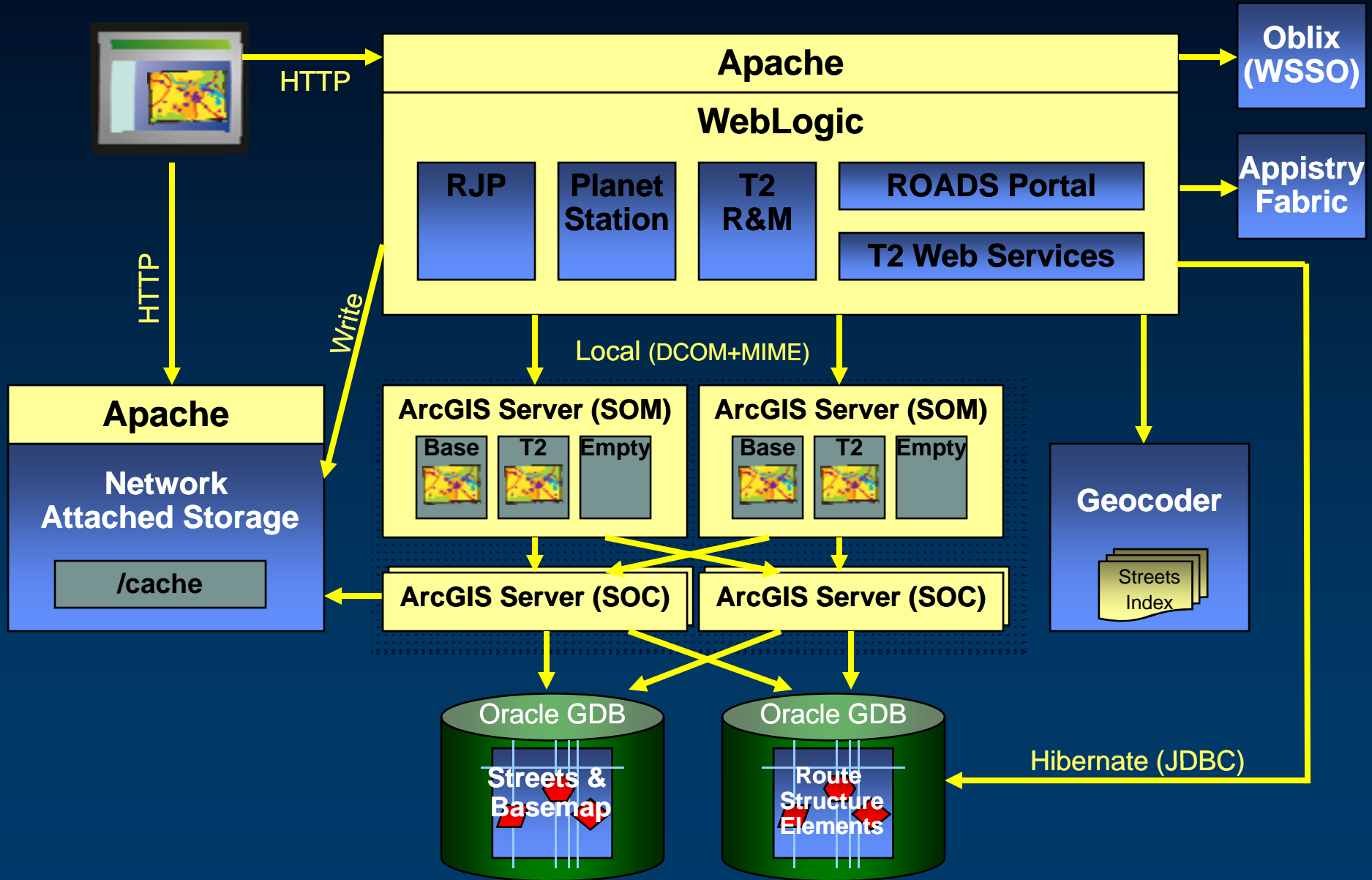
FedEx Express – Challenges

- **Very complicated business process for desktop editing**
- **Very loose requirements for web application**
- **Spatially analyzing and displaying 1+ billion points**
- **Integration with other non-spatially aware applications**
- **Deployment to high-availability, clustered WebLogic Environment**

FedEx Express –Architecture Overview



FedEx Express – Server Architecture



FedEx Express – Lessons Learned

- **Know the IT Standards**
 - **Rules regarding shared file systems caused significant problems**
 - **Resulted in complex caching workflow**
 - **Resulted in complex output storage mechanism**
 - **Clustered Web / Application Server environment introduced challenges**
 - **Apache timeout of 5 minutes prevented map books from being created**
 - **Serialization of web session could not be supported**

FedEx Express – Lessons Learned

- **Thoroughly document requirements and use cases**
 - Without solid requirements and use cases, even a moderately sized development project can go astray
 - Use cases explain how the users expect to interact with the application
 - Requirements provide additional detail on parameters and behavior not obvious to the end users
 - FedEx map viewer requirements were loose
 - Lead to misinterpretation of behavior
 - Significant changes were required late in the project lifecycle just to satisfy the user community
 - Use a process and a tool to capture this information

FedEx Express – Lessons Learned

- **Development → Production takes A LOT of time**
 - Many levels of testing are required to certify a business critical set of applications for production
 - FedEx has 5 separate levels:
 - Level 1: Developer Testing
 - Level 2: User Testing, Round 1 (UAT)
 - Level 3: User Testing, Round 2 (UAT)
 - Level 4: Load Testing
 - Level 5: Production Look-alike, Final Testing
 - Other IT organizations have “Integration Level” or “High Availability Level”

FedEx Express – Lessons Learned

- **ArcGIS Server on Linux works, and it works well**
 - 9.2 release had many improvements over 9.1
 - No longer reliant on a Windows machine for authentication
 - Some challenges with rollout
 - Silent install made it difficult for system teams to deploy to large number of instances
 - Look for improvements at 9.3

FedEx Express – Lessons Learned

- **Dynamic data with cached basemap can be tricky**
 - **Three specific requirements were difficult to meet :**
 - **Sub-second performance**
 - **Ability to zoom to any scale (not at fixed levels)**
 - **Ability to export the entire map view with layout in PDF format**
 - **Developed hybrid solution:**
 - **2 resources, one cached and one dynamic**
 - **Cached resource had basemap content in as map cache**
 - **Dynamic resource had business data, along with the basemap data turned off**
 - **Clever manipulation of resources was required, but all three requirements were met**

FedEx Express – Lessons Learned

- **Map Printing != Map Production**
 - Most applications have a requirement for printing
 - Printing normally comes in two flavors:
 - Export current map to a chart / layout (HTML/PDF)
 - Export a predefined product using some of the current map settings such as center point or scale
 - Exporting products can have a significant impact on the system
 - Large exporting times
 - Fine-grained manipulation of the page layout
 - Complex rules for map surrounds

NOTE: Exporting to PDF with ArcGIS Server requires access to ArcObject proxies (Local Connection)

BHP Billiton SDI – Background

- **Company**

- World's largest diversified natural resources company
- 38,000 employees working in more than 100 operations in approximately 25 countries
- 2006 profits exceeded \$10 billion

- **Business Problem**

- Improve productivity through more efficient management and sharing of spatial information.
- Provide a single enterprise-wide location to search for and retrieve spatial Information.
- Create a simple, streamlined process for publishing GIS content

BHP Billiton SDI – Background

- **SAP Enterprise Portal as the corporate portal standard**
 - Deployed to 4 nodes around the world for efficiency
 - Integrated with Active Directory for single-sign on
 - Java-based development of “iViews” (ie. Portlets or WebParts)
- **Both .NET and Java are used throughout the company**
 - Business-units within BHP Billiton have their own standards
 - Few corporate IT standards
- **All systems managed by CSC**
 - Windows 2003 Server throughout

BHP Billiton SDI – Technology Stack

- **ESRI Technologies**

- ArcGIS Server 9.1
- ArcIMS 9.1
- ArcSDE 9.1
- ArcGIS Desktop 9.1
- GIS Portal Toolkit 2.0

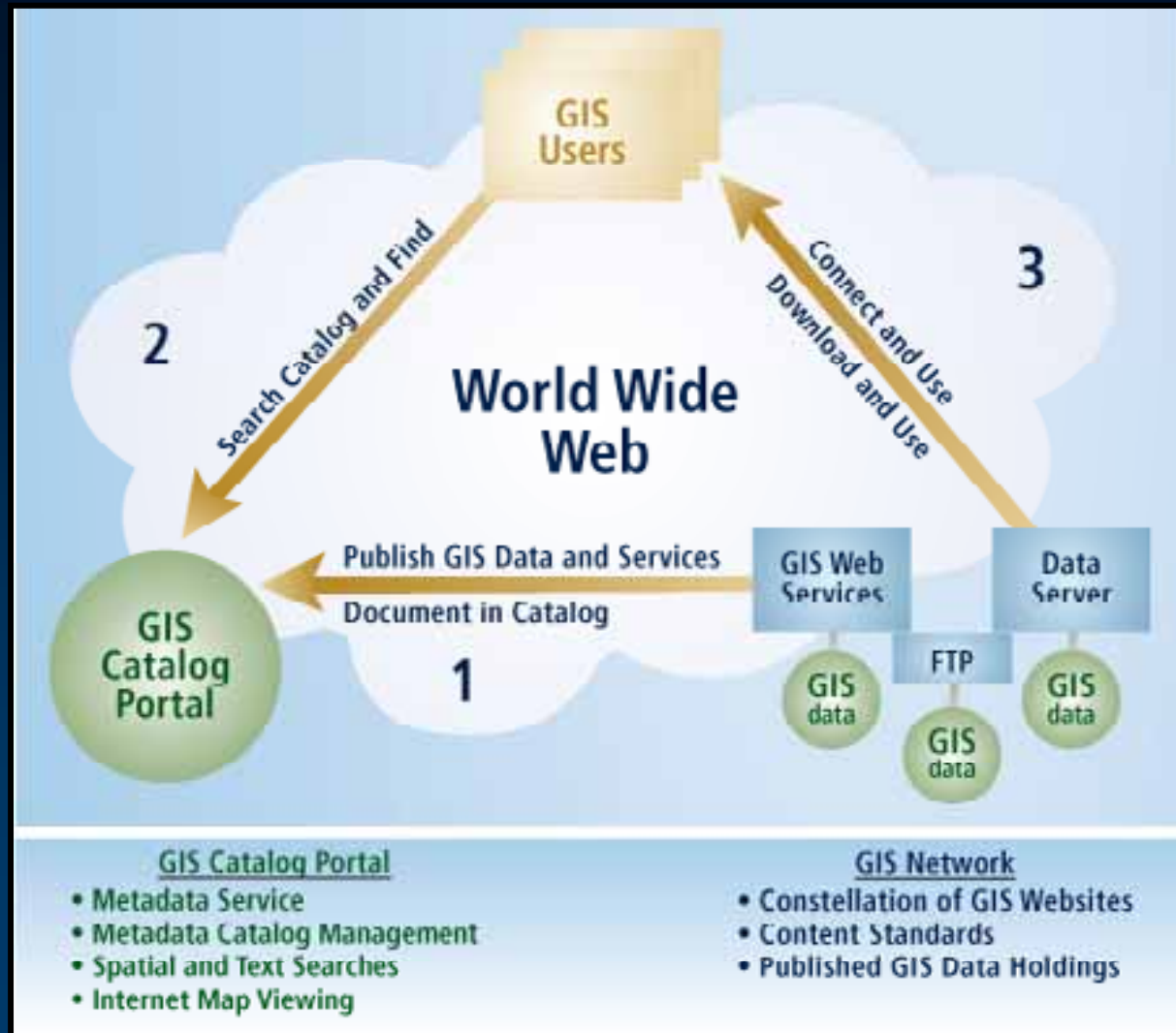
- **Other Technologies**

- SAP Enterprise Portal
- Microsoft IIS w/ Active Directory Integration
- Apache Tomcat
- Oracle 9i RDBMS

BHP Billiton SDI – Challenges

- **SDI infrastructure to be used by several applications and services throughout the company on independent development cycles**
- **Fast searching of metadata from anywhere in the world**
- **Complex security requirements**
 - Fine-grained restriction of map services
 - Single-sign on for all web applications using Active Directory
- **Support offline access to federated content**
- **Support for AXL-based map services**

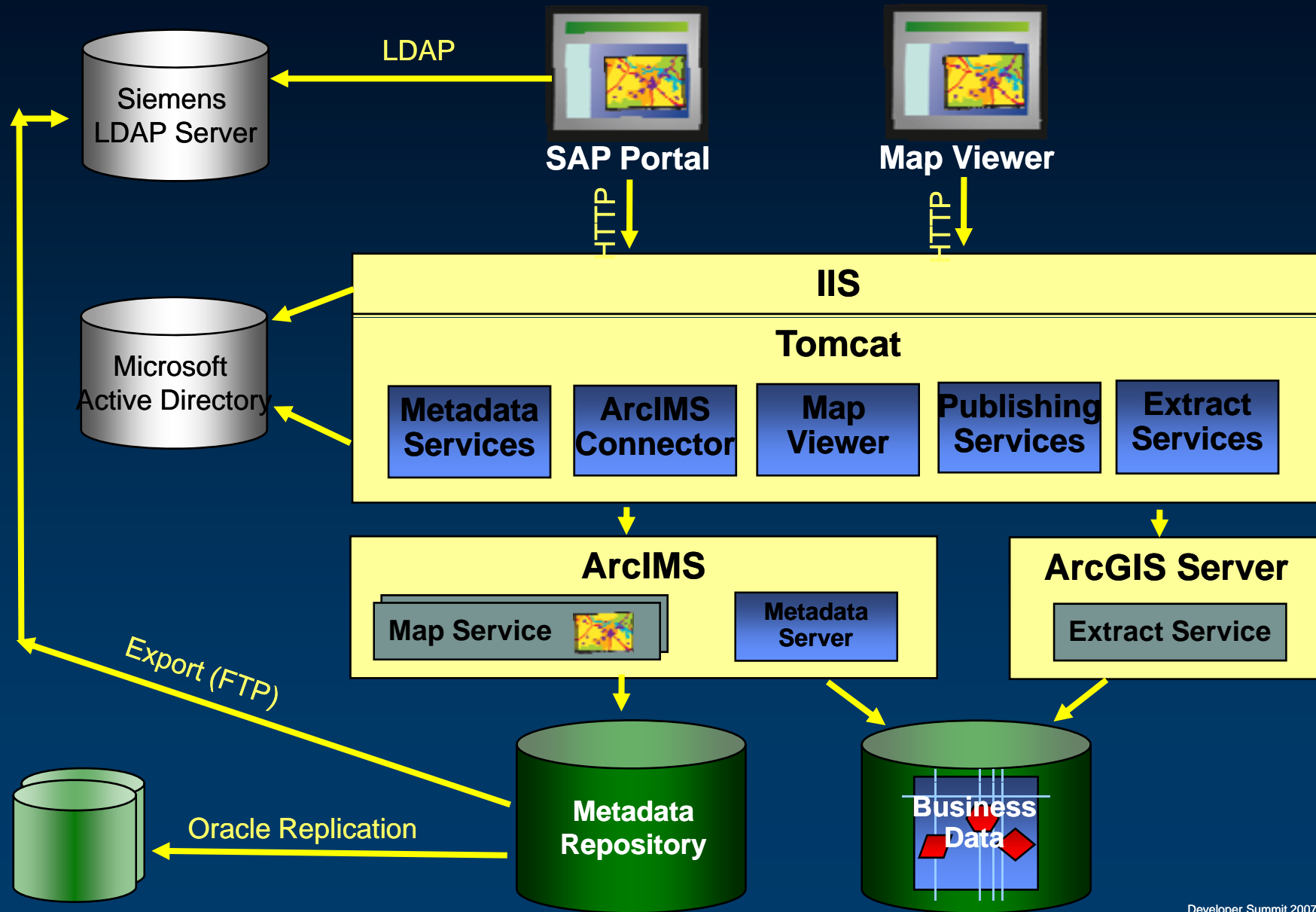
BHP Billiton SDI – Portal Concept



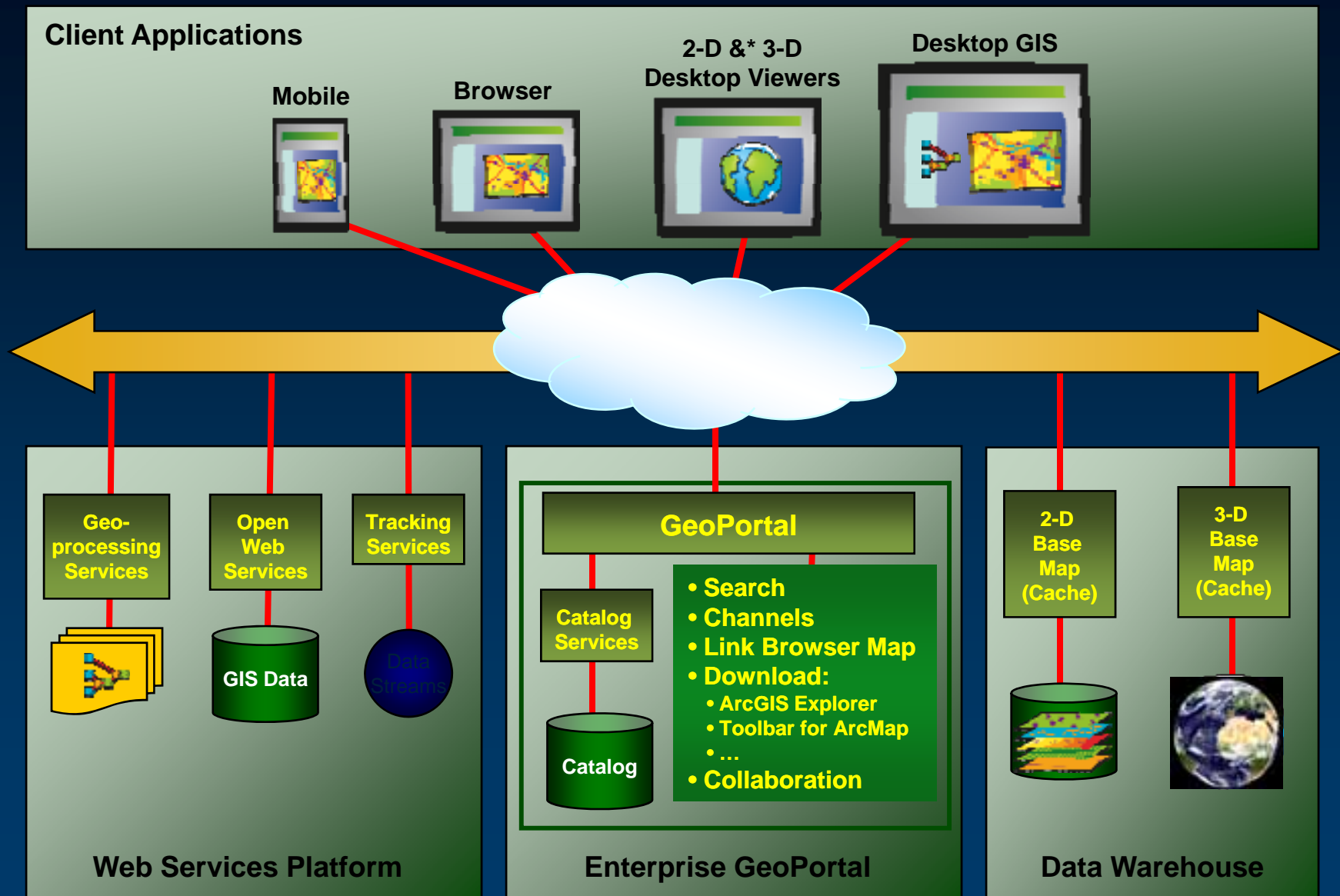
BHP Billiton SDI – Node Distribution



BHP Billiton SDI – Architecture Overview



BHP Billiton SDI – Next Generation



BHP Billiton – Lessons Learned

- **Metadata is very important**
 - Can be involved than one would think
 - Enforce a corporate standard developed by the community
 - Good metadata is very good, bad metadata is very bad
 - Consider the type of metadata being published and how clients that discover it can interact with the content
 - Map service
 - Map layer
 - Featureclass
 - Globes
 - Geoprocessing Models and Scripts

BHP Billiton SDI – Lessons Learned

- **Federation == Complication**
 - **Creating a Federated SDI requires a number of web services**
 - **Web services calling web services calling web services (globally)**
 - **Single-sign on adds another dimension of complexity**
 - **A fast, federated search may require metadata replication**

BHP Billiton SDI – Lessons Learned

- **Version upgrades are non-trivial**
 - **Server software has a number of dependencies**
 - Desktop applications depend on GIS Servers
 - Desktop applications depend on database
 - Web applications depend on GIS Servers
 - GIS Servers depend on database
 - **Carefully think through a rollout plan before moving forward with any version upgrade**
 - Research all version compatibility issues
 - Realize that this applies to all software, not just ESRI components

NOTE: Always perform the upgrade in a test environment first

NGA ePODS – Background

- **Organization**

- US Government agency providing timely, relevant, and accurate geospatial intelligence in support of national security objectives
- Support global safety of navigation (Nautical & Aeronautical)

- **Business Problem**

- Safety of navigation charts are very out of date and expensive to update
- These products must be made available to a larger audience “on demand”, and must contain the “best available” NGA data
 - Manual replacement not an option
 - Desktop / Thick client solution not an option

NGA ePODS – Background

- **J2EE as the standard server development platform**
 - Web applications and services deployed to WebLogic
 - Support .NET server applications if justifiable
- **High availability a must**
 - Web application used around the world, 24 hours a day
- **Cross platform environment**
 - Web / Application Servers: Windows 2003 Server
 - ArcIMS Servers: Windows 2003 Server
 - ArcGIS Servers: Windows 2003 Server
 - Database Servers: Solaris

NGA ePODS – Technology Stack

- **ESRI Technologies**

- ArcGIS Server .NET 9.2
- ArcIMS 9.2
- ArcSDE 9.1 / 9.2
- ArcGIS Desktop 9.2 w/ PLTS Extension

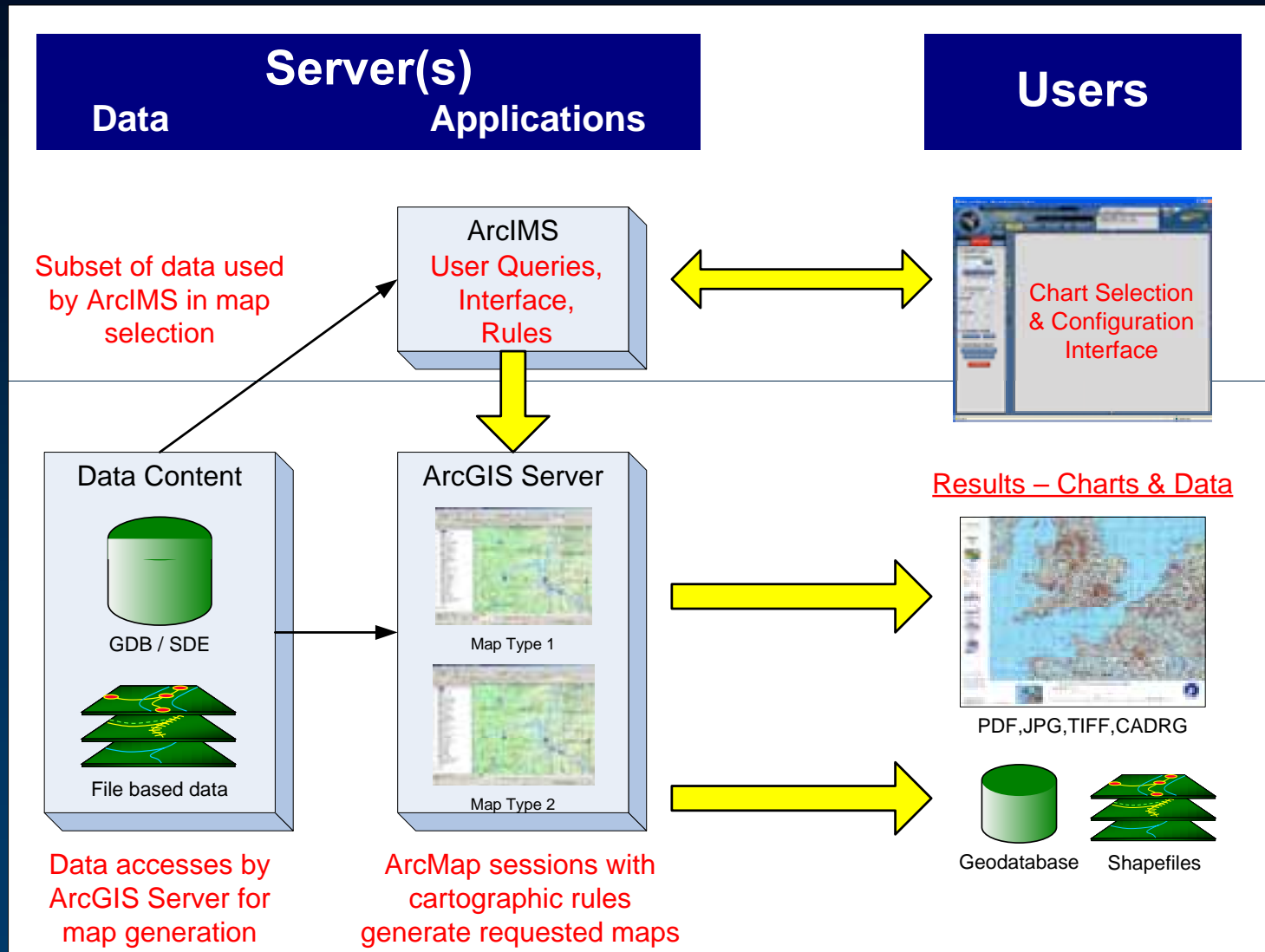
- **Other Technologies**

- Apache HTTP Server
- WebLogic Server 9.2
- Oracle 9i / 10g RDBMS

NGA ePODS – Challenges

- **Very complex rules for cartographic output**
 - Dynamic map surrounds
 - Large sizes (up to E-size)
 - Support cartographic “refinement” post-export
- **All advanced product options to be exposed through web service interfaces**
- **Support asynchronous processing of web service requests**

NGA ePODS - Architecture



NGA ePODS – Lessons Learned

- **True map production is very involved**
 - Often the cartographic requirements for map production are very rigid
 - Typically based on specifications
 - Complex map surrounds that update dynamically as the map changes
 - Translates to heavy load on the server
 - Consider PLTS w/ Server extension
 - Look for POD framework solution from ESRI Professional Services

NGA ePODS – Lessons Learned

- **Cartographers will always want to fine tune**
 - Even with the best server-based solution, often its still not possible to meet all aspects of the specification
 - Consider providing the capability to export “finishing product”
 - Downloads the pertinent data in file format (clip and ship)
 - Downloads an MXD configured to read downloaded data
 - Allows the cartographer to fine tune the MXD with desktop tools, then export to PDF directly from their workstation

Summary

Project Experiences

- Enterprise systems are complicated, and need to be well defined and designed
- Enterprise GIS adds another dimension to enterprise systems, but they are still enterprise
- Look for other case studies and learn from the experiences of others

Don't reinvent the wheel!

Further questions?

- **TECH-TALK AREAS**

- **What:** Further opportunity to discuss questions and concerns with presenters and subject matter experts
- **Where:** Tech Talk Area 3
- **When:** during the next 30 minutes

- **ESRI Showcase**

- **Meet the teams**

- **ESRI Developers Network (EDN) website**

- **<http://edn.esri.com>**

Q & A