Geographic information service aggregation

Service aggregation introduction

The promotion process of GIS applications in various industries has been through decades. The traditional GIS application is usually focused on the single application system itself to meet the demand of a specific business unit or department. It gradually leads to the "Isolated Information Island" problem. With the trends of information globalization and integration, as well as the rapid development of GIS technology, more and more enterprises, institutions and local government departments put forward new demands for their GIS information system respectively.

On the one hand, it`s about the demand of sharing spatial data. Previously, GIS gradually applied to various fields and all levels of departments in the same field built their own spatial databases. In the nationwide, databases of country level, province level, city level and county level were built gradually. As the deepening of GIS technology, it was found that databases at all levels must be shared and integrated. Transportation (roads) data, for instance, would be changed when the data of the basic unit level is changed. The higher level unit director would like to capture changes as soon as possible so that people can quickly make appropriate response without going through a series of actions that basic units report the change of data to higher level units and higher level units receive, calibration, modification, storage data and add data to the database or send unqualified data back to lower level units. That was because GIS systems of all levels of departments were independent of each other, i.e., the "Isolated Information Island" problem.

On the other hand, it is about the demand of sharing GIS functions. Because of the constantly increase of user demands, GIS system function modules need to expand continually and the cost of redesign and integration of GIS systems become the endless investment trap. At this time, enterprises require a more agile business system, and GIS system needs to become more flexible to make the enterprise respond quickly on the basis of the changing demands. For government departments, it`s expected that the inter-departmental "Isolated Information Island" problem and the phenomenon of fragmentation can be broken, make full use of the specialized information services at all departments to form government information system that departments could be inter-connected to each other and information resources could be integrated and shared. Let`s take the "Beijing-Zhuhai Expressway" as an example. The whole "Beijing-Zhuhai Expressway" runs through six provinces which are Beijing, Hubei, Henan, Hubei, Hunan and Guangdong. It is more than 3000 Km long from Beijing in the north to Zhuhai (in Guangdong) in the south. The actual management and conservation of Beijing-Zhuhai Expressway is the responsibility of six different provinces and municipalities. But the Ministry of Communication is also interested in the data situation of various sections of the expressway and expects to analysis and query data of all provinces and municipalities, check different building levels, conservation areas, jurisdictions, construction units, building`s investors, conservation situations, etc. So, independent GIS systems which were built previously for regional departments cannot meet this demand.

In order to flexibly solve the problems of how to reuse GIS data and functionality, SuperMap Software provides the Service GIS technology framework. With the development and implementation of GIS Services, Geographic Information successfully ushered in new service-oriented model of geographic information sharing and the era of geographic information service aggregation.

The definition of Geographic Information Service Aggregation

The definition of geographic information service aggregation

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Geographic information service aggregation, following the standardized service specification, integrates different sources of standardized geographic information services, generating new services by parsing and integrating standard spatial data, reusing and reconstructing geographic information providers' GIS functions. The subject of geographic information service aggregation is service and the result of aggregation is new service. Standardized specifications provide conditions of data sharing for geographic information. Geographic information service aggregation provides the technical support for spatial data sharing and the implementation of service-based GIS functionality sharing.

Elements of geographic information service aggregation

The three elements of geographic information service aggregation are geographic information services which will be aggregated (provider), aggregator and aggregated geographic information services (aggregating results). To aggregate services from different sources and then generate and publish new services, service providers need to provide services which follow standard geographic information specification or whose service standards are public. Based on common service integration (arrangement) standards, such as BPEL, BPM, etc., the aggregator reads geographic information from providers following standard specification to build new business need-based geographic information services. The aggregator needs not only to read spatial information with different service standards, but also to be able to generate new geographic information services from integrated spatial information based on the standard specification. This ensures that the aggregated services can be seamlessly integrated into the standard service-oriented technology framework to make the extension and integration of business more convenient.

The relationship of geographic information service aggregation with Mashup, Overlay, BPEL and ESB

Geographic information service aggregation solves the problem of "how to reuse GIS data and GIS functions", which aims at the agility of enterprise-level GIS applications, ensuring the optimization of the business information flow, business reconstruction, and resource allocation. The final result of geographic information service aggregation is always the service. New services generated from aggregation process can still be providers of future business restructuring, which provides unlimited extension possibilities for the agility of enterprise-level GIS applications.

In recent years, aiming the issue of business agility, big software vendors launched their own technologies, such as Mashup, Overlay, BPEL, ESB, etc. All of these technologies have their own entry point, applicable direction and technical details. Geographic information service aggregation technology does not belong to any of above technologies. It is based on GIS features and the standard specification to fuse various services and then republish services.

Mashup is a new technology on the internet. A mashup is a Web page or application that uses and combines data, presentation, or functionality from two or more sources to create new services. The term implies easy, fast integration, frequently using open APIs and data sources to produce enriched results that were not necessarily the original reason for producing the raw source data. Therefore, Mashup is an early prototype of service aggregation and the primary expression and form of the aggregation application. The drawback of this aggregation is the possibility of causing "Isolated Information Island" problem again.

Overlay is to add a new image layer to the original map image, which is a marshup for the GIS map.

BPEL, business process execution language, is a programming language based on XML used to describe business processes. Each step of the described business process is implemented by the web service. In 2002, IBM, BEA and Microsoft developed and introduced a language as a description of web service coordination. The description itself is provided by web services and can be used as web services. By means of BPEL, a being used interface of web service can be described, such as the order with which the information needs to be entered. The subject of geographic information service aggregation is service. Therefore, the geographic information service aggregation can be integrated into BPEL. Further, by means of the description of BPEL business process, a geographic information service aggregation with the business process can be implemented as well.

ESB (Enterprise Service Bus) is an enterprise architecture bus. It is used to solve the problem of service interaction (implemented by message exchange). It is responsible for managing the service directory, resolving request method and message format, and providing addressing and forwarding services to service providers. It is a middleware between the service requester and the service provider and capable of unified service management and service integration in different formats. ESB is only used for service connection instead of business logic and re-servicing after being connected. The relationship between geographic information service aggregation and ESB is

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similar with BPEL. Geographic information service aggregation can be integrated into ESB or you can also use ESB to implement geographic information service aggregation.

The specifications of geographic information service aggregation

Geographic information service aggregation is a technique which brings the business agility for GIS spatial data and the interoperability of GIS functions. It does not simply overlay and then display some spatial services and spatial data, or expect to optimize the integration of spatial data and GIS functions, but rather expect the aggregated result to have the same business agility, so that it would be convenient for potential demand changing at this time or even in the future. Therefore, to implement the geographic information aggregation, some specifications are required which includes the standardization followed by the aggregation, the input and output of the aggregation and describable aggregation processes.

1 Related Service Standards

The development of standards is aimed to allow different units to interoperate and share resources with each other. Because different sources of geographic information services are involved by service aggregation, the basic insurance of geographic information service interoperation is that both service providers and aggregators follow public spatial data service standards, common service standards and common service integration standards.

1.1 Spatial Data Service Standard

The spatial data service standard is a constraint condition for providers and aggregators of the geographic information service aggregation. In this case, service providers and aggregated services have to follow somewhat spatial data service standards to publish their spatial information and GIS function services. Spatial data service standards include interface specifications of spatial data interoperation which developed by International Standardization Organizations (ISO/TC211) or technical alliances (such as OGC), GeoRss specification and some open service interface specifications such as Google Maps, Virtual Earth, etc.

OGC and ISO/TC211 together launched web-based (XML) spatial data interoperation specifications including Web Map Service, Web Feature Service, Web Coverage Service and GML which is a geographic information markup language used for spatial data transmission and transformation. In 2008, KML had became one of OGC standards.

GeoRSS is an "aggregation of geocoding object ", GeoRSS is the extension of RSS in the field of geographical information. Now, we can say that it is an actual standard of geographic object aggregation which supported by Yahoo, Microsoft, Google, etc.

Spatial data services are not only as spatial data service specifications for web services but also as standards for spatial data interoperation. Geographic information service aggregator can get desired data through this interface if the GIS service provider supports this interface. From the technology perspective, web service can be understood as an application which provides an interface to call from outside. It can be called by any language with any platform and system. This application can be implemented by any programming language we use today.

1.2 (Common) Service Standards

Web service common standards like WS-*, WSDL, SOAP, SCA, etc, that ensure the implementation of cross-platform, cross-language and cross-hardware interoperation for GIS or other web services. Therefore, one of critical constraints of the implementation of geographic information service aggregation is to deploy, describe and build a web service based on common service standards SOAP, WSDL, WS-* or SCA. For example, the aggregated map service published by the SOAP protocol.

1.3 (Common) Service Integration (Arrangement) Standards

Geographic information service integration can not only integrate or overlay various services, but also arrange and implement GIS functions basing on business demand and service arrangement standards. Therefore, geographic information service integration can support common service integration (arrangement) standards, such as BPEL, BPM, WS-CDL, OSGi, etc. In the case of city offending vehicle automatic monitoring alarm system, ESB arranges vehicle monitoring searching services, searching and analysis services and alarm systems. The differences between various types of services are screened out by the "enterprise service bus". The coupling of differences is removed to

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make them combine freely so that the business process of automatic vehicle monitoring can be implemented.

2 Aggregation Input and Output Types

In order to easily build GIS applications, the subject of both input and output of geographic information service aggregation is GIS service.

Both aggregation providers and aggregated GIS services have to follow service aggregation specifications that both aggregation input and output have to be one of the following standard services: OGC, ISO/TC211 W*S Service, KML Service, GeoRSS Service, SuperMap IS/iServer public GIS service interface, public service interfaces from third-party GIS service providers, such as GoogleMaps and Virtual Earth.

Aggregated GIS services need to support one of the following protocols: the REST-style web service, the SOAP protocol service and the primary binary GIS service.

There is a many-to-one relationship between input and output of geographic information service aggregation that multi-source (the number of n) GIS services, with the help of the aggregator and some business arrangements, finally aggregated into one GIS service for publishing. Several integration relationships are included:

- Many-to-one relationships for spatial data: n -> 1; f(n) -> 1. Multi-source spatial data is aggregated and finally aggregated spatial data is provided and published as services.
- Many-to-one relationships for maps: n -> 1; f(n) -> 1. multi-source spatial data is aggregated. The performance of the aggregation is the process for map processing and the aggregation result (maps). Then, the maps are published.
- Many-to-one relationships for aggregation process: n -> 1; f(n) -> 1. multi-source GIS service has to go through a process of aggregation in the aggregator that the process shows a relationship of many-to-one. For example, n GIS services will be aggregated. According to the business process arrangement, GIS service 1 can be aggregated with GIS service 2 and the result can also be aggregated with GIS service 3, such as the production of thematic maps. After multi-process aggregation arrangement, an aggregation result will be finally generated.

3 Describable aggregation processes

The describable aggregation process is that 1) input service can be described; 2) the aggregation service itself can be described; 3) output service can be described.

These descriptions provide metadata of aggregated services as well as content and process for the service aggregation. The aggregation result is metadata of new GIS services. According to the metadata, aggregation services implement a complete aggregation. By means of the description of metadata of aggregated services, aggregation services can get data and functions from aggregated services on their own initiatives. With the metadata description of the aggregation service capacity itself ,including the aggregation scope, types of aggregators, etc, service aggregations can identify the capability scope of aggregation and types of service which they can handle. In addition, appropriate aggregators can be built. Service aggregations output their result according to the metadata description of aggregation results including output integrated map names, map scopes, layer information and map-related information.

Implementation of geographical information service aggregation

SuperMap iServer implements geographical information service aggregation and encapsulates the aggregation technology as the aggregation service for external distribution. The aggregation service follows the aggregation constraint, conducts data and function integration on multiple GIS services, and finally publishes the aggregation result as a new GIS service. Since SuperMap iServer also provides simple, convenient aggregation service operation mode, the user only need to configure the aggregation metadata parameters in the service management tools to obtain the needed aggregation service.

1 Service aggregation mechanism

The SuperMap iServer aggregation service structure mainly consists of four parts as shown in the following

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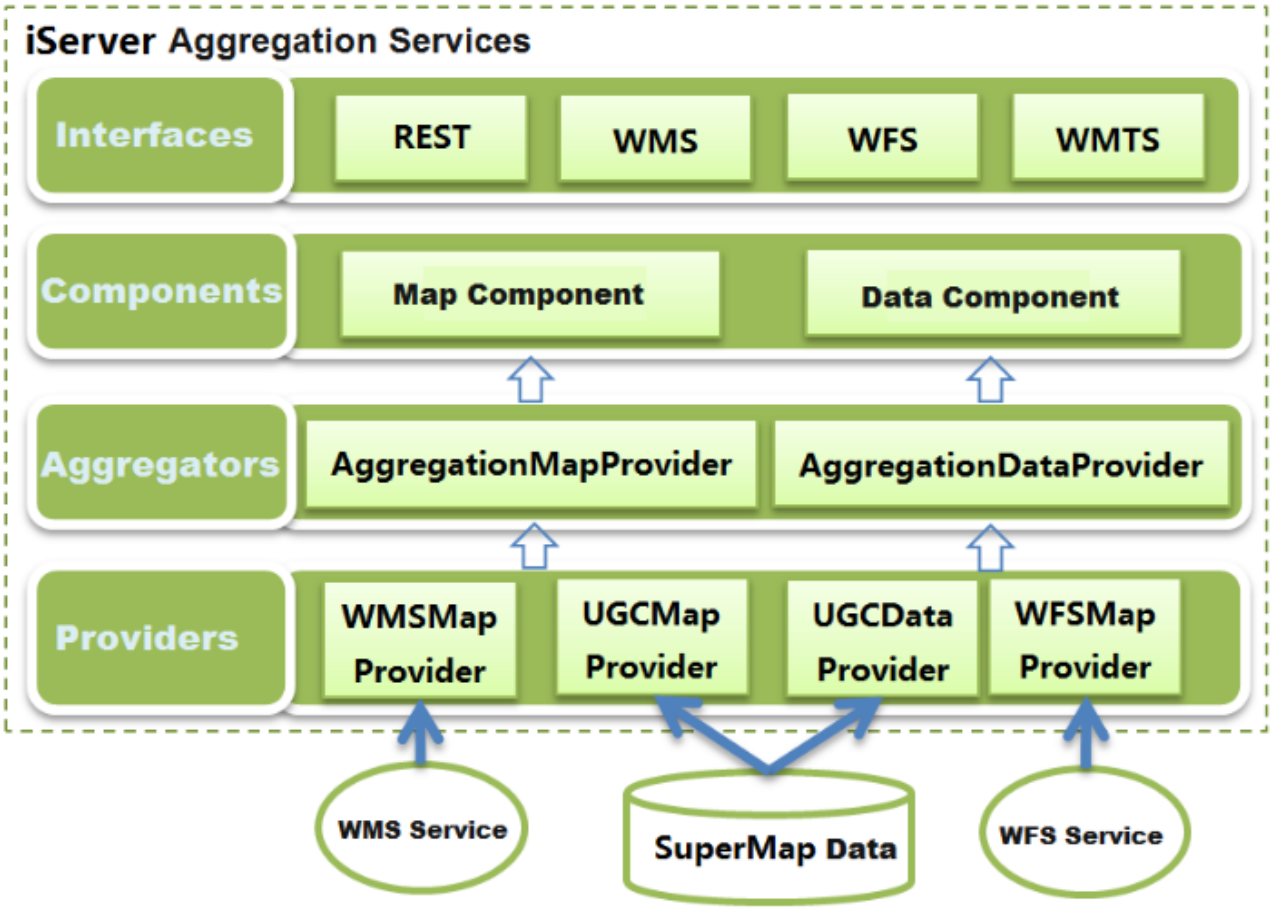
figure, including the service provider, the service aggregator, the service component, and the service interface. These four layers interact and implement the service-aggregation-new-service aggregation processing operation. According to the content of the GIS aggregation, the aggregation operation can be categorized as aggregating maps (including maps and GIS functionalities), aggregating spatial data, or aggregating advanced GIS analytical functionalities. The service component, the service aggregator, and the service provider layers of the SuperMap iServer aggregation service respectively provide corresponding modules for different aggregation operatioh (e.g. aggregating maps, aggregating spatial data, etc.). For example, the service provider includes various map service providers (WMSMapProvider, UGCMapProvider, UGCDataProvider, etc.); the service aggregator includes the map service aggregation provider (AggregationMapProvider) and the spatial data service aggregation provider (AggregationDataProvider); the service component layer includes the data service component, the map service component, the analytical service component, etc. The interaction relationship among the modules of these three layers are shown in the following figure: The map service component, the map service aggregation provider, and the map provider (such as, WMSMapProvider and UGCMapProvider) can call each other; they follow the same interfaces and implement the map operation related aggregation service. The data service component, the data service aggregation provider, and the data provider (UGCDataProvider) can call each other; they follow the same interfaces and implement the spatial data management related aggregation service. The service interface layer provides various interfaces; for example, REST Servlet and WMS Servlet are responsible for the interaction between various types of GIS services and the client, according to different communication protocols and standards.



Aggregation provider--service aggregator

The aggregation provider is also called service aggregator in SuperMap iServer. It aggregates the GIS services or the spatial data gotten by the service provider according to the GIS request submitted by the client. For example, if one needs to get Beijing's road information, one can use the map aggregation provider (AggregationMapProvider) to aggregate Beijing's road map provided by WMSMapProvider and Beijing's administrative division map provided by UGCMapProvider.

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According to the type of the aggregation operation, SuperMap iServer respectively provides the map aggregation provider implementing the map aggregation operation (AggregationMapProvider) and the data aggregation provider implementing the spatial data aggregation operation (AggregationDataProvider).

Type	Module class name	Functionality	Service provider type for the aggregation
Map aggregation provider	com.supermap.services.providers.AggregationMapProvider	Used to perform map related aggregation, including the following: 1) Overlay of maps with the same geographical extent, such as, image overlay. 2) Aggregation of map parameters, such as, map parameter overlay. 3) Map browsing of aggregated map services, such basic operations as zooming. 4) Measure operation of aggregated map services. 5) Query operation of aggregated map services, implementing overlay for the query results.	UGCMapProvider WMSMapProvider RestMapProvider WMTSMapProvider Map related domain service provider
Spatial data aggregation provider	com.supermap.services.providers.AggregationDataProvider		UGCDataProvider WFSProvider Spatial data related domain service provider

Note that not only the SuperMap iServer provided service provider can be identified and aggregated by the service aggregator, but also SuperMap iServer can make user-defined service providers be automatically identified by the service aggregator and participate the aggregation process. For some standard services or third-party services, SuperMap iServer does not provide corresponding service providers to interact with. The user can build their own service providers for services of the class through the domain service extension. For example, a user-built service provider that interacts with GoogleMap services--GoogleMapProvider registers this service provider with the SuperMap iServer server and conducts the aggregation assembly. The service aggregator then automatically identify the user-defined service provider and add it to the aggregation process.

Service provider

The service provider is mainly responsible for finding long-distance GIS services, interacting with them, and reading spatial data and GIS functionalities provided by the GIS services. SuperMap iServer provides the following service providers:

Type	class name	Functionality
UGC service provider	com.supermap.services.providers.UGCMapProvider	Accesses GIS data of the SuperMap type. Processes map service functionalities (including measuring, zooming out, zooming in, querying,

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		etc.) through the GIS processing core of SuperMap.
WMS service provider	com.supermap.services.providers.WMSMapProvider	Accesses specified long-distance WMS services, distributes GIS requests, and obtains the results.

The user can build their own domain service provider according to the domain service extending mechanism, in order to implement interactions with third-party GIS services. The user-built domain service provider can also be identified by the service aggregator through the aggregation assembly mechanism and participates the aggregation process.

Service component

The service component layer respectively provides map service component (MapComponent), data service component (DataComponent), and analysis service component (AnalystsComponent). These components conduct various strategical technology encapsulation for the aggregation, including safety strategy, cache strategy, etc.

Service interface

Service components are published in the service interface layer. The service interface layer determines the service types that can be published. Currently SuperMap iServer provides REST Servlet and WMS Servlet, that is, it can publish REST styled GIS services and WMS services.

2 Task assignment for multiple service aggregation

The geographical information service aggregation can be categorized into two types. The first is the different type service aggregation, which aggregates map services, data services, and analysis services from different sources, and provides rich GIS service capabilities. Take an example to aggregate the SuperMap iServer path analysis service for Beijing's roads, the GeoRSS data service for third-party provided restaurant and commercial network, and WMS Beijing image map service, through SuperMap iServer, to construct a Beijing information service platform for the public. The task assignment for this type of aggregation is relatively clear: The client submits GIS requests to the SuperMap iServer aggregation service; according to the request type, the aggregation service processes map related requests, spatial data related requests, spatial analysis requests, respectively through the map service aggregation provider (AggregationMapProvider), the spatial data service aggregation provider (AggregationDataProvider), and the spatial analysis service aggregation provider.

The second type of aggregation is the same type service aggregation. For example, two services both can provide transportation planning analysis service: one provides transportation planning analysis service for Chengdu; and the other Chongqing. Aggregating the two services builds a city transportation planning service platform. The client submits a transportation planning request, how would the aggregation service assign the task? Another good example is that two map services have the same map extent: one provides the administrative division map for Shanghai; and the other provides the water system distribution map for Shanghai. When asked to use the map of the first service as the base map and draw the water system distribution map for various areas of Shanghai, how to aggregate?

The aggregation service of SuperMap iServer is not simply overlaying services. The aggregation service provider saves the status of the aggregated service node, including the geographical extent of the aggregated service, the map name, etc. When the aggregation service provider aggregates services of the same type, as in the above example, the aggregation service provider assigns the task to the appropriate service node, according to the request parameters (such as, the map name, the map extent, the map layer, etc.) passed by the client. For example, if the client requests the transportation plan between two locations in Shenyang, the aggregation service provider utilizes the transportation planning analysis service of Shenyang.

When the aggregation service processes contents of the same geographical extent, it will obtain maps of this extent and related map parameters from various service providers, overlay maps provided by various service providers through the aggregator, form a new map, and return it to the client. At the same time, it returns the related parameters of the new map to the client, including the geographical extent, the map layer information, etc. As in the above example, the aggregation service conducts image overlay for Shanghai administrative division map and the water system distribution map according to the request, forms a new water system distribution map for Shanghai's administrative districts, and returns the map as well as the map layer information (including the map layer information

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of both Shanghai administrative division map and Shanghai water system map) to the client.

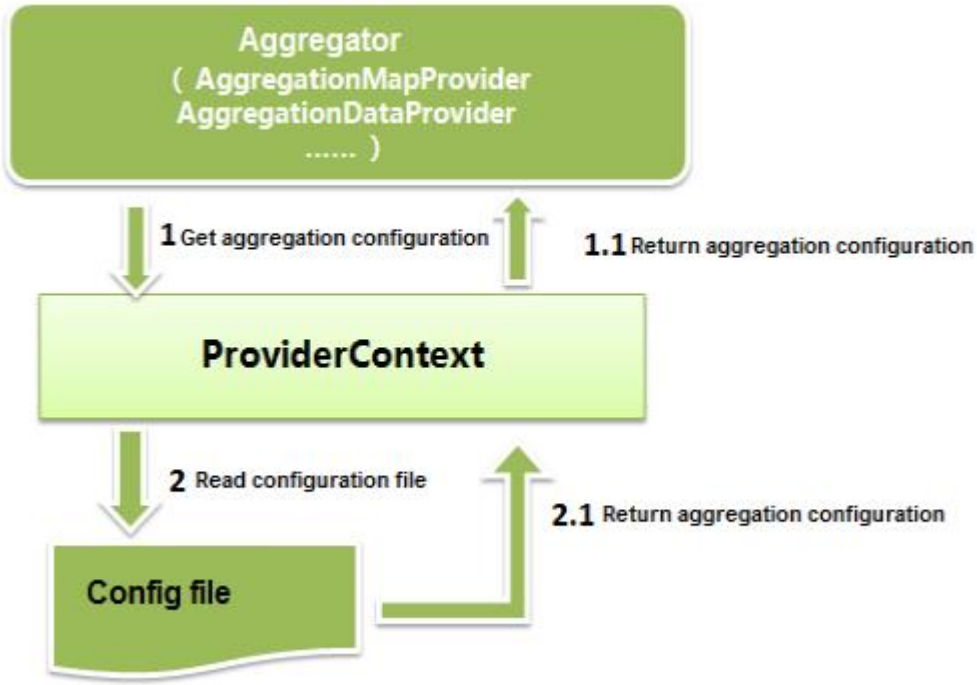
Please note that, when aggregating multiple map services, the map service providers must provide the maps in the same projected coordinate system; otherwise, the service aggregator can not reach accurate aggregation results in the absence of a unified projected coordinate system.

3 Cache technology for aggregation service data

4 Assembly management for service aggregation

The SuperMap iServer service aggregator (AggregationMapProvider, AggregationDataProvider, etc.) is a type of Provider that specializes in providing the aggregation service. This type of service aggregators can screen the internal implementation of the aggregation service, and utilize the SuperMap iServer dependency injection service management mode to conduct assembly management on the service aggregatioin. That is the assembly management mode of the service aggregation is identical to the service configuration mode of other types of service providers: The manager of the aggregation service only needs to configure the service aggregator (AggregationMapProvider, AggregationDataProvider, etc.) and the corresponding aggregation configuration information class (such as, AggregationMapProviderSetting, AggregationDataProviderSetting) in the SuperMap iServer service configuration file. The aggregation server then can control the service aggregation contents to satisfy the needs of the service aggregation. The detailed assembly mechanism is shown as follows:

The SuperMap iServer aggregation service provider calls the service provider context, accesses the aggregation service metadata list of the configuration file, gets the aggregation service configuration information (AggregationMapProviderSetting and AggregationDataProviderSetting), based on this information automatically finds the aggregated service, adds it as "datasource" through the aggregation server to the iServer service, and conducts the aggregation analysis.



Therefore, the assembly management of the service aggregation provides the description information of the input, the output, and the aggregation process for the SuperMap iServer aggregation service, and guides the SuperMap iServer aggregation service to implement the aggregation operation.

Below is the current assembly information of the map service aggregator (AggregationMapProvider) and its corresponding aggregation configuration information class (AggregationMapProviderSetting) provided by SuperMap iServer:

Type	Assembly Information
AggregationMapProvider	innerProvider: names of the map providers to be aggregated

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	name: name of the aggregation server
AggregationMapProvider Setting	targetName: name of the aggregated map name: name of the configuration instance serviceInfos: service node information list, where the service node information mainly includes the following contents: type: node type of the service, which prescribes the service node type of UGCMapProvider is "UGC", and the service node type of WMSMapProvider is "WMS". binding: service binding information. For the UGCMapProvider service, the binding information content has the following format: "mapName=XXX ; outputPath=XXX ; putputSite=XXX" address: service binding address. For the UGCMapProvider service, the SuperMap workspace path needs to be set, e.g. "data\\world.sxw" (relative java path); for the WMSMapProvider service, the WMS service address needs to be set.

The aggregation iServer WebManager only needs to configure related properties of the above mentioned aggregation server and the configuration management class. The SuperMap iServer aggregation server then will perform the aggregation operation according to the manager's request.

AggregationMapProviderSetting is the aggregation configuration information class specially designed by SuperMap iServer according to the map service type of the existing service provider. To aggregate UGCMapProvider and WMSMapProvider, one can configure AggregationMapProviderSetting. If the user hopes the aggregation server to aggregate third-party outside services, one can extend the aggregation server and the aggregation configuratioin information class according to the characteristics of the third-party services. The extension method of the aggregation server and the aggregation configuration information class is the same as the extension method of the SuperMap iServer domain service. For details please see the introduction to the domain service extension.

For managers of the aggregation service, one can directly configure such information as the aggregatioin service's service nodes through the configuration file of SuperMap iServer, or alternatively, one can configure the aggregation service through the SuperMap iServer Manager using the visualization work interface.

5 Extension method for service aggregation

The Publishing and Management of Geographic Information Service Aggregation

SuperMap iServer specially provides a iServer WebManager which is a web based visual service management tool to make service administrators operate more easily.

The configuration of aggregation services includes:

1. Configuring GIS service providers to be aggregated.

2. Configuring the aggregation service provider (aggregator).

3. Configuring the GIS service component whose GIS functions are implemented by calling the aggregation provider.

4. Configuring the interface for aggregation service publishing (REST, WMS, etc.).

Let`s take an example (the configuration management of aggregation of the world map and the map of Beijing area) to introduce how to manage service aggregation.

1 Configuring GIS services to be aggregated

A service aggregation is that multiple GIS services integrate and recombine to finally generate new GIS services.

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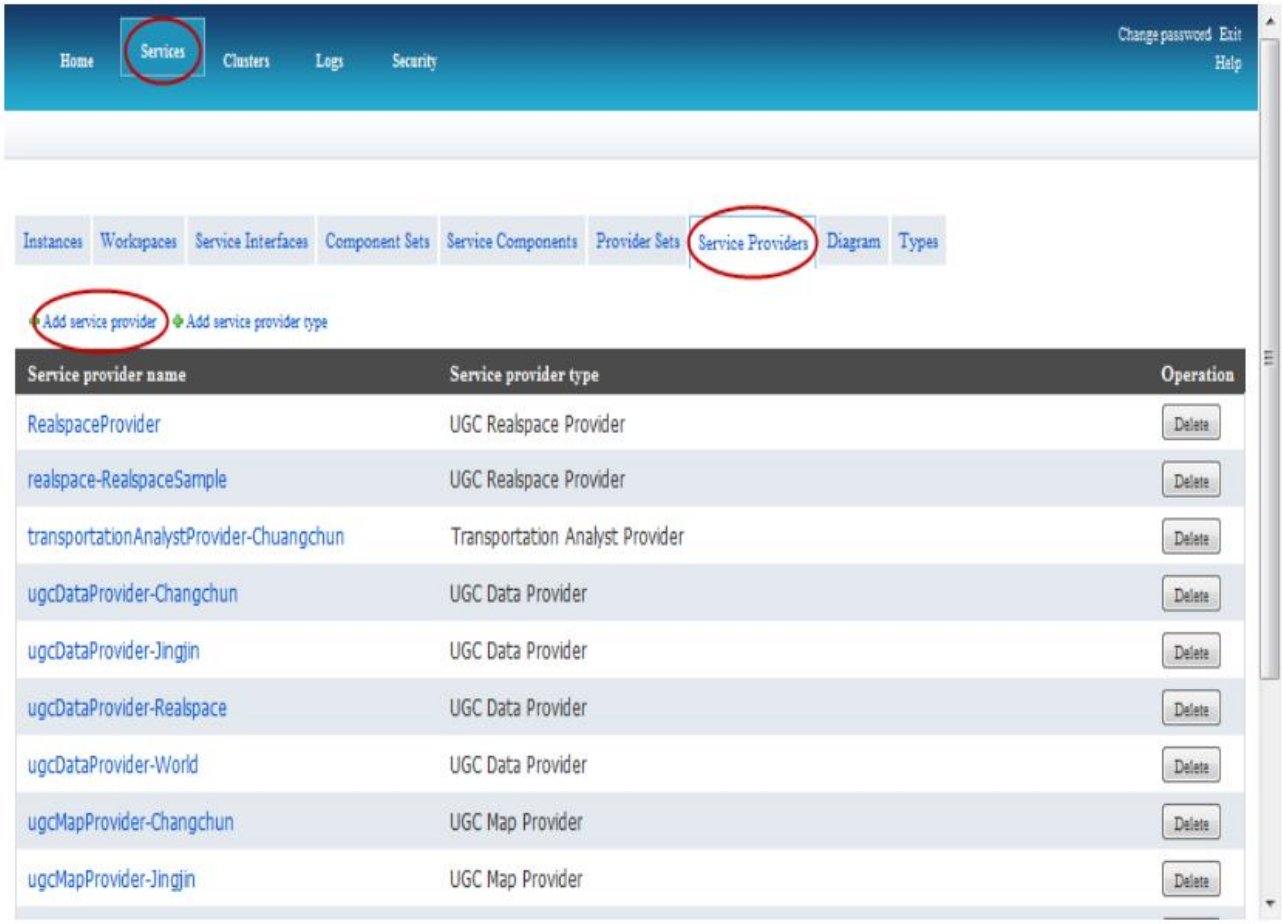
Therefore, to aggregate services, it is necessary to set the source of aggregation (the GIS service which will be integrated). In SuperMap iServer, service providers can package various third-party standard services to support function implementations of GIS service components using various GIS function services provided by SuperMap GIS core. Thus, in SuperMap iServer, providers of configuration service is the source of GIS service configuration including the spatial data information, output and publishing paths of processed maps, etc.

As mentioned above, to aggregate the world map and the map of Beijing area, it is first to configure each of these two map services. Providers of these two maps are created. Spatial data information and the output path of processed map images provided by them are sat respectively. Detailed operations are as follows:

Step 1: Go to the service management web page. Enter "http:// [GIS server address]:8090/iserver/services/manager/" at the address bar of the browser and enter service management authorized user name and password to access the home page of server manager.

Step 2: Go to the operating page for service providers.



Step 3: Click [add service provider (set)] icon in the page of [service provider (set)] tab. The detailed service provider information configuration page will pop up.

Step 4: Configure the service provider's information. In the "Add Service Provider" page, the administrator provides opportunities for the service provider to set its identifying name or the provider`s name or select the type of the service provider. To see specific configuration parameters please refer to the configuration management part of the online help. We will not talk about it here. In this case, let's add the world map service named "ugsMapProvider1" and the service provider of Beijing area map named "ugcMapProvider2".

2 Configuring Aggregator

An aggregator is a type of service provider that GIS service (such as map services, data services, etc.) from GIS

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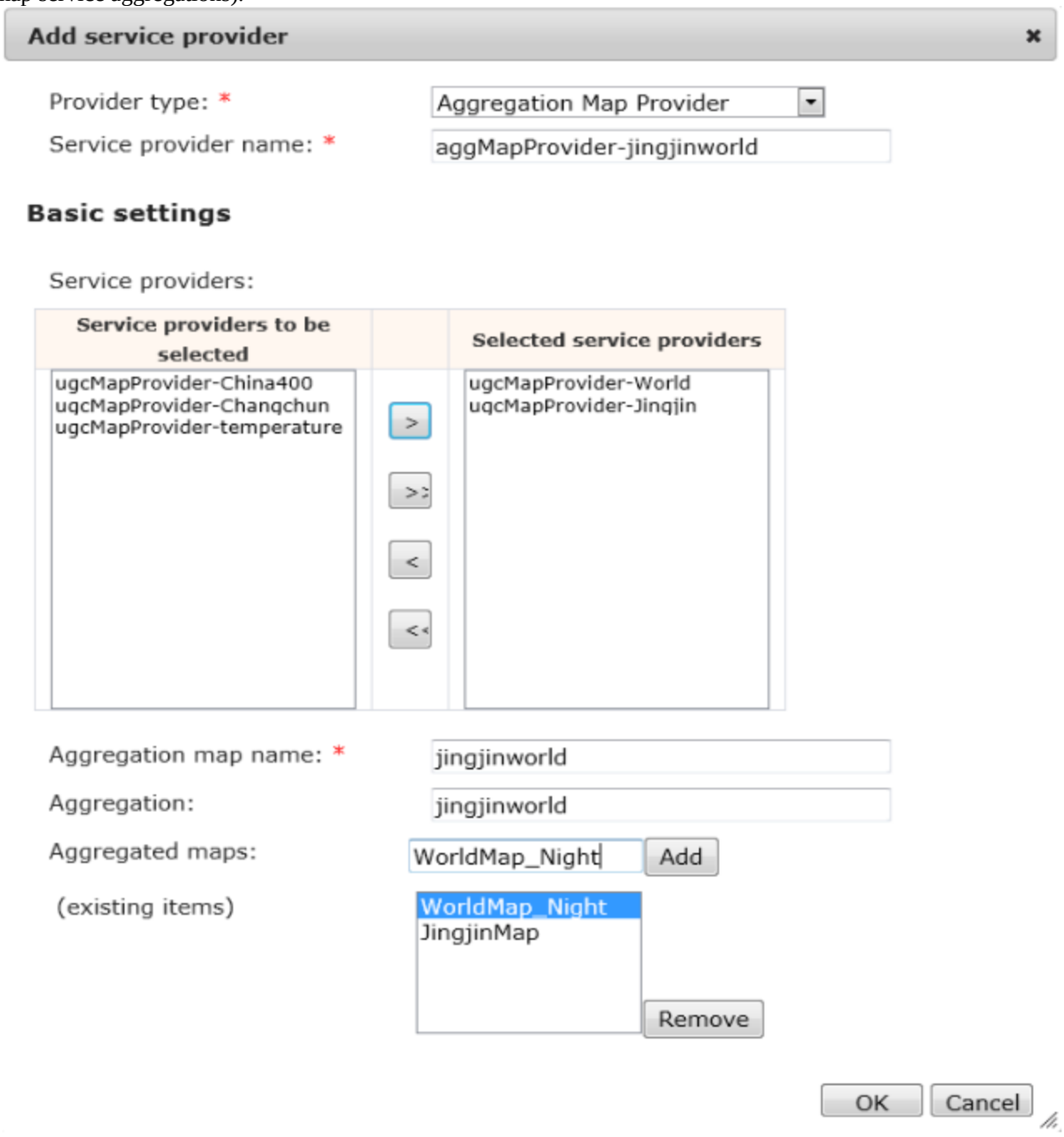
service provider can be integrated by the aggregator. Therefore, the second content to implement the configuration management operation of aggregation services is to configure the aggregator (add a service provider). The type of the service provider is an aggregation map service provider or an aggregation data service provider.

In this case, operations of aggregator configuration are as follows:

1) Steps about how to add service providers are described above and will not describe here anymore.

2) After entering the "Add Service Provider" page, a detailed information configuration page, please select "Aggregation Map Service Provider" in the list of "Types of Service providers" (because the aggregation belongs to map service aggregations).



3) After selecting the type of services, this page will redisplay appropriate configuration information for service providers based on the selected type and configure aggregation providers. It includes names of aggregation service

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providers, whether or not the provider is available, which GIS services will be aggregated by the aggregator, names of aggregated maps, output paths of aggregated maps and the information of the site where maps will be published.

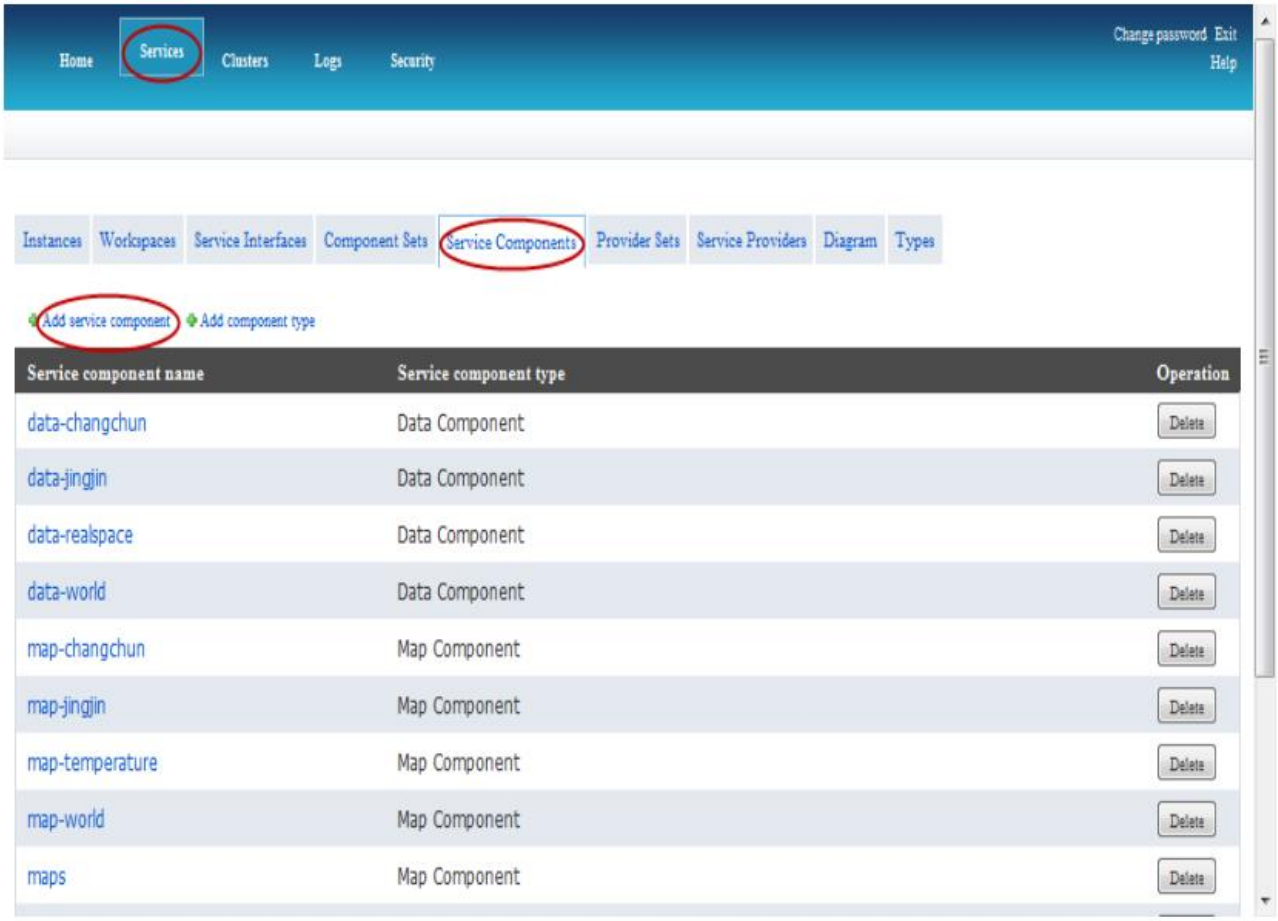
4) To complete the configuration, please click the "Confirm" button after configuring the aggregator information.

3 Configuring GIS Service Component

SuperMap iServer roughly packages aggregation functions provided by aggregation service providers through GIS service component. It unifies function interfaces of GIS module with the same type. Therefore, the third content to configure management aggregation services is to complete the configuration of GIS service components including setting the relationship between GIS service components and the aggregator.

In this case, the configuration of GIS service components is as follows:

Step 1: Go to GIS service components operating page.



Step 2: click [Add Service Component] icon in the page of [Service Component (set)] tab. The detailed service component information configuration page will pop up.

Step 3: Configure service component information. "Add Service Component" page mainly configure the name and type of the service component and choose which service provider to be called by the service component to implement GIS functions. This page will automatically display the list of service providers which are able to call by the selected type of service component. So, users just need to choose one of them from the service provider list. In this example, we will add a GIS service component. Please select "map service" type, and now the list of "using providers/collection" displays all service providers or sets which are able to call, including the aggregation provider "aggra" which is already configured above. Then select the aggregation provider "aggra" to make sure that the service component can publish aggregation data provided by "aggra". Finally, please enter the path of output images and the publishing site information.

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Step 4: Click "Confirm" button to complete the configuration of service components.

4 Configuring Interface for Aggregation Service Publishing

Aggregation services determine which protocol will be used for publishing by service interfaces. SuperMap iServer provides REST servlet, WMS Servlet, WFS servlet by default. Users configure service interfaces based on types and demands of service components, such as: map service type can be published by REST Servlet and WMS Servlet; data service type can be published by REST servlet and WFS Servlet. To know specific configuration operations of service interfaces, please refer to descriptions in the configuration operation part of the online help, we will not talk about it here.

5 Publishing Aggregation Service

After the several sections described above, an aggregation service is done! At this point, we can see the service example named [service component name/service interface name] in the service example page of iServer WebManager. There is a button on the right side which is used to determine if you want start the service. By clicking the button, users can choose start or stop the aggregation service.

Prospect

Cloud computing, a term which is increasingly popular in the industry and it also attracts a large scale of investment. Many companies are involved, such as IBM, Amazon, Akamai, Sun, EMC, Salesforce.com, etc. Cloud computing, so to speak, is considered the next revolution in the IT industry and it will bring a fundamental change in both work styles and business models. GIS services serve as a cloud of the cloud computing with the GIS service aggregation capacity which provided by GIS service providers. Such a Cloud has unlimited ability of extension and guaranteed data security. It is believed that GIS cloud computing will be an indispensable cloud in the cloud computing field.

SuperMap iServer implements the geographic information service aggregation technology and makes conveniences of the aggregation service management mechanism. It enables the sharing and mutual operation of GIS functionality to be more operational and spatial data integration to be much easier as well. GIS service aggregation, therefore, further promotes the deepening of GIS social division and enhances the competitive power of service providers.

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