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Event Publisher

```
public class ResearchEventPublisher{

   private static Log log = LogFactory.getLog(ResearchEventPublisher.class);
   private static DataPublisher privateDataPublisher;
   private static DataPublisher currentDataPublisher;
   private static int count = 0;
   public static void main(String[] args) {
                                        System.setProperty("org.xml.sax.driver",
"com.sun.org.apache.xerces.internal.parsers.SAXParser");
       System.setProperty("javax.xml.parsers.DocumentBuilderFactory","com.sun.org.
apache.xerces.internal.jaxp.DocumentBuilderFactoryImpl");
      System.setProperty("javax.xml.parsers.SAXParserFactory","com.sun.org.apache
.xerces.internal.jaxp.SAXParserFactoryImpl");
            System.out.println("Starting WSO2 Event ResearchEventPublisher Stream
Client");
          AgentHolder.setConfigPath(publisher.schedular.util.DataPublisherUtil.filePat
h + "/src/main/java/files/configs/data-agent-config.xml");
         publisher.schedular.util.DataPublisherUtil.setTrustStoreParams();
         String protocol = "thrift";
         String singleNodeHost = "tcp://localhost:7611";
         String username = "admin";
         String password = "admin";
      try{
           privateDataPublisher = new DataPublisher(protocol, singleNodeHost, null,
username, password);
         currentDataPublisher = privateDataPublisher;
                                                List<Object[]> eventsList =
```

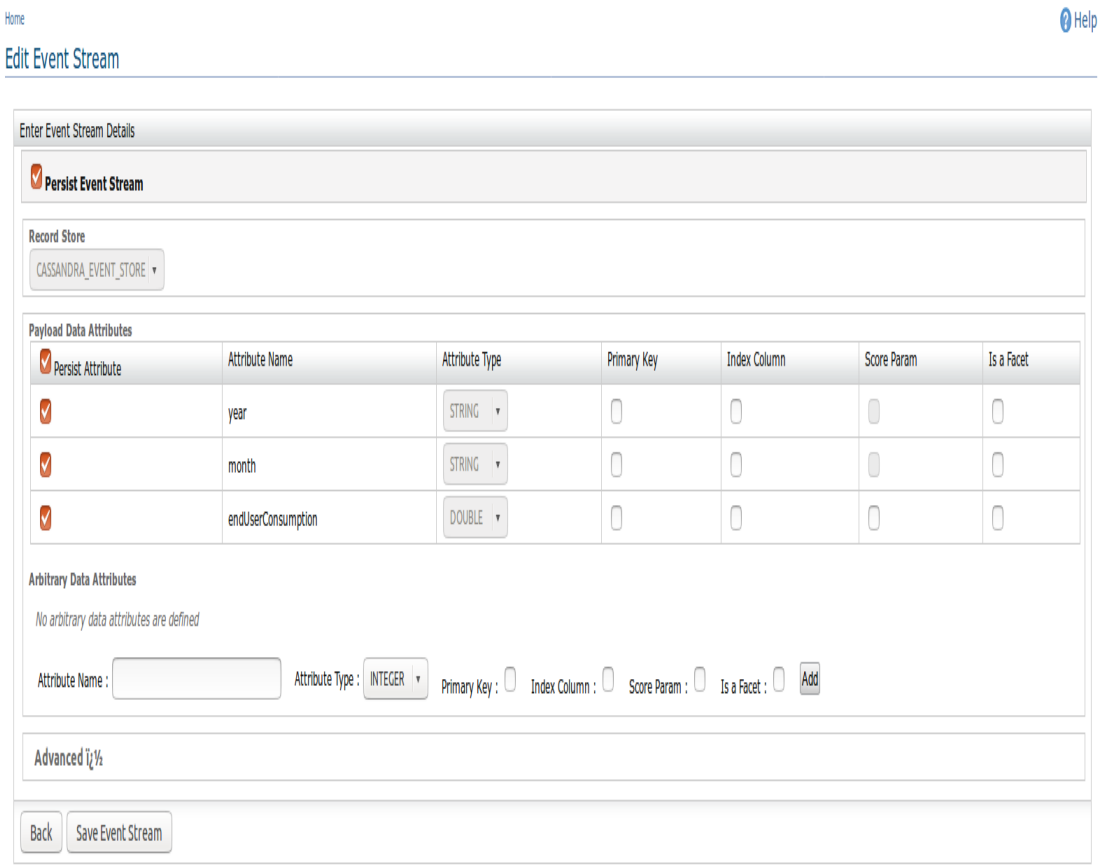
```
StatisticsInputReaderTask.readCurrentValuesFromFile("/home/shani/MSC/research/swiss/resources/swissDataGridData2016.csv");
            for (Object[] eventpayload : eventsList){
                publishEvent(eventpayload, "ControlBlock:1.0.0");
            }
        }catch(Exception e) {
            log.error("Exception occurred while Publishing data",e);
        }
    }
    public static void publishEvent(Object[] eventPayload, String streamId) throws InterruptedException {
            Event event = new Event(streamId, System.currentTimeMillis(), null, null, eventPayload);
        currentDataPublisher.publish(event);
        Thread.sleep(900000);
    }
}
```

Creating the data publisher with the Stream definition

```
public class DataPublisherUtil {
   private static Log log = LogFactory.getLog(DataPublisherUtil.class);
                                    public    static    String    filePath          =
"/home/shani/MSC/research/swiss/eventPublisherMsc/";
   static File securityFile = new File(filePath + "src/main/java/files/configs");
   public static void setTrustStoreParams() {
      String trustStore = securityFile.getAbsolutePath();
       System.setProperty("javax.net.ssl.trustStore", trustStore + "" + File.separator +
"client-truststore.jks");
      System.setProperty("javax.net.ssl.trustStorePassword", "wso2carbon");
   }
   public static Map<String, StreamDefinition> loadStreamDefinitions() {
      String directoryPath = filePath + "/src/main/java/files/streamDefinitions";
      File directory = new File(directoryPath);
         Map<String, StreamDefinition> streamDefinitions = new HashMap<String,
StreamDefinition>();
      if (!directory.exists()) {
                                log.error("Cannot load stream definitions from " +
directory.getAbsolutePath() + " directory not exist");
         return streamDefinitions;
      }
      if (!directory.isDirectory()) {
                                log.error("Cannot load stream definitions from " +
directory.getAbsolutePath() + " not a directory");
         return streamDefinitions;
      }
      File[] defFiles = directory.listFiles();
      if (defFiles != null) {
         for (final File fileEntry : defFiles) {
            if (!fileEntry.isDirectory()) {
               BufferedReader bufferedReader = null;
```

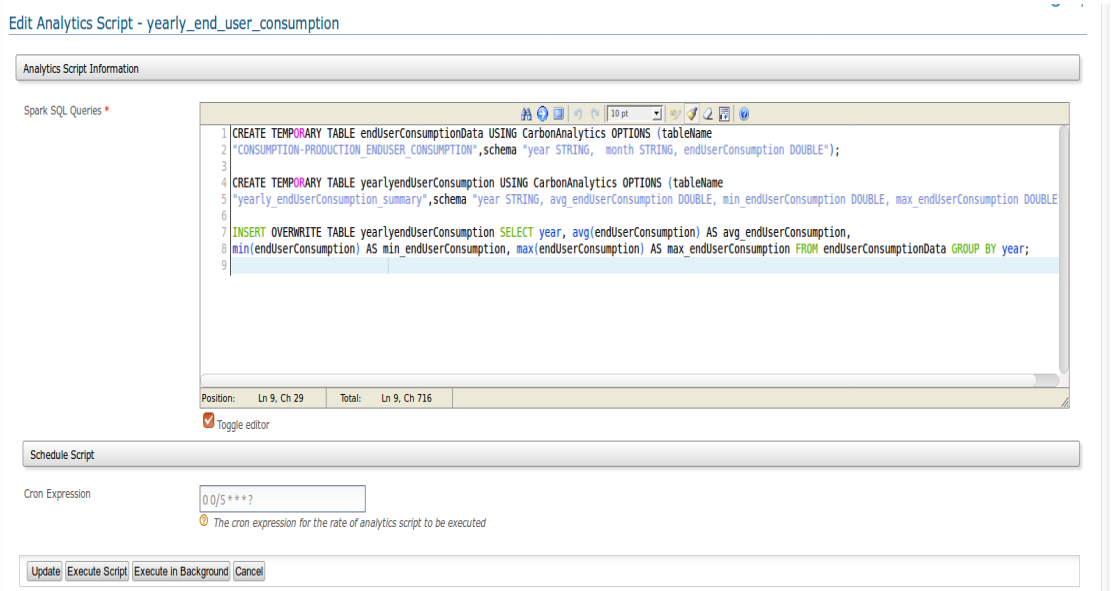
```
                StringBuilder stringBuilder = new StringBuilder();
                try {
                    bufferedReader = new BufferedReader(new FileReader(fileEntry));
                    String line;
                    while ((line = bufferedReader.readLine()) != null) {
                        stringBuilder.append(line).append("\n");
                    }
                                                    StreamDefinition streamDefinition =
EventDefinitionConverterUtils.convertFromJson(stringBuilder.toString().trim());
                                        streamDefinitions.put(streamDefinition.getStreamId(),
streamDefinition);
                } catch (FileNotFoundException e) {
                    log.error("Error in reading file " + fileEntry.getName(), e);
                } catch (IOException e) {
                    log.error("Error in reading file " + fileEntry.getName(), e);
} catch (MalformedStreamDefinitionException e) {
      log.error("Error in converting Stream definition " + e.getMessage(),
} finally {
bufferedReader.close();
   try {
      if (bufferedReader != null) {
      }
   } catch (IOException e) {
log.error("Error occurred when reading the file : " +e.getMessage(), e);
                    }
                }
            }
         }
      }
      return streamDefinitions;
   }
}
```

Persisting the Event



Appendix B Figure 1 persisting events

Creating the Spark SQL script



Appendix B Figure 2 Spark SQL script

Appendix C - Data preprocesser

```
import java.io.BufferedReader;
import java.io.FileReader;
import java.io.IOException;
import java.text.DecimalFormat;
import java.text.NumberFormat;
import java.util.ArrayList;
import java.util.Comparator;
import java.util.List;
public class DataCruncher {
   private static final String datapath = "home/shani/MSC/research/swiss/datasets";
   private static final List<Datapoint> data = new ArrayList<Datapoint>();
   public static void main(String[] args) throws IOException {
      BufferedReader br = new BufferedReader(new FileReader(datapath +
"/data2015.csv"));
      boolean isHeaderSkipped = false;
      try {
         StringBuilder sb = new StringBuilder();
         String line = br.readLine();
         while (line != null) {
            if (isHeaderSkipped == false){
               isHeaderSkipped = true;
            } else {
               dailyAverage(line);
            }
            line = br.readLine();
         }
      } finally {
         br.close();
      }
      outputResults();
   }
```

```
    private static void outputResults(){
        data.sort(Comparator.comparing(datapoint -> datapoint.hashCode()));
        data.forEach(datePoint -> {
            System.out.println(datePoint.toString());
        });
    }

    private static void dailyAverage(String line){
        final String[] columns = line.split(",");
        int year = Integer.parseInt(columns[0]);
        int month = Integer.parseInt(columns[1]);
        int date = Integer.parseInt(columns[2]);;
        double consumption = Double.parseDouble(columns[3]);
        int season = Integer.parseInt(columns[4]);
        int holidayFlag = Integer.parseInt(columns[5]);



        Datapoint dataPoint = getDataPoint(year, month, date, season, holidayFlag);
        dataPoint.adjustAverage(consumption);
    }

    private static Datapoint getDataPoint(int year, int month, int date, int season, int
holidayFlag){
        Datapoint newDatapoint = new Datapoint(year, month, date, season,
holidayFlag);


        for (Datapoint d : data){
            if (d.equals(newDatapoint)){
                return d;


            }
        }
        data.add(newDatapoint);
```

```
        return newDatapoint;
    }

    static class Datapoint{
        public int month;
        int date;
        int year;
        double totalConsumption = 0.0;
        int dataPoints = 0;
        int season;
        int holidayFlag;
        static NumberFormat formatter = new DecimalFormat("#0.00");

        public Datapoint(int year, int month, int date, int season, int holidayFlag){
            this.year = year;
            this.month = month;
            this.date =  date;
            this.season = season;
            this.holidayFlag = holidayFlag;
        }

        public void adjustAverage(double newConsumptions){
            totalConsumption += newConsumptions;
            dataPoints++;
        }

        @Override
        public String toString(){
            return Integer.toString(year) + "," +           ((month < 10) ? "0" +
Integer.toString(month) : Integer.toString(month)) + "," +
                    ((date < 10) ? "0" + Integer.toString(date) : Integer.toString(date)) + ","
+
                    formatter.format(totalConsumption/dataPoints) + "," +
```

```
            Integer.toString(season) + "," +
            Integer.toString(holidayFlag);
    }
    @Override
    public boolean equals(Object obj){
      if (obj == null) {
        return false;
      }
      if (!Datapoint.class.isAssignableFrom(obj.getClass())) {
        return false;
      }
      final Datapoint other = (Datapoint) obj;
      if (this.year == other.year && this.month == other.month && this.date ==
other.date){
        return true;
      } else {
        return false;
      }
    }
    @Override
    public int hashCode(){
      String hashString = Integer.toString(year) +
            ((month < 10) ? "0" + Integer.toString(month) : Integer.toString(month))
+
            ((date < 10) ? "0" + Integer.toString(date) : Integer.toString(date)) ;
      return  Integer.parseInt(hashString);
    }
  }
}
```

Appendix D – Source for building the model to predict energy consumption – with one factor

```
%matplotlib inline
import numpy as np
import pandas as pd
import matplotlib.pylab as plt

from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error

import seaborn as sns
sns.set_style("darkgrid")
sns.set_context("poster")

def rolling_univariate_window(time_series, window_size):
    shape = (time_series.shape[0] - window_size + 1, window_size)
    strides = time_series.strides + (time_series.strides[-1],)
    return np.lib.stride_tricks.as_strided(time_series, shape=shape, strides=strides)

def build_rolling_window_dataset(time_series, window_size):
    last_element = time_series[-1]
    time_series = time_series[:-1]
    X_train = rolling_univariate_window(time_series, window_size)
    y_train = np.array([X_train[i, window_size-1] for i in range(1, X_train.shape[0])])

    return X_train, np.hstack((y_train, last_element))

def train_test_split(no_of_training_instances, X_all, y_all):
    X_train = X_all[0:no_of_training_instances, :]
    X_test = X_all[no_of_training_instances:, :]
    y_train = y_all[0:no_of_training_instances]
    y_test = y_all[no_of_training_instances:]
```

```
    return X_train, X_test, y_train, y_test


def print_graph(X_all, X_test, y_all, y_test, y_pred):
    training_size = X_all.shape[0] - X_test.shape[0]
    x_full_limit = np.linspace(1, X_all.shape[0], X_all.shape[0])
    y_pred_limit = np.linspace(training_size+1, training_size + 1 + X_test.shape[0],
X_test.shape[0])
    plt.plot(x_full_limit, y_all, label='actual', color='b', linewidth=1)
    plt.plot(y_pred_limit, y_pred, '--', color='r', linewidth=2, label='prediction')
    plt.legend(loc=0)
    plt.show()


data_set = pd.read_csv('/home/sajith/shani-project/datasets/consumptions.csv')
data_set = data_set.values.flatten()


window_size = 16
training_set_size = 30


X_all, y_all = build_rolling_window_dataset(data_set, window_size)
X_train, X_test, y_train, y_test = train_test_split(training_set_size, X_all, y_all)


lr = LinearRegression(normalize=True)
lr.fit(X_train, y_train)
y_pred = lr.predict(X_test)
print "mean_absolute_error: %f" %(mean_absolute_error(y_test, y_pred))
print_graph(X_all, X_test, y_all, y_test, y_pred)
```

Appendix E – Source code for building the prediction model with multiple regression

```
%matplotlib inline
import numpy as np
import pandas as pd
import matplotlib.pylab as plt

from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error

import seaborn as sns
sns.set_style("darkgrid")
sns.set_context("poster")



def train_test_split(no_of_training_instances, X_all, y_all):
    X_train = X_all[0:no_of_training_instances, :]
    X_test = X_all[no_of_training_instances:, :]
    y_train = y_all[0:no_of_training_instances]
    y_test = y_all[no_of_training_instances:]

    return X_train, X_test, y_train, y_test

def print_graph(X_all, X_test, y_all, y_test, y_pred):
    training_size = X_all.shape[0] - X_test.shape[0]
    x_full_limit = np.linspace(1, X_all.shape[0], X_all.shape[0])
    y_pred_limit = np.linspace(training_size+1, training_size + 1 + X_test.shape[0],
X_test.shape[0])
    plt.plot(x_full_limit, y_all, label='actual', color='b', linewidth=1)
    plt.plot(y_pred_limit, y_pred, '--', color='r', linewidth=2, label='prediction')
    plt.legend(loc=0)
    plt.show()
```

```
data_set = pd.read_csv('/home/sajith/shani-project/datasets/summarized.csv')
training_set_size = 30

y_all =
data_set['Total_Energy_Consumed_by_end_users_Swiss_controlblock'].values
X_all = data_set[['year', 'date', 'month', 'season', 'publicHoliday']].values
X_train, X_test, y_train, y_test = train_test_split(training_set_size, X_all, y_all)

lr = LinearRegression(normalize=True)
lr.fit(X_train, y_train)
y_pred = lr.predict(X_test)
print "mean_absolute_error: %f" %(mean_absolute_error(y_test, y_pred))
print_graph(X_all, X_test, y_all, y_test, y_pred)
```

Illustration Index