Using Streaming Service

As the volume of real-time data grows dramatically, people want to display real-time data on the mobile phones and PCs. SuperMap iServer 9D can meet this need by providing the Streaming Service.

SuperMap iServer 9D supports protocols including **WebSocket, TCP, HTTP, and Kafka in its Streaming Service. Real-time data in the formats** including **CSV, JSON, and GeoJSON is supported. The Spark Streaming distributed computing framework is used to filter and analyze real-time data streams.** The result data is output and stored in the format of CSV, JSON, or GeoJSON. In iServer, the Data Flow Service can be used to send the analysis result of real-time data to clients**.**

iServer Streaming Service provides the following analysis functions:

- Filter the real-time data by spatial or attribution relationship;
- Do property mapping on real-time data;
- Do geofencing on real-time data.

Configuring Streaming Service

The steps are as follows:

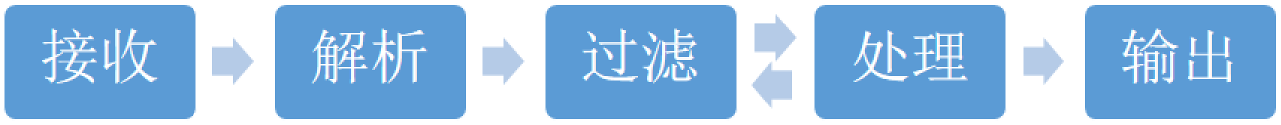
Start Spark cluster

The Streaming Service is based on Spark Streaming distributed real time calculating framework, so please start Spark cluster before configuring it. You can use the built-in Spark in iServer to create cluster. Before creating cluster, you need to make necessary settings, please see Prepare the environment to use the built-in Spark in iServer. You also can create Spark cluster service in other computer. After specifying the Spark cluster, access iServer Manager>Cluster to set.

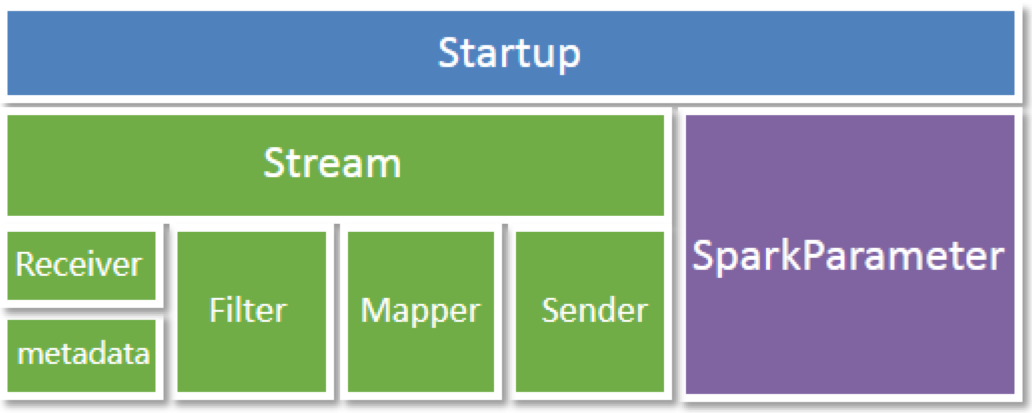
Compose the flow processing model

The Streaming Service uses the flow processing model as the service provider, which specifies the necessary information when running service.

The process of spatio-temporal flow processing includes:



The real-time data processing model consists of four parts: Receiver, Filter, Mapper, and Sender. Each part as a node, can be connected and merged together to build a real-time data processing stream: Stream. In addition to Stream, there are some auxiliary parameters as the operating conditions of the entire service, which is stored together in the startup parameter type-Startup. The processing model is as follows:



For how to compose the flow processing model, please refer to Compose the flow processing model.

Publish and manage the Streaming Service

The completed stream processing model can be saved as a file with a suffix of .streaming. It can be uploaded and published by iServer Quickly publish Streaming Service. You can also write the contents of the stream processing model directly to the "configuration information" and then publish.

After the successful publishing, enter the service management page http: // {ip}: {port} / iserver / manager / services / {streamingServiceName} /, the service instance can be suspended, start, deleted and performed other operations. You can view the basic information, running status, and configuration information for the service.

Streaming Service output

iServer provides Data Flow Service and iServer DataStore as the output of the Streaming Service.

When the Streaming Service is published, it supports the simultaneous publishing of the Data Flow Service, so that the result of the analysis can be sent to the client instantly, and the client can receive it automatically through subscription. When you compose a stream processing model, set the output data to Elasticsearch to output the results of the analysis to the spatio-temporal database created by iServer DataStore.

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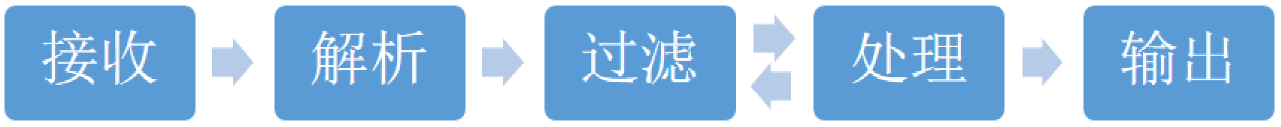

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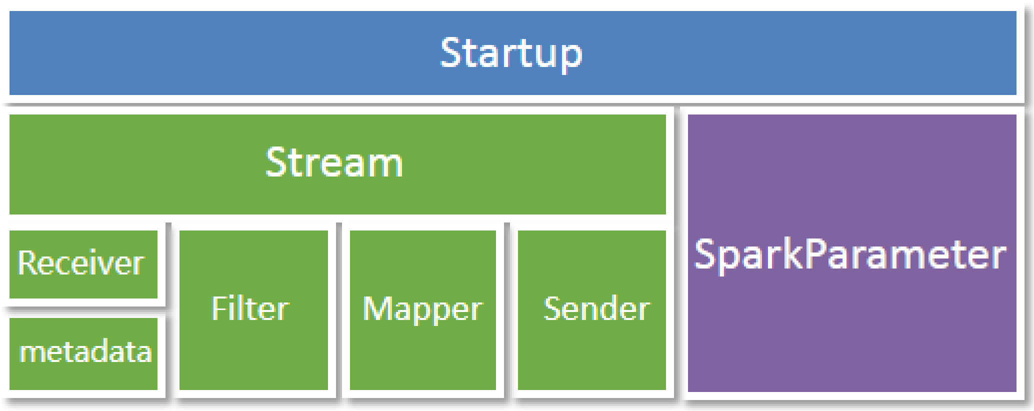

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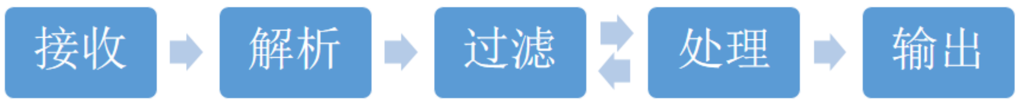
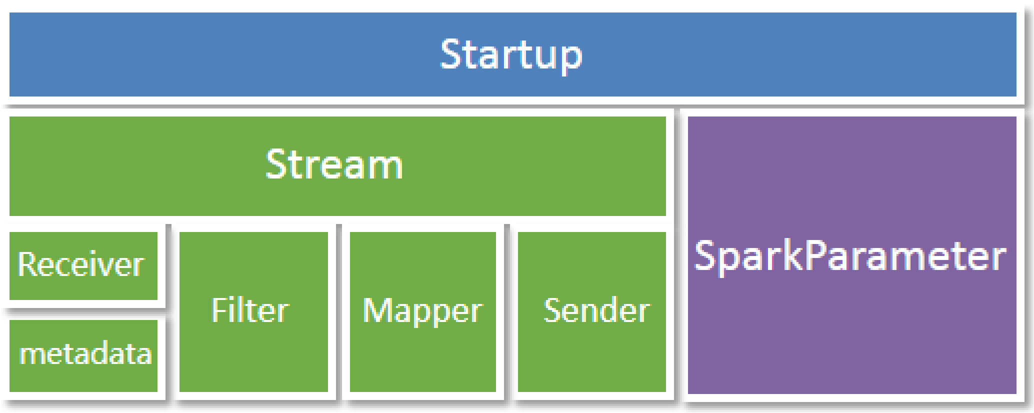


The real-time data processing model consists of four parts: Receiver, Filter, Mapper, and Sender. Each part as a node, can be connected and merged together to build a real-time data processing stream: Stream. In addition to Stream, there are some auxiliary parameters as the operating conditions of the entire service, which is stored together in the startup parameter type-Startup. The processing model is as follows:



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Writing a flow processing

model

Example

The definition of flow processing model is written by JSON and mainly composed of two parts: SparkParameter and Stream. SparkParameter is used to set the runtime parameter for Spark Streaming, and Stream contains the parameters for the running stream of real-time input data. Here is an example of a complete flow processing model:

```
{
  "version": 9000,
  "sparkParameter": {
    "checkPointDir": "tmp",
    "interval": 5000
  },
  "stream": {
    "nodeDic": {
  "Filter": {// filter the current data to clean and arrange them
"filter": "[X] > [Y] && [X] > 20",
        "name": "Filter",
        "source": "",
        "description": "",
        "prevNodes":  [// list of preorder nodes of the current node
"Xplus2"
],
"NextNodes": [// list of subsequent nodes of the current node
```

```
          "SendToES"
        ],
        "className":
"com.supermap.bdt.streaming.filter.FeatureFilter"
      },
      "SetalliteReceiver": {  //receive data
        "url": "https://api.wheretheiss.at/v1/satellites/25544",
        "reader": {
          "className":
"com.supermap.bdt.streaming.formatter.JsonFormatter"
        },
        "metadata": {
          "title": "",
          "epsg": -1000,
          "fieldInfos": [
            {
              "name": "X",
              "source": "longitude",
              "nType": "DOUBLE"
            },
            {
              "name": "Y",
              "source": "latitude",
              "nType": "DOUBLE"
            }
          ],
          "featureType": "POINT"
        },
        "name": "SetalliteReceiver",
        "source": "",
        "description": "",
        "prevNodes": [],
        "nextNodes": [
          "Xplus2"
        ],
        "className":
"com.supermap.bdt.streaming.receiver.HttpReceiver"
      },
      "SendToES": { //Output data
        "url": "192.168.12.122",
        "queueName": "streamingresult",
        "directoryPath": "IIS",
        "bitmap$0": false,
        "formatter": {
          "separator": ",",
          "className":
"com.supermap.bdt.streaming.formatter.CSVFormatter"
        },
        "name": "SendToES",
        "source": "",
        "description": "",
        "prevNodes": [
          "Filter"
        ],
        "nextNodes": [],
        "className":
"com.supermap.bdt.streaming.sender.EsAppendSender"
      },
      "Xplus2": { //field mapping
        "fieldName": "X",
        "expression": "[X] * 2",
        "name": "Xplus2",
        "source": "",
        "description": "",
        "prevNodes": [
          "SetalliteReceiver"
        ],
        "nextNodes": [
          "Filter"
        ],
        "className":
"com.supermap.bdt.streaming.map.FeatureCalculateMapper"
      }
    }
  }
}
```

Main parameters

Refer to the example above to write a flow processing model. This section will introduce the following parameters, to help you write a flow processing model according to the actual configuration.

SparkParameter

- checkPointDir: Sets the Save directory of the CheckPoint feature of Streamging. String type.
- interval: int type. Sets the interval at which Streaming runs in milliseconds.

Stream

- nodeDic: the dictionary that holds the running nodes.
- StreamNode: node base class for runtime stream, which records the basic information such as name, source, and description of the node, and the order in which the most important node is running. Use prevNodes to record the list of nodes before the current node, nextNodes to record the list of nodes after the current node. The vaules of prevNodes and nextNodes are an array and each element of the array is the name of each corresponding node; that is, each node can have more than one predecessor node or more than one subsequent node. For Receiver node, prevNodes is empty; For Sender node, nextNodes is empty. If a node has more than one predecessor node , then the metadata of theses predecessor nodes must be the same; otherwise, the execution will report errors.

Receiver

Inherited from StreamNode, as the entry of stream data processing, receiving data from a variety of sources, including Socket, WebSocket, Http, file system, etc. Receiver need to set metadata parameter to receive information. Receiver node consists of three parts: their own description information such as name, source, etc .; message metadata: metadata; message read format: reader.

Realtime data services support the following receive methods:

SocketReceiver: inherited from Receiver, used to receive Socket message. The parameters to be specified are:

- ipAddress——String type. The IP address of the Socket service from which SocketReceiver receives message.
- port—— int type, the port number of the Socket service

```
{
"ipAddress" : "127.0.0.1",
"port" : 9527,
"name" : "socketReceiver",
"source" : "Socket Receiver",
"description" : "Receive some message from socketServer",
"prevNodes" : [],
"nextNodes" : [],
"className": "com.supermap.bdt.streaming.receiver.SocketReceiver "
}
```

MultiSocketReceiver: inherited from Receiver, while receiving multiple nodes of the Socket message, the received message content must be the same. The parameters to be specified are:

- servers——Array[String] type. Multiple service addresses to receive. Each array object is an address, and the address and the port is separated by a colon.

```
{
  "servers": [
    "192.168.1.1:9527",
    "192.168.1.1:9528",
    "192.168.1.2:9527"
  ],
  "name": "multiSocketReceiver",
  "source": "MultiSource Socket Receiver",
  "description": "Receive message from multi socket server",
  "prevNodes": [],
  "nextNodes": [],
"className":
"com.supermap.bdt.streaming.receiver.MultiSocketReceiver"
}
```

SocketServerReceiver: inherited from Receiver, Socket server receiving node, used as a server to receive other Socket customers to send the message. The parameters to be specified are:

- Port: int type. The started listening port on the socket server.

```
{
  "port": 9527,
  "name": "socketServerReceiver",
  "source": "SocketServer Receiver",
  "description": "Receive message from socket client",
  "prevNodes": [],
  "nextNodes": [],
"className":
"com.supermap.bdt.streaming.receiver.SocketServerReceiver"
}
```

WebSocketReceiver: inherited from Receiver, receive WebSocket message node. The parameters to be specified are:

- Url: String type. WebSocket service address.

```
{
  "url": "ws://192.168.1.1:9527/websocket ",
  "name": "webSocketReceiver",
  "source": "WebSocket Receiver",
  "description": "Receive message from websocket server",
  "prevNodes": [],
  "nextNodes": [],
  "className":
"com.supermap.bdt.streaming.receiver.WebSocketReceiver"
}
```

TextFileReceiver: inherited from Receiver, monitor the specified directory, and read the contents of the new file. The parameters to be specified are:

- directoryPath——directory of monitored files, such as HDFS directory: hdfs:///data/; directory in Linux system: /user/share/data; directory in Windows system: C:/data.

```
{
  "directoryPath": "'hdfs:///data/'",
  "name": "textFileReceiver",
  "source": "Text File Receiver",
  "description": "Listen new file in folder",
  "prevNodes": [],
  "nextNodes": [],
  "className": "com.supermap.bdt.streaming.receiver.TextFileReceiver"
}
```

KafkaReceiver: A node that inherits from Receiver and receives kafka messages. The parameters to be specified are:

- servers - String type. Server list. If there are multiple items, separate servers by commas, and separate the ports with semicolons ";"
- topics ——Array [String] type. kafka topic array
- groupid——String type. kafka's groupID
- offset——String type. The location read by kafka. The default value is latest, that is, to read the latest news

```
{  "servers": "192.168.1.1:9092, 192.168.1.2:9092,
192.168.1.3:9092 ,192.168.1.4:9092",
  "topics": [
    "topic1",
    "topic2"
  ],
  "groupid": "groupId",
  "offset": "latest",
  "name": "kafkaReceiver",
  "source": "Kafka Receiver",
  "description": "Receive message from Kafka",
  "prevNodes": [],
  "nextNodes": [],
"className": "com.supermap.bdt.streaming.receiver.KafkaReceiver"
}
```

HttpReceiver: inherited from Receiver, a message node to receive HTTP. Currently only the Get method of HTTP is supported.

- Url: String type. Http service address.

```
{
  "url": "https://api.wheretheiss.at/v1/satellites/25544",
  "name": "httpReceiver",
  "source": "HTTP Receiver",
  "description": "Get message from web",
  "prevNodes": [],
  "nextNodes": [],
  "className": "com.supermap.bdt.streaming.receiver.HttpReceiver"
}
```

JMSReceiver: A node that inherits from the Receiver, receives the JMS standard protocol message, and receives messages such as ActiveMQ, RabbitMQ, and other message middleware.

- url——JMS message service address
- port——int type. Message service port
- queueName ——String type Message Queue Name
- jdniName——String type. The JDNI name of the corresponding message middleware. You need to find it from the official website of the middleware
- username——String type. username
- password——String type. password

```
{
  "url": "192.168.1.1",
  "port": 9527,
  "queueName": "data",
  "jdniName":
"org.apache.activemq.jndi.ActiveMQInitialContextFactory",
  "userName": "user",
  "password": "password",
  "name": "jmsReceiver",
  "source": "JMS Receiver",
  "description": "Receive message from JMS(Java Message Service) for
ActiveMQ",
  "prevNodes": [],
  "nextNodes": [],
"className": "com.supermap.bdt.streaming.receiver.JMSReceiver"
}
```

metadata

metadata is written in the Receiver parameter, which is the metadata of the received message, used to describe the definition format of the message. The following information need to be specified:

- title: The name of the metadata used to distinguish between other metadata. String type.
- featureType: FeatureType class. The geographic feature type converted from the received message, such as POINT, LINE, REGION, etc.
- epsg: int type. The Projected EPSG coding of metadata geographic elements.
- fieldInfos: field information converted from the message received. You need to specify:
    - name: String type. Field name, unique identifier for the field
    - source: String type. The position of the field in the original information which determines from which position to parse the information. If the original information is in CSV format, the value of source should be the field number in the CSV, such as, "source": "4" represents the fifth field in the CSV data; If the original data is in json format, then the value of source is the key of key-value-pair in json data.
    - nType: FieldType type. Field type, such as: TEXT, DOUBLE, INT and so on.

reader

The content format of the received message, including CSV format, JSON format, or GeoJson format.

CSVFormatter: Indicates that the content of the received message is in CSV format. You need to specify:

- separator: Specifies the delimiter, the default is a comma

```
"reader": {
    "separator": ",",
    "className": "com.supermap.bdt.streaming.formatter.CSVFormatter"
  }
```

JsonFormatter: The format of the received message content is JSON. Here is an example:

```
"reader": {
    "className": "com.supermap.bdt.streaming.formatter.JsonFormatter"
  }
```

GeoJsonFormatter: The format of the received message content is GeoJSON. Here is an example:

```
"reader": {
    "className": "com.supermap.bdt.streaming.formatter.JsonFormatter"
  }
```

Filter

Inherited from StreamNode, used to filter the current data, and cleaning and sorting the data. You need to specify:

- filter: If you need to get the field value for logical operations, use the keyword [], such as [ID]> 10. Multiple expressions can be used to connect directly with && (or) or || (or), and use parentheses () to adjust the priority order, such as [ID]> 10 && ([X]> = 10 || [= 65.32). Note that the use of the keywords IN, MATCHES, EXISTS, ISNULL, together with other expressions, must be enclosed in brackets, such as ([ID] IN 1,3,5,7,9) && [X]> 100.

Table 1 list of logical operators supported by the filter parameter

Operator	Description
==	Is equal to (=) This operator holds objects whose attribute value is equal to the specified value. For example, [ID] = 3.

	Note: double type, the contrast accuracy is10E-10. Must be used carefully.
!=	Is not equal to (! =) This operator retains objects whose attribute value is not equal to the specified value. For example, [Name]! = "A". Note: double type, the contrast accuracy is10E-10. Must be used carefully.
>	Greater than (>) This operator retains objects whose property value is greater than the specified value. For example, [Speed]> 50
>=	Greater than or equal to (> =) This operator retains objects whose property value is greater than or equal to the specified value. For example, [Speed]>= 50
<	Less than (<) This operator retains an object whose attribute value is less than the specified value. For example, [X] < 10.231
<=	Less than or equal to (<=) This operator retains an object whose attribute value is less than or equal to the specified value. For example, [Y] <= 40
IN	IN In the specified list the operator retains the object when the value of the specified field exists in the comma-separated list of values. For example, [Code] IN HK1,HK3,HK5

MATCHES	MATCHES Regular Expression Match This operator holds the object when the value of the specified field matches the regular expression. For example, [Code] MATCHES "^ HK [135]" Note: Regular expressions that need to be matched need to be enclosed in quotation marks
EXISTS	Whether the EXISTS field exists When the specified field exists in the received event scenario, the operator holds the object. For example, EXISTS [X].
ISNULL	ISNULL whether it is empty When the specified field contains a null value, the operator retains the object. For example, [X] ISNULL.

Mapper

Inherited from StreamNode, used to create field mapping and managing the fields, including: field mapping, adding fields, deleting fields, field operations and geofence.

Add a field

- insertIndex——int type Location to add a field
- fieldname——String type The name of the field to add
- nType——SFieldType type The type of the field to add
- expression——String type The field value to add can be the value of an operation expression for an existing field:

```
"insertMapper": {
        "insertIndex": 1,
        "fieldName": "XX",
        "nType": "DOUBLE",
        "expression": "[X] * 2",
        "name": "insertMapper",
        "source": "Insert Field",
        "description": "Insert Field by X * 2",
        "prevNodes": [],
        "nextNodes": [],
        "className":
"com.supermap.bdt.streaming.map.FeatureInsertMapper"
      }
```

Delete field

- deleteFieldNames: delete the field name array

```
"deleteMapper": {
        "deleteFieldNames": [
    "F1",
    "F2"
  ],
        "name": "deleteMapper",
        "source": "delete Field",
        "description": "delete Field F1 and F2,
        "prevNodes": [],
        "nextNodes": [],
        "className":
"com.supermap.bdt.streaming.map.FeatureDeleteMapper"
      }
```

Field mapping

- srcToDesIndexPair: the correspondence between the field in the source data (the serial number of the field in the stream) and the name
- srcToDesNamePair: the correspondence between the field name and the new name

```
"mapMaper": {
        "srcToDesNamePair": {
          "ID": "newID_Name",
          "Y": "newY_Name",
          "X": "newX_Name"
        },
        "srcToDesIndexPair": {
          "ID": 0,
          "Y": 2,
          "X": 1
        },
        "name": "mapMaper",
        "source": "Map Fields",
        "description": "Map Fields with new name and index",
        "prevNodes": [],
        "nextNodes": [],
        "className":
"com.supermap.bdt.streaming.map.FeatureMapMapper"
      }
```

Field operation

- fieldName: The target field name
- expression: The expression of the field

```
"calculateMapper": {
        "fieldName ": Fcal,
        "expression": "[X] * 2",
        "name": "calculateMapper",
        "source": "calculate Field",
        "description": "calculate Field by X * 2",
        "prevNodes": [],
        "nextNodes": [],
        "className":
"com.supermap.bdt.streaming.map.FeatureCalculateMapper "
      }
```

Geofence

- connection: The source of the geofence object.
    - type——String type. Datasource type
    - Info——Array[DsInfo] type. Datasource connection information.
    - server: The data server
    - datasetNames: Array [String] type. The dataset name used for the geofence
- fenceName——String type. The Name field of the object that is within the geofence.
- fenceID——String type. The ID field of the object that is within the geofence. That is, the field that uniquely identifies the object.
- withinFieldName——String type. The field name of the new field, which is used to record whether the current object is in the geographic fence.

- statusFieldName——String type. The field name of the new field, which is used to record whether the current object's state is entering the geo-fence or leaving the geo-fence.

```
"GeoFenceMapper": {
        "connection": {
          "type": "udb",
          "info": [
            {
              "server": "Z: \\airport.udb",
              "datasetNames": [
                "airports_40"
              ]
            }
          ]
        },
        "fenceName": "NAME",
        "fenceID": "SmID",
        "withinFieldName": "geoWithin",
        "statusFieldName": "geoStatus",
        "name": "GeoFenceMapper",
        "source": "Geomark Transformation",
        "description": "",
        "prevNodes": [
          "SocketReceiver"
        ],
        "nextNodes": [
          "GeoJsonSocketSender",
          "FenceWithinFilterOut",
          "FenceWithinFilterIn"
        ],
        "className": "com.supermap.bdt.streaming.map.GeoTaggerMapper"
      }
```

Sender

Inherited from StreamNode, as exit for stream data processing, sending data outwards. Includes:

- EsAppendSender
- EsUpdateSender

- FileSender
- JMSSender
- SenderBase
- SMSSender
- SocketClientSender
- SocketServerSender
- WebSocketClientSender
- WebSocketTool

Take the example of the commonly used WebSocket protocol, the configuration of sending data is shown as follows:

```
"webSocketSender": {
        "path": "ws://127.0.0.1/data",
        "name": "webSocketSender",
        "source": "WebSocket Sender",
        "description": "Send message to WebSocket Server",
        "prevNodes": [],
        "nextNodes": [],
        "className":
"com.supermap.bdt.streaming.sender.WebSocketClientSender"
      }
```

Take outputting to ElasticSearch as an example:

```
      "ESSender": {
        "url": "192.168.168.33",
        "queueName": "aircondition",
        "directoryPath": "test1",
        "bitmap$0": false,
        "formatter": {
          "className":
"com.supermap.bdt.streaming.formatter.GeoJsonFormatter"
        },
        "name": "ESSender",
        "source": "ES sender
        "description": "",
        "prevNodes": [
          "TextFileReceiverJson"
        ],
        "nextNodes": [],
        "className":
"com.supermap.bdt.streaming.sender.EsAppendSender"
      }
```

With the example settings above, you can output the result of the analysis of the data to the spatio-temporal database created by iServer DataStore.

After the flow processing model is written, you can save the file as a file with a suffix of .streaming, or you can publish it directly into the "configuration information" when you Publish the Streaming Service Quickly.

Configuring Streaming Service

The steps are as follows:

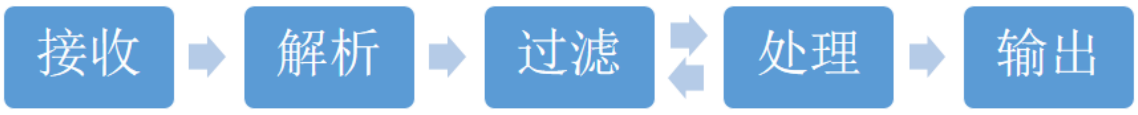
Start Spark cluster

The Streaming Service is based on Spark Streaming distributed real time calculating framework, so please start Spark cluster before configuring it. You can use the built-in Spark in iServer to create cluster. Before creating cluster, you need to make necessary settings, please see Prepare the environment to use the built-in Spark in iServer. You also can create Spark cluster service in other computer. After specifying the Spark cluster, access iServer Manager>Cluster to set.

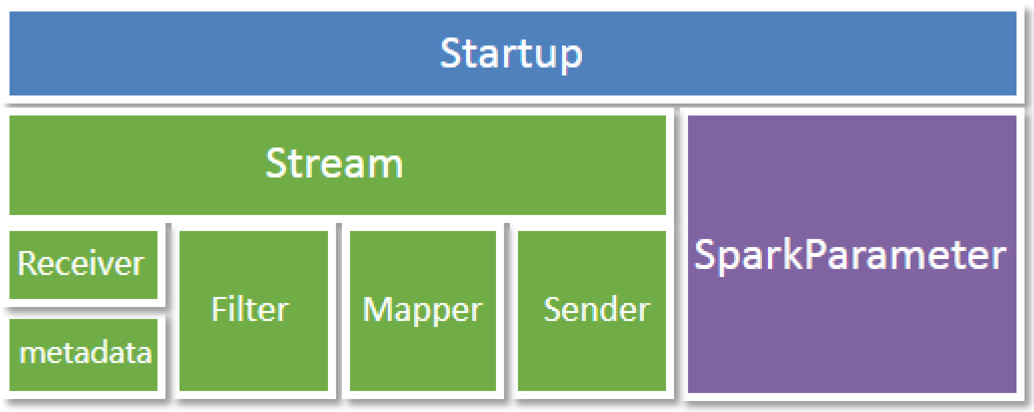
Compose the flow processing model

The Streaming Service uses the flow processing model as the service provider, which specifies the necessary information when running service.

The process of spatio-temporal flow processing includes:



The real-time data processing model consists of four parts: Receiver, Filter, Mapper, and Sender. Each part as a node, can be connected and merged together to build a real-time data processing stream: Stream. In addition to Stream, there are some auxiliary parameters as the operating conditions of the entire service, which is stored together in the startup parameter type-Startup. The processing model is as follows:



For how to compose the flow processing model, please refer to Compose the flow processing model.

Publish and manage the Streaming Service

The completed stream processing model can be saved as a file with a suffix of .streaming. It can be uploaded and published by iServer Quickly publish Streaming Service. You can also write the contents of the stream processing model directly to the "configuration information" and then publish.

After the successful publishing, enter the service management page http: // {ip}: {port} / iserver / manager / services / {streamingServiceName} /, the service instance can be suspended, start, deleted and performed other operations. You can view the basic information, running status, and configuration information for the service.

Streaming Service output

iServer provides Data Flow Service and iServer DataStore as the output of the Streaming Service.

When the Streaming Service is published, it supports the simultaneous publishing of the Data Flow Service, so that the result of the analysis can be sent to the client instantly, and the client can receive it automatically through subscription. When you compose a stream processing model, set the output data to Elasticsearch to output the results of the analysis to the spatio-temporal database created by iServer DataStore.

Configuring Streaming Service

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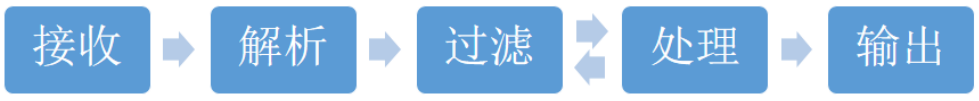

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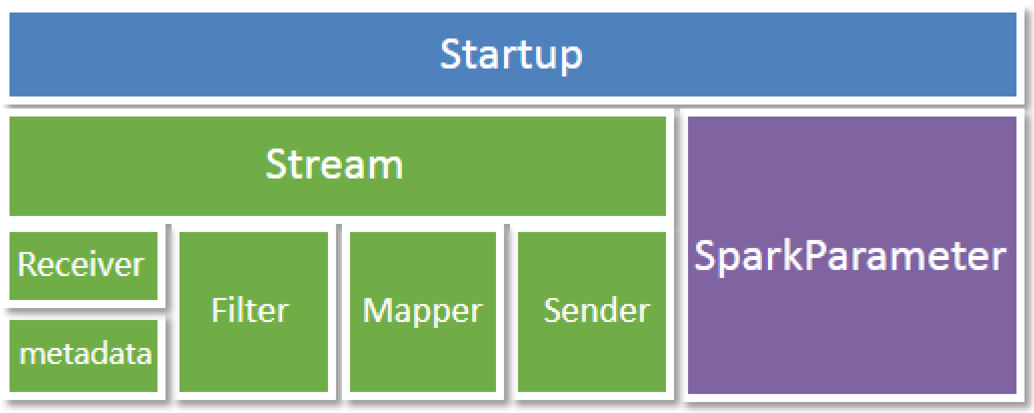

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