A Real-Time Analytics Platform for Large-scale Industrial Process Monitoring and Control

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Architecture of the Real-time Analytics Platform

Data Sources
- Meta and Raw Data Files
- DeltaV
- Streaming Server
- Protocol Adapter
- Crude Simulator
- OPC Server
- Streaming DeltaV Module
- Rosemount Gateway
- Secure I/O API
- Data Concentrator
- Others

Run-time Execution
- Kafka Cluster
  - Bolts
  - Spouts
- Storm Cluster

Heterogeneous Data Sources
- Data Flow System
- RT Processing Framework
- Data Storage System
- Data Visualization

Hbase Cluster
- Distributed Storage System
- Database APIs
  - SQL, MapReduce, HBase, Meta Data
- Hadoop
- MongoDB

Model Editor

Batch Loading Protocol with ISDN Terminal

Raw Data
- Alarms and RT Values

Raw Data

Data/Event Streaming
- File Load and Web APIs
- Thrift Interface
Heterogeneous Data Sources

Testbed setup in UConn Wireless Sensing and Control Lab

An overview of the crude simulator

WirelessHART mesh network simulator

Imaging systems for plant monitoring
Data Flow and Real-time Processing Framework

A combination of Kafka and Storm frameworks to achieve delivery guarantee and real-time processing on time series data.

Research Goals
- Elastic computation model;
- Minimum resource utilization;
- End-to-end timing guarantee;
Efficient Database Schema Design

We designed efficient database schemas in HBase for both raw and aggregated unstructured time series data.

**TAG_TABLE:** Applies a two way lookup to store the <Tag ID, Tag Name> and <Tag Name, Tag ID> pairs.

**DATA_TABLE:** Every row holds an hour's raw data for a tag.

**AGG_HH_DATA_TABLE:** Every row holds an hour's aggregated data for a tag in the scale of minutes.
Real-time Data Visualization

A rich set of web services to access the HBase through Thrift interface. This enables to visualize time series data and statistics in real-time.

Time series data zoom in and zoom out

Multiple time series data selection and real-time visualization

Time series data shift with different scales
Thank you and welcome to our demo!