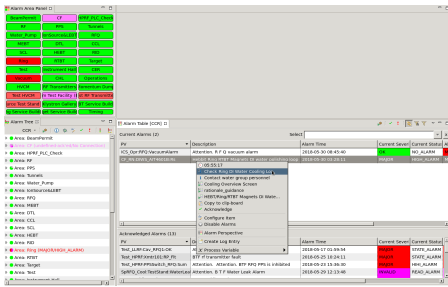# CS-Studio Alarm System Using **kafka** APACHE

Kay Kasemir, Oak Ridge National Laboratory, TN, USA

Alarm System Helps Operators

- Monitors PVs
- Displays those in alarm
  - Until 'acknowledged' and recovered
- .. with
  - Guidance
  - Related displays
  - Support for email, logbook
- Allow online changes
  - Add/remove PVs
  - Change Guidance etc.

Architecture since ~2009

- **RDB: Configuration**
  - ☑ Configuration
  - ☑ Persists last state
  - - Cannot get updates
- **Message Service: Updates**
  - ☑ Get State updates
  - ☑ Get configuration updates
  - - Cannot persist configuration
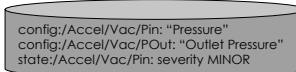
config:/Accel/Vac/Pin: "Pressure"
config:/Accel/Vac/POut: "Outlet Pressure"
state:/Accel/Vac/Pin: severity MINOR

state:/Accel/Vac/POut: severity MAJOR
state:/Accel/Vac/Pin: severity MINOR_ACK
config:/Accel/Vac/Pin: "Inlet Pressure"
config:/Accel/Vac: "Call 123-456-8910"
state:/Accel/Vac/Pin: severity OK

2018: Consider **kafka** APACHE Streaming Platform

Message stream options

a) Send message and forget
b) Persist messages until disk is full
c) 'Compact' messages

config:/Accel/Vac/Pin: "Pressure"
config:/Accel/Vac/POut: "Outlet Pressure"
state:/Accel/Vac/Pin: severity MINOR
state:/Accel/Vac/POut: severity MAJOR
state:/Accel/Vac/Pin: severity MINOR_ACK
config:/Accel/Vac/Pin: "Inlet Pressure"
config:/Accel/Vac: "Call 123-456-8910"
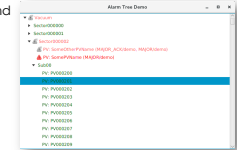state:/Accel/Vac/Pin: severity OK

Time
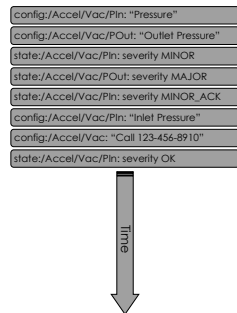
Initial Tests
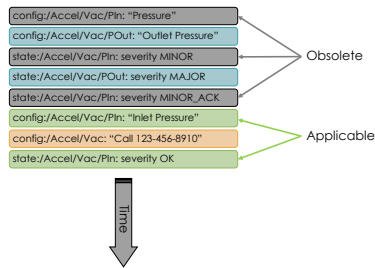
2010 Test (PosgreSQL, JMS)
- Create hierarchy with 50000 PVs
  - 5 minutes
- Show config in new Alarm Tree
  - Nothing shown until all loaded after 30 seconds
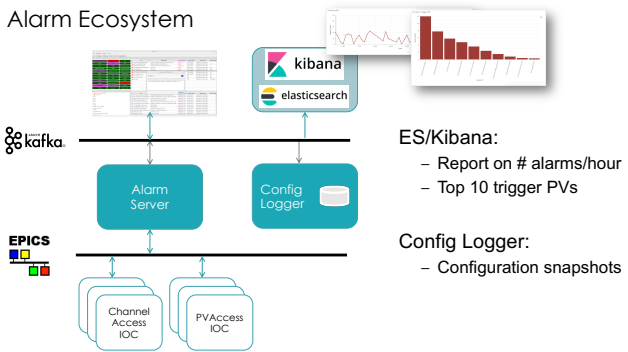- Handle Alarm Updates
  - 10 per second

2018 Test (Kafka)
- 100000 PVs
  - ☑ 10 seconds
  - ☑ Shows growing tree for 10 seconds
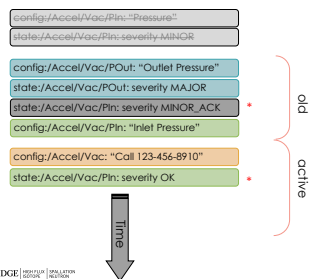 - ☑ 500 per second

Clients only need the most recent message

config:/Accel/Vac/Pin: "Pressure"
config:/Accel/Vac/POut: "Outlet Pressure"
state:/Accel/Vac/Pin: severity MINOR
state:/Accel/Vac/POut: severity MAJOR
state:/Accel/Vac/Pin: severity MINOR_ACK
config:/Accel/Vac/Pin: "Inlet Pressure" — Applicable
config:/Accel/Vac: "Call 123-456-8910"
state:/Accel/Vac/Pin: severity OK

Obsolete

Time

Alarm Ecosystem

ES/Kibana:
- Report on # alarms/hour
- Top 10 trigger PVs

Config Logger:
- Configuration snapshots

Compacted Kafka Message Store

Old segment keeps *single* message with *last* value for each item

config:/Accel/Vac/Pin: "Pressure"
state:/Accel/Vac/Pin: severity MINOR

config:/Accel/Vac/POut: "Outlet Pressure"
state:/Accel/Vac/POut: severity MAJOR
state:/Accel/Vac/Pin: severity MINOR_ACK *
config:/Accel/Vac/Pin: "Inlet Pressure"

config:/Accel/Vac: "Call 123-456-8910"
state:/Accel/Vac/Pin: severity OK *

old / active / Time

New clients get at least one message with most recent information for each item.

Maybe a few more recent updates from 'active' segment.

From then on, updates as information changes.

* Old segment might include messages obsoleted in active segment.

CS-Studio Alarm System Update

RDB & JMS → **kafka** APACHE

- Same XML import/export
- Similar UI
- Operational on SNS beam lines since Jan. 2019
- Performance headroom

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