DATATRONiQ

Orchestrating a proprietary endurance qualification system for HV batteries with KNIME

KNIME Spring Summit 2017 – Berlin

Maximilian Mücke (ACCUmotive) and Jürgen Walter (DATATRONIQ)

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Agenda

1. Speakers
2. Challenge
3. Initial Solution
4. Current Solution
5. Future Plans

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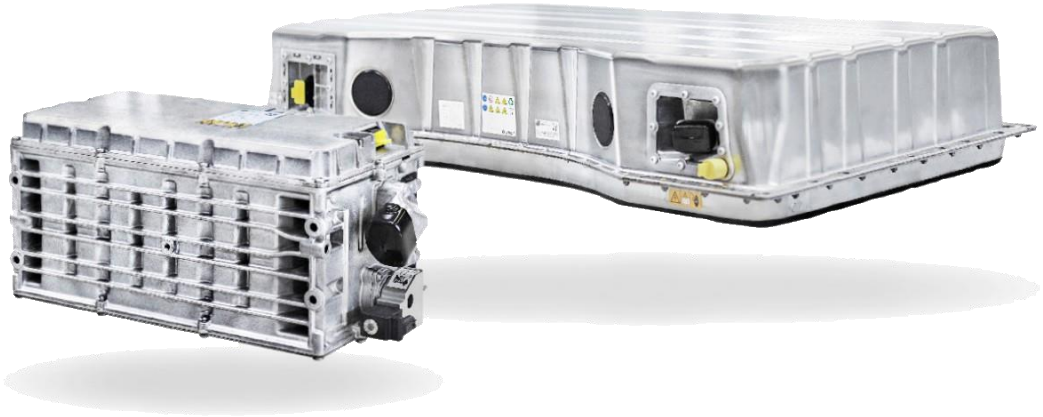
Maximilian Mücke – ACCUmotive

- Data Analyst at ACCUmotive
- Make testing data more accessible to his team
- Responsible for developing the teams software environment
- Currently pursuing Master's degree in Business Analytics at Ulm University



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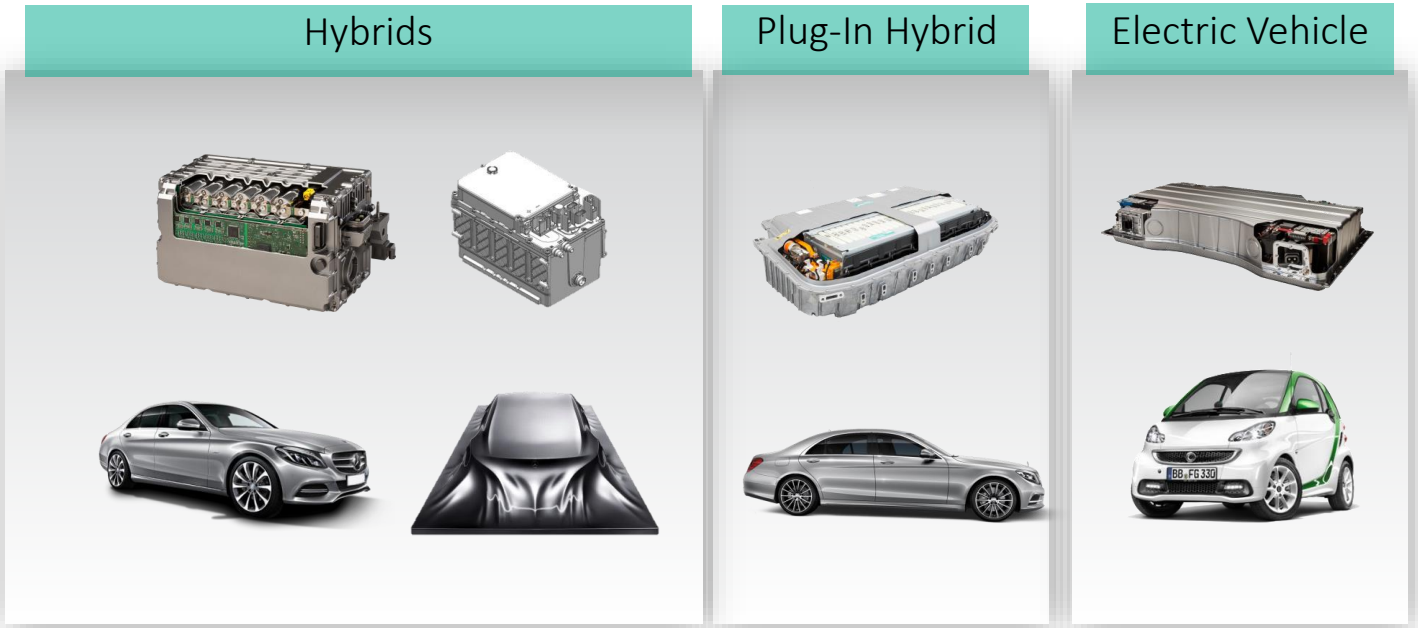
Deutsche ACCUMOTIVE GmbH & Co. KG

- A Daimler Company
- Advanced Lithium-Ion Batteries
- Research & development based in Kirchheim unter Teck/Nabern
- Production based in Kamenz



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Jürgen Walter – Datatroniq

- Industrial IoT
- Predictive Maintenance
- Better OEE
  - Quality, Availability, Performance
- Cloud & Hardware
- KNIME Partner
  - Custom Projects

- Co-Founder, HW & SW, Cloud

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Challenge

- Analysis of endurance and performance tests of HV Batteries
  - Endurance qualification under real world conditions
  - Testbed to simulate accelerated aging of equipment
  - Both, for HV and LV batteries, compare latest SMART car battery
- Lots of data, multiple GB per hour
- Custom, in-house developed analysis methodology
  - Proprietary algorithms & intellectual property
  - Implemented on C/C++, user interface = programming API

→ How to make those tools and algorithms more easily available to engineering team w/ no/little coding/programming experience

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Use KNIME to orchestrate analytics workflow

- Encoding of domain knowledge
  - what you see is what you get
  - KNIME Workflow = process documentation
- Democratize access to library of proprietary algorithms
  - familiar KNIME node instead of API-only C++ access
- KNIME Server
  - Proven, reliable workflow manager
  - Web Portal for “customer” self-service; mostly reporting
- Intuitive, visual interface
  - Quickly explore ideas w/ additional metrics from raw data
  - Easily communicate core concepts of particular workflow/analysis
  - Help manage complexity

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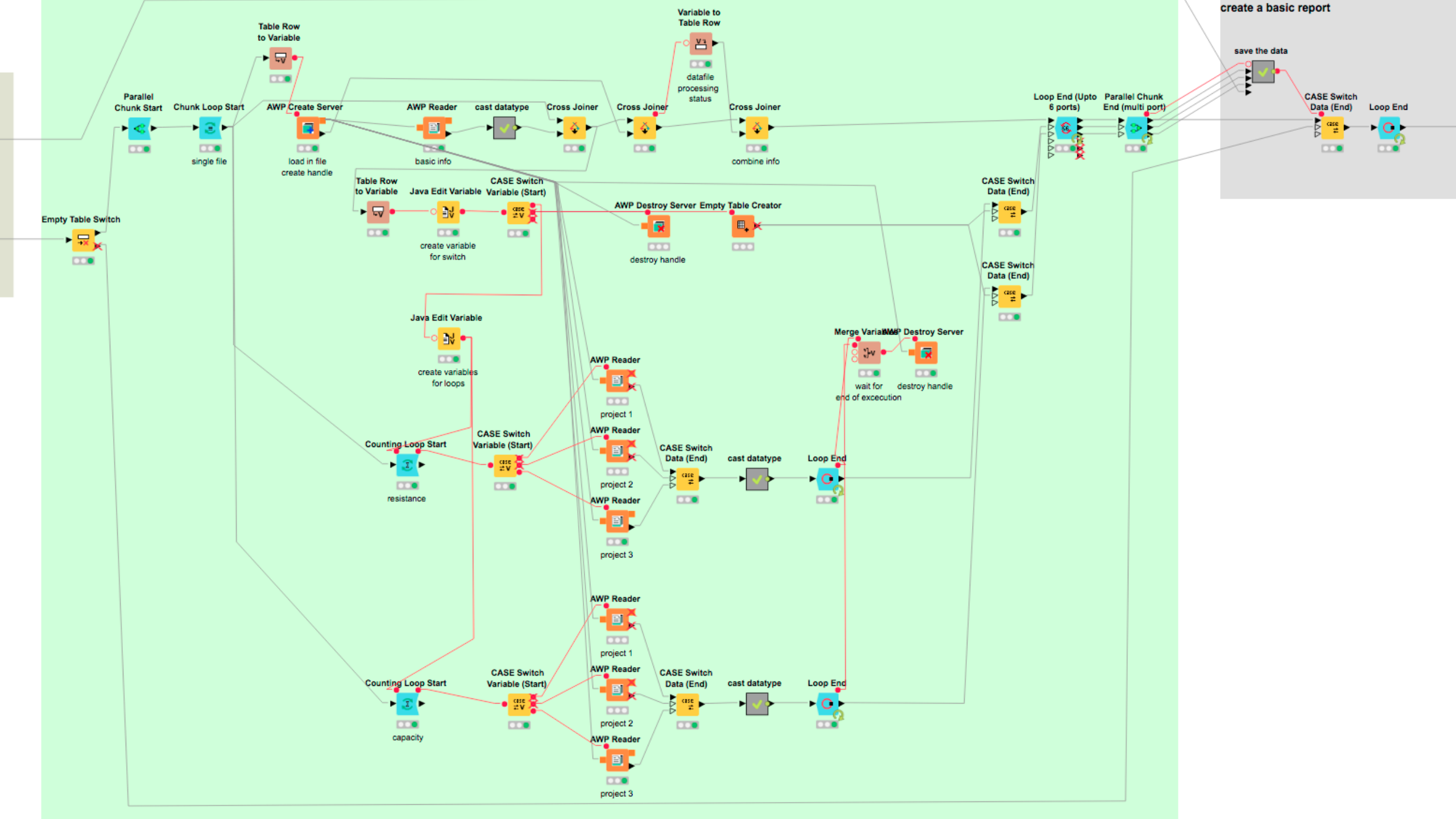
create a basic report
Table Row to Variable
Variable to Table Row
save the data
Parallel Chunk Start
Chunk Loop Start
AWP Create Server
AWP Reader
cast datatype
Cross Joiner
Cross Joiner
Cross Joiner
Loop End (Upto 6 ports)
Parallel Chunk End (multi port)
CASE Switch Data (End)
Loop End
datafile processing status
single file
load in file create handle
basic info
combine info
Empty Table Switch
Table Row to Variable
Java Edit Variable
CASE Switch Variable (Start)
AWP Destroy Server
Empty Table Creator
CASE Switch Data (End)
create variable for switch
destroy handle
CASE Switch Data (End)
Java Edit Variable
create variables for loops
Merge Variables
AWP Destroy Server
wait for end of excecution
destroy handle
AWP Reader
project 1
AWP Reader
project 2
AWP Reader
project 3
Counting Loop Start
CASE Switch Variable (Start)
CASE Switch Data (End)
cast datatype
Loop End
resistance
AWP Reader
project 1
AWP Reader
project 2
AWP Reader
project 3
Counting Loop Start
CASE Switch Variable (Start)
CASE Switch Data (End)
cast datatype
Loop End
capacity

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Initial Solution – KNIME node development

- Student project, proof-of-concept
- Inconsistent reliability
- (Very) limited parallelism
- Based on Java Native Interface
  - Tight, deep integration, needs C++-Header files, compilation steps
- Shared memory between C/C++ library and Java VM
  - Good for performance/large data
  - Requires lots of effort to get stable and robust

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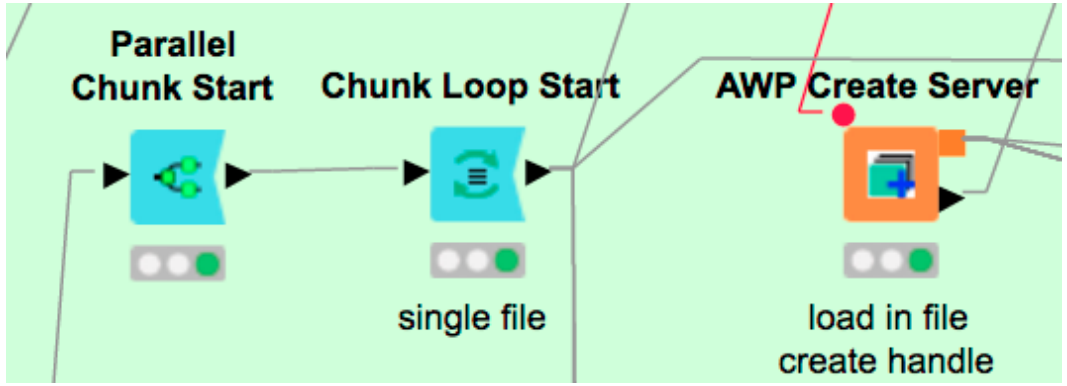
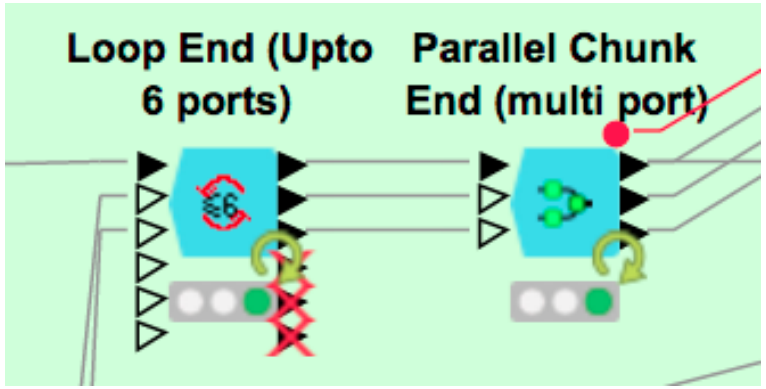
Align with “Loop” concept in KNIME

- Simple, yet effective workload manager
- Parallelize work; expose (meta-)data for flow control
- Expose status and progress data
  - Facilitate loop control: retry, skip
  - Reporting for long running workflows - some scenarios run up to 24hrs





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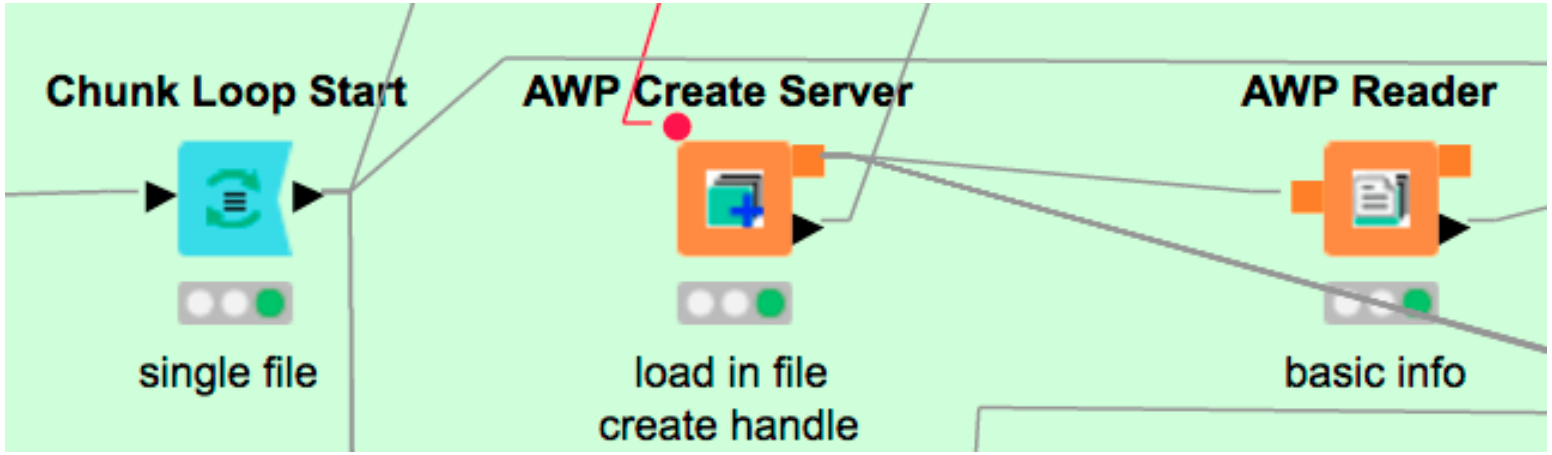
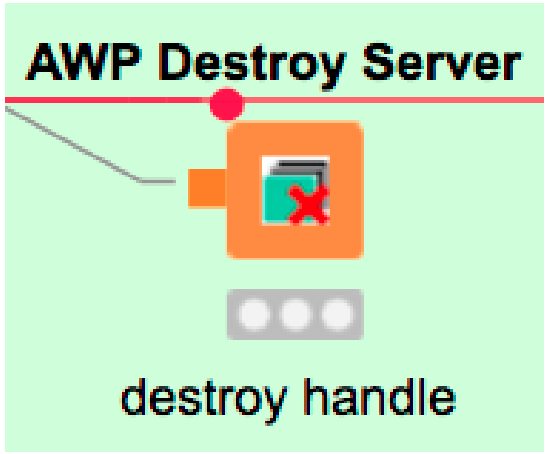
Group of Nodes for AWP (“Auswerteplattform”)

- Create AWP Server – AWP Reader – Destroy AWP Server
- Inspired by KNIME Big Data: Create/Use/Destroy Spark





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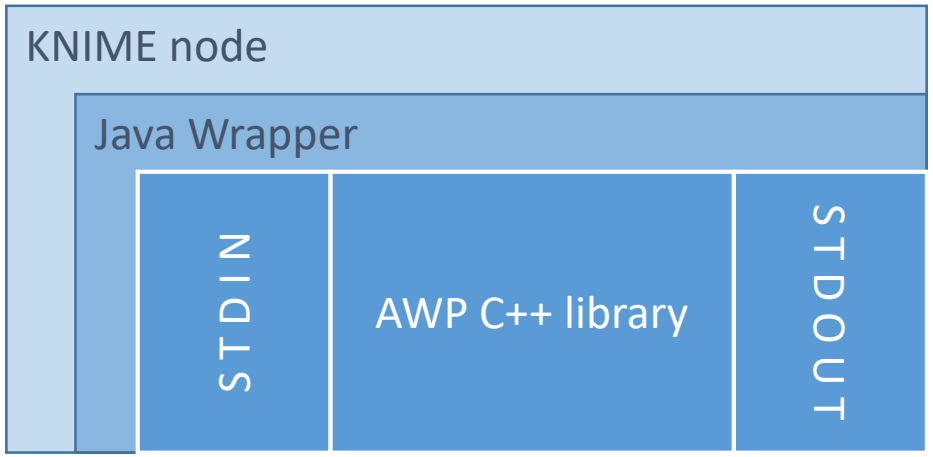
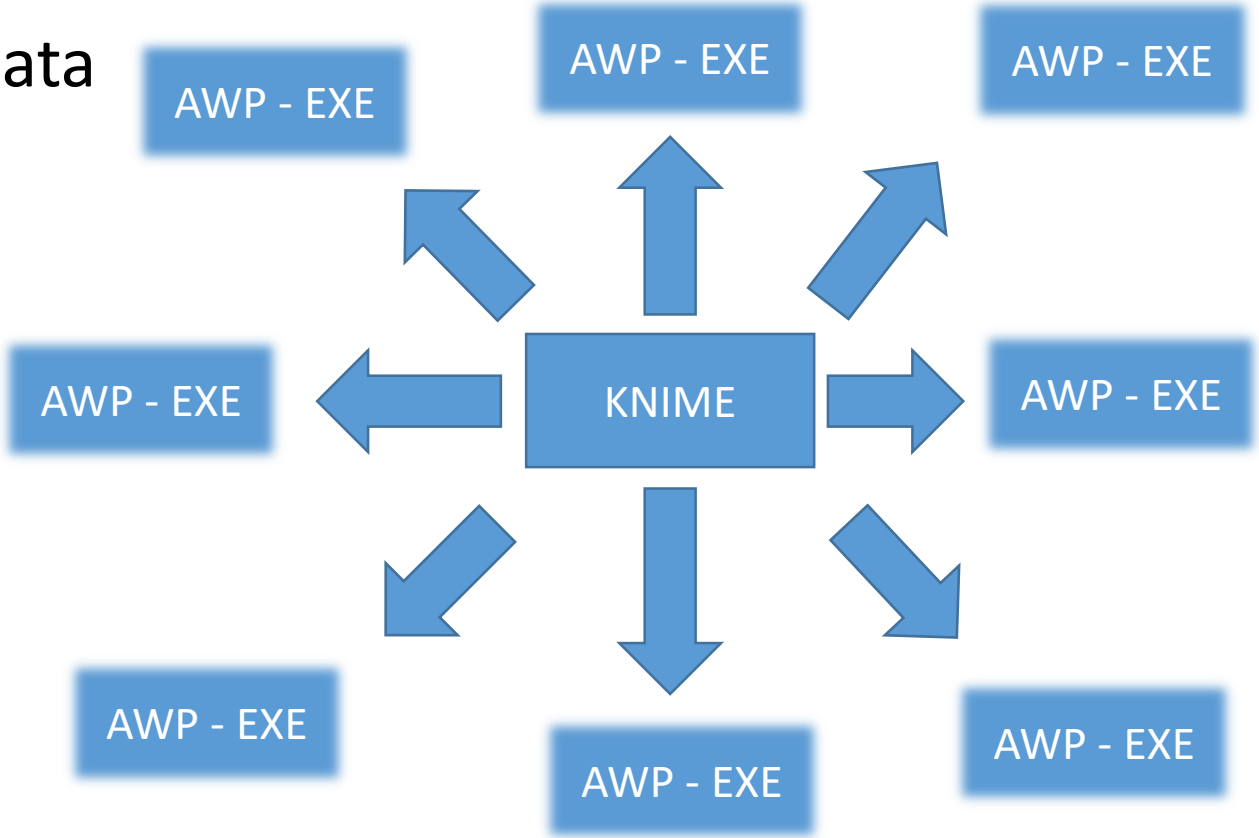
STDIO binary protocol instead of Java Native Interface (JNI) w/

- More robust, versatile
- Well suited for small chunks of data





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Future Plans

- Replace custom binary protocol between AWP C++ library and Java wrapper with Google Protobuffers
- Improve current measurement data management
  - Currently flat files organized by naming convention
  - Based on semantics, flexible database management system
- Improve handling of analysis results / insights
  - Currently KNIME table writer
  - Future: export to centralized SQL database

Contact

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