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PaVoS

# Entwurfsdokument

Version 0.1

# Visualizing & Mining of Geospatial Sensorstreams with Apache Kafka

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# 1 Einleitung

# 2 Sequenzdiagramme

Die folgenden Sequenzdiagramme sollen den Ablauf von einzelnen Anwendungsfällen im PaVoS-System illustrieren. Die Interaktionen der Klassen miteinander in verschiedenen Situationen wird somit verdeutlicht.

## 2.1 Bridge

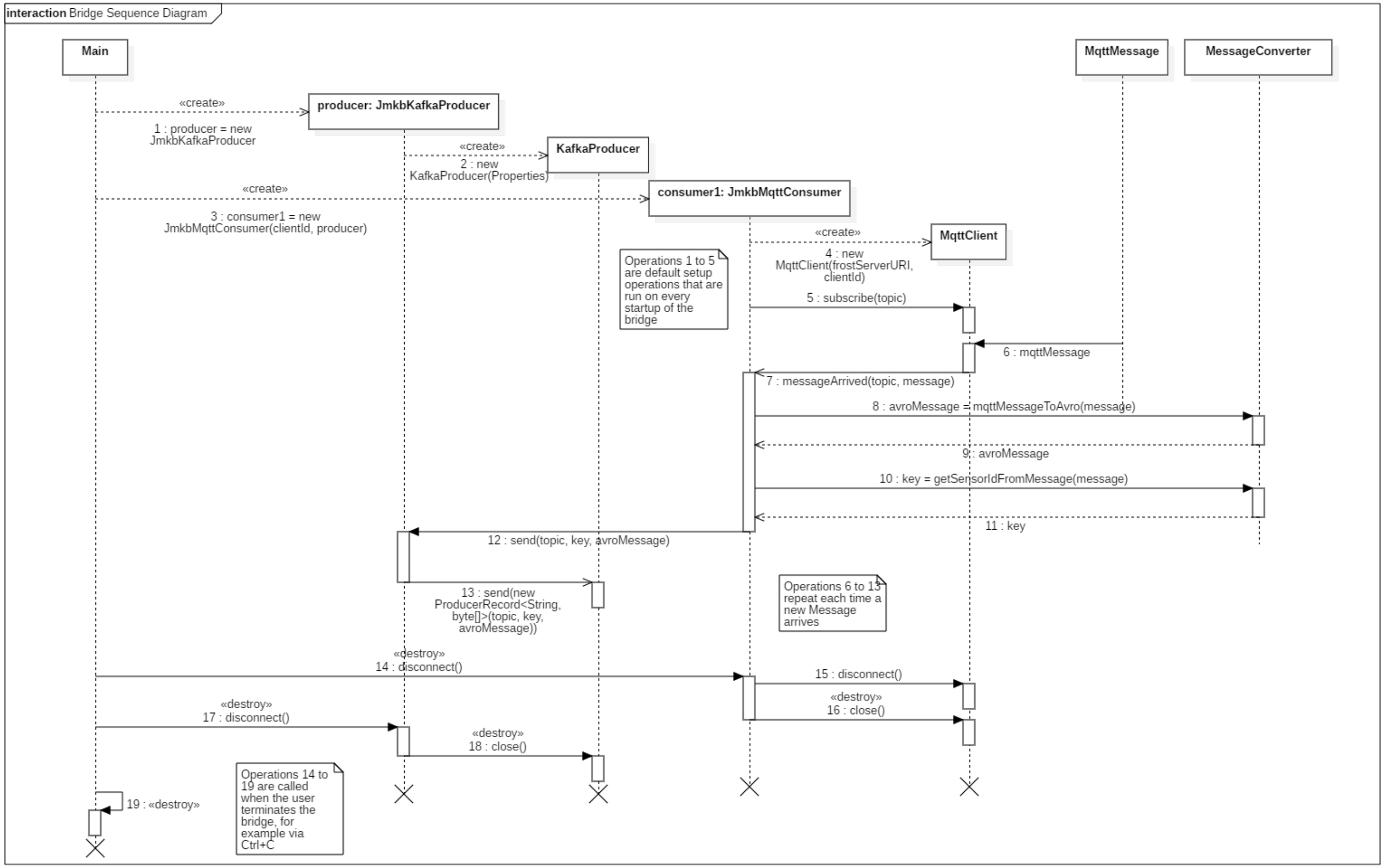
In diesem Sequenzdiagramm wird der Ablauf der Bridge beschrieben, die MQTT-Nachrichten in Records umwandelt und diese an Kafka weiterleitet. Die Bridge läuft komplett unabhängig vom restlichen System.
Die Bridge kann sich in einer von drei Phasen befinden:

1. **Aufbauphase:** Hier findet die Prüfung der Parameter und das Initialisieren der benötigten Klassen statt.
2. **Bereitschaftsphase:** Hier ist die Bridge bereit, Nachrichten von MQTT anzunehmen, zu konvertieren und an Kafka weiter zu senden.
3. **Abbauphase:** Hier werden die Verbindungen zu MQTT und Kafka getrennt, anschließend wird die Bridge beendet.

In der Aufbauphase (in diesem Diagramm Operationen 1-5) wird zunächst ein `JmkbKafkaProducer` erstellt, der intern einen `KafkaProducer` mit bestimmten Einstellungen initialisiert und eine Verbindung zum Kafka Broker aufbaut. Danach wird ein `JmkbMqttConsumer` erstellt, der intern einen `MqttClient` mit bestimmten Einstellungen initialisiert, welcher eine Verbindung zum MQTT-Server aufbaut und die Topics abonniert, die vom FROST-Server angeboten werden.

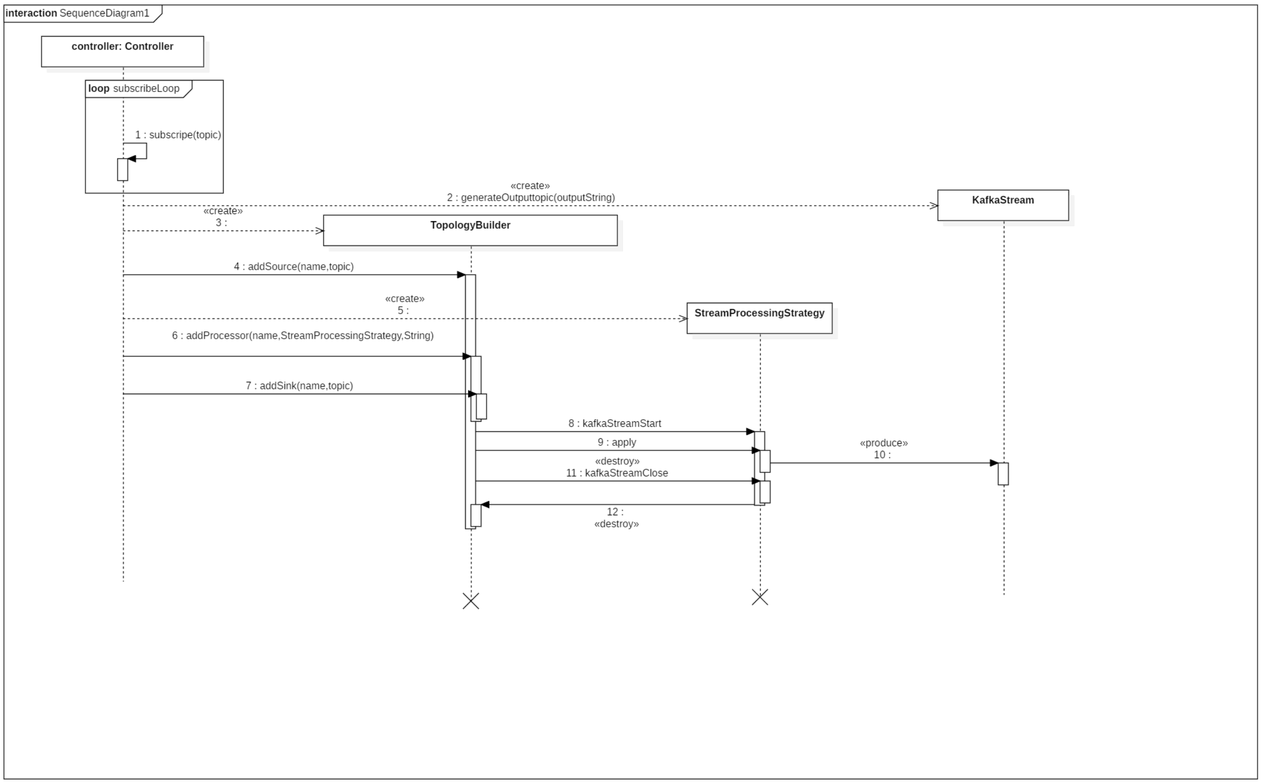
Nun beginnt die Bereitschaftsphase. Sobald eine Nachricht beim MqttClient ankommt, wird die Methode `messageArrived` des `JmkbMqttConsumer`s aufgerufen. In dieser Methode wird aus der erhaltenen Nachricht die IOT-ID des Sensors gefiltert und die Nachricht wird in das Avro-Format konvertiert. Diese zwei Daten sind dann key und value für das Kafka `ProducerRecord` und werden über einen Aufruf der `send`-Methode des `JmkbKafkaProducer`s in ein solches Format gewandelt. Anschließend wird das Record durch den KafkaProducer an Kafka gesendet.

In der Abbauphase werden die `disconnect`-Methoden von `JmkbMqttConsumer` und `JmkbKafkaProducer` aufgerufen, die jeweils die Verbindungen zu MQTT und Kafka sauber trennen und die Clients schließen. Die Abbauphase beginnt nur dann, wenn der Nutzer des Programms es willkürlich schließt oder das System es beendet.


interaction Bridge Sequence Diagram
Main
producer: JmkbKafkaProducer
KafkaProducer
consumer1: JmkbMqttConsumer
MqttClient
MqttMessage
MessageConverter
«create»
1 : producer = new JmkbKafkaProducer
«create»
2 : new KafkaProducer(Properties)
«create»
3 : consumer1 = new JmkbMqttConsumer(clientId, producer)
«create»
4 : new MqttClient(frostServerURI, clientId)
5 : subscribe(topic)
Operations 1 to 5 are default setup operations that are run on every startup of the bridge
6 : mqttMessage
7 : messageArrived(topic, message)
8 : avroMessage = mqttMessageToAvro(message)
9 : avroMessage
10 : key = getSensorIdFromMessage(message)
11 : key
12 : send(topic, key, avroMessage)
13 : send(new ProducerRecord&lt;String, byte[]&gt;(topic, key, avroMessage))
Operations 6 to 13 repeat each time a new Message arrives
«destroy»
14 : disconnect()
15 : disconnect()
«destroy»
16 : close()
«destroy»
17 : disconnect()
«destroy»
18 : close()
19 : «destroy»
Operations 14 to 19 are called when the user terminates the bridge, for example via Ctrl+C

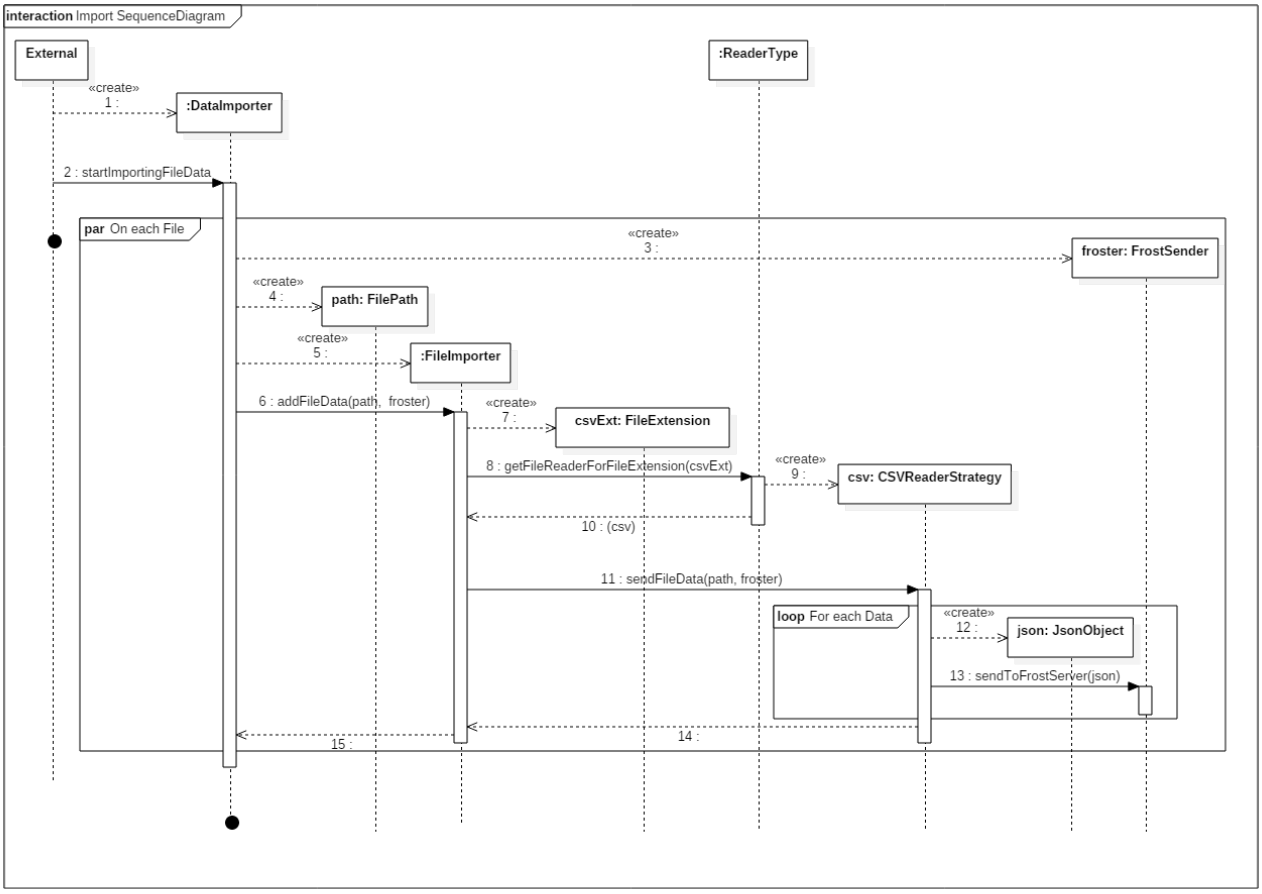
## 2.2 Core

Core


interaction SequenceDiagram1
controller: Controller
loop subscribeLoop
1 : subscripe(topic)
«create»
2 : generateOutputtopic(outputString)
KafkaStream
«create»
3 :
TopologyBuilder
4 : addSource(name,topic)
«create»
5 :
StreamProcessingStrategy
6 : addProcessor(name,StreamProcessingStrategy,String)
7 : addSink(name,topic)
8 : kafkaStreamStart
9 : apply
«produce»
10 :
«destroy»
11 : kafkaStreamClose
12 :
«destroy»

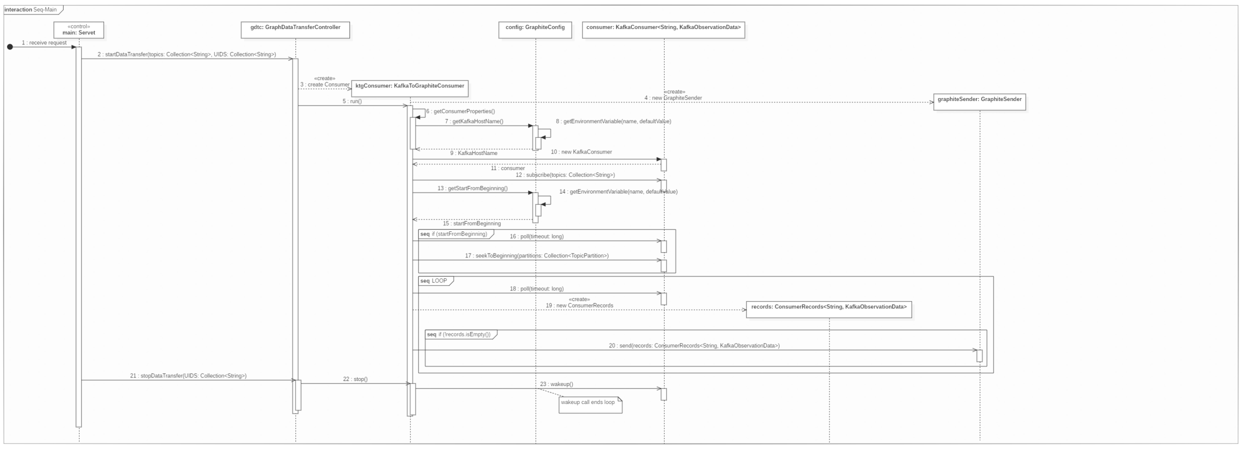
## 2.3 Import

Import

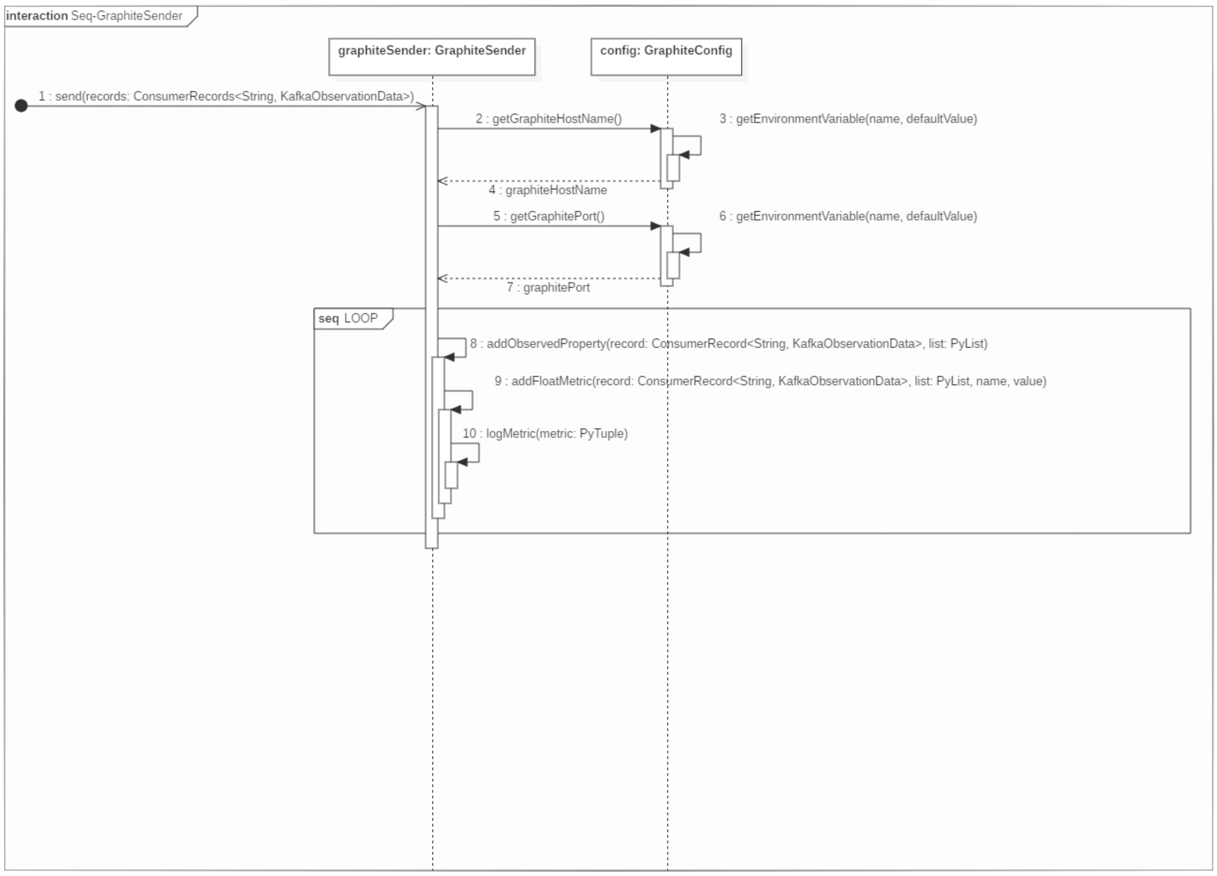


## 2.4 Graphite

Graphite Main

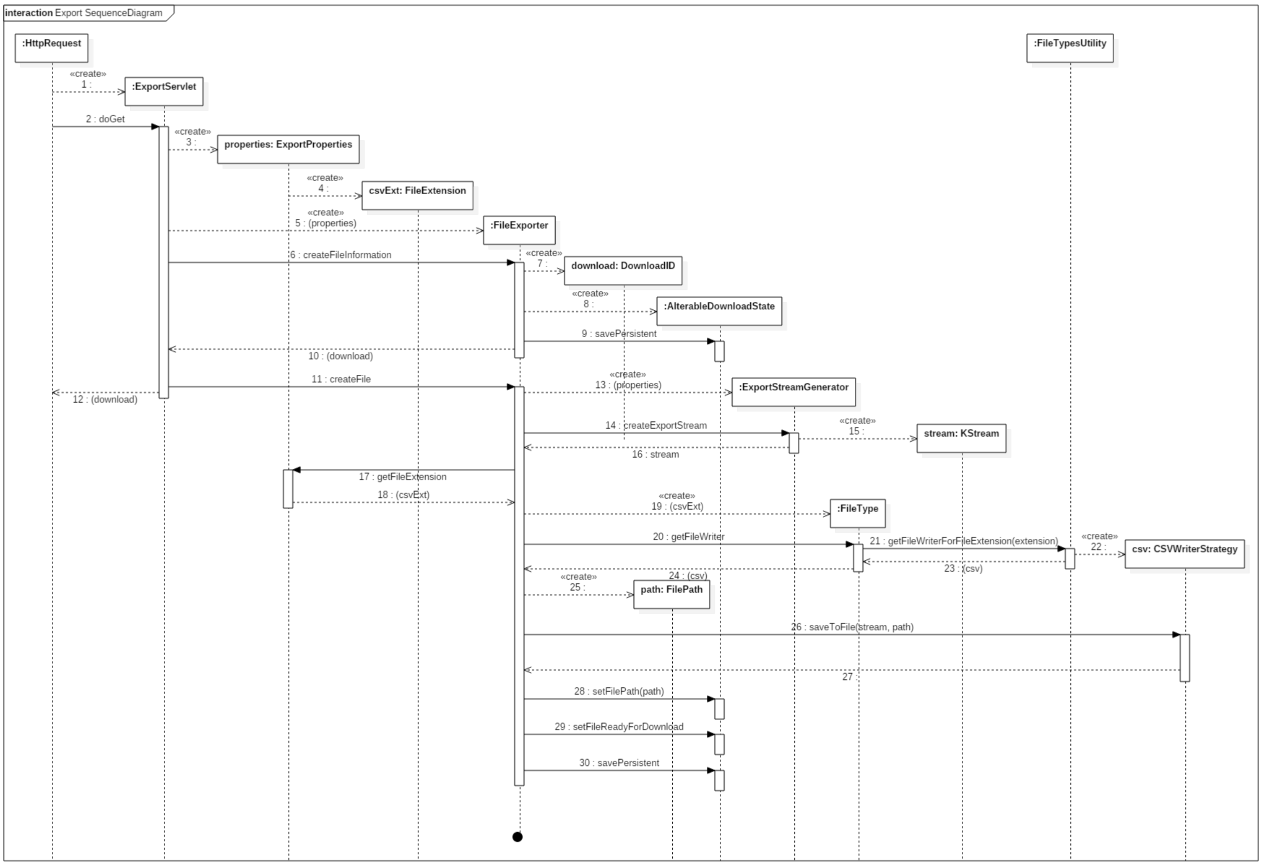

interaction Seq-Main
«control»
main: Servet
gdtc: GraphDataTransferController
config: GraphiteConfig
consumer: KafkaConsumer<String, KafkaObservationData>
1 : receive request
2 : startDataTransfer(topics: Collection<String>, UIDS: Collection<String>)
«create»
3 : create Consumer
ktgConsumer: KafkaToGraphiteConsumer
«create»
4 : new GraphiteSender
graphiteSender: GraphiteSender
5 : run()
6 : getConsumerProperties()
7 : getKafkaHostName()
8 : getEnvironmentVariable(name, defaultValue)
9 : KafkaHostName
10 : new KafkaConsumer
11 : consumer
12 : subscribe(topics: Collection<String>)
13 : getStartFromBeginning()
14 : getEnvironmentVariable(name, defaultValue)
15 : startFromBeginning
seq if (startFromBeginning)
16 : poll(timeout: long)
17 : seekToBeginning(partitions: Collection<TopicPartition>)
seq LOOP
18 : poll(timeout: long)
«create»
19 : new ConsumerRecords
records: ConsumerRecords<String, KafkaObservationData>
seq if (!records.isEmpty())
20 : send(records: ConsumerRecords<String, KafkaObservationData>)
21 : stopDataTransfer(UIDS: Collection<String>)
22 : stop()
23 : wakeup()
wakeup call ends loop

Graphite Sender

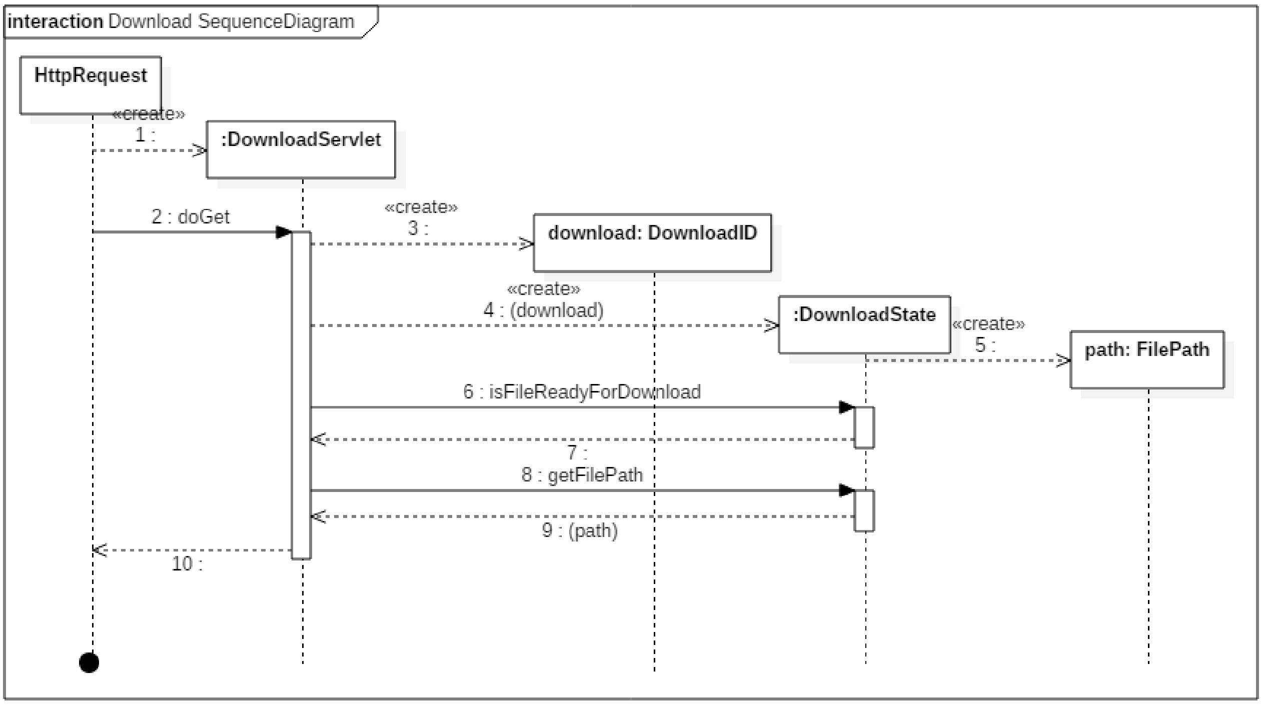

interaction Seq-GraphiteSender
graphiteSender: GraphiteSender
config: GraphiteConfig
1 : send(records: ConsumerRecords<String, KafkaObservationData>)
2 : getGraphiteHostName()
3 : getEnvironmentVariable(name, defaultValue)
4 : graphiteHostName
5 : getGraphitePort()
6 : getEnvironmentVariable(name, defaultValue)
7 : graphitePort
seq LOOP
8 : addObservedProperty(record: ConsumerRecord<String, KafkaObservationData>, list: PyList)
9 : addFloatMetric(record: ConsumerRecord<String, KafkaObservationData>, list: PyList, name, value)
10 : logMetric(metric: PyTuple)

## 2.5 Export

Export



Download


interaction Download SequenceDiagram
HttpRequest
:DownloadServlet
download: DownloadID
:DownloadState
path: FilePath
«create»
1 :
2 : doGet
«create»
3 :
«create»
4 : (download)
«create»
5 :
6 : isFileReadyForDownload
7 :
8 : getFilePath
9 : (path)
10 :

# 3 Klassendiagramme

## Class Hierarchy

### Classes

- java.lang.Object
    - Bridge.JmkbKafkaProducer (in 3.1.1, page 13)
    - Bridge.JmkbMqttConsumer (in 3.1.2, page 15)
    - Bridge.MessageConverter (in 3.1.3, page 17)
    - Bridge.PropertiesFileReader (in 3.1.4, page 18)
    - Bridge.SchemaRegistryConnector (in 3.1.5, page 19)

## 3.1 Package Bridge

*Package Contents* *Page*

**Classes**

### 3.1.1 Class JmkbKafkaProducer

This class creates a Kafka producer using defined settings and publishes records to the Kafka Cluster.

### Declaration

```
public class JmkbKafkaProducer
 extends java.lang.Object
```

### Constructor summary

**JmkbKafkaProducer()** Default constructor

### Method summary

**disconnect()** Disconnects this Kafka producer from the Kafka Cluster and closes the producer.
**send(String, byte[])** Asynchronously sends a record to the topic.

### Constructors

- **JmkbKafkaProducer**

  ```
  public JmkbKafkaProducer()
  ```

  - **Description**

    Default constructor

### Methods

- **disconnect**

  ```
  public void disconnect()
  ```

  - **Description**

    Disconnects this Kafka producer from the Kafka Cluster and closes the producer.

- **send**

  ```
  public void send(java.lang.String topic ,byte[] avroMessage)
  ```

  - **Description**

    Asynchronously sends a record to the topic.

  - **Parameters**

    * `topic` – The topic.
    * `avroMessage` – The message to send.

### 3.1.2 Class JmkbMqttConsumer

This class serves as an MqttClient that consumes messages from the specified FROST-Server address. On message arrival, it will initiate the conversion of the message to a desired format via MqttMessageConverter and supply the converted message to a JmkbKafkaProducer. An instance of this class should be destroyed with a call to the disconnect() method.

#### Declaration

```
public class JmkbMqttConsumer
 extends java.lang.Object
```

#### Constructor summary

**JmkbMqttConsumer()** Default constructor

#### Method summary

**connectionLost(Throwable)** This method is called when the connection to the server is lost.
**deliveryComplete(IMqttDeliveryToken)** Called when delivery for a message has been completed, and all acknowledgments have been received.
**disconnect()** Disconnects client from MQTT and closes the client.
**JmkbMqttConsumer(String, JmkbKafkaProducer)** This constructor for this class.
**messageArrived(String, MqttMessage)** This method is called when a message arrives from the server.

#### Constructors

- **JmkbMqttConsumer**

  ```
  public JmkbMqttConsumer()
  ```

  - **Description**

    Default constructor

#### Methods

- **connectionLost**

  ```
  public void connectionLost(java.lang.Throwable cause)
  ```

  - **Description**

    This method is called when the connection to the server is lost.

  - **Parameters**
    - `cause` – the reason behind the loss of connection.

- **deliveryComplete**

```
public void deliveryComplete(IMqttDeliveryToken token)
```

  - **Description**

    Called when delivery for a message has been completed, and all acknowledgments have been received. In this implementation of this method, nothing happens.
  - **Parameters**
    - `token` – the delivery token associated with the message.

- **disconnect**

```
public void disconnect()
```

  - **Description**

    Disconnects client from MQTT and closes the client.

- **JmkbMqttConsumer**

```
public void JmkbMqttConsumer(java.lang.String clientId,
    JmkbKafkaProducer producer)
```

  - **Description**

    This constructor for this class. Creates a new MqttClient and subscribes to the topics specified in the SensorThings API standard. A unique identifier and a JmkbKafkaProducer should be supplied.
  - **Parameters**
    - `clientId` – The unique identifier for the MqttClient.
    - `producer` – A JmkbKafkaProducer.

- **messageArrived**

```
public void messageArrived(java.lang.String topic,MqttMessage
    message)
```

- **Description**

  This method is called when a message arrives from the server. This method is invoked synchronously by the MQTT client. An acknowledgment is not sent back to the server until this method returns cleanly. Any additional messages which arrive while this method is running will build up in memory, and will then back up on the network. When this method is called, the supplied message will be converted to an Avro message and forwarded to an instance of JmkbKafkaProducer, which will then send the message to the Kafka Cluster.

- **Parameters**
  - `topic` – name of the topic on the message was published to
  - `message` – the actual message.

### 3.1.3 Class MessageConverter

This convenience class provides static methods to convert a given message to another format.

#### Declaration

```
public class MessageConverter
 extends java.lang.Object
```

#### Constructor summary

**MessageConverter()** Default constructor

#### Method summary

**getSensorIdFromMessage(byte[])** This method returns the sensor ID that has supplied the information in the message.

**mqttMessageToAvro(MqttMessage)** This method converts a given MqttMessage, which contains information in the JSON format, to an Avro message in a byte array.

#### Constructors

- **MessageConverter**

  ```
  public MessageConverter()
  ```

  - **Description**

    Default constructor

#### Methods

- **getSensorIdFromMessage**

  ```
  public static java.lang.String getSensorIdFromMessage(byte[] message
      )
  ```

  - **Description**

    This method returns the sensor ID that has supplied the information in the message. In detail, this method searches for the key 'iot.id' in the message and returns the value associated with the key.
  - **Parameters**
    - `message` – The message from which to extract the sensor ID.
  - **Returns** – The sensor ID.

- **mqttMessageToAvro**

  ```
  public static byte[] mqttMessageToAvro(MqttMessage message)
  ```

  - **Description**

    This method converts a given MqttMessage, which contains information in the JSON format, to an Avro message in a byte array.
  - **Parameters**
    - `message` – The message to convert.
  - **Returns** – The message in Avro format.

### 3.1.4 Class PropertiesFileReader

A class that reads properties from the configuration file (jmkb.properties) and provides a method for getting a property by key.

#### Declaration

```
public class PropertiesFileReader
 extends java.lang.Object
```

#### Constructor summary

**PropertiesFileReader()** Default constructor

#### Method summary

**getProperty(String)** Searches for the property with the specified key in jmkb.property.

### Constructors

- **PropertiesFileReader**

  ```
  public PropertiesFileReader()
  ```

  - **Description**

    Default constructor

### Methods

- **getProperty**

  ```
  public void getProperty(java.lang.String key)
  ```

  - **Description**

    Searches for the property with the specified key in jmkb.property.

  - **Parameters**
    - `key` – The value associated with the key or null if the key is not found.

## 3.1.5 Class SchemaRegistryConnector

Convenience class which provides methods for interacting with the schema registry.

### Declaration

```
public class SchemaRegistryConnector
 extends java.lang.Object
```

### Constructor summary

**SchemaRegistryConnector()** Default constructor

### Method summary

**getSchemaById(int)** Requests the schema associated with the schema ID from the schema registry.

**getSchemaBySubject(String)** Requests the latest version of the schema associated with the given subject from the schema registry.

**getSchemaBySubject(String, int)** Requests the given version of the schema associated with the given subject from the schema registry.

### Constructors

- **SchemaRegistryConnector**

  ```
  public SchemaRegistryConnector()
  ```

  - **Description**

    Default constructor

### Methods

- **getSchemaById**

  ```
  public java.lang.String getSchemaById(int id)
  ```

  - **Description**

    Requests the schema associated with the schema ID from the schema registry. Returns the schema if successful, null if not.
  - **Parameters**
    - `id` – The schema id.
  - **Returns** – The schema if successful, null if not.

- **getSchemaBySubject**

  ```
  public java.lang.String getSchemaBySubject(java.lang.String subject)
  ```

  - **Description**

    Requests the latest version of the schema associated with the given subject from the schema registry. Returns the schema if successful, null if not.
  - **Parameters**
    - `subject` – The subject of the schema.
  - **Returns** – The schema if successful, null if not.

- **getSchemaBySubject**

  ```
  public java.lang.String getSchemaBySubject(java.lang.String subject ,
      int version)
  ```

  - **Description**

    Requests the given version of the schema associated with the given subject from the schema registry. Returns the schema if successful, null if not.

- **Parameters**
  - `subject` – The subject of the schema.
  - `version` – The schema version.
- **Returns** – the schema if successful, null if not.

## Class Hierarchy

### Classes

- java.lang.Object
  - Import.CSVReaderStrategy (in 3.2.2, page 23)
  - Import.DataImporter (in 3.2.3, page 25)
  - Import.FileImporter (in 3.2.4, page 25)
  - Import.FrostSender (in 3.2.5, page 26)
  - Import.NetCDFReaderStrategy (in 3.2.6, page 27)
  - Import.ReaderType (in 3.2.7, page 29)

### Interfaces

- Import.FileReaderStrategy (in 3.2.1, page 22)

## 3.2 Package Import

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**Interfaces**

**Classes**

### 3.2.1 Interface FileReaderStrategy

Interface for the FileReaderStrategy classes. Realization of a Strategy to be able to swap out the way a File has to be read.

#### Declaration

```
public interface FileReaderStrategy
```

#### All known subinterfaces

NetCDFReaderStrategy (in 3.2.6, page 27), CSVReaderStrategy (in 3.2.2, page 23)

#### All classes known to implement interface

NetCDFReaderStrategy (in 3.2.6, page 27), CSVReaderStrategy (in 3.2.2, page 23)

#### Method summary

**sendFileData(FilePath, FrostSender)** Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

#### Methods

- **sendFileData**

  ```
  void sendFileData(FilePath path,FrostSender froster)
  ```

  - **Description**

    Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

  - **Parameters**
    - `path` – Is the FilePath of the File to Import.
    - `froster` – Is the FrostSender instance that will be used to send the files data to the Frost-Server.

### 3.2.2 Class CSVReaderStrategy

Implementation of the FileReaderStrategy interface for CSV files.

#### Declaration

```
public class CSVReaderStrategy
 extends java.lang.Object implements FileReaderStrategy
```

#### Constructor summary

**CSVReaderStrategy()** Default constructor

### Method summary

**sendFileData(FilePath, FrostSender)** Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

**sendFileData(FilePath, FrostSender)** Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

### Constructors

- **CSVReaderStrategy**

```
public CSVReaderStrategy()
```

  - **Description**

    Default constructor

### Methods

- **sendFileData**

```
public void sendFileData(FilePath path, FrostSender froster)
```

  - **Description**

    Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

  - **Parameters**
    - `path` – Is the FilePath of the File to Import.
    - `froster` – Is the FrostSender instance that will be used to send the files data to the Frost-Server.

- **sendFileData**

```
public void sendFileData(FilePath path, FrostSender froster)
```

  - **Description**

    Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

  - **Parameters**
    - `path` – Is the FilePath of the File to Import.
    - `froster` – Is the FrostSender instance that will be used to send the files data to the Frost-Server.

### 3.2.3 Class DataImporter

Importer for data that should be added to PaVoS. Import takes place for files in a specified folder of the server.

#### Declaration

```
public class DataImporter
 extends java.lang.Object
```

#### Constructor summary

**DataImporter()** Default constructor

#### Method summary

**startImportingFileData()** Checks for files in the specified import folder and opens a new thread for each of them, where a FileImporter is started to import the contained data.

#### Constructors

- **DataImporter**

  ```
  public DataImporter()
  ```

  – **Description**
    Default constructor

#### Methods

- **startImportingFileData**

  ```
  public void startImportingFileData()
  ```

  – **Description**
    Checks for files in the specified import folder and opens a new thread for each of them, where a FileImporter is started to import the contained data.

### 3.2.4 Class FileImporter

Importer for the Data contained in a File. Takes the Data and sends them to the FROST-Server.

#### Declaration

```
public class FileImporter
 extends java.lang.Object
```

#### Constructor summary

**FileImporter()** Default constructor

#### Method summary

**addFileData(FilePath, FrostSender)** Adds the Data of a File at a specified FilePath to the FROST-Server.

#### Constructors

- **FileImporter**

  ```
  public FileImporter()
  ```

  - **Description**

    Default constructor

#### Methods

- **addFileData**

  ```
  public void addFileData(FilePath path,FrostSender froster)
  ```

  - **Description**

    Adds the Data of a File at a specified FilePath to the FROST-Server. To do so, the FileExtension of the File is determined.With help of the readerTypeClass the matching implementation of the FileReaderStrategy interface for the FileExtension is generated and can be used to get the Data from then File.

  - **Parameters**
    - `path` – Is the FilePath of the File to Import.
    - `froster` – Is the FrostSender instance that will be used to send the files data to the Frost-Server.

### 3.2.5 Class FrostSender

sends Data to the FROST-Server.

#### Declaration

```
public class FrostSender
 extends java.lang.Object
```

#### Constructor summary

**FrostSender()** Default constructor

#### Method summary

**sendToFrostServer(JsonObject)** Sends the given JsonObject to the FROST-Server.

#### Constructors

- **FrostSender**

  ```
  public FrostSender()
  ```

  - **Description**

    Default constructor

#### Methods

- **sendToFrostServer**

  ```
  public void sendToFrostServer(JsonObject json)
  ```

  - **Description**

    Sends the given JsonObject to the FROST-Server.
  - **Parameters**
    - `json` – Represents a single ObservedProperty.

### 3.2.6 Class NetCDFReaderStrategy

Implementation of the FileReaderStrategy interface for NetCDF files.

#### Declaration

```
public class NetCDFReaderStrategy
 extends java.lang.Object implements FileReaderStrategy
```

#### Constructor summary

**NetCDFReaderStrategy()** Default constructor

### Method summary

**sendFileData(FilePath, FrostSender)** Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

**sendFileData(FilePath, FrostSender)** Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.

### Constructors

- **NetCDFReaderStrategy**

  ```
  public NetCDFReaderStrategy()
  ```

  - **Description**

    Default constructor

### Methods

- **sendFileData**

  ```
  public void sendFileData(FilePath path,FrostSender froster)
  ```

  - **Description**

    Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.
  - **Parameters**
    - `path` – Is the FilePath of the File to Import.
    - `froster` – Is the FrostSender instance that will be used to send the files data to the Frost-Server.

- **sendFileData**

  ```
  public void sendFileData(FilePath path,FrostSender froster)
  ```

  - **Description**

    Reades from a File as specified by the FilePath and sends the information in it to the FROST-Server using the FrostSender that was provided.
  - **Parameters**
    - `path` – Is the FilePath of the File to Import.
    - `froster` – Is the FrostSender instance that will be used to send the files data to the Frost-Server.

### 3.2.7 Class ReaderType

Is like a chooser for the right FileReaderStrategy. If a new Strategy is added, this class needs some changes to use the new Strategy.

#### Declaration

```
public class ReaderType
 extends java.lang.Object
```

#### Constructor summary

**ReaderType()** Default constructor

#### Method summary

**getFileReaderForFileExtension(FileExtension)** Gives a new Instance of a FileReaderStrategy for the specified FileExtension.

#### Constructors

- **ReaderType**

  ```
  public ReaderType()
  ```

  - **Description**

    Default constructor

#### Methods

- **getFileReaderForFileExtension**

  ```
  public static FileReaderStrategy getFileReaderForFileExtension(
      FileExtension extension)
  ```

  - **Description**

    Gives a new Instance of a FileReaderStrategy for the specified FileExtension.
  - **Parameters**
    - `extension` – is the FileExtension for which a FileReaderStrategy has to be generated.
  - **Returns** – An instance of an implementation of the FileReaderStrategy interface.

## Class Hierarchy

### Classes

- java.lang.Object
    - DatabaseConnection.ClusterID (in 3.3.1, page 31)
    - DatabaseConnection.Facade (in 3.3.3, page 32)
    - DatabaseConnection.HttpServlet (in 3.3.5, page 35)
        - DatabaseConnection.GridDataServlet (in 3.3.4, page 34)
        - DatabaseConnection.SensorListServlet (in 3.3.9, page 38)
    - DatabaseConnection.KafkaToStorageProcessor (in 3.3.6, page 36)
    - DatabaseConnection.Maintainer (in 3.3.7, page 37)
        - DatabaseConnection.DataMaintainer (in 3.3.2, page 31)
        - DatabaseConnection.SensorMaintainer (in 3.3.10, page 39)
    - DatabaseConnection.MaintenanceManager (in 3.3.8, page 37)
    - DatabaseConnection.ZoomLevel (in 3.3.11, page 40)

## 3.3 Package DatabaseConnection

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**Classes**

### 3.3.1 Class ClusterID

This class describes a unique identification of a cluster via longitude and latitude.

#### Declaration

```
public class ClusterID
 extends java.lang.Object
```

#### Constructor summary

**ClusterID()** Default constructor

#### Constructors

- **ClusterID**

  ```
  public ClusterID()
  ```

  - **Description**

    Default constructor

### 3.3.2 Class DataMaintainer

This class maintains the sensordata in the StorageSolution.

#### Declaration

```
public class DataMaintainer
 extends DatabaseConnection.Maintainer
```

#### Constructor summary

**DataMaintainer()** Default constructor

#### Method summary

**summarize(TimeUnit)** This method takes data of a certain TimeUnit and summarizes it into the next higher TimeUnit.

#### Constructors

- **DataMaintainer**

  ```
  public DataMaintainer()
  ```

  - **Description**

    Default constructor

#### Methods

- **summarize**

  ```
  public void summarize(TimeUnit timeUnit)
  ```

  - **Description**

    This method takes data of a certain TimeUnit and summarizes it into the next higher TimeUnit. The summarized data is then saved back into the StorageSolution. The original data of the lower TimeUnit is then deleted from the database.
  - **Parameters**
    - `timeUnit` – The TimeUnit to summarize.

### 3.3.3 Class Facade

A facade to simplify access to a StorageSolution, such as a database. Through the methods, data can be inserted into the StorageSolution and certain information about its content requested.

#### Declaration

```
public class Facade
 extends java.lang.Object
```

#### Constructor summary

**Facade()** Default constructor

#### Method summary

**getGrid(ClusterID[], ZoomLevel, Time)** Returns an appropriate grid of clusters in the requested grid section for the specified ZoomLevel and time.

**getSensors(ObservationType, ClusterID)** Fetches all sensors from the given cluster that observe the given ObservedProperty and returns an array of sensors.

**subscribeToZoomLevelStream(KStream)** Subscribes to the given KafkaStream, which contains ZoomLevel-specific data and initiates processing of its records.

### Constructors

- **Facade**

  ```
  public Facade()
  ```

  - **Description**

    Default constructor

### Methods

- **getGrid**

  ```
  public Grid getGrid(ClusterID[] clusters,ZoomLevel zoom,Time time)
  ```

  - **Description**

    Returns an appropriate grid of clusters in the requested grid section for the specified ZoomLevel and time. The (first) two values of the ClusterID array define the grid section from which to get the data.

  - **Parameters**
    - ∗ `clusters` – An array of ClusterIDs from which the first two entries are taken to compute the section of the Grid to get the data from.
    - ∗ `zoom` – The ZoomLevel from which to get the data.
    - ∗ `time` – The point in time.
  - **Returns** – A grid with the computed data.

- **getSensors**

  ```
  public java.util.Set getSensors(ObservationType type,ClusterID id)
  ```

  - **Description**

    Fetches all sensors from the given cluster that observe the given ObservedProperty and returns an array of sensors.

  - **Parameters**
    - ∗ `type` – The ObservationType of the requested sensors.
    - ∗ `id` – The ID of the cluster.
  - **Returns** – An array of sensors.

- **subscribeToZoomLevelStream**

```
public void subscribeToZoomLevelStream(KStream stream)
```

- **Description**

  Subscribes to the given KafkaStream, which contains ZoomLevel-specific data and initiates processing of its records.
- **Parameters**
  - `stream` – The stream to subscribe to.

### 3.3.4 Class GridDataServlet

An HTTPServlet for requesting Grid data.

#### Declaration

```
public class GridDataServlet
 extends DatabaseConnection.HttpServlet
```

#### Constructor summary

**GridDataServlet()** Default constructor

#### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** This method calls the getGrid method of the Facade to get a Grid of clusters at a certain ZoomLevel and Time .

#### Constructors

- **GridDataServlet**

```
public GridDataServlet()
```

- **Description**

  Default constructor

#### Methods

- **doGet**

```
public void doGet(HttpServletRequest req,HttpServletResponse res)
```

- **Description**

  This method calls the getGrid method of the Facade to get a Grid of clusters at a certain ZoomLevel and Time . This saves the Grid into res.

- **Parameters**
  - `req` – An HttpServletRequest object that contains the request the client has made of the servlet.
  - `res` – An HttpServletResponse object that contains the response the servlet sends to the client.

#### Members inherited from class HttpServlet

`DatabaseConnection.HttpServlet` (in 3.3.5, page 35)

- `public void` **doGet**`(HttpServletRequest` **req**`, HttpServletResponse` **res**`)`

### 3.3.5 Class HttpServlet

An abstract HTTPServlet.

#### Declaration

```
public class HttpServlet
 extends java.lang.Object
```

#### All known subclasses

SensorListServlet (in 3.3.9, page 38), GridDataServlet (in 3.3.4, page 34)

#### Constructor summary

**HttpServlet()** Default constructor

#### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** Called by the server (via the service method) to allow a servlet to handle a GET request.

#### Constructors

- **HttpServlet**

  ```
  public HttpServlet()
  ```

  - **Description**

    Default constructor

### Methods

- **doGet**

  ```
  public void doGet(HttpServletRequest req,HttpServletResponse res)
  ```

  - **Description**

    Called by the server (via the service method) to allow a servlet to handle a GET request.

  - **Parameters**

    - `req` – An HttpServletRequest object that contains the request the client has made of the servlet.
    - `res` – An HttpServletResponse object that contains the response the servlet sends to the client.

## 3.3.6 Class KafkaToStorageProcessor

This class converts KafkaStream records to data that can be inserted into the StorageSolution.

### Declaration

```
public class KafkaToStorageProcessor
 extends java.lang.Object
```

### Constructor summary

**KafkaToStorageProcessor()** Default constructor

### Method summary

**subscribe(KStream)** Subscribes to the given KafkaStream and converts the data to the appropriate format for the StorageSolution.

### Constructors

- **KafkaToStorageProcessor**

  ```
  public KafkaToStorageProcessor()
  ```

  - **Description**

    Default constructor

#### Methods

- **subscribe**

  ```
  public void subscribe(KStream stream)
  ```

  - **Description**

    Subscribes to the given KafkaStream and converts the data to the appropriate format for the StorageSolution. If a stream is already subscribed to, unsubscribes from the old stream and subscribes to the new one.
  - **Parameters**
    - `stream` – The KStream to subscribe to.

### 3.3.7 Class Maintainer

An abstract class describing a Maintainer, which performs maintenance on certain data in the StorageSolution.

#### Declaration

```
public class Maintainer
 extends java.lang.Object
```

#### All known subclasses

SensorMaintainer (in 3.3.10, page 39), DataMaintainer (in 3.3.2, page 31)

#### Constructor summary

**Maintainer()** Default constructor

#### Constructors

- **Maintainer**

  ```
  public Maintainer()
  ```

  - **Description**

    Default constructor

### 3.3.8 Class MaintenanceManager

This class manages the way the methods of Maintainers are called to make sure the StorageSolution content is maintained.

#### Declaration

```
public class MaintenanceManager
 extends java.lang.Object
```

#### Constructor summary

**MaintenanceManager()** Default constructor

#### Method summary

**startMaintenance()** This method should be called as soon as the database is started.

#### Constructors

- **MaintenanceManager**

  ```
  public MaintenanceManager()
  ```

  - **Description**

    Default constructor

#### Methods

- **startMaintenance**

  ```
  public void startMaintenance()
  ```

  - **Description**

    This method should be called as soon as the database is started. Through calls to instances of Maintainers, summarizes data in the database and deletes data that has become obsolete as a result of the summarization.

### 3.3.9 Class SensorListServlet

An HTTPServlet for requesting a list of sensors.

#### Declaration

```
public class SensorListServlet
 extends DatabaseConnection.HttpServlet
```

#### Constructor summary

**SensorListServlet()** Default constructor

#### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** This method calls the getSensors method of the Facade to get a list of Sensors that are in a certain cluster.

#### Constructors

- **SensorListServlet**

```
public SensorListServlet()
```

  - **Description**

    Default constructor

#### Methods

- **doGet**

```
public void doGet(HttpServletRequest req,HttpServletResponse res)
```

  - **Description**

    This method calls the getSensors method of the Facade to get a list of Sensors that are in a certain cluster.

  - **Parameters**

    * `req` – An HttpServletRequest object that contains the request the client has made of the servlet.
    * `res` – An HttpServletResponse object that contains the response the servlet sends to the client.

#### Members inherited from class HttpServlet

`DatabaseConnection.HttpServlet` (in 3.3.5, page 35)

- `public void` **`doGet`**`(HttpServletRequest` **`req`**`, HttpServletResponse` **`res`**`)`

### 3.3.10 Class SensorMaintainer

This class maintains the list of sensors saved in the StorageSolution.

#### Declaration

```
public class SensorMaintainer
 extends DatabaseConnection.Maintainer
```

#### Constructor summary

**SensorMaintainer()** Default constructor

#### Method summary

**checkSensorsOfCluster(ClusterID)** This method checks if the sensors registered to the given cluster are up to date.

#### Constructors

- **SensorMaintainer**

  ```
  public SensorMaintainer()
  ```

  – **Description**

    Default constructor

#### Methods

- **checkSensorsOfCluster**

  ```
  public void checkSensorsOfCluster(ClusterID cluster)
  ```

  – **Description**

    This method checks if the sensors registered to the given cluster are up to date. A sensor is up to date if data has been received from it in the last 24 hours. If this requirement is not met, the sensor is deleted from the database.

  – **Parameters**

    ∗ `cluster` – The cluster to check.

### 3.3.11 Class ZoomLevel

This class describes a zoom level for the map.

### Declaration

```
public class ZoomLevel
 extends java.lang.Object
```

### Constructor summary

**ZoomLevel()** Default constructor

### Constructors

- **ZoomLevel**

  ```
  public ZoomLevel()
  ```

  - **Description**

    Default constructor

## Class Hierarchy

### Classes

- java.lang.Object
  - Download.DownloadID (in 3.5.2, page 57)
  - Download.DownloadState (in 3.5.3, page 57)
    - Download.AlterableDownloadState (in 3.5.1, page 55)
  - Export.AbstractExporter (in 3.4.2, page 44)
    - Export.FileExporter (in 3.4.6, page 49)
  - Export.CSVWriterStrategy (in 3.4.3, page 45)
  - Export.ExportProperties (in 3.4.4, page 46)
  - Export.ExportStreamGenerator (in 3.4.5, page 48)
  - Export.FileExtension (in 3.4.7, page 50)
  - Export.FileType (in 3.4.8, page 51)
  - Export.FileTypesUtility (in 3.4.9, page 52)
  - Export.NetCDFWriterStrategy (in 3.4.10, page 53)
  - ExportDownloadCommunication.HttpServlet (in 3.6.4, page 62)
    - ExportDownloadCommunication.DownloadServlet (in 3.6.1, page 59)
    - ExportDownloadCommunication.ExportServlet (in 3.6.2, page 60)
    - ExportDownloadCommunication.FileExtensionServlet (in 3.6.3, page 61)
    - ExportDownloadCommunication.StatusServlet (in 3.6.5, page 63)

### Interfaces

- Export.FileWriterStrategy (in 3.4.1, page 43)

## 3.4 Package Export

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**Classes**

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**FileExporter** ........ 49

Exporter of Data from Kafka to a File.

**FileExtension** ........ 50

Represents the FileExtension of a File.

**FileType** ........ 51

Is used to store a FileExtension information and give the right FileWriter for this FileExtension.

**FileTypesUtility** ........ 52

Utility class that provides static methods to get all supported FileExtensions and one to get a new Instance of the FileWriter associated with a given FileExtension.

**NetCDFWriterStrategy** ........ 53

Implementation of the FileWriterStrategy interface for NetCDF files.

### 3.4.1 Interface FileWriterStrategy

Interface for the FileWriterStrategy classes. Realization of a Strategy to be able to swap out the way a File has to be saved.

#### Declaration

```
public interface FileWriterStrategy
```

#### All known subinterfaces

NetCDFWriterStrategy (in 3.4.10, page 53), CSVWriterStrategy (in 3.4.3, page 45)

#### All classes known to implement interface

NetCDFWriterStrategy (in 3.4.10, page 53), CSVWriterStrategy (in 3.4.3, page 45)

#### Method summary

**saveToFile(KStream, FilePath)** Creates a File as specified by the FilePath and saves the Data from the provided KafkaStream into it.

#### Methods

- **saveToFile**

```
void saveToFile(KStream stream, FilePath path)
```

- **Description**

  Creates a File as specified by the FilePath and saves the Data from the provided Kafka-Stream into it.
- **Parameters**
  - * `stream` – is the KStream, that should be exported to a File.
  - * `path` – Is the FilePath, where the new File should be created.

### 3.4.2 Class AbstractExporter

Abstract Exporter of Data to a File.

#### Declaration

```
public class AbstractExporter
 extends java.lang.Object
```

#### All known subclasses

FileExporter (in 3.4.6, page 49)

#### Field summary

**properties** Contains the Properties of an Export Request.

#### Constructor summary

**AbstractExporter()** Default constructor

#### Method summary

**createFile()** Generates the File with the desired Data.
**createFileInformation()** Creates Information for that Export.

#### Fields

- `public ExportProperties` **properties**
  - Contains the Properties of an Export Request.

#### Constructors

- **AbstractExporter**

```
public AbstractExporter()
```

  - **Description**

    Default constructor

#### Methods

- **createFile**

  ```
  public void createFile()
  ```

  - **Description**

    Generates the File with the desired Data.

- **createFileInformation**

  ```
  public DownloadID createFileInformation()
  ```

  - **Description**

    Creates Information for that Export. These Information will be used to identifie a File for the WebGUI, that gets the created DownloadID.

  - **Returns** – Is the DownloadID for the started Export.

### 3.4.3 Class CSVWriterStrategy

Implementation of the FileWriterStrategy interface for CSV files.

#### Declaration

```
public class CSVWriterStrategy
 extends java.lang.Object implements FileWriterStrategy
```

#### Constructor summary

**CSVWriterStrategy()** Default constructor

#### Method summary

**saveToFile(KStream, FilePath)** Creates a File as specified by the FilePath and saves the Data from the provided KafkaStream into it.
**saveToFile(KStream, FilePath)** Creates a File as specified by the FilePath and saves the Data from the provided KafkaStream into it.

### Constructors

- **CSVWriterStrategy**

  ```
  public CSVWriterStrategy()
  ```

  - **Description**

    Default constructor

### Methods

- **saveToFile**

  ```
  public void saveToFile(KStream stream, FilePath path)
  ```

  - **Description**

    Creates a File as specified by the FilePath and saves the Data from the provided Kafka-Stream into it.

  - **Parameters**

    * `stream` – is the KStream, that should be exported to a File.
    * `path` – Is the FilePath, where the new File should be created.

- **saveToFile**

  ```
  public void saveToFile(KStream stream, FilePath path)
  ```

  - **Description**

    Creates a File as specified by the FilePath and saves the Data from the provided Kafka-Stream into it.

  - **Parameters**

    * `stream` – is the KStream, that should be exported to a File.
    * `path` – Is the FilePath, where the new File should be created.

## 3.4.4 Class ExportProperties

Contains the Properties of an Export Request.

### Declaration

```
public class ExportProperties
 extends java.lang.Object
```

### Constructor summary

**ExportProperties()** Default constructor

### Method summary

**getClusters()** Get the ClusterIDs that should be exported.
**getFileExtension()** Get the FileExtension for the Export File.
**getObservedProperties()** Get the ObservedProperties that should be exported.
**getSensorIDs()** Get the SensorIDs that should be exported.
**getTimeFrame()** Get the TimeFrame of the Data that should be exported.

### Constructors

- **ExportProperties**

  ```
  public ExportProperties()
  ```

  - **Description**

    Default constructor

### Methods

- **getClusters**

  ```
  public java.util.Set getClusters()
  ```

  - **Description**

    Get the ClusterIDs that should be exported. Always only exports a Groupd of Sensors or a Group of Clusters. The other Option is Empty.
  - **Returns** – The Clusters that should be taken in the Export.

- **getFileExtension**

  ```
  public FileExtension getFileExtension()
  ```

  - **Description**

    Get the FileExtension for the Export File.

  - **Returns** – The FileExtension for the File to export.

- **getObservedProperties**

  ```
  public java.util.Set getObservedProperties()
  ```

  - **Description**

    Get the ObsorvedProperties that should be exported.
  - **Returns** – The ObservedProperties that should be used for the export.

- **getSensorIDs**

  ```
  public java.util.Set getSensorIDs()
  ```

  - **Description**

    Get the SensorIDs that should be exported. Always only exports a Groupd of Sensors or a Group of Clusters. The other Option is Empty.
  - **Returns** – The SensorIDs of the Data that should be exported.

- **getTimeFrame**

  ```
  public TimeFrame getTimeFrame()
  ```

  - **Description**

    Get the TimeFrame of the Data that should be exported.
  - **Returns** – The TimeFrame of the Data to be exported.

### 3.4.5 Class ExportStreamGenerator

Generates a Stream for the Export by asking for one at the PaVoS Core and Subscribing to it.

#### Declaration

```
public class ExportStreamGenerator
 extends java.lang.Object
```

#### Field summary

**properties** Contains the Properties of an Export Request.

#### Constructor summary

**ExportStreamGenerator()** Default constructor

#### Method summary

**createExportStream()** Asks for a KafkaStream and subscribes to it.

#### Fields

- `public ExportProperties` **properties**
  - Contains the Properties of an Export Request.

#### Constructors

- **ExportStreamGenerator**

```
public ExportStreamGenerator()
```

  - **Description**

    Default constructor

#### Methods

- **createExportStream**

```
public KStream createExportStream()
```

  - **Description**

    Asks for a KafkaStream and subscribes to it. Then gives it through to the needed part for the export.
  - **Returns** – Is a KStream of the Data that should be exported.

### 3.4.6 Class FileExporter

Exporter of Data from Kafka to a File.

#### Declaration

```
public class FileExporter
 extends Export.AbstractExporter
```

#### Constructor summary

**FileExporter()** Default constructor

### Method summary

**createFile()** Generates the File with the desired Data.
**createFileInformation()** Creates Information for that Export.

### Constructors

- **FileExporter**

  ```
  public FileExporter()
  ```

  – **Description**
    Default constructor

### Methods

- **createFile**

  ```
  public void createFile()
  ```

  – **Description**
    Generates the File with the desired Data.

- **createFileInformation**

  ```
  public DownloadID createFileInformation()
  ```

  – **Description**
    Creates Information for that Export. These Information will be used to identifie a File for the WebGUI, that gets the created DownloadID.

  – **Returns** – Is the DownloadID for the started Export.

### Members inherited from class AbstractExporter

`Export.AbstractExporter` (in 3.4.2, page 44)

- `public void` **createFile**`()`
- `public DownloadID` **createFileInformation**`()`
- `public` **properties**

## 3.4.7 Class FileExtension

Represents the FileExtension of a File. Is used to match the right FileFormat for an export or import.

#### Declaration

```
public class FileExtension
 extends java.lang.Object
```

#### Constructor summary

**FileExtension()** Default constructor

#### Constructors

- **FileExtension**

  ```
  public FileExtension()
  ```

  - **Description**
    Default constructor

### 3.4.8 Class FileType

Is used to store a FileExtension information and give the right FileWriter for this FileExtension.

#### Declaration

```
public class FileType
 extends java.lang.Object
```

#### Field summary

**extension** The FileExtension is defining the FileType.

#### Constructor summary

**FileType()** Default constructor

#### Method summary

**getFileWriter()** Gives an instance of the implemented FileWriter that is associated with this FileType, thus this FileExtension.

#### Fields

- `public FileExtension` **extension**
  - The FileExtension is defining the FileType.

#### Constructors

- **FileType**

  ```
  public FileType()
  ```

  - **Description**

    Default constructor

#### Methods

- **getFileWriter**

  ```
  public FileWriterStrategy getFileWriter()
  ```

  - **Description**

    Gives an instance of the implemented FileWriter that is associated with this FileType, thus this FileExtension. To do so it uses the static method getFileWriterForFileExtension from the FileTypesUtility class.
  - **Returns** – Is a new instance of an implementation of a FilWriterStrategy.

### 3.4.9 Class FileTypesUtility

Utility class that provides static methods to get all supported FileExtensions and one to get a new Instance of the FileWriter associated with a given FileExtension. If a new FileWriter is added to PaVoS, this class needs some changed to be able to return the new FileWriter.

#### Declaration

```
public class FileTypesUtility
 extends java.lang.Object
```

#### Constructor summary

**FileTypesUtility()** Default constructor

#### Method summary

**getAllPossibleFileExtensions()** Gives all supported FileExtensions in an ArrayList.
**getFileWriterForFileExtension(FileExtension)** Gives a new Instance of the FileWriter associated witha given FileExtension.

### Constructors

- **FileTypesUtility**

  ```
  public FileTypesUtility()
  ```

  - **Description**
    Default constructor

### Methods

- **getAllPossibleFileExtensions**

  ```
  public static java.util.Set getAllPossibleFileExtensions()
  ```

  - **Description**
    Gives all supported FileExtensions in an ArrayList.
  - **Returns** – Is an Array of the possible FileExtensions for an Export.

- **getFileWriterForFileExtension**

  ```
  public static FileWriterStrategy getFileWriterForFileExtension(
      FileExtension extension)
  ```

  - **Description**
    Gives a new Instance of the FileWriter associated witha given FileExtension.
  - **Parameters**
    - `extension` – Is the FileExtension for which a new instance of an Implementation of the FileWriterStrategy is wanted.
  - **Returns** – Is the instance of the implementation of a FileWriterStrategy.

## 3.4.10 Class NetCDFWriterStrategy

Implementation of the FileWriterStrategy interface for NetCDF files.

### Declaration

```
public class NetCDFWriterStrategy
 extends java.lang.Object implements FileWriterStrategy
```

### Constructor summary

**NetCDFWriterStrategy()** Default constructor

### Method summary

**saveToFile(KStream, FilePath)** Creates a File as specified by the FilePath and saves the Data from the provided KafkaStream into it.
**saveToFile(KStream, FilePath)** Creates a File as specified by the FilePath and saves the Data from the provided KafkaStream into it.

### Constructors

- **NetCDFWriterStrategy**

  ```
  public NetCDFWriterStrategy()
  ```

  - **Description**

    Default constructor

### Methods

- **saveToFile**

  ```
  public void saveToFile(KStream stream,FilePath path)
  ```

  - **Description**

    Creates a File as specified by the FilePath and saves the Data from the provided KafkaStream into it.
  - **Parameters**
    - `stream` – is the KStream, that should be exported to a File.
    - `path` – Is the FilePath, where the new File should be created.
- **saveToFile**

  ```
  public void saveToFile(KStream stream,FilePath path)
  ```

  - **Description**

    Creates a File as specified by the FilePath and saves the Data from the provided KafkaStream into it.
  - **Parameters**
    - `stream` – is the KStream, that should be exported to a File.
    - `path` – Is the FilePath, where the new File should be created.

## 3.5 Package Download

### 3.5.1 Class AlterableDownloadState

Verifies for the State of a Download. Can also change it.

#### Declaration

```
public class AlterableDownloadState
 extends Download.DownloadState
```

#### Constructor summary

**AlterableDownloadState()** Default constructor

#### Method summary

**getFilePath()** Gives the FilePath associated with this DownloadID.
**isFileReadyForDownload()** Checks if a File is Ready to be downloaded.
**savePersistent()** Save the changed Data persistently.
**setFilePath(void)** Defines the FilePath for the DownloadID.
**setFileReadyForDownload()** Validate, that the File is ready to be downloaded.

#### Constructors

- **AlterableDownloadState**

  ```
  public AlterableDownloadState()
  ```

  - **Description**

    Default constructor

### Methods

- **getFilePath**

  ```
  public FilePath getFilePath()
  ```

  - **Description**

    Gives the FilePath associated with this DownloadID.
  - **Returns** – The FilePath of the File for the Download.
- **isFileReadyForDownload**

  ```
  public boolean isFileReadyForDownload()
  ```

  - **Description**

    Checks if a File is Ready to be downloaded.
  - **Returns** – A boolean whether the file is downloadable or not.
- **savePersistent**

  ```
  public void savePersistent()
  ```

  - **Description**

    Save the changed Data persistently.
- **setFilePath**

  ```
  public void setFilePath(void path)
  ```

  - **Description**

    Defines the FilePath for the DownloadID.
  - **Parameters**
    - `path` – Is the FilePath to be set.
- **setFileReadyForDownload**

  ```
  public void setFileReadyForDownload()
  ```

  - **Description**

    Validate, that the File is ready to be downloaded.

#### Members inherited from class DownloadState

`Download.DownloadState` (in 3.5.3, page 57)

- `public` **downloadID**
- `public FilePath` **getFilePath**`()`
- `public boolean` **isFileReadyForDownload**`()`

### 3.5.2 Class DownloadID

Is an Identifier for a specific Download, so that the right file can be fount for a requeststed Download.

#### Declaration

```
public class DownloadID
 extends java.lang.Object
```

#### Constructor summary

**DownloadID()** Default constructor

#### Constructors

- **DownloadID**

  ```
  public DownloadID()
  ```

  - **Description**

    Default constructor

### 3.5.3 Class DownloadState

Verifies for the State of a Download.

#### Declaration

```
public class DownloadState
 extends java.lang.Object
```

#### All known subclasses

AlterableDownloadState (in 3.5.1, page 55)

#### Field summary

**downloadID** Is an Identifier for a specific Download.

### Constructor summary

**DownloadState()** Default constructor

### Method summary

**getFilePath()** Gives the FilePath associated with this DownloadID.
**isFileReadyForDownload()** Checks if a File is Ready to be downloaded.

### Fields

- `public DownloadID` **downloadID**
  - Is an Identifier for a specific Download.

### Constructors

- **DownloadState**

  ```
  public DownloadState()
  ```

  - **Description**

    Default constructor

### Methods

- **getFilePath**

  ```
  public FilePath getFilePath()
  ```

  - **Description**

    Gives the FilePath associated with this DownloadID.
  - **Returns** – The FilePath of the File for the Download.

- **isFileReadyForDownload**

  ```
  public boolean isFileReadyForDownload()
  ```

  - **Description**

    Checks if a File is Ready to be downloaded.
  - **Returns** – A boolean whether the file is downloadable or not.

## 3.6 Package ExportDownloadCommunication

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**Classes**

### 3.6.1 Class DownloadServlet

Servlet to let the WebGUI download a finished Export.

#### Declaration

```
public class DownloadServlet
 extends ExportDownloadCommunication.HttpServlet
```

#### Field summary

**downloadID** Is an Identifier for a specific Download.

#### Constructor summary

**DownloadServlet()** Default constructor

#### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** Handles a GET request by sending the desired File to the WebGUI.

#### Fields

- `public DownloadID` **downloadID**
  - Is an Identifier for a specific Download.

#### Constructors

- **DownloadServlet**

  ```
  public DownloadServlet()
  ```

  - **Description**

    Default constructor

#### Methods

- **doGet**

  ```
  public void doGet(HttpServletRequest req,HttpServletResponse res)
  ```

  - **Description**

    Handles a GET request by sending the desired File to the WebGUI.
  - **Parameters**
    * `req` – Is the HttpServletRequest.
    * `res` – Is the HttpServletResponse.

#### Members inherited from class HttpServlet

`ExportDownloadCommunication.HttpServlet` (in 3.6.4, page 62)

- `public void` **`doGet`**`(HttpServletRequest` **`req`**`, HttpServletResponse` **`res`**`)`

### 3.6.2 Class ExportServlet

HttpServlet to get a Dataexport request from the WebGUI.

#### Declaration

```
public class ExportServlet
 extends ExportDownloadCommunication.HttpServlet
```

#### Field summary

**properties** Contains the Properties of an Export Request.

#### Constructor summary

**ExportServlet()** Default constructor

#### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** Handles a GET request by starting the export of the desired Data.

#### Fields

- `public ExportProperties` **properties**
  - Contains the Properties of an Export Request.

#### Constructors

- **ExportServlet**

  ```
  public ExportServlet()
  ```

  - **Description**

    Default constructor

#### Methods

- **doGet**

  ```
  public void doGet(HttpServletRequest req,HttpServletResponse res)
  ```

  - **Description**

    Handles a GET request by starting the export of the desired Data. At the same time a DownloadID is sent back to the WebGUI, so that it can check for the File.
  - **Parameters**
    * `req` – Is the HttpServletRequest.
    * `res` – Is the HttpServletResponse.

#### Members inherited from class HttpServlet

`ExportDownloadCommunication.HttpServlet` (in 3.6.4, page 62)
- `public void` **doGet**`(HttpServletRequest` **req**`, HttpServletResponse` **res**`)`

### 3.6.3 Class FileExtensionServlet

Servlet, to let the WebGUI ask for the available FileExtensions for the Export.

#### Declaration

```
public class FileExtensionServlet
 extends ExportDownloadCommunication.HttpServlet
```

#### Constructor summary

**FileExtensionServlet()** Default constructor

#### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** Handles a GET request by sending Information about the available FileExtensions.

#### Constructors

- **FileExtensionServlet**

  ```
  public FileExtensionServlet()
  ```

  - **Description**
    Default constructor

#### Methods

- **doGet**

  ```
  public void doGet(HttpServletRequest req,HttpServletResponse res)
  ```

  - **Description**
    Handles a GET request by sending Information about the available FileExtensions.
  - **Parameters**
    * `req` – Is the HttpServletRequest.
    * `res` – Is the HttpServletResponse.

#### Members inherited from class HttpServlet

`ExportDownloadCommunication.HttpServlet` (in 3.6.4, page 62)

- `public void` **doGet**`(HttpServletRequest` **req**`, HttpServletResponse` **res**`)`

### 3.6.4 Class HttpServlet

Provides an abstract class to be subclassed to create an HTTP servlet suitable for a Web site. (javax.servlet.http.HttpServlet)

#### Declaration

```
public class HttpServlet
 extends java.lang.Object
```

#### All known subclasses

StatusServlet (in 3.6.5, page 63), FileExtensionServlet (in 3.6.3, page 61), ExportServlet (in 3.6.2, page 60), DownloadServlet (in 3.6.1, page 59)

#### Constructor summary

**HttpServlet()** Default constructor

#### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** Called by the server (via the service method) to allow a servlet to handle a GET request.

#### Constructors

- **HttpServlet**

  ```
  public HttpServlet()
  ```

  - **Description**

    Default constructor

#### Methods

- **doGet**

  ```
  public void doGet(HttpServletRequest req,HttpServletResponse res)
  ```

  - **Description**

    Called by the server (via the service method) to allow a servlet to handle a GET request.

  - **Parameters**
    - `req` – Is the HttpServletRequest.
    - `res` – Is the HttpServletResponse.

### 3.6.5 Class StatusServlet

Servlet to let the WebGUI check if a Download is ready.

### Declaration

```
public class StatusServlet
 extends ExportDownloadCommunication.HttpServlet
```

### Field summary

**downloadID** Is an Identifier for a specific Download.

### Constructor summary

**StatusServlet()** Default constructor

### Method summary

**doGet(HttpServletRequest, HttpServletResponse)** Handles a GET request by checking the availability of the desired download.

### Fields

- `public DownloadID` **downloadID**
  - Is an Identifier for a specific Download.

### Constructors

- **StatusServlet**

  ```
  public StatusServlet()
  ```

  - **Description**

    Default constructor

### Methods

- **doGet**

  ```
  public void doGet(HttpServletRequest req,HttpServletResponse res)
  ```

  - **Description**

    Handles a GET request by checking the availability of the desired download.
  - **Parameters**
    - `req` – Is the HttpServletRequest.
    - `res` – Is the HttpServletResponse.

### Members inherited from class HttpServlet

`ExportDownloadCommunication.HttpServlet` (in 3.6.4, page 62)

- `public void` **doGet**`(HttpServletRequest` **req**, `HttpServletResponse` **res**`)`