Domain Spatial Service Extension(DSSE)

- <u>Domain Spatial Service Extension(DSSE)</u>
- <u>Principle of DSSE</u>
- <u>Sample of DSSE</u>

DSSE overview

Why providing DSSE

When the general GIS services cannot satisfy specific needs of a certain industry, the GIS service platform needs to provide a flexible mechanism for extending the services. Developers can incorporate these specific function requirements into the GIS service platform by using this extension mechanism, to provide the industry with a service system for processing spatial information.

Currently, there are a number of approaches to extending GIS services in the GIS platform. Each approach has its own advantages and disadvantages, and is suitable under certain situations.

Type	Description	Advantages	Disadvantages
Fixed extension interface	Custom interfaces are provided in a service, based on which developers can implement specifics of special functions. If the CustomInvoke interface is opened in a service, developers can implement special custom functions by overloading the CustomInvoke() method.	Easy development. It is only needed to implement method overloading.	The interface is not transparent. The interface user and provider need to agree on the format of passed parameters and output result beforehand. Furthermore, a fixed interface can only provide the special functions of one single service, thus is not suitable for customization for complicated business.
Building function modules	Implements a set of workflow-based GIS services through building function modules. The GIS service platform provides a mechanism for building models. Developers can build models for GIS function modules, in order to realize GIS services that have certain workflow for processing business.	The modeling is simple and easy to use.	It can build models for existing function modules, but cannot create or integrate extensions for new business.
The mechanism for extending domain spatial information services	This extension mechanism provides flexible and easy-to-extend framework for developing service components. In this framework, developers can quickly develop domain spatial information services with characteristics suitable for various domains using the basic GIS modules provided in SuperMap iServer. Domain spatial information services can be integrated to the SuperMap iServer service system using simple and flexible configuration tools. People who need services can then obtain more professional spatial service.	Flexible and easy to extend.	

What is DSS

SuperMap iServer categorizes spatial services into two types. One is general spatial services (GSS) provided by SuperMap iServer itself, including 3D, etc. The other type is domain spatial information services (DSS) which users

build by themselves for processing spatial information based on special business logics of their domains, such as a map service for wind direction symbols applied in the meteorology industry. Although users need to develop the services themselves, SuperMap iServer provides a flexible and agile framework for developing service components as well as a mechanism for operating service components. When developing service components, users can incorporate their business logics with the built-in GIS service modules, and easily integrate their DSS in the service framework in SuperMap iServer.

What applications need DSS

Basic map services, spatial analysis services, realspace services, and data services provided in SuperMap iServer cover most of the spatial processing functions. But spatial information service alone may not satisfy business requirements of an industry. It may be needed to incorporate the business features or existing business data of an industry into spatial information processing, in order to build a set of spatial information services proper for the specific business logics of this industry. To achieve this, custom business service components can be built with the domain spatial information service mode provided in SuperMap iServer. Then the services can be published by using the domain spatial information service extension mechanism of SuperMap iServer.

● Domain spatial information services built from integrating GIS and business models required by the system

Business rules in different industries can be different. Some businesses have logics requirements on spatial information processing that built-in GIS processing modules in SuperMap iServer cannot realize. Therefore users can build custom domain spatial information services that incorporate business logic relationships in their industry to process spatial information. To achieve this, users can employ the GIS processing modules in SuperMap iServer. For example, a stochastic hydrological modeling analysis service can be built for the water conservancy industry. The built-in GIS analysis functions in SuperMap iServer cannot implement the algorithms for stochastic hydrological modeling, whereas the hydrological analyses in the water conservancy industry do not consider the characteristics of spatial variability. Therefore, users can integrate the stochastic hydrological modeling algorithms in the industry and the spatial information processing functions in GIS, to build a spatial information-oriented stochastic hydrological modeling analysis service for the water conservancy industry. This service can be used to analyze drought characteristics and stochastic variability of storm and flood processes in a watershed, to design retention systems, and to support decision making on planning a hydrological and water resource system.

● Domain spatial information services with multiple GIS functions combined

Usually every interaction between a client and a SuperMap iServer spatial service is based on a single GIS function request, such as finding the query result and map location corresponding to a keyword. If a business request needs a combination of two or more GIS functions to obtain a result, the user can combine multiple GIS functions through building a domain spatial information service. This type of domain spatial information services only requires the user to arrange a set of GIS functions. The specific GIS operations can be implemented using the service provider modules in the SuperMap iServer framework.

● Domain spatial information services integrated with original business systems

For businesses that have built information platforms, integrating GIS technology's capacity to process spatial information can certainly help with decision making and information management in the businesses. Users can build domain spatial information services that integrate the original business systems, information management, and decision systems, by using the extension mechanism of SuperMap iServer spatial information services. Interfaces that can be interacted with the original systems can be published in the domain spatial information services. In this way, the original business data can be effectively presented with GIS functions, and the information representation as well as business decision making and management can be fully supported. Domain spatial information services in SuperMap iServer provide some special industries with excellent solutions to the integration between business and spatial information.

DSSE features

● An open framework of a service system allows easy DSS extension

The framework of a service system in SuperMap iServer is composed of layers and modules. Services are configured and deployed in a unified fashion. A service framework in SuperMap iServer has three layers. Each layer contains relatively independent function modules in which specific operation contents are implemented. Users can build function modules that conform to the business logics of their industries on any level of the framework, or develop domain spatial information service components by extending a module on a layer. The modules on the layers

of services published by SuperMap iServer are organized by the service configuration and management component. Users can deploy their custom DSSs to the SuperMap iServer service system using the service configuration and management component. By doing this, the DSSs are published.

- Supporting abundant and multi-level GIS service modules

As mentioned above, relatively independent function modules are built in each level of the SuperMap iServer service framework. For example, the basic map service provider module--UGCMapProvider, the 3D service provider module--3DProvider, the RESTful interface module--REST Servlet, etc. These modules communicate with other modules via interfaces. When designing and developing a DSS, the user can implement the GIS processing part by using built-in GIS service modules in SuperMap iServer, and then combine GIS and the business logics of the industry. The built-in GIS service modules in SuperMap iServer are tools for a user to implement the GIS part of a DSS, so that the user can quickly develop a spatial-oriented domain service component.

- Flexible mechanism for customizing business services

The extension mechanism of domain spatial information services in SuperMap iServer provider users with a flexible construction mechanism for industry application-based spatial operations. All the modules in the framework of a SuperMap iServer service system are organized and published with the service configuration and management component, which operates by reading the service assembly information and module metadata. This kind of configuration mechanism makes it possible for users to freely combine function modules from the layers. To integrate a custom DSS to a SuperMap iServer system and publish the DSS, the user only needs to describe the metadata of the DSS, and describe its modules and its relationships between the modules on each layer.

DSSE Principles

Domain spatial service extensions in SuperMap iServer provide users with a flexible and open service component development framework as well as a series of SPIs of domain spatial information services, so that users can easily grasp the development of domain spatial information services.

Framework of DSS Component Development

As the figure indicates, SuperMap iServer is built by develop framework of tri-level structure system.
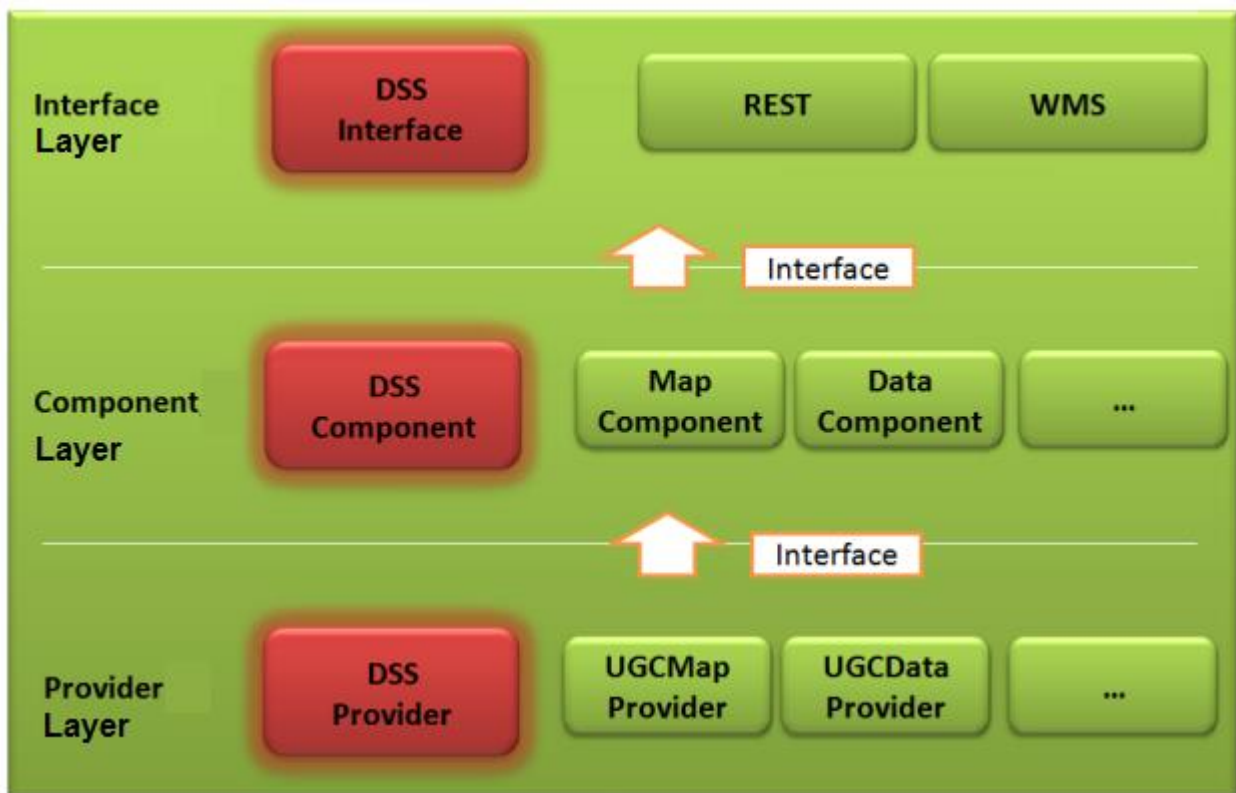
- Realizes the GIS function dealing by the GIS computing core or third party GIS service, e.g., UGCMapProvider realizes the GIS function of map operation by the UGO core.
- Module of Component level: devided by the GIS function, package Provider modules, e.g., Map Component calls the Map Provider module in Provider level, and provides serial GIS functions of the map operation
- Servlet or Interface in the Interface level: built by different service mode, Servlet or Interface, publish Component module as various kinds of service, e.g.: Map Component as REST style map service, Data Component as WFS service.

Modules of the 3 levels connect by the unified interface, this ensures the conversation availability between modules. Create relationship between modules dynamically for each module in the 3 levels by the configuration files (describing the module calling relationship between each level) and dependence injection tech (calling dynamically by the relationship between each level). All kinds of GIS services provided by SuperMap iServer is built by the module's combination and affection between the 3 levels.

Multi-level service structure of SuperMap iServer provides great basic framework for the domain space information service expansion of users. By the self business demanding, user could develop function module matches with own business feature on any level of the SuperMap iServer service system. Domain space information service module and the built-in module within SuperMap iServer have the same status, SuperMap iServer could published it finally as the domain space information service.

About specific classfication and information of the three levels module, please refer to:each module of the 3 levels。

DSS SPIs

The domain spatial information service SPIs provide users with a series of interfaces for building domain spatial information service components, such as ProviderContextAware, ComponentContextAware, InterfaceContextAware and ProviderContext, ComponentContext, and InterfaceContext.

XXXContextAware is a context dependent interface that SuperMap iServer provides to service modules on each layer. Through the setXXXContext (XXXContext context) method of this interface, SuperMap iServer assigns the context information (a XXXContext object) related to a DDS in the service configuration file to the DSS, using the dependency injection technology. Once the DSS obtains XXXContext, it can directly call the linked module objects. For example, in the following figure, the setComponentContext (ComponentContext context) method of ComponentContextAware is implemented in DSSComponent which is built on the Component layer. Then the needed Provider object is obtained through ComponentContext, and the GIS functions of this object are re-arranged.
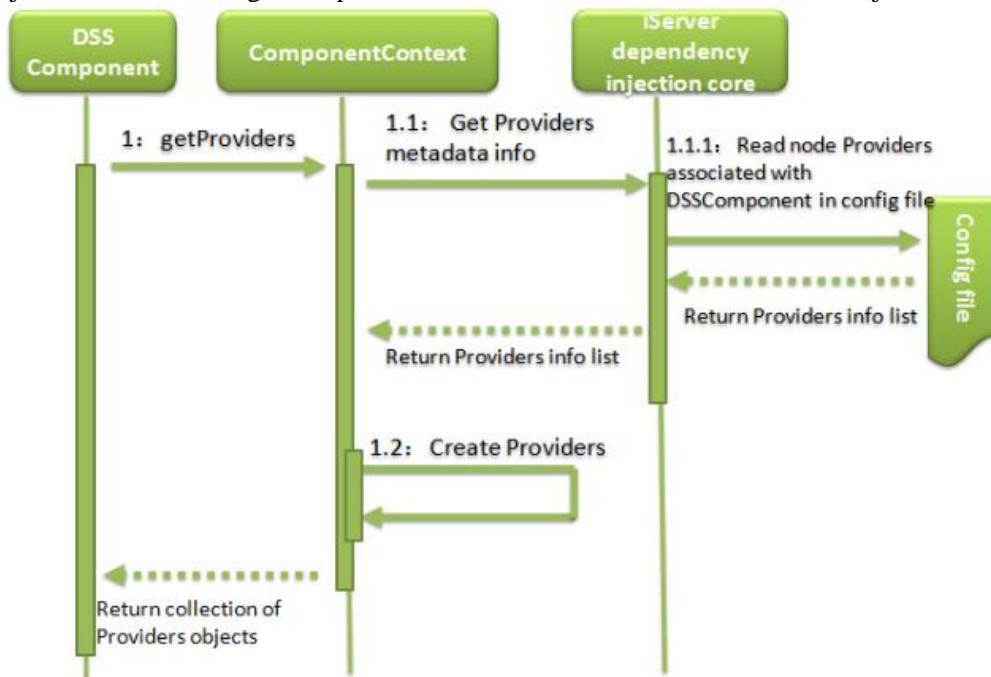
omni domain space information service expansion

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SuperMap iServer provides a flexible mechanism for constructing and publishing services that applies to both GSS and DSS.

Server service framework is a three-layer architecture, that is, GIS service provider layer, GIS service component layer, and GIS service interface layer. For more details, please refer to Architecture. DSSE can be performed on any of the three layers.

- Extension for Provider Layer

Service providers in iServer indicates the sources GIS capabilities. By extending service providers, the sources of GIS capabilities can be expanded. For instance, a map service provider can be extended to read iServer 2008 map caches, therefore publishing map caches from iServer 2008 as different types of services, like REST services, WMS services, etc., in iServer. Also, a map service provider can be extended to realize the capability of getting GoogleMaps map services, therefore publishing map services from GooleMaps as different types of services, like REST services, WMS services, etc., in iServer.

Meanwhile, new types of service providers can be defined to realize capabilities for certain domains. Domain service providers can be combined and encapsulated on the component layer with other service providers as more coarse-weight module, realizing the integration of domain capabilities and GIS capabilities.

Please refer to Extension for Provider Layer.

- Extension for Component Layer

The service component layer is resonsible for the combination and encapsulation of capabilities provided by service providers.

When the capabilities of the current service components cannot satisfy the needs, we can extend the existing service components to encapsulate more capabilities.

Meanwhile, the extension of the service component layer can be combined with the service interface layer extension. The newly extended service component can be published as Web service through the extended service interface, which is got from defining new resource in the JAX-RS mechanism, customizing new service interface, etc.

For instance, for the applications in the Meteorological field, to integrate weather forecast and weather alterting services into iServer, the service component layer needs to be extended accordingly.

Please refer to Extension for Component Layer.

- Extension for Interface Layer

The service interface layer is the layer for the display of capabilities. By extending service interfaces, the formats in which services are provided by iServer can be enriched (please refer to), therefore better satisfying the needs of users.

Besides, by extending existing service interfaces, such as JaxrsServletForJersey and RestServlet, to customize new REST reource implementations, the capabilities of the domain components can better match the service interfaces.

Please refer to Extension for Interface Layer.

Besides, domain modules extended based on iServer can be integrated into iServer WebManager (Please refer to Integrating Domain Module into WebManager). Also, clusters can be built based on domain domain spatial services (please refer to Building DSS Cluster).

Other overall sample about domain service expansion please refer to：3 levels structure expansion overall sample.

Brief

In summary, domain spatial information service components constructed by users can be flexibly integrated into the SuperMap iServer service system. The constructed DSSs can communicate and be integrated with built-in modules on the three layers in SuperMap iServer. These organization relationships do not need to be fixed in the programs during developing a DSS. Domain service components can be integrated into the SuperMap iServer service framework for publishing through: implementing ContextAware interfaces; then describing metadata about the combination of components in the configuration file; and calling support classes (Context) which are provided in SuperMap iServer for constructing domain service components, to retrieve modules on the higher-level layer during the development of a DSS.

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