



Enterprise Integration for Developers

Options, Considerations and Experiences

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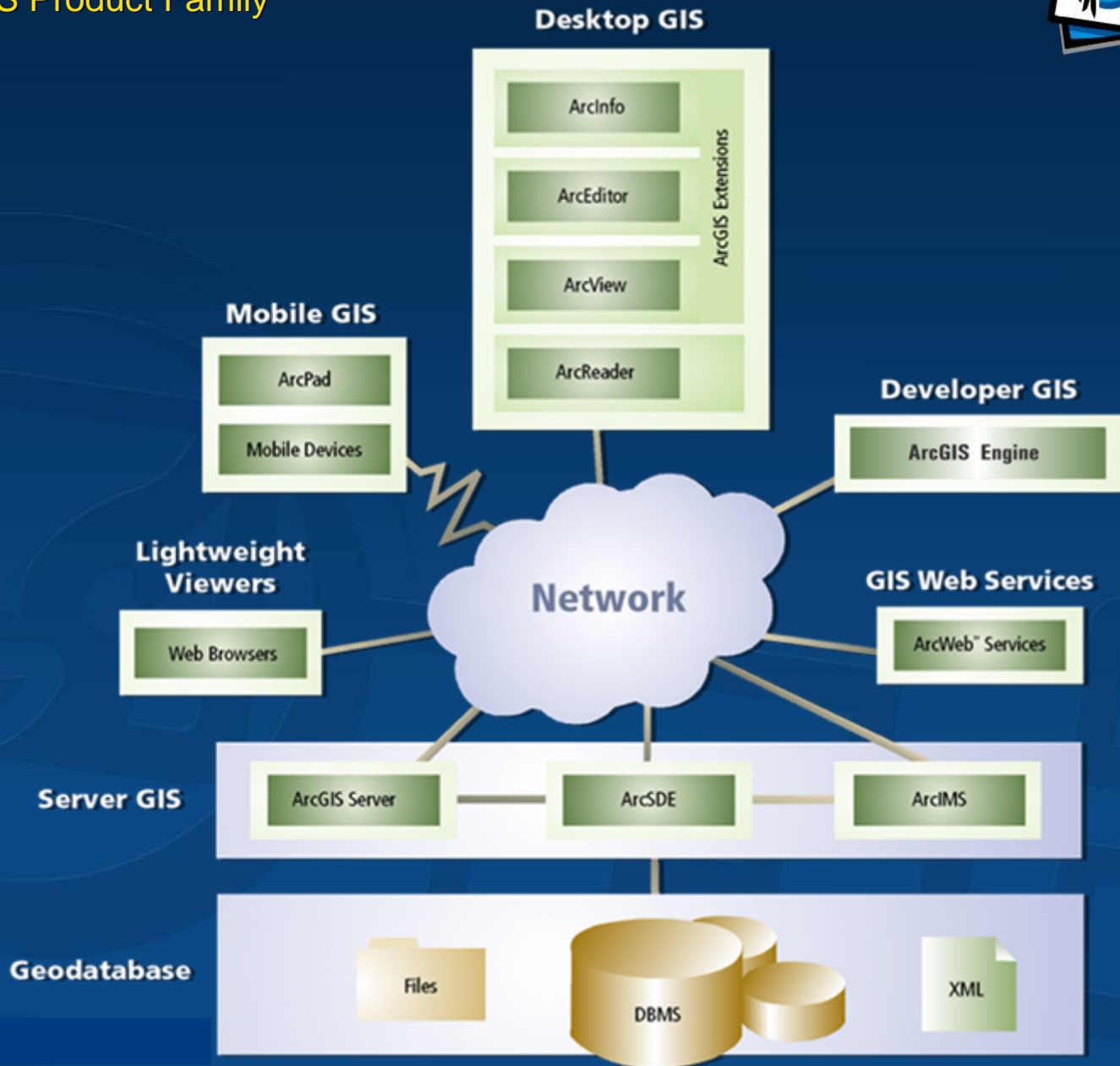
What is “Enterprise”?



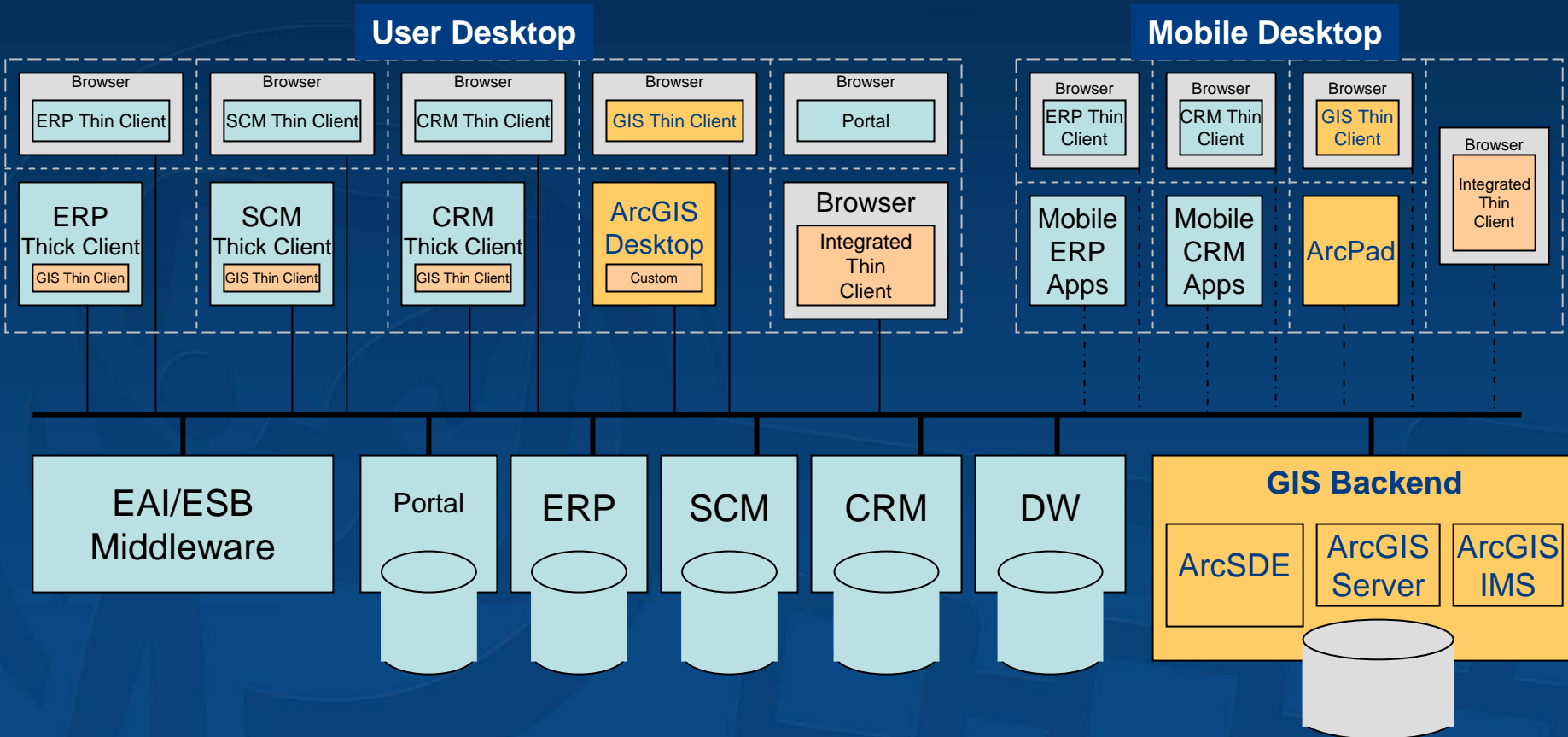
- An *enterprise* consists of all functional departments, people, and systems within an organization
- Successful *enterprises* have a “free flow” of information between the systems that support their missions and functions
- *Enterprise* requires interoperability
- EIS = Enterprise Information System
 - Ex. GIS, ERP and CRM

ESRI Technology Platform

ArcGIS Product Family



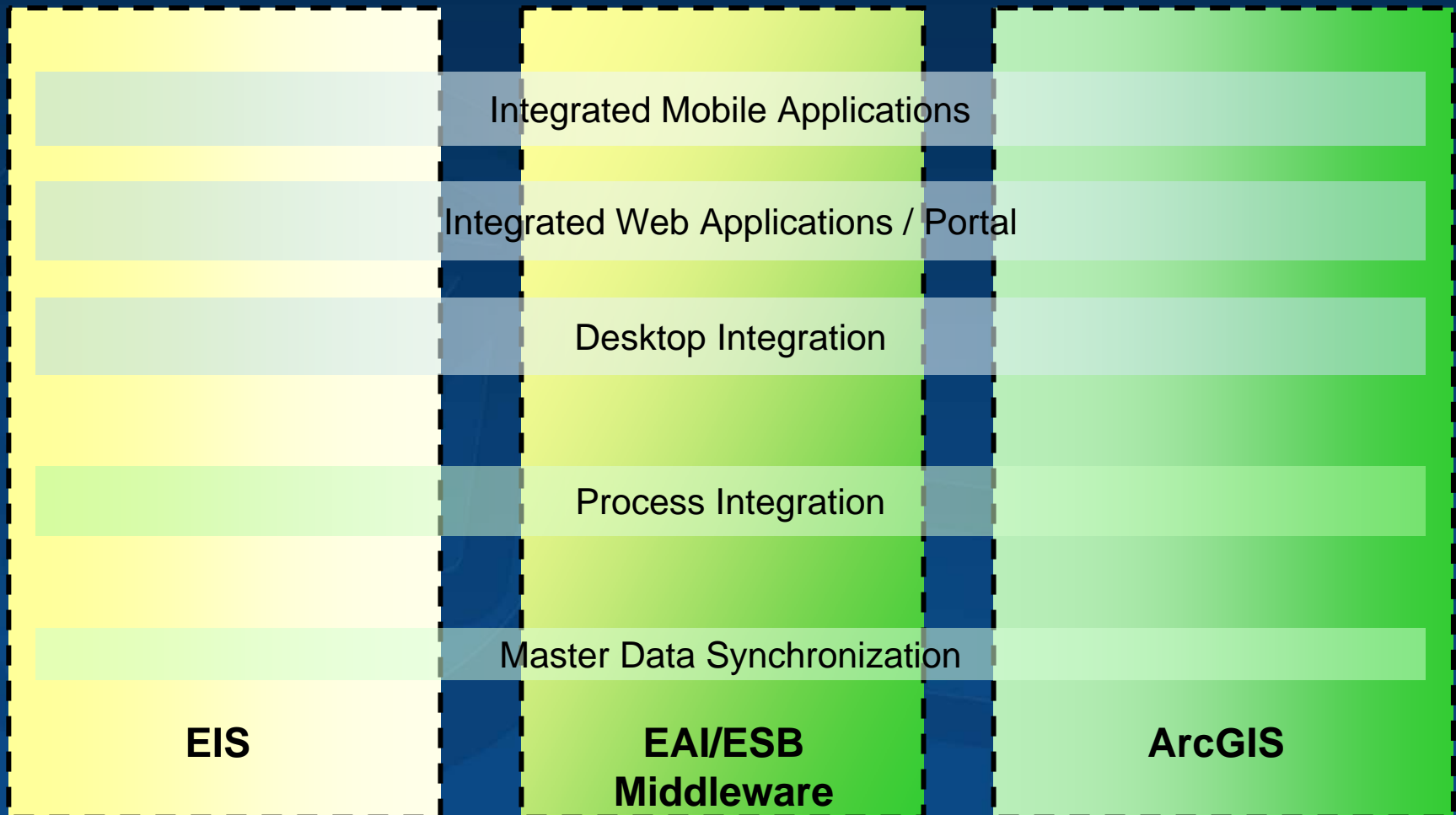
Example Enterprise Landscape



ESRI ArcGIS with SAP NetWeaver for mySAP Solutions



Integrated applications make use of an enhanced enterprise platform.



Scenarios



- Scenario 1: Visualization of external EIS data in maps
- Scenario 2: GIS user interface based business processes that call external EIS services
- Scenario 3: External EIS user interface based business processes that require maps
- Scenario 4: External EIS user interface based business processes enhanced with calls to GIS services
- Scenario 5: Background processes that involve both external EIS and GIS services
- Scenario 6: Web and Portal applications that have GIS and external EIS components
- Scenario 7: Mobile applications that have GIS and external EIS components
- Scenario 8: Visualizing and analyzing data warehouse information with maps

Scenario 1: Visualization of external EIS data in maps



- Example use cases:
 - Visualize work order status of business objects.
 - Visualize sales performance of sales regions.
- Identifiable patterns:
 - GIS pulls data using direct calls to the external EIS
 - GIS pulls data using EAI middleware
 - External data pulled live
 - External data cached in GIS

Scenario 2: GIS UI based business processes that call external EIS services



- Example use cases:
 - Mass change on business data based on a spatial criteria.
 - Network design process interaction with material goods warehouse.
- Identifiable patterns:
 - GIS direct calls to EIS services
 - GIS calls using EAI middleware

Scenario 3: External EIS UI based business processes that require maps



- Example use cases:
 - A business object needs to be located on the map.
 - A location needs to be included in the process.
 - Statuses of a collection of business objects need to be visualized with reference to location.
 - A map tool is required for selection of the business object.
- Identifiable patterns:
 - Map tool embedded in external EIS UI
 - External EIS UI interacts with ArcMap

Scenario 4: External EIS UI based business processes enhanced with calls to GIS services



- Example use cases:
 - Making use of utility network tracing for selection of business objects.
 - Making use of geocoding to verify addresses.
 - Making use of spatial query to determine business zones.
- Identifiable patterns:
 - External EIS direct calls to GIS services
 - External EIS calls via EAI middleware

Scenario 5: Background processes that involve both external EIS and GIS services



- Example use cases:
 - Data synchronization processes.
 - Simple case: all data flow in one direction.
 - Complex case: involve bi-direction posting of data changes.
 - Update of external EIS data in the GIS cache for use in scenario 1.
- Identifiable patterns:
 - Direct calls
 - Calls via EAI middleware
 - Composite business process running in EAI middleware

Scenario 6: Web and Portal applications that have GIS and external EIS components



- Example use cases:
 - Traditional EIS thick client applications redeployed on the web and portal.
 - A new breed of applications that cover a whole workflow, implemented using existing services from both GIS and external EIS, and deployed on a portal.
- Identifiable patterns:
 - Tightly coupled web applications
 - Loosely coupled portal based applications

Scenario 7: Mobile applications that have GIS and external EIS components



- Example use cases:
 - Locating assets on the field and subsequently updating asset information.
 - Locating assets on the field with a given EIS data filter.
- Identifiable patterns:
 - Tightly coupled mobile applications
 - Loosely coupled mobile applications

Scenario 8: Visualizing and analyzing data warehouse information with maps



- Example use cases:
 - Map based reports using sales or marketing data
 - Business intelligence applications with integrated map visualization
- Identifiable patterns:
 - Pulling of report data from a data warehouse
 - Pushing of report data from a BI tool to mapping services

Technical Patterns



- Pattern 1: ArcMap direct calls to an external EIS system
- Pattern 2: ArcMap indirect calls to an external EIS system
- Pattern 3: Map tool integrated inside an external EIS thick-client
- Pattern 4: Backend-to-backend communication: direct connection
- Pattern 5: Backend-to-backend communication via EAI/ESB middleware
- Pattern 6: Tightly couples web applications
- Pattern 7: Loosely coupled portlet applications
- Pattern 8: Tightly coupled mobile applications
- Pattern 9: Loosely coupled mobile applications
- Pattern 10: OLAP access to data warehouses
- Pattern 11: GIS integration with BI reporting tools and dashboards



Pattern 1: ArcMap direct calls to an external EIS system

- Data can be streamed online
 - Live data
 - Slower performance
 - Is the data directly available or is it a result of complex queries?
 - How much data needs to be shown on the map?
- Data can be cached in the GIS
 - Fast performance
 - Data not fresh

Pattern 1: ArcMap direct calls to an EIS system



- Can be a silent call -- no external EIS UI.
- Call can bring up the EIS UI as a separate window pop-up.
- May require an EIS specific connector especially for calls that involve the EIS UI.
- ArcMap Tools and Commands host the trigger for calling the services in the EIS system
- ArcMap Extension is used to host the connection session to the EIS backend

Pattern 1: ArcMap direct calls to an EIS system



- SAP specific example:
 - Prior to release 6.20, service calls had to be made using an RFC connector
 - .NET connector and Java connector
 - Supports SAPGUI
 - RFC connector:
 - .NET connector and Java connector
 - Supports SAPGUI
 - For 6.20 and above, services are made available as a web service



Pattern 1: ArcMap direct calls to an EIS system



Video



Pattern 2: ArcMap indirect calls to an external EIS system

- Very similar to Pattern 1 except calls made indirectly via EAI middleware
- Calls are always silent – no ERP UI
- Can require an EAI specific connector but most EAI middleware support web services
- ArcMap Tools and Commands host the trigger for calling the services in the EIS system
- ArcMap Extension is used to host the connection session to the EAI middleware



Pattern 2: ArcMap indirect calls to an external EIS system

- SAP specific example:
 - SAP's EAI or ESB middleware is called Exchange Infrastructure (XI)
 - SAP XI supports web services
 - Other middleware can also be used:
 - IBM WebSphere
 - iWay
 - WebMethods
 - Microsoft BizTalk
 - BEA WebLogic



Pattern 3: Map tool integrated inside an external EIS thick-client



- There are three possibilities for the map tool:
 - ArcObjects based
 - web application based
 - web services based
- The web application and web services options are the most feasible.
 - Zero install and no expensive client licenses required
 - The tool tends to be easy to use and simple.
- The coupling between the external EIS process and the map tool process is via client side scripting.
 - Exchange of data is possible but limited



Pattern 3: Map tool integrated inside an external EIS thick-client

- SAP specific example:
 - SAPGUI has a COM container
 - ActiveX controls can be embedded
 - SAPGUI comes with a browser control
 - The SAP ABAP process can execute methods in the ActiveX control
 - ABAP events can be raised by the ActiveX control process



Pattern 3: Map tool integrated inside an external EIS thick-client



Demo

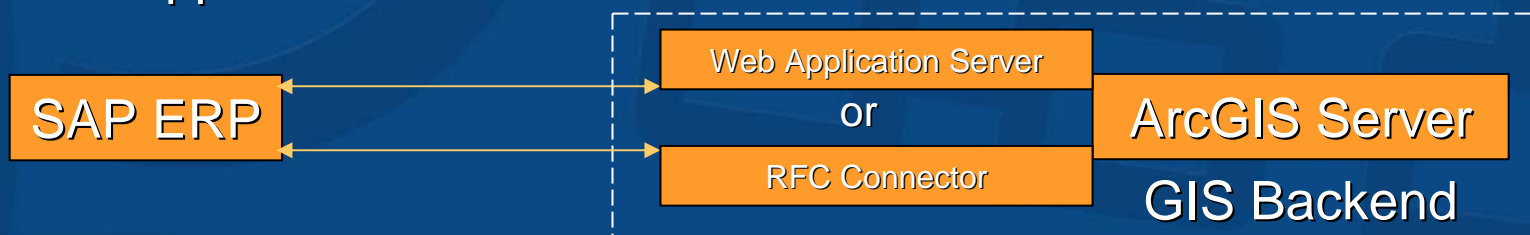
Pattern 4: Backend-to-backend direct calls



- Most EIS systems support web services for communicating with external systems
 - Requires a web server or a web application server in front of ArcGIS Server, ArcIMS or ArcSDE
- If tight coupling is required (ex. stateful transactions) then EIS specific connectors are required.

Pattern 4: Backend-to-backend direct calls

- SAP specific example:
 - For SAP version is prior to 6.20, an RFC connector is required
 - GIS as a server call: an RFC server hosts the RFC connector and makes ArcObjects calls via ArcGIS Server
 - SAP as a server: a custom coarse grain object running in ArcGIS Server hosts the RFC connector
 - For SAP version 6.20 and above, web services are supported in both directions
 - SAP NetWeaver J2EE server can be used as the web application server for ArcGIS



Pattern 5: Backend-to-backend communication via EAI middleware

- Service Oriented Architecture
- EAI serves as the Enterprise Service Bus
- On the GIS side:
 - web services are used
 - a web application server is crucial
 - ArcGIS Server is crucial when data updates are required or special services like utility network tracing are required



Pattern 5: Backend-to-backend communication via EAI middleware

- SAP specific example:
 - SAP XI or other EAI/ESB middleware can be used
 - SAP NetWeaver J2EE server can be used as the web application server for ArcGIS



Pattern 6: Tightly coupled web applications



- Tightly coupled web applications – EIS and GIS components are controlled in one web application.
- Components can be web services based.
- Components can involve state full connectors.
- GIS components could also use ArcObjects or ArcXML directly
- Can be deployed in a portal
 - Web application wrapped as a portlet
 - Purpose built portlet

Pattern 6: Tightly coupled web applications



- SAP specific examples:
 - JSP application running on SAP NetWeaver J2EE server using the SAP Java Connector and the ArcIMS Java Connector
 - ASP.NET application using the SAP.NET Connector and ArcObjects via ArcGIS Server
 - ASP.NET or JSP application calling web services (both SAP ERP and ArcGIS)
 - Composite applications wrapped as a URL iView and deployed inside SAP NetWeaver Portal server
 - Purpose built iView that directly runs inside SAP NetWeaver Portal server



Pattern 7: Loosely coupled portlet applications

- Portlets are combined into a single portal page
- Portlets are able to interact – loosely coupled via client side scripting
- Two types of GIS portlets
 - Traditional web applications wrapped into a portlet
 - Purpose built portlet



Pattern 7: Loosely coupled portlet applications

- SAP specific example:
 - SAP iViews are combined with GIS based iViews into one portal page
 - SAP's Portal Client Framework allows data bagging and eventing between iViews

Pattern 7: Loosely coupled portlet applications



Demo



Pattern 8: Tightly coupled mobile applications

- Tightly coupled mobile applications – EIS and GIS components are controlled in one application
- Target devices
 - PDAs
 - SmartPhones
 - Laptops, etc
- ESRI relevant technology
 - ArcGIS Engine
 - ArcGIS Server Mobile Development Kit
 - ArcWeb Mobile Toolkit
 - ArcWeb Services



Pattern 8: Tightly coupled mobile applications

- SAP specific example:
 - SAP Mobile Infrastructure
 - Java 2.0 based
 - JSP server running on the mobile device
 - Java based application occasionally connected to the network
 - Combine SAP MI and ArcGIS Engine
 - ArcGIS Engine map control not visible!
 - Not possible for PDAs and SmartPhones
 - Java based application with persistent network connectivity
 - Combine SAP MI and ArcWeb Services



Pattern 9: Loosely coupled mobile applications

- Loosely coupled applications – external EIS application and GIS application are standalone applications
- Target devices
 - PDAs
 - SmartPhones
 - Laptops, etc
- ESRI relevant technology
 - ArcGIS Engine
 - ArcWeb Services
 - ArcPad



Pattern 9: Loosely coupled mobile applications

- SAP specific example:
 - SAP MI JSP application interacting with:
 - ArcGIS Engine via ActiveX
 - ArcWeb Services based web application
 - ArcPad via ActiveX and DDE
 - SAP Mobile Asset Management 3.0 has an ArcPad integration example
 - Zoom to coordinate
 - GIS data synchronization

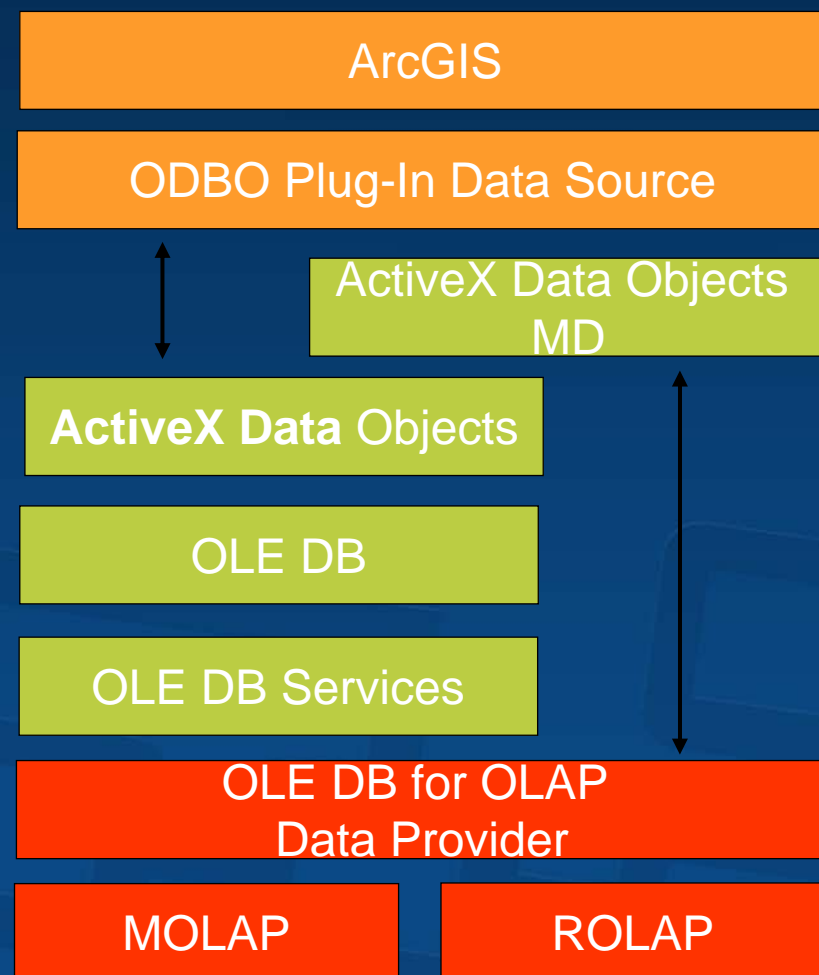
Pattern 10: OLAP access to data warehouses

- Utilize ArcGIS to visualize information in data warehouses
- Loosely coupled integration
- Pulling of information through standard or proprietary interfaces
 - Snapshot replication or live link
- Spatial reference of warehouse data
 - Indirect (postal codes, names) -> Join or relate to spatial data
 - Direct (warehouse data contains coordinates/geometries)
- Impedance mismatch
 - ArcGIS: 2-dimensional (attribute) tables
 - OLAP: multi-dimensional cubes



Pattern 10: OLAP access to data warehouses

- OLAP for ArcGIS
 - Standard Technology
 - Query Language: Multi-Dimensional Expressions (MDX)
 - Driver Interface: OLE DB for OLAP (ODBO)
 - High-level API: Multidimensional ActiveX Data Objects (ADO MD)
 - ArcObjects API (Plug-in Data Source)
 - ArcGIS Desktop
 - ArcGIS Server
 - ArcIMS ArcMap Server
 - Free add-on



Pattern 10: OLAP access to data warehouses



Demo



Pattern 11: GIS functionality integrated in Web-based BI tool

- Combine BI functionality with genuine GIS functionality:
 - Complex multi-dimensional data exploration and analysis
 - Dashboards (charts & tables)
 - Thematic maps
 - Geographic filtering (buffer, drive times)
- Tightly coupled integration
 - Seamless integration in BI environment
 - Bi-directional interfaces
- Data can be pushed to GIS or pulled from GIS
- Requires software development kit and sufficient documentation
- Impedance mismatch remains a problem



Pattern 11: GIS functionality integrated in Web-based BI tool

- If BI environment is based on ...
 - J2EE/JSP: Java Connector, ArcObjects Java API
 - J2EE/Java Server Faces (JSF): Java ADF
 - Microsoft .NET Web Controls: .NET ADF
- Integration options
 - ArcIMS
 - Option: Export report data to ArcSDE-enabled database and join layers on-the-fly
 - Option: Use ArcXML to create rendering instructions on-the-fly
 - ArcGIS Server
 - Option: Use ArcObjects API to manipulate rendering on-the-fly
 - Option: Use Plug-in data source approach to directly connect to data warehouse
 - Option: Use Plug-in data source approach to implement memory data source

Pattern 11: GIS functionality integrated in Web-based BI tool



Demo

Conclusion



- GIS enterprise integration has many touch points between GIS and the external EIS.
- Point-to-point communication is still an option.
- There is momentum towards SOA and EAI/ESB based communication.
 - Most EIS vendors support web services
 - Process orchestration is best managed centrally in a EAI/ESB middleware
- The ArcGIS technology platform is flexible and open to interoperability that suits enterprise integration.



Q&A