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I^2

INTERACTIVE REAL-TIME VISUALIZATION FOR STREAMING DATA WITH APACHE FLINK AND APACHE ZEPPELIN

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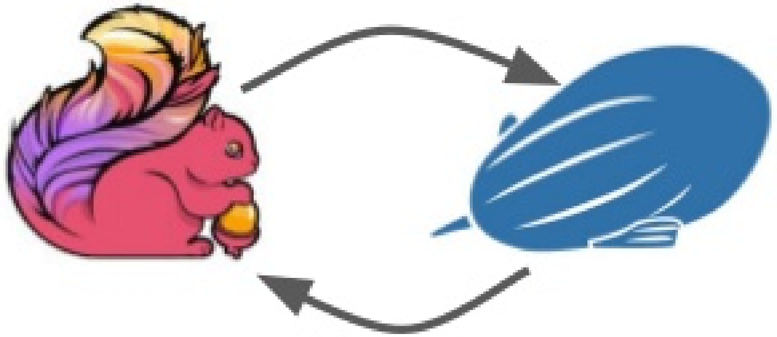
It’s worth it to postpone checking your mails!

We connect Flink and Zeppelin to visualize data-streams in real-time.

We make front-end settings available to running Flink jobs.



We adapt running Flink jobs to visualization requirements.

We reduce the amount of processed and transferred data while providing loss-free plots.

i.e., we visualize 12.000 events per second without crashing the front end.

We enable visualization-driven development of Flink jobs.

two types of interactivity

(i) through code changes

change and deploy the code of analysis pipelines and corresponding result visualizations in a one-click fashion

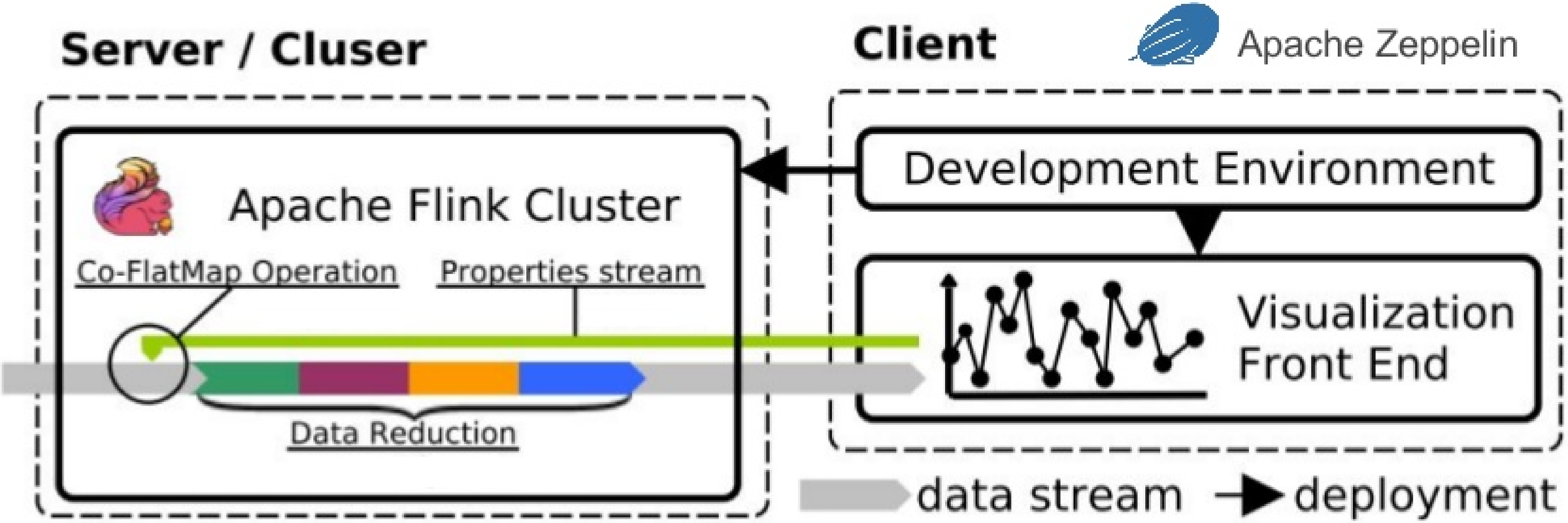
Rapid data-driven development of data analysis pipelines

(ii) through an interactive visualization GUI

change visualization properties (e.g. the zoom level in a map) while the underlying Flink job adapts at runtime

Reduces processed and transferred data while still providing loss-free visualizations

Architecture Overview



I² - Live Demonstration

The DEBS 2013 Grand Challenge

Christopher Mutschler, Holger Ziekow, Zbigniew Jerzak; DEBS'13

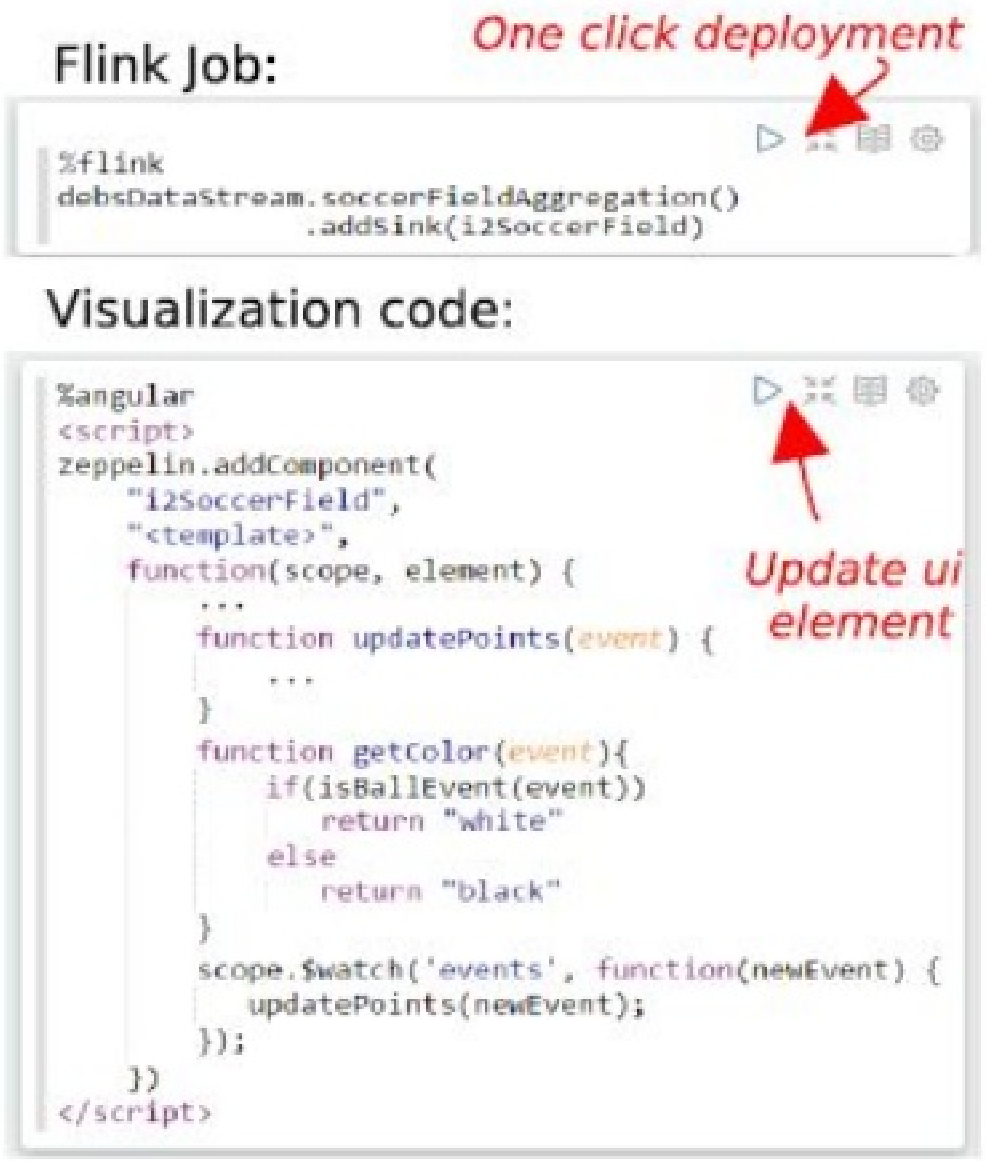
Data:

- Sensor data from a football match
  (speed, acceleration, and position of the ball and players)
- Up to 2000 Hz frequency
- roughly 12.000 data points per second

Demo

I^2

Development Environment



Flink Job:

One click deployment

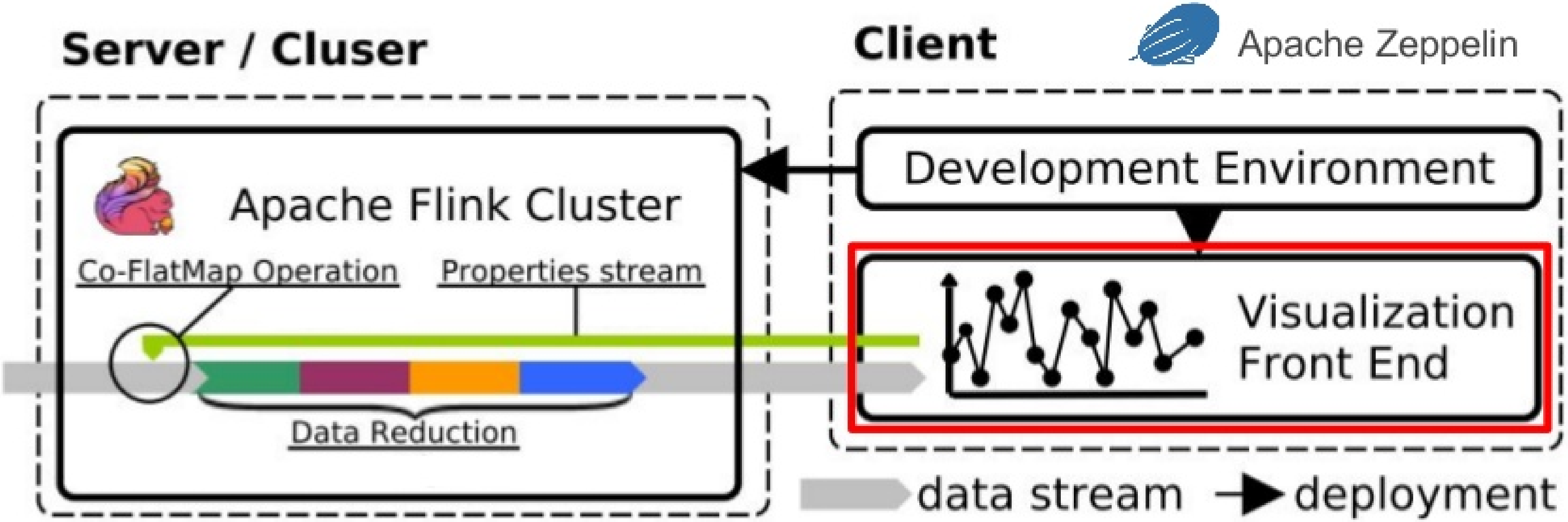
```
%flink
debsDataStream.soccerFieldAggregation()
                 .addSink(i2SoccerField)
```

Visualization code:

```
%angular
<script>
zeppelin.addComponent(
     "i2SoccerField",
     "<template>",
     function(scope, element) {
          ...
          function updatePoints(event) {
               ...
          }
          function getColor(event){
               if(isBallEvent(event))
                   return "white"
               else
                   return "black"
          }
          scope.$watch('events', function(newEvent) {
             updatePoints(newEvent);
          });
     })
</script>
```

Update ui element

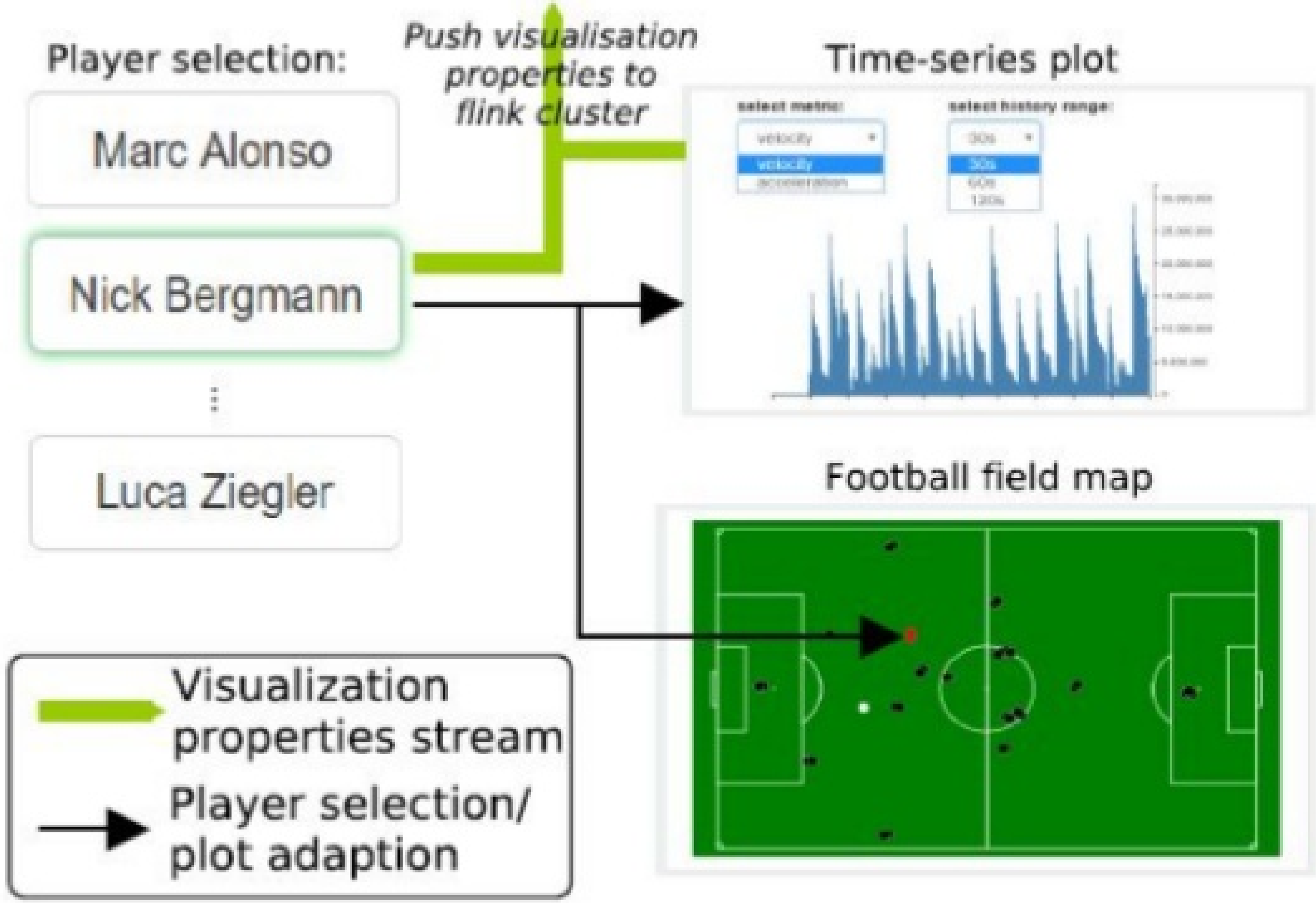
Architecture Overview



Visualization Front End

UI components push visualization properties to the flink cluster

Stream only visible data points towards the front end



Player selection:

Marc Alonso

Nick Bergmann

⋮

Luca Ziegler

Push visualisation properties to flink cluster

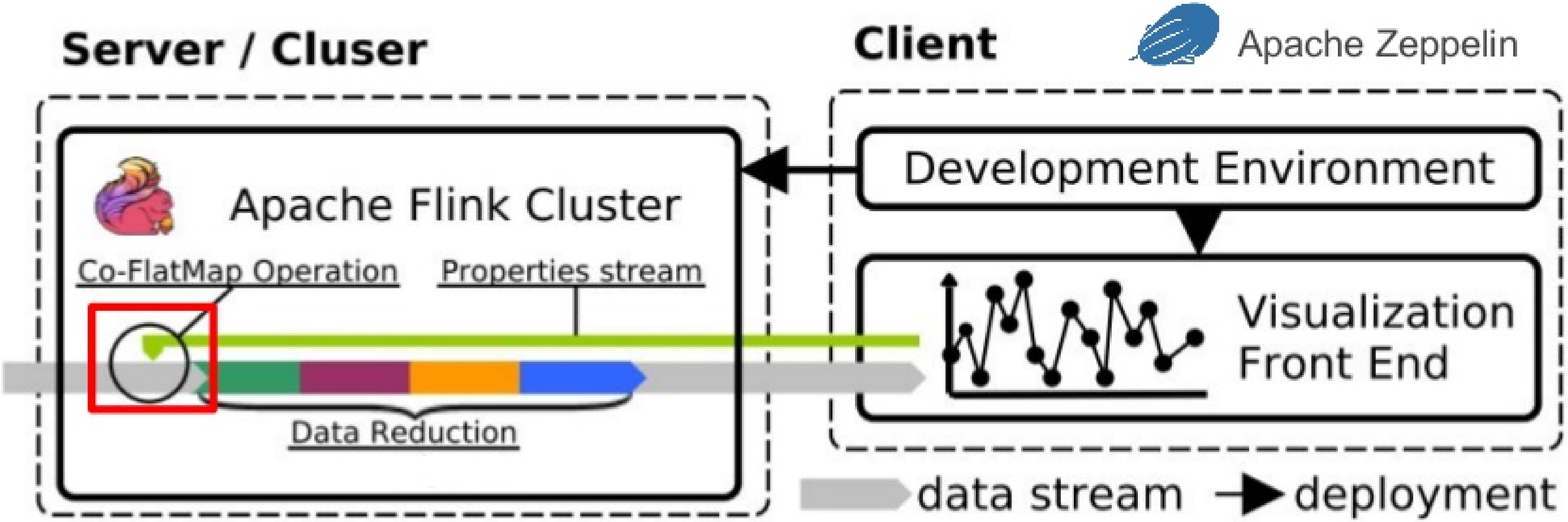
Time-series plot

Football field map

— Visualization properties stream

→ Player selection/ plot adaption

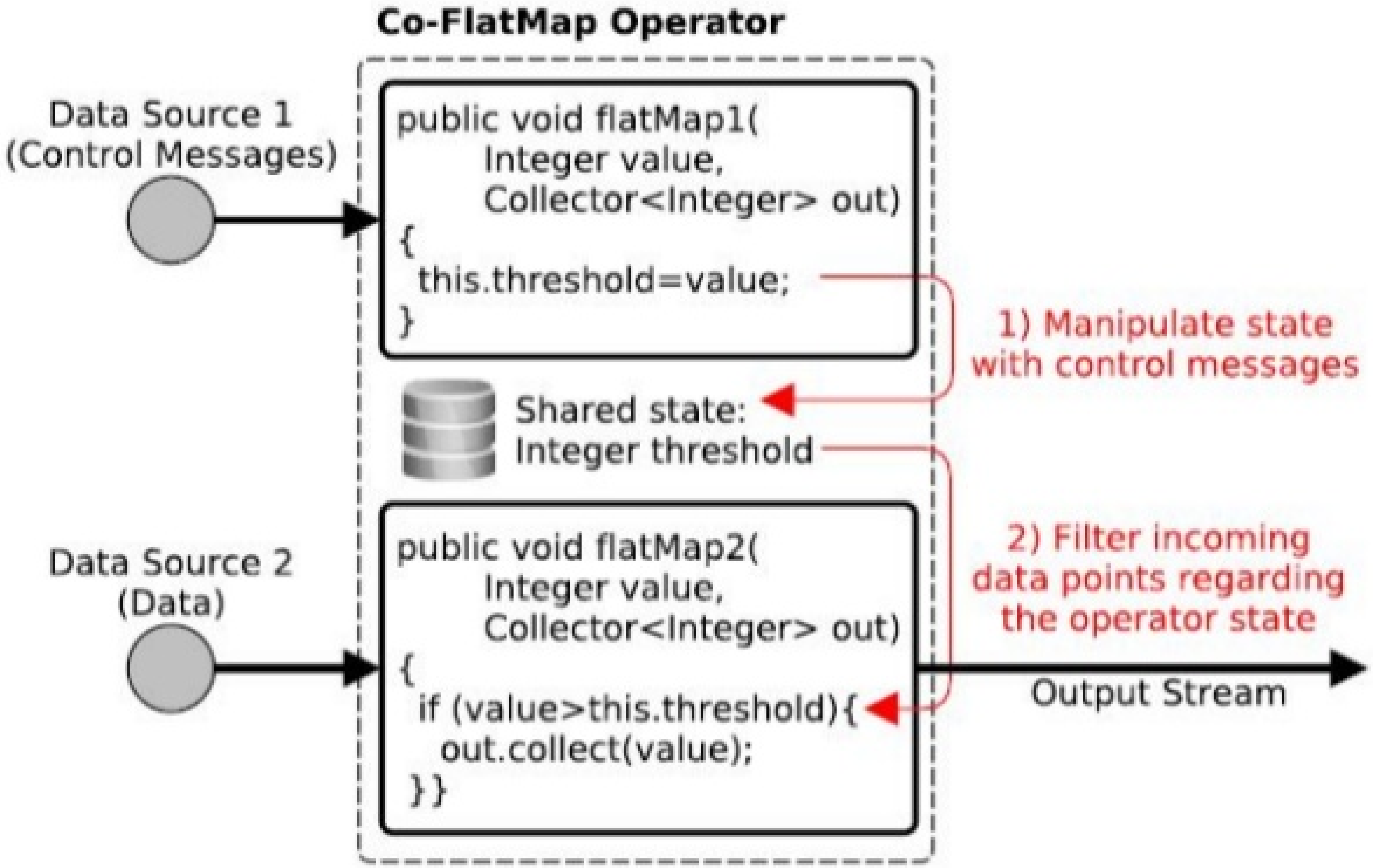
Architecture Overview



Adaptive Operator Example: Adapt to Visualization Settings

Control Messages:
Updates to a filter threshold

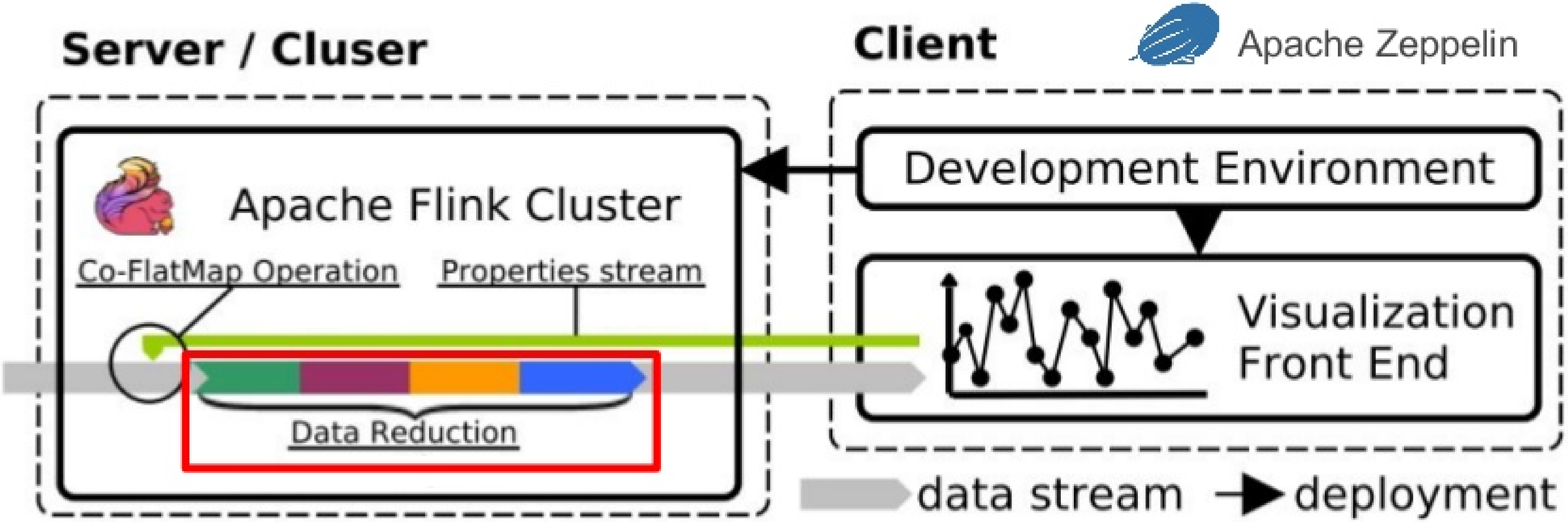
Data Processing:
Filter according to current threshold



```
public void flatMap1(
        Integer value,
        Collector<Integer> out)
{
 this.threshold=value;
}
```

```
public void flatMap2(
        Integer value,
        Collector<Integer> out)
{
 if (value>this.threshold){
   out.collect(value);
 }}
```

Architecture Overview



Loss-free Visualization with Reduced Costs

M4: A Visualization-Oriented Time Series Data Aggregation

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SAP AG
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Volker Markl
Technische Universität Berlin
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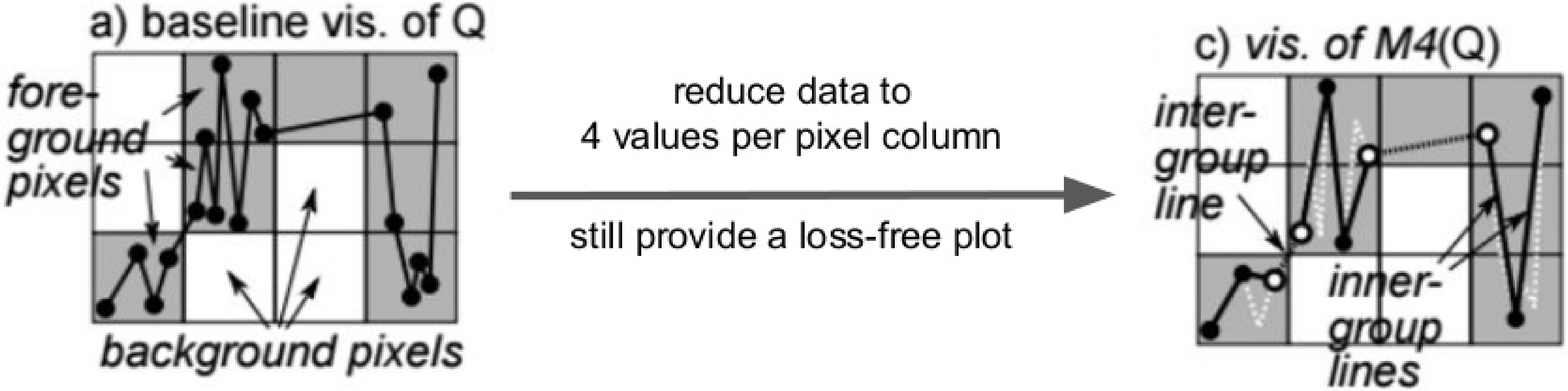
VLDB
2014

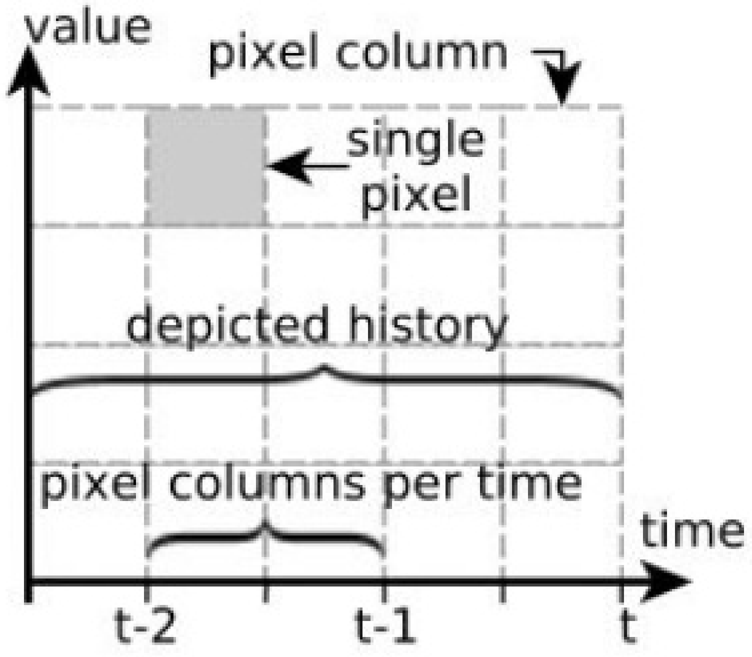
Big data time series often contain more data per pixel than we can display.



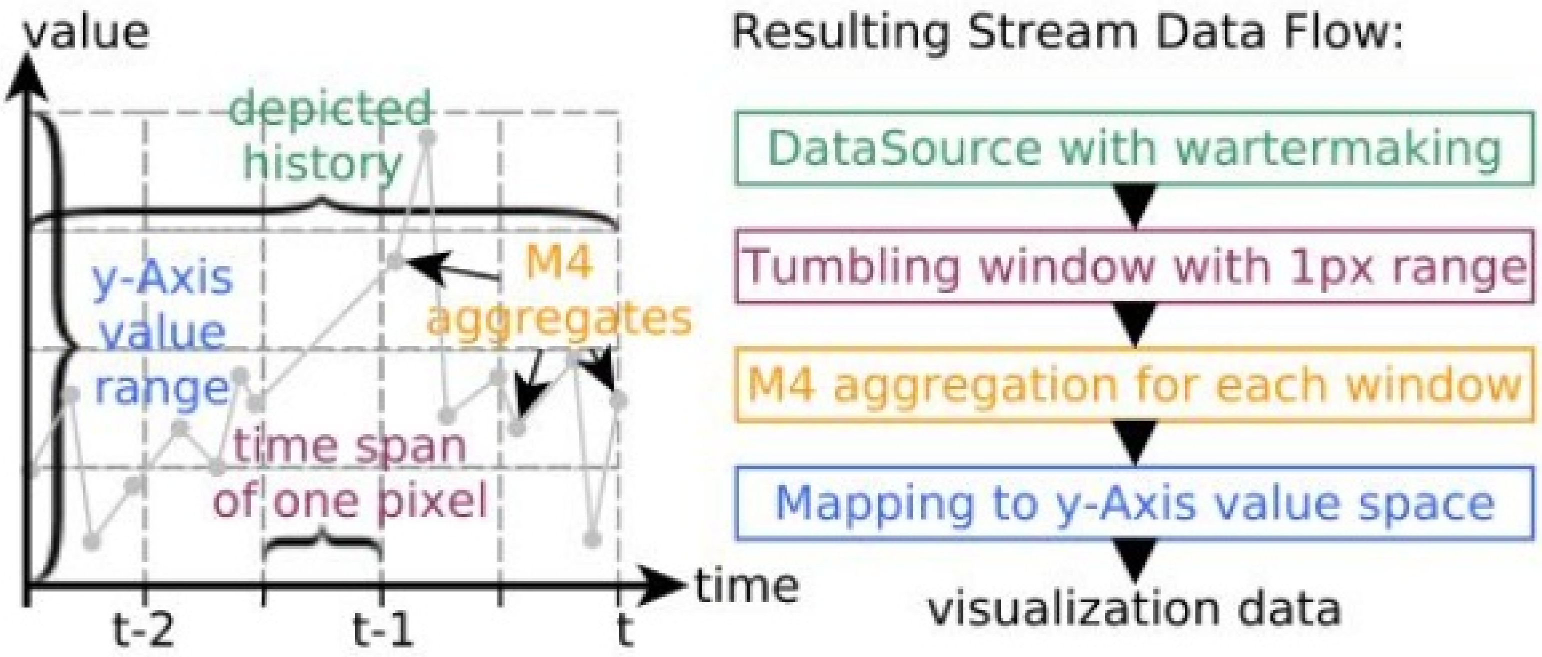
reduce data to
4 values per pixel column

still provide a loss-free plot

I² introduces a streaming ready version of M4



(a) The tradeoff between depicted history and plot precision.



Resulting Stream Data Flow:

DataSource with wartermaking

Tumbling window with 1px range

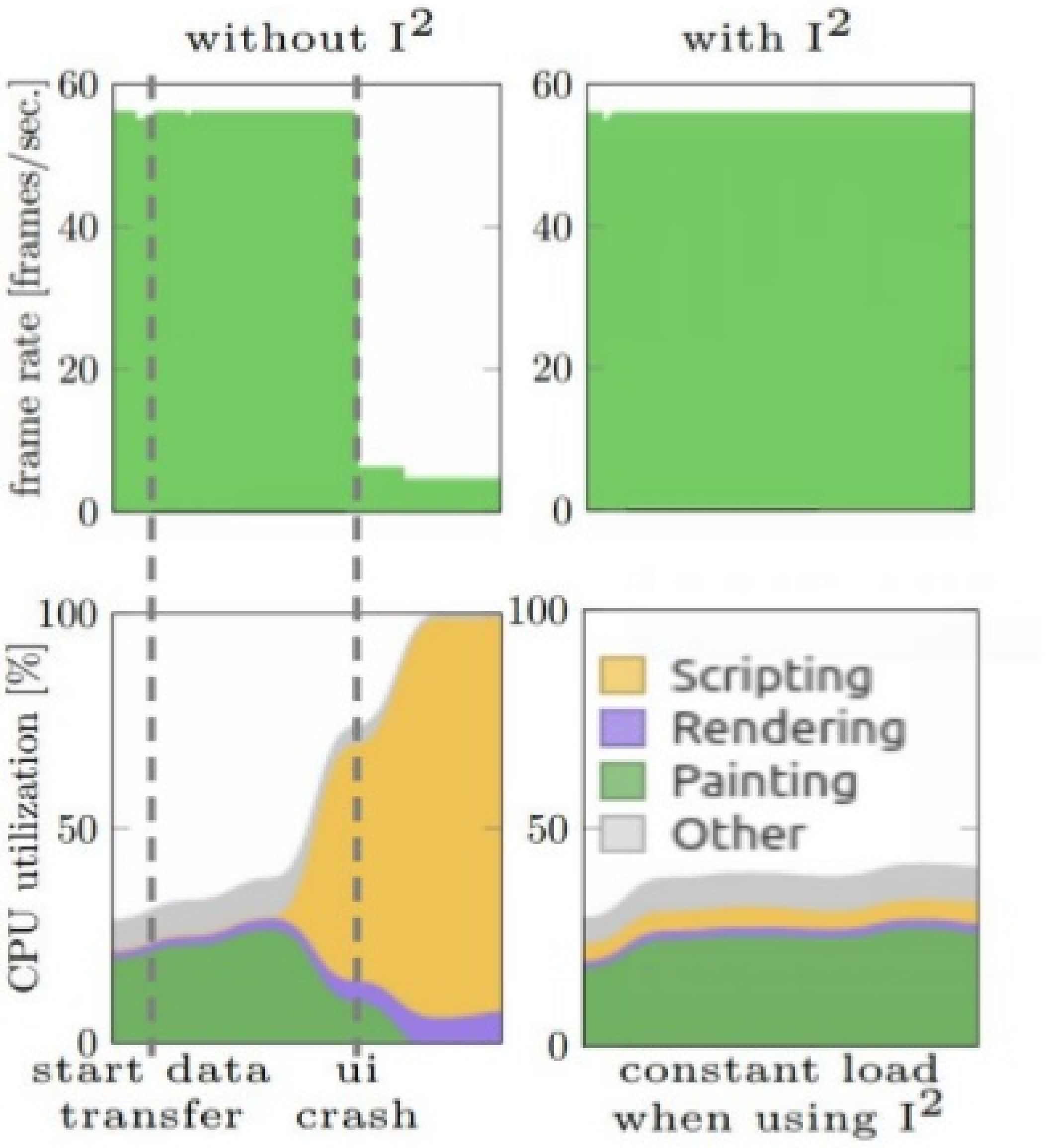
M4 aggregation for each window

Mapping to y-Axis value space

visualization data

(c) Deriving a stream data flow program for the real-time visualization of time-series data with M4.

The Impact of I² on the Visualization Front End



Thank you for joining our Session!

Summary

- Live visualization with Flink and Zeppelin
- Adapt jobs to changed setting at runtime
- Reduce data transfer and processing effort w/o quality-loss
- Support the development with live-visualization

Open Source

I^2 github.com/TU-Berlin-DIMA/i2

hub.docker.com/r/tuberlindima/i2

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