CLOUDERA

Open Source Data Management for Car-to-Cloud

Michael Ger
Managing Director, Manufacturing & Automotive
Cloudera

GENIVI®

CLOUDERA AT A GLANCE

One stop shop for Big Data management for analytics

Unified open source architecture

Hybrid and multi-cloud

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CLOUDERA ENTERPRISE DATA WAREHOUSE

Any Data. Anywhere. From Edge to AI

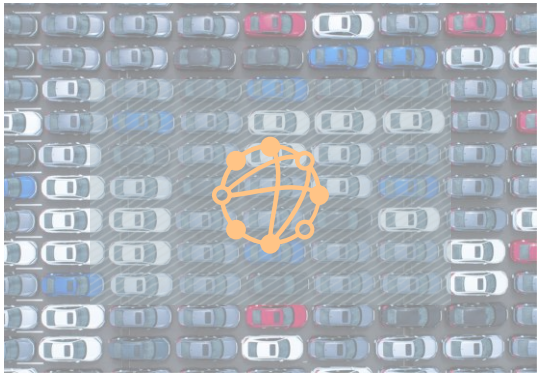
Traditional Data Warehouse Optimization

- BI Reporting
- Data Warehouse Offload
- ETL Optimization

Operations & Events Data Warehouse

- IOT Data (Sensors, Logs, etc.)
- Connected Vehicles
- Connected Factories (Industry 4.0)
- Etc.

Research & Discovery Data Warehouse



- Unstructured Data (Images, Video, etc.)
- Intelligent Search
- Autonomous Vehicle Research

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DID YOU KNOW?

10 of the top 10 Automotive OEMs
Trust Cloudera for Big Data-Enabled Digital Transformations

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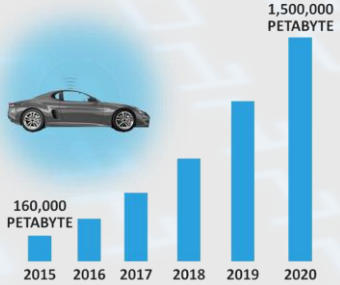
DATA TRENDS

Connected Vehicle Data



10X by 2020*

* Source: Cowen and Company, Gartner

Autonomous Vehicle Data

TERABYTES

per vehicle, per day

Industrial Internet Data

2X faster than any other data source

* Source: Wikibon

Real-Time Data

1.5X faster than traditional data

* Source: IDC

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CAR TO CLOUD – DATA MANAGEMENT ON 5 LEVELS

THE EDGE

MANAGING THE EDGE

ENTERPRISE FLOW/STREAM ANALYTICS

EDGE TO AI

CONNECTED COMMUNITIES

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EDGE DATA COLLECTION - MINIFI AGENTS

- Extremely small footprint
- Java and C++ agents
  - JRHEL/CentOS, Debian/Ubuntu, Android*
- Key data management functions
  - Filtering, buffering, guaranteed delivery, prioritized queuing
- Secure
  - Encryption, certificate-based authentication
  - Data tagging and provenance
- Execute Machine Learning (ML) models including Tensorflow

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GOING SMALLER – FROM NIFI TO MINIFI

Supporting the Need for Smaller Footprints on the Edge

Application	Memory Footprint	Characteristics
MiNiFi Agent (Java)	10s to 100s of MBs	• Feature parity and reuse of core NiFi libraries
MiNiFi Agent (C++)	100s kBs to MBs	• Write once**, run anywhere. • Adaptable to lower level interfaces
MiNiFi Library	10s kBs	• Write n-many times, embed, run anywhere • Language libraries to support tagging, FlowFile format, Site to Site protocol and provenance generation without a full processing framework • Customizable to environments without disk storage or where threading is prohibitive • Language SDKs, Mobile Platforms

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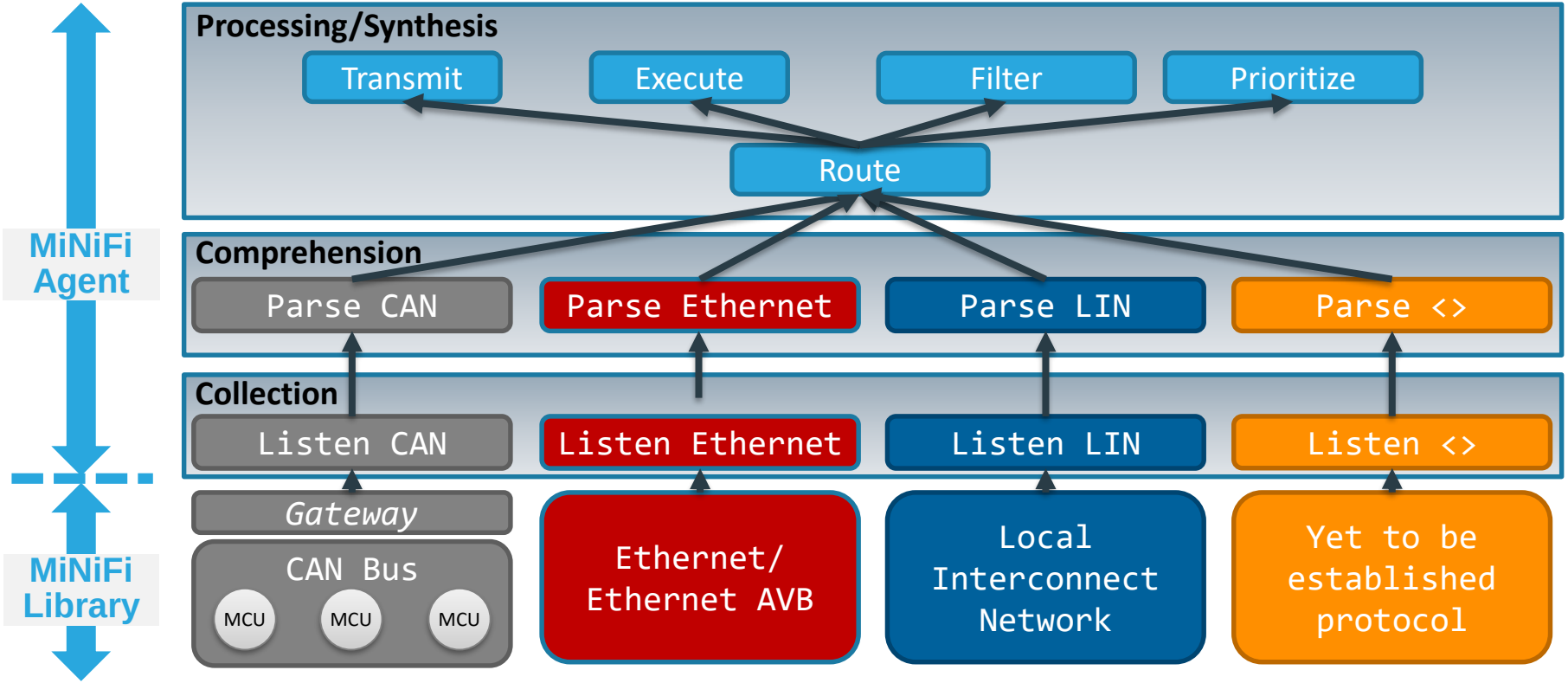
MINIFI IN CONNECTED CAR



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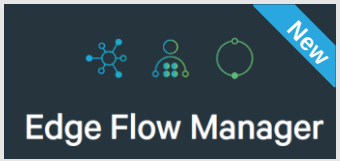
CLOUDERA EDGE MANAGEMENT (CEM)

Edge Management Hub



Edge Agent Management

- **Central management** of agents
- **Collect data** from edge device
- **Push intelligence** to edge

Data

Intelligence

Edge Agents

- **Data Collection and Processing** at the Edge
- **Small, lightweight footprint**

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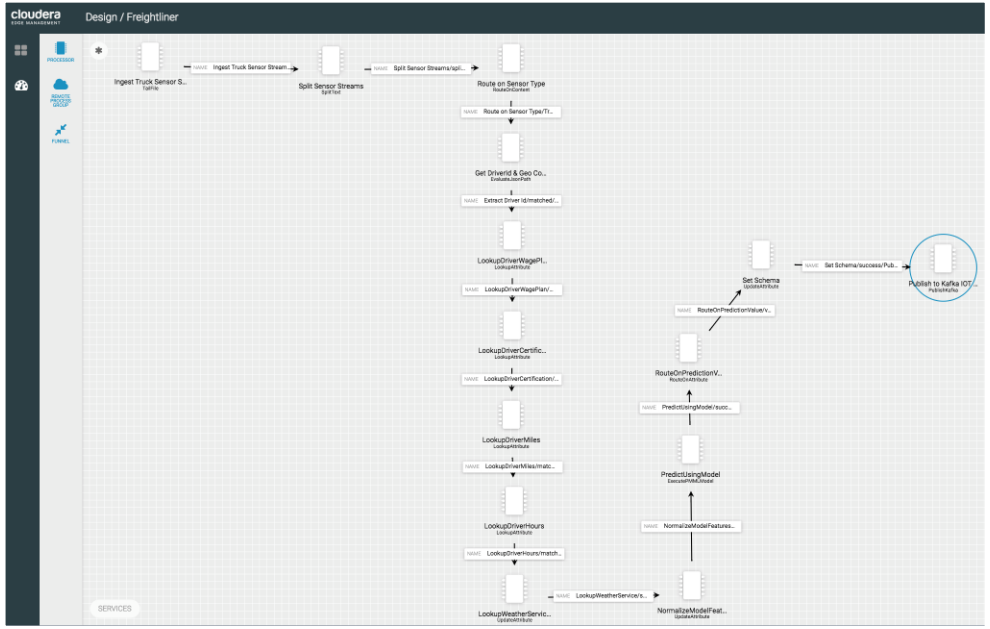
EDGE FLOW MANAGER

- **Edge Management Hub**
- Graphical user interface to develop and deploy flows to edge
- Monitor thousands of edge agents
- Deploy updated Machine Learning (ML) models to edge agents
- Integration with NiFi Registry



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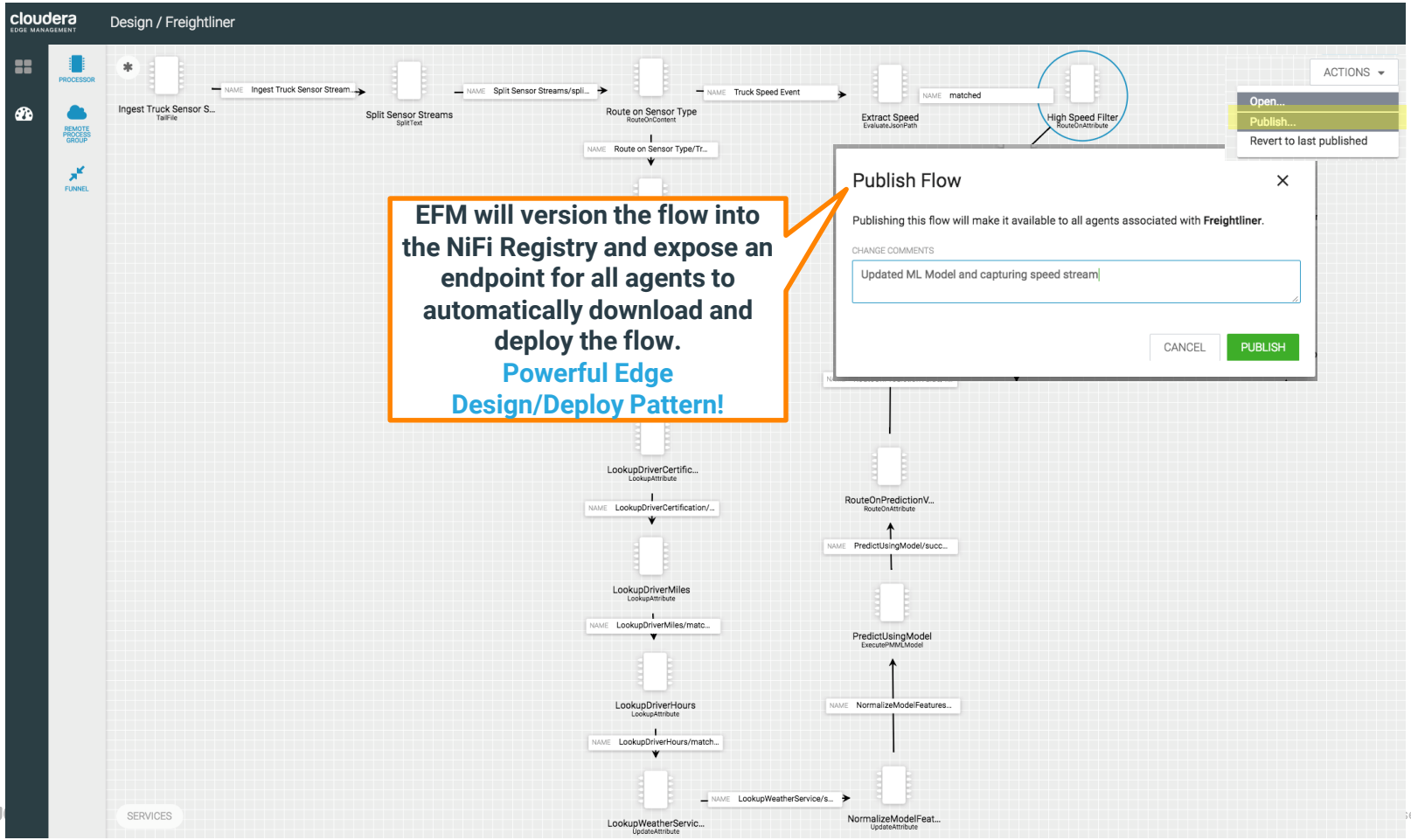
INTELLIGENCE TO THE EDGE – PUSH ML MODELS TO EDGE



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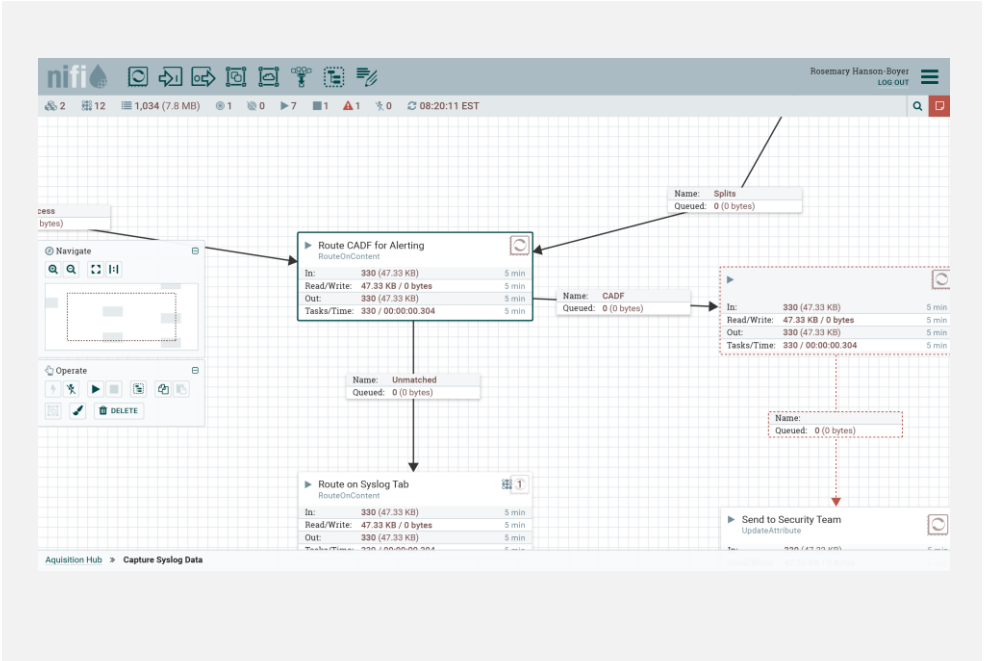
FLOW MANAGEMENT VIA NIFI

- Based on Apache NiFi
- Highly configurable flow creation
- Web-based user interface
- 300+ prebuilt processors
- Secure - fine grained encryption
- Data provenance
- Guaranteed delivery
  - Buffer data during system interruptions
- Designed for extensibility
- NiFi Registry



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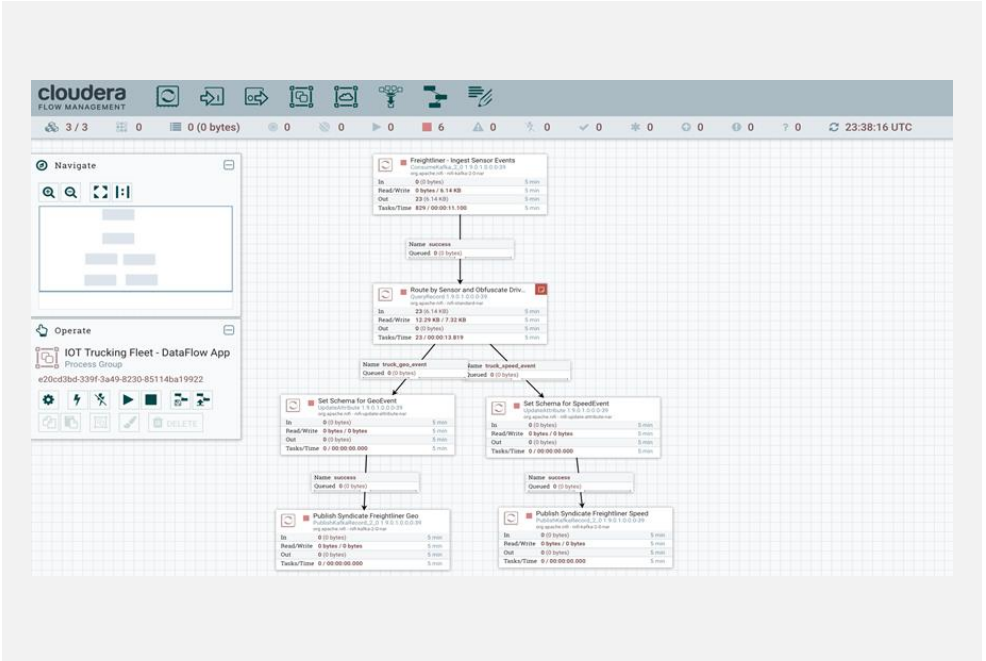
WHAT CAN BE DONE WITH NIFI PROCESSORS?

300+ Pre-Built Processors

- **Ingestion**: connectors to read/write data from/to several data sources
  - **Protocols:** HTTP (S), AMQP, MQTT, UDP, TCP, CEF, JMS, (S) FTP, AWSIoT, Raw Socket Protocol
  - **Brokers:** Kafka, JMS, AMQP, MQTT etc.
  - **Databases:** JDBC, MongoDB, HBase, Cassandra etc.
- **Extraction** (XML, JSON, Regex, Grok etc.)
- **Transformation**
  - Format conversion (JSON to Avro, CSV to ORC etc.)
  - Compression/decompression, Merge, Split, encryption etc.
- **Data enrichment**
  - Attribute, content, rules etc.
- **Routing**
  - Priority, dynamic/static, based on content or metadata etc.



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300+ PROCESSORS FOR DEEPER ECOSYSTEM INTEGRATION

FTP
SFTP
HL7
UDP
XML
HTTP
WebSocket
Email
HTML
Image
Syslog
AMQP

Hash | Encrypt | GeoEnrich
Merge | Tail | Scan
Extract | Evaluate | Replace
Duplicate | Execute | Translate
Split | Fetch | Convert

Parse Records | Convert Records
Route Text | Distribute Load
Route Content | Generate Table Fetch
Route Context | Jolt Transform JSON
Control Rate | Prioritized Delivery

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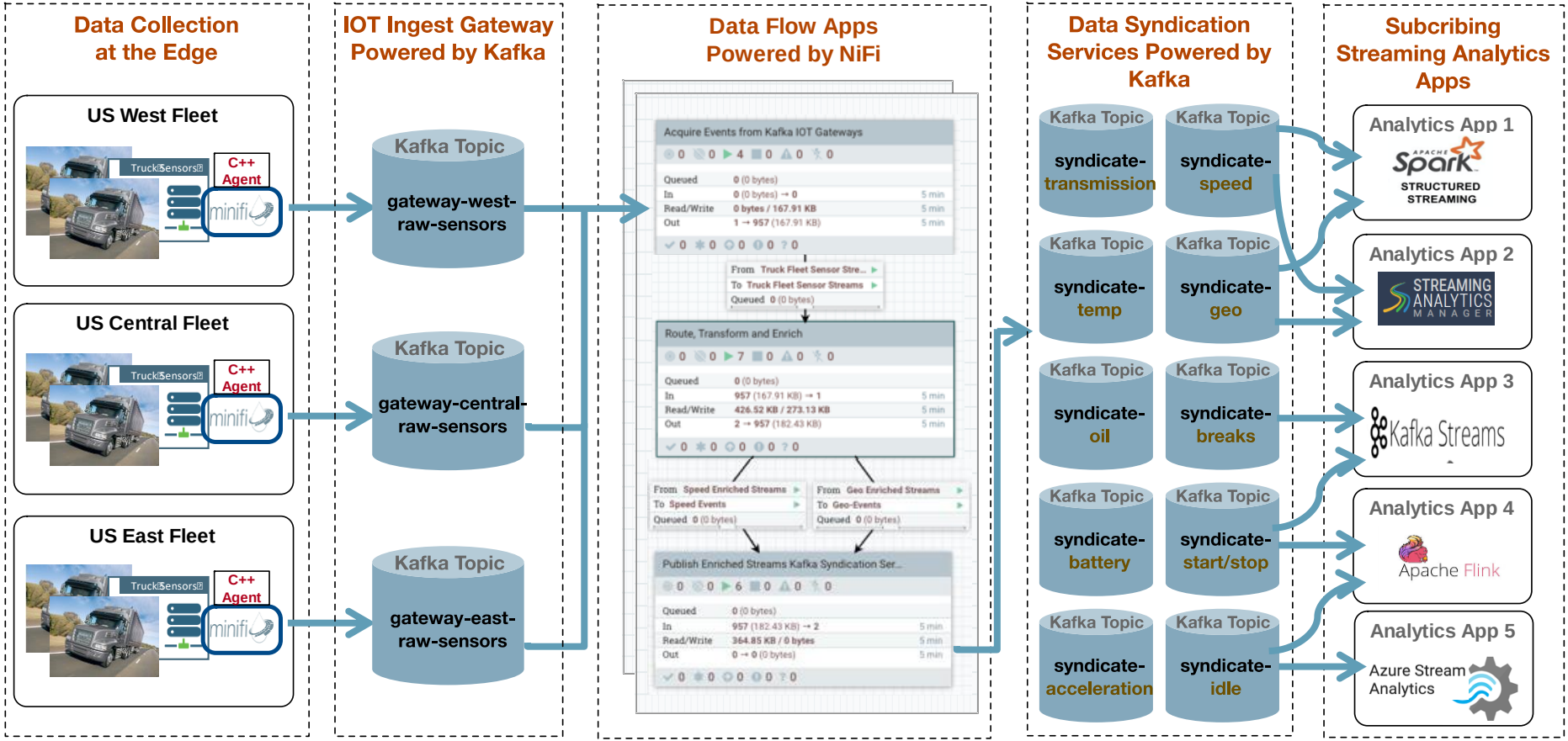
STREAMING ANALYTICS REFERENCE ARCHITECTURE



EXAMPLE - LAS VEGAS CONNECTED VEHICLE PILOT

City Fleet Vehicle In Operation

Monitor Vehicle Conditions

Approaching Active Bus Stop?

Issue Alert to In-Vehicle Display Unit

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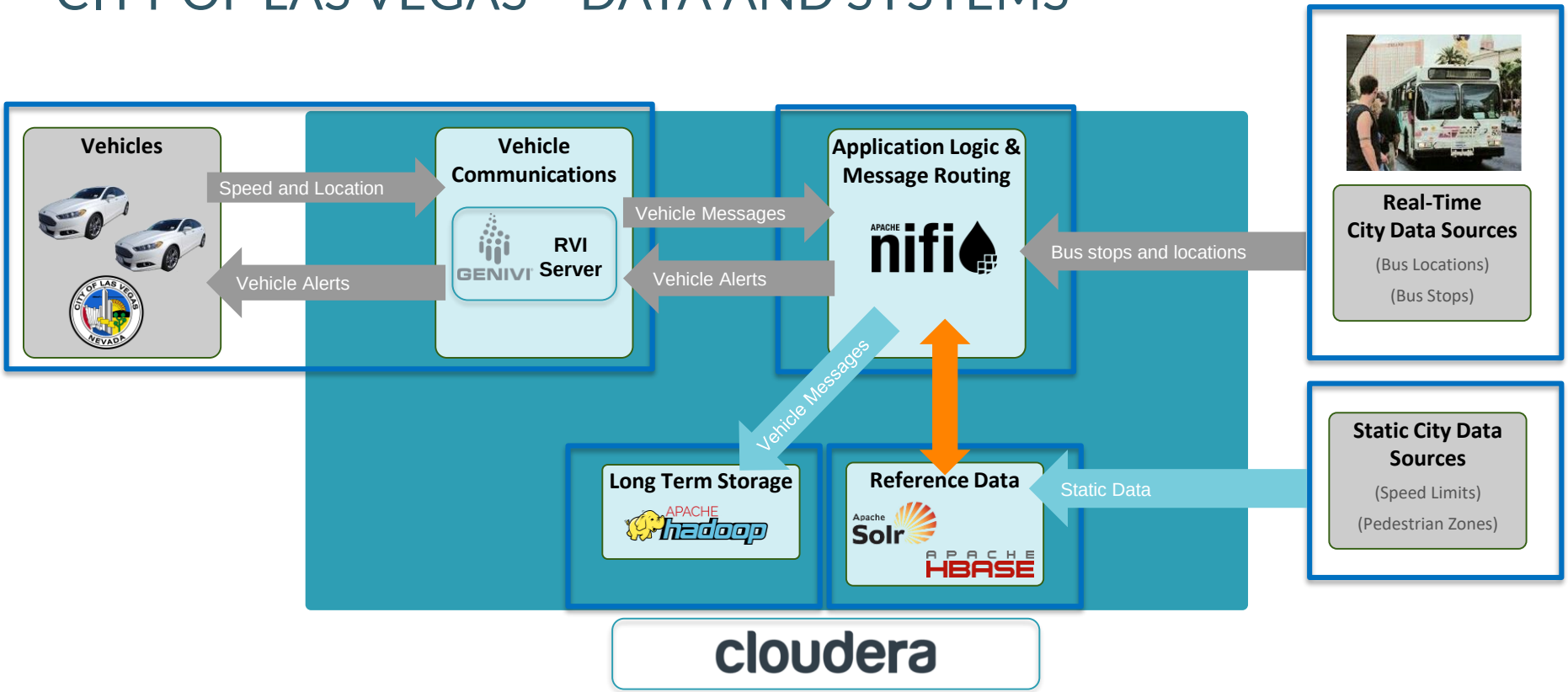
CITY OF LAS VEGAS – DATA AND SYSTEMS



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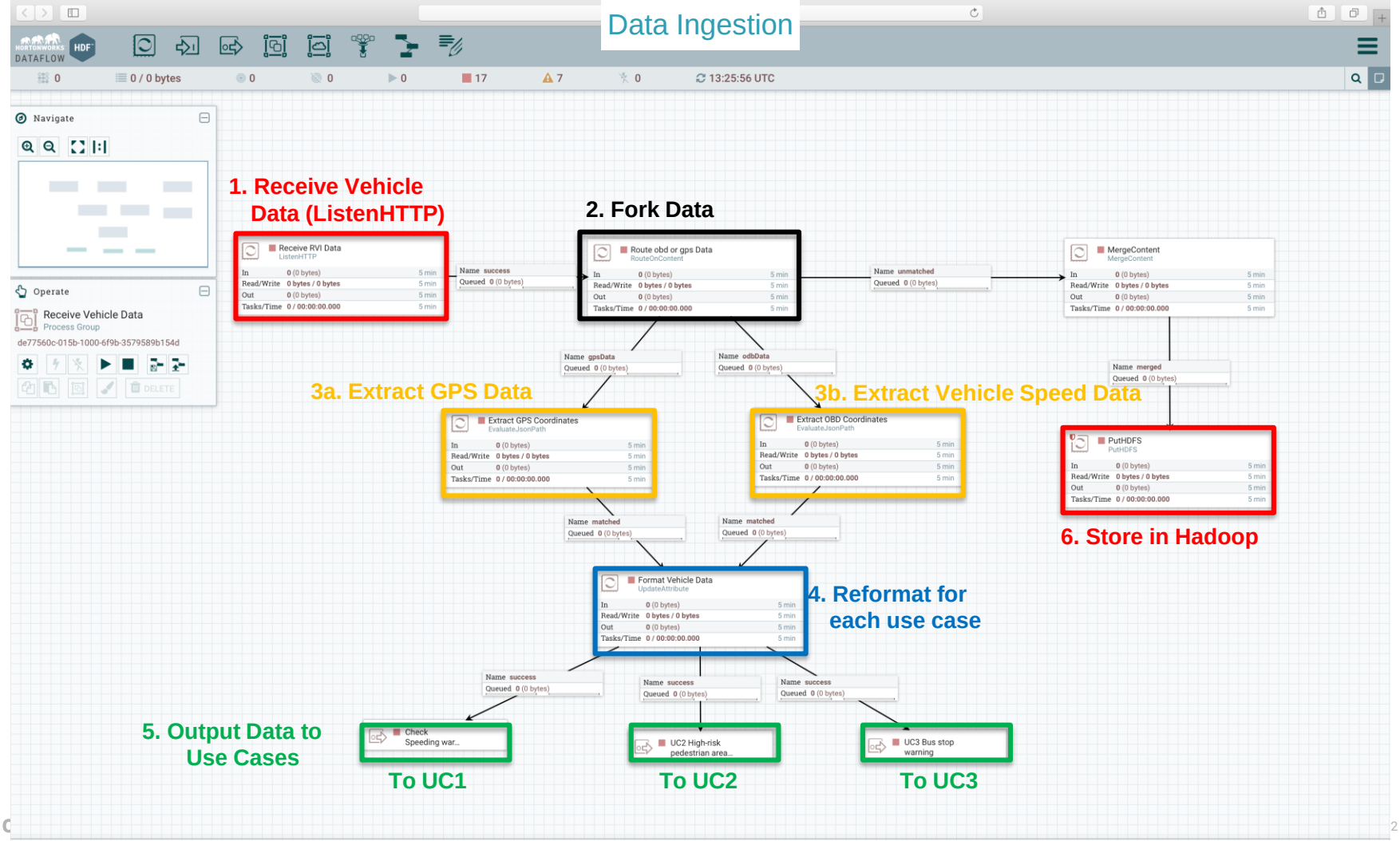
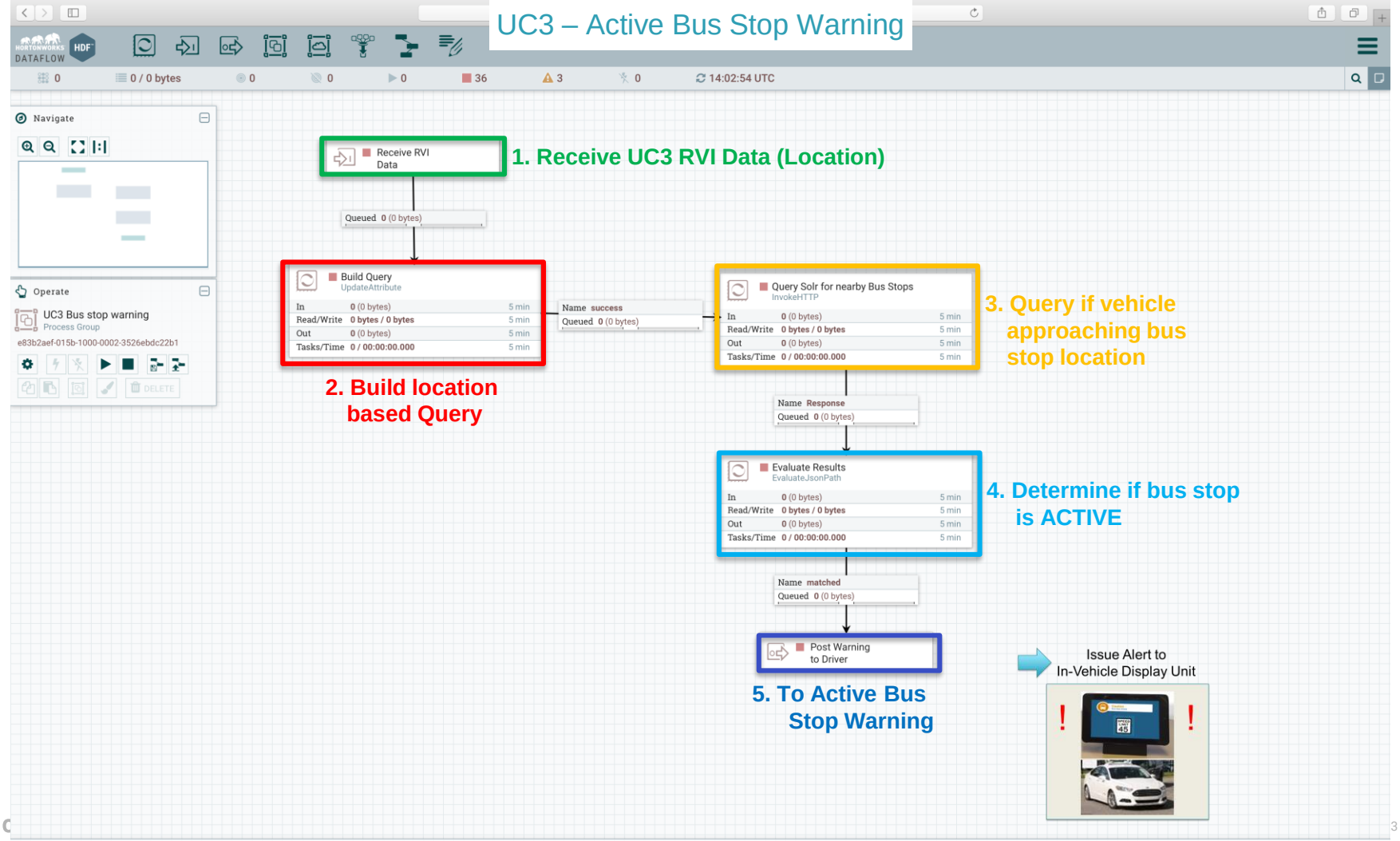
Data Ingestion



UC3 – Active Bus Stop Warning



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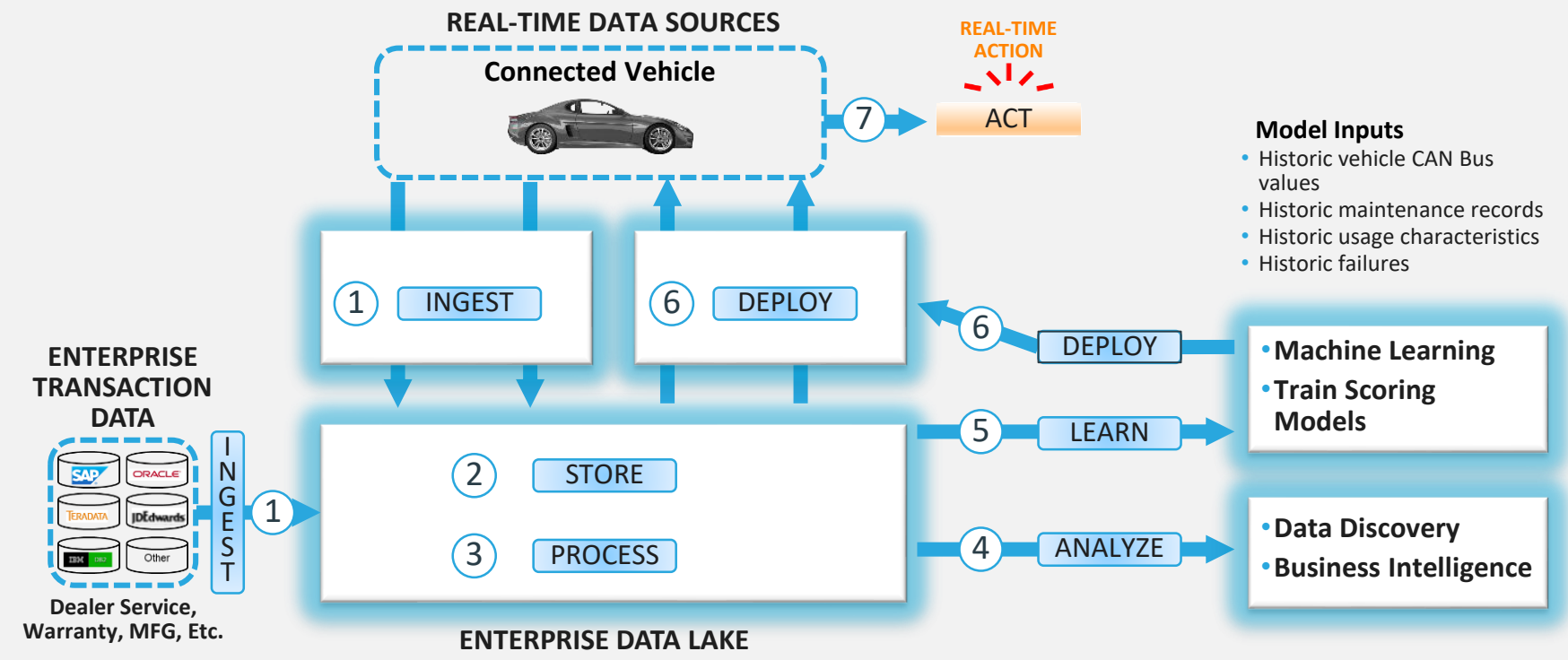
CONNECTED VEHICLE ANALYTICS LIFECYCLE

Example: Vehicle Predictive Maintenance



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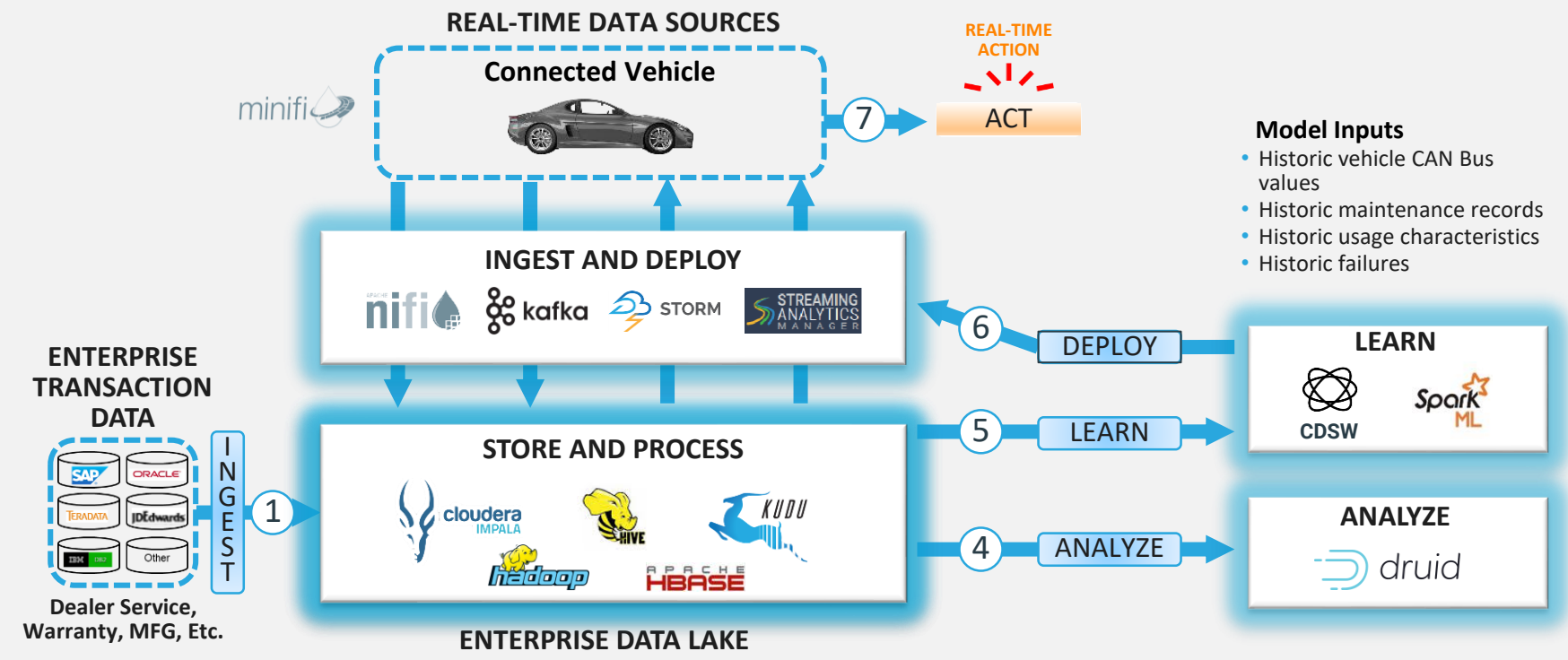
SOLUTION COMPONENT DETAIL



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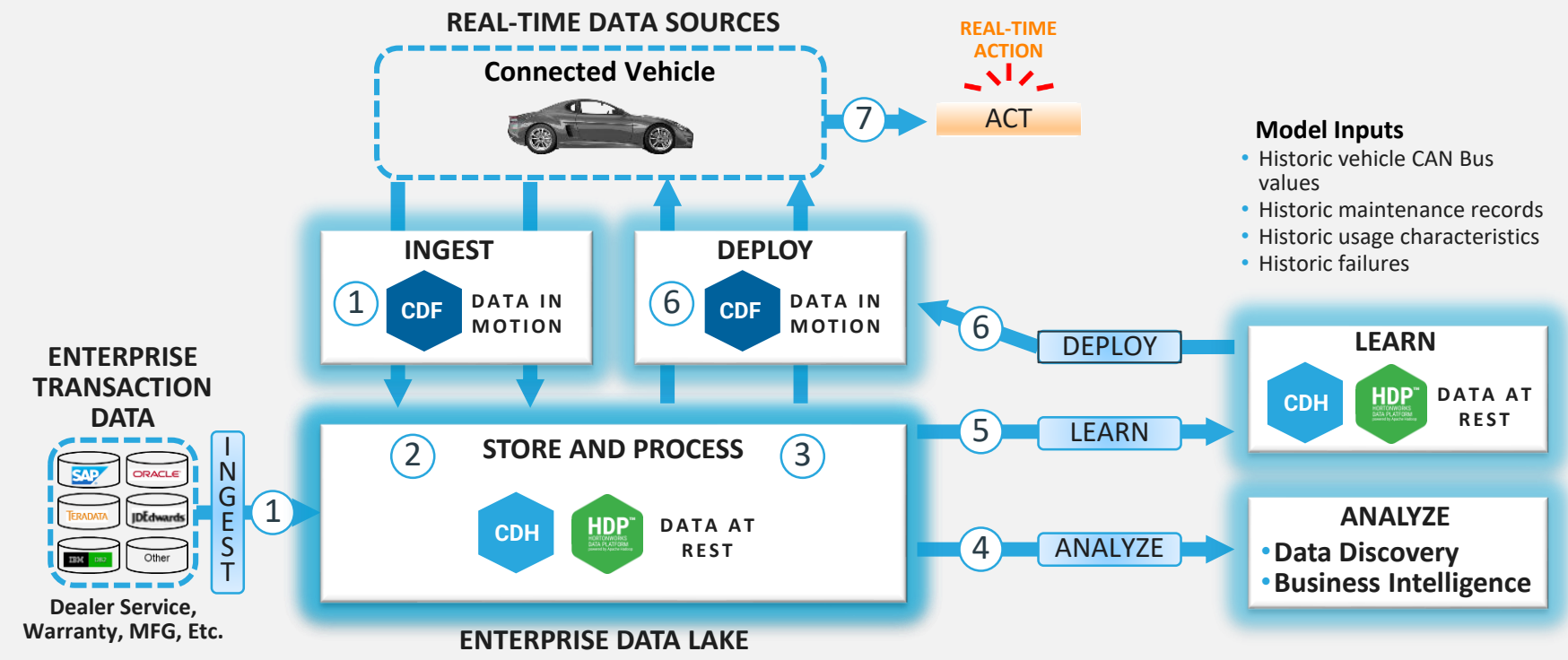
CLOUDERA FOR CONNECTED VEHICLE INNOVATION



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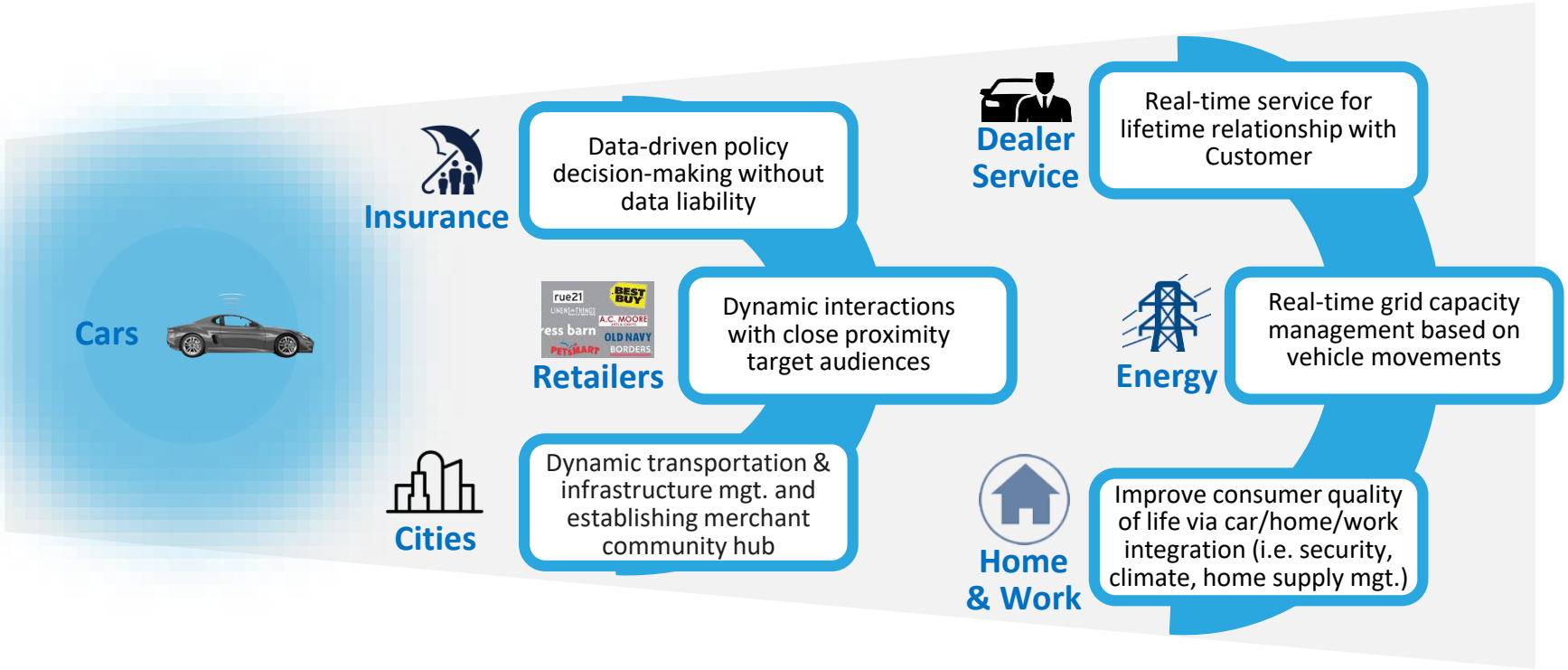
CONNECTED VEHICLE IS LEADING THE TRANSFORMATION

Monetizing the Connected Vehicle



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ESTABLISHING TRUST – WHAT'S REQUIRED?

Data Providers

- Control who can see what data
- Control what data can be combined

Connected Communities

End-Users

ASK QUESTION

DELIVER INSIGHT

Secured views of data and insights

✓ **Data access across systems**

- Each data provider shares specific *data assets* and defines specific data sharing rules

✓ **Controlling who sees what data**

- Each data provider precisely defines *which end-users can see their data* throughout the data lifecycle

✓ **Data audit across the ecosystem**

- Each data provider can track *data usage* across the data lifecycle, including the *data's origin, where it is used, and how it changes over time*

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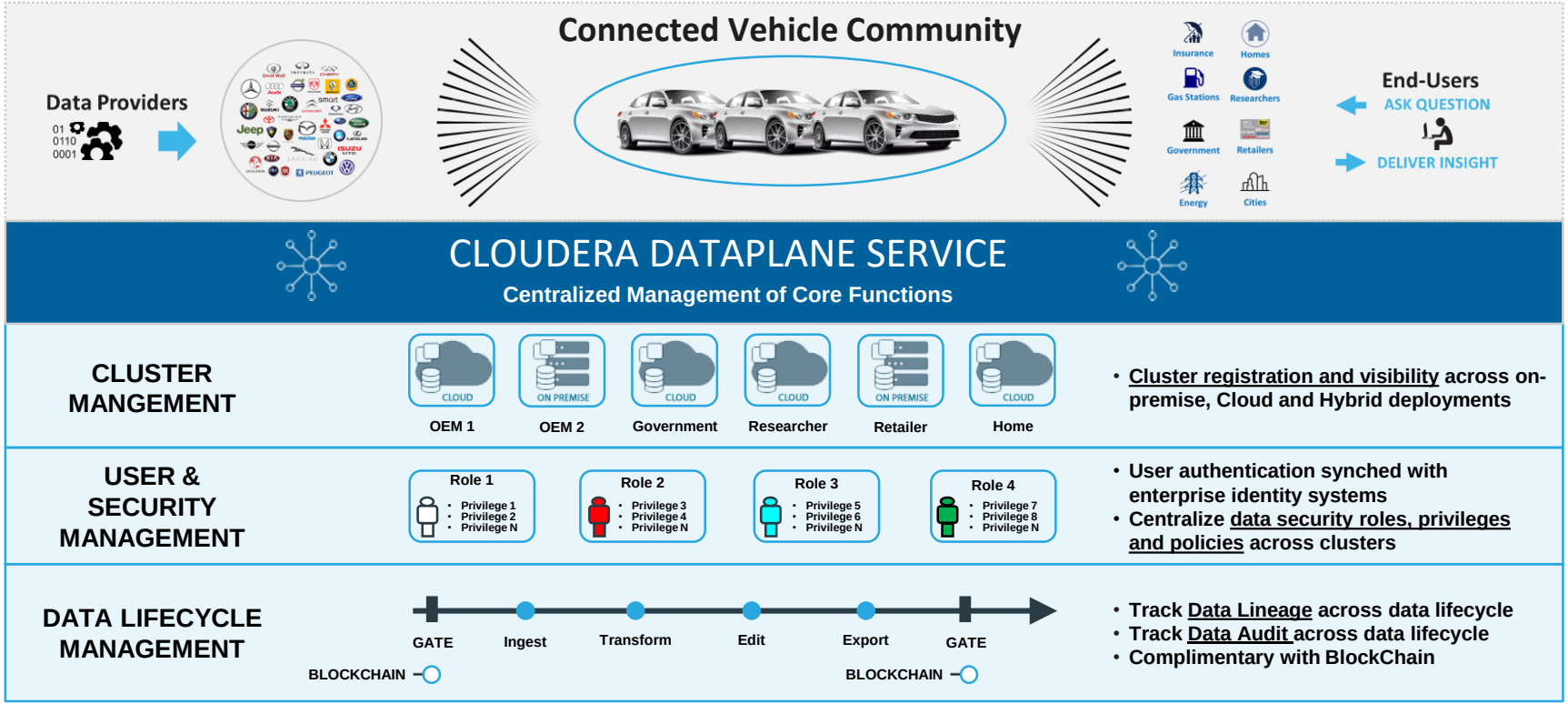
HOW IT WORKS.....



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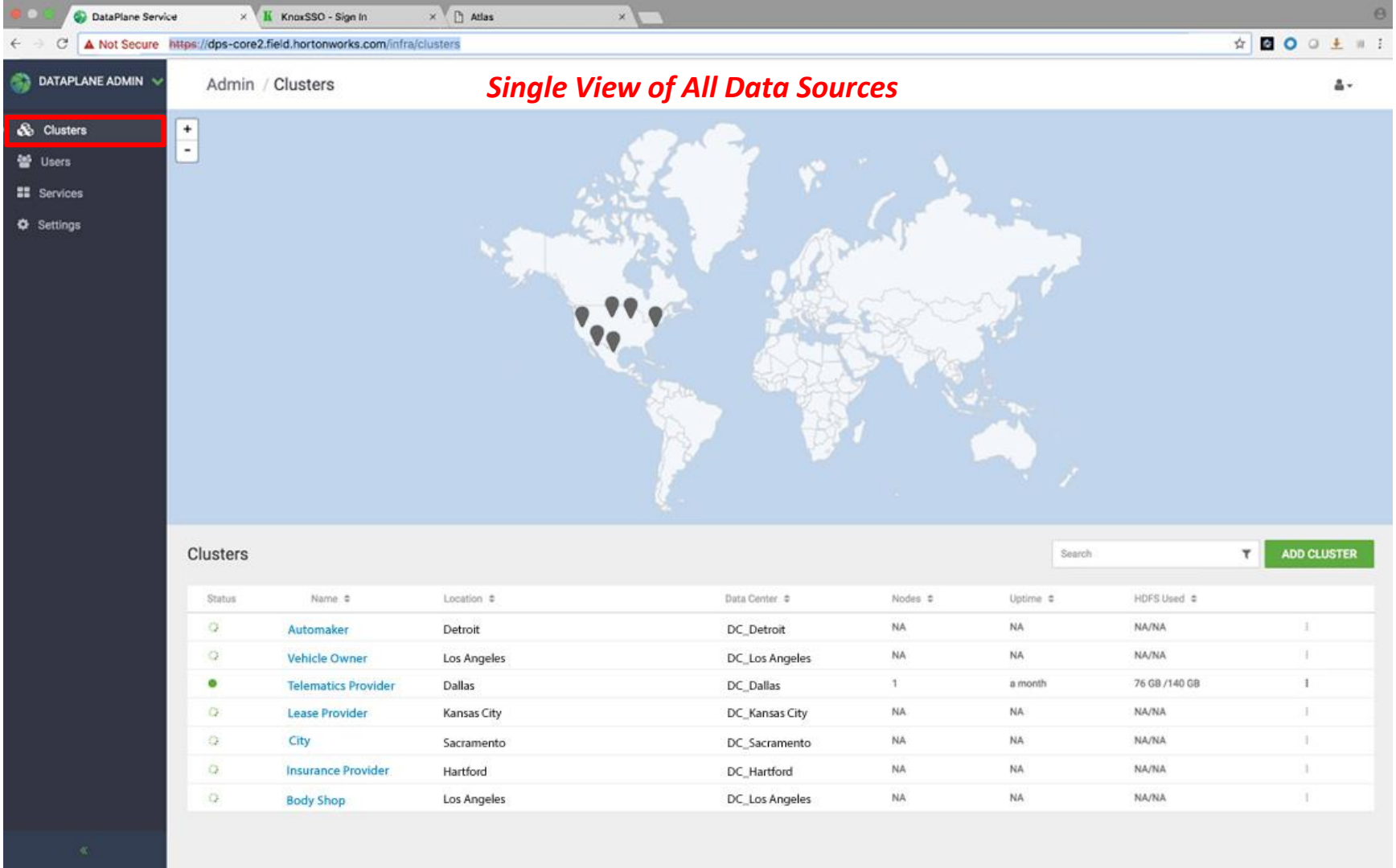
DataPlane Service
KnoxSSO - Sign In
Atlas
Not Secure
https://dps-core2.field.hortonworks.com/infra/clusters
DATAPLANE ADMIN
Clusters
Users
Services
Settings
Admin / Clusters
Single View of All Data Sources
Clusters
Search
ADD CLUSTER
Status
Name
Location
Data Center
Nodes
Uptime
HDFS Used
Automaker
Detroit
DC_Detroit
NA
NA
NA/NA
Vehicle Owner
Los Angeles
DC_Los Angeles
NA
NA
NA/NA
Telematics Provider
Dallas
DC_Dallas
1
a month
76 GB /140 GB
Lease Provider
Kansas City
DC_Kansas City
NA
NA
NA/NA
City
Sacramento
DC_Sacramento
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DC_Los Angeles
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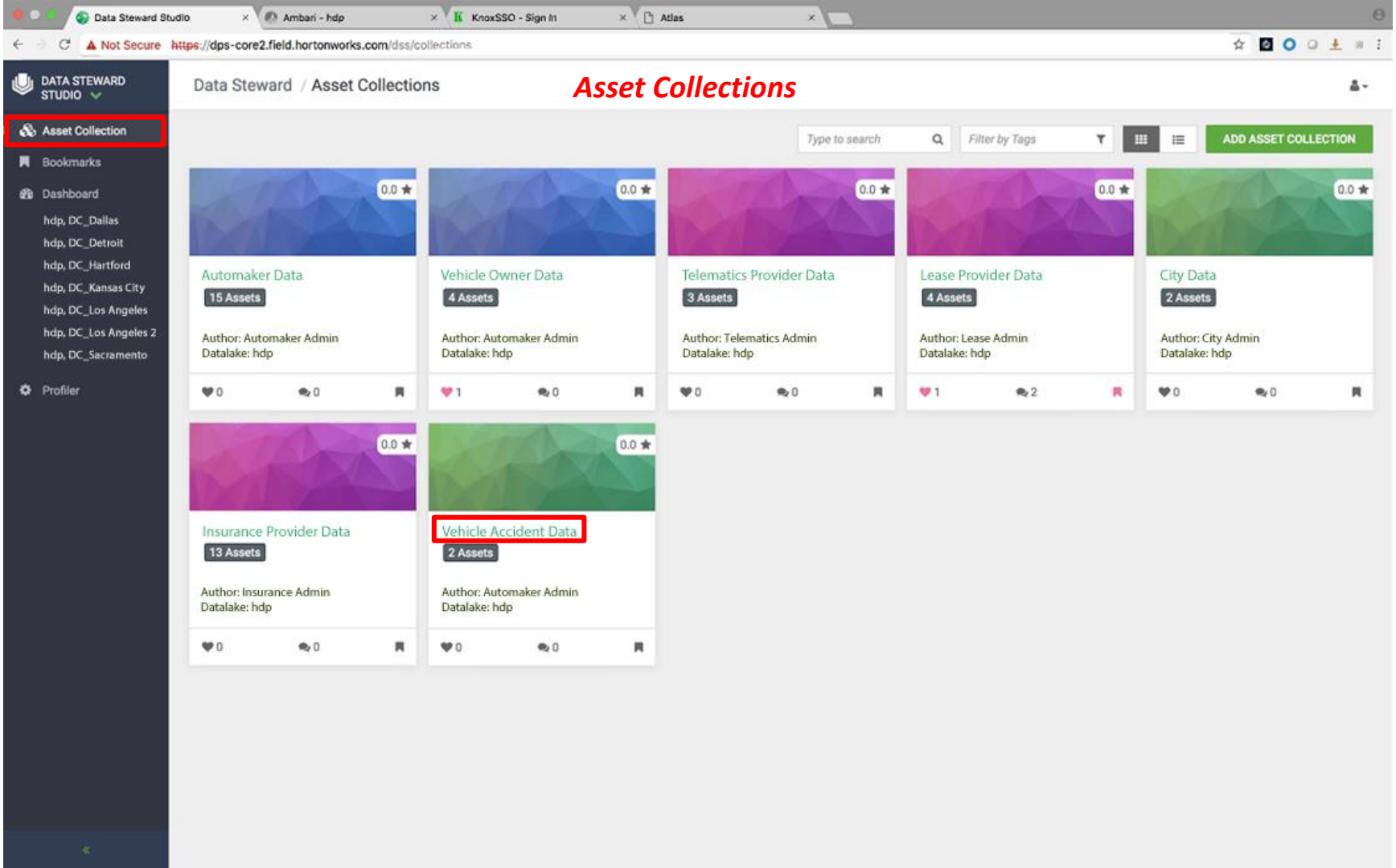
NA
NA/NA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DATA STEWARD STUDIO
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hdp, DC_Detroit
hdp, DC_Hartford
hdp, DC_Kansas City
hdp, DC_Los Angeles
hdp, DC_Los Angeles 2
hdp, DC_Sacramento
Profiler
Data Steward / Asset Collections
Asset Collections
Type to search
Filter by Tags
ADD ASSET COLLECTION
Automaker Data
15 Assets
Author: Automaker Admin
Datalake: hdp
Vehicle Owner Data
4 Assets
Author: Automaker Admin
Datalake: hdp
Telematics Provider Data
3 Assets
Author: Telematics Admin
Datalake: hdp
Lease Provider Data
4 Assets
Author: Lease Admin
Datalake: hdp
City Data
2 Assets
Author: City Admin
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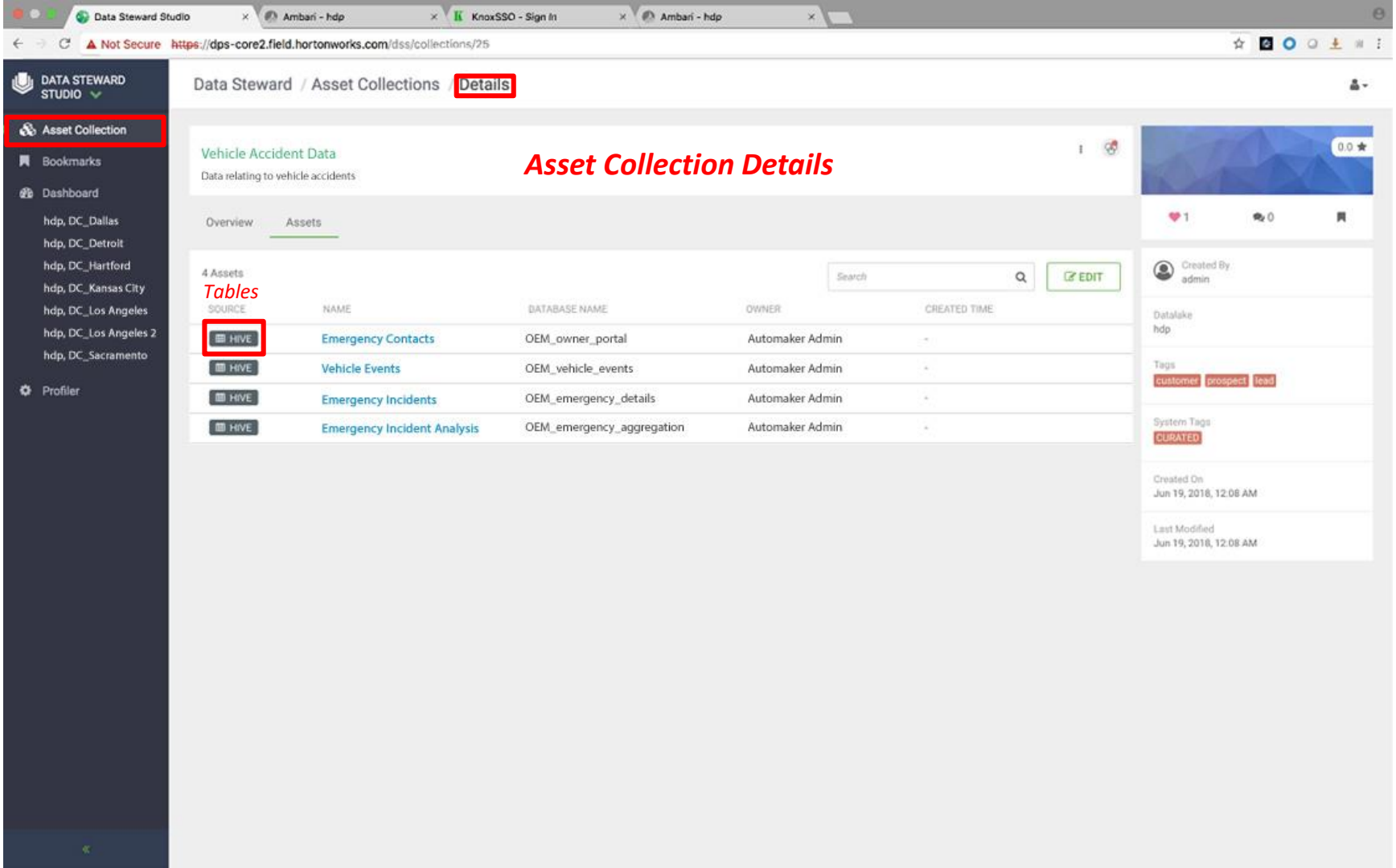
Author: Automaker Admin
Datalake: hdp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hdp, DC_Sacramento
Profiler
Data Steward / Asset Collections / Details
Vehicle Accident Data
Data relating to vehicle accidents
Asset Collection Details
Overview
Assets
4 Assets
Tables
Search
EDIT
SOURCE
NAME
DATABASE NAME
OWNER
CREATED TIME
HIVE
Emergency Contacts
OEM_owner_portal
Automaker Admin
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Vehicle Events
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Emergency Incidents
OEM_emergency_details
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HIVE
Emergency Incident Analysis
OEM_emergency_aggregation
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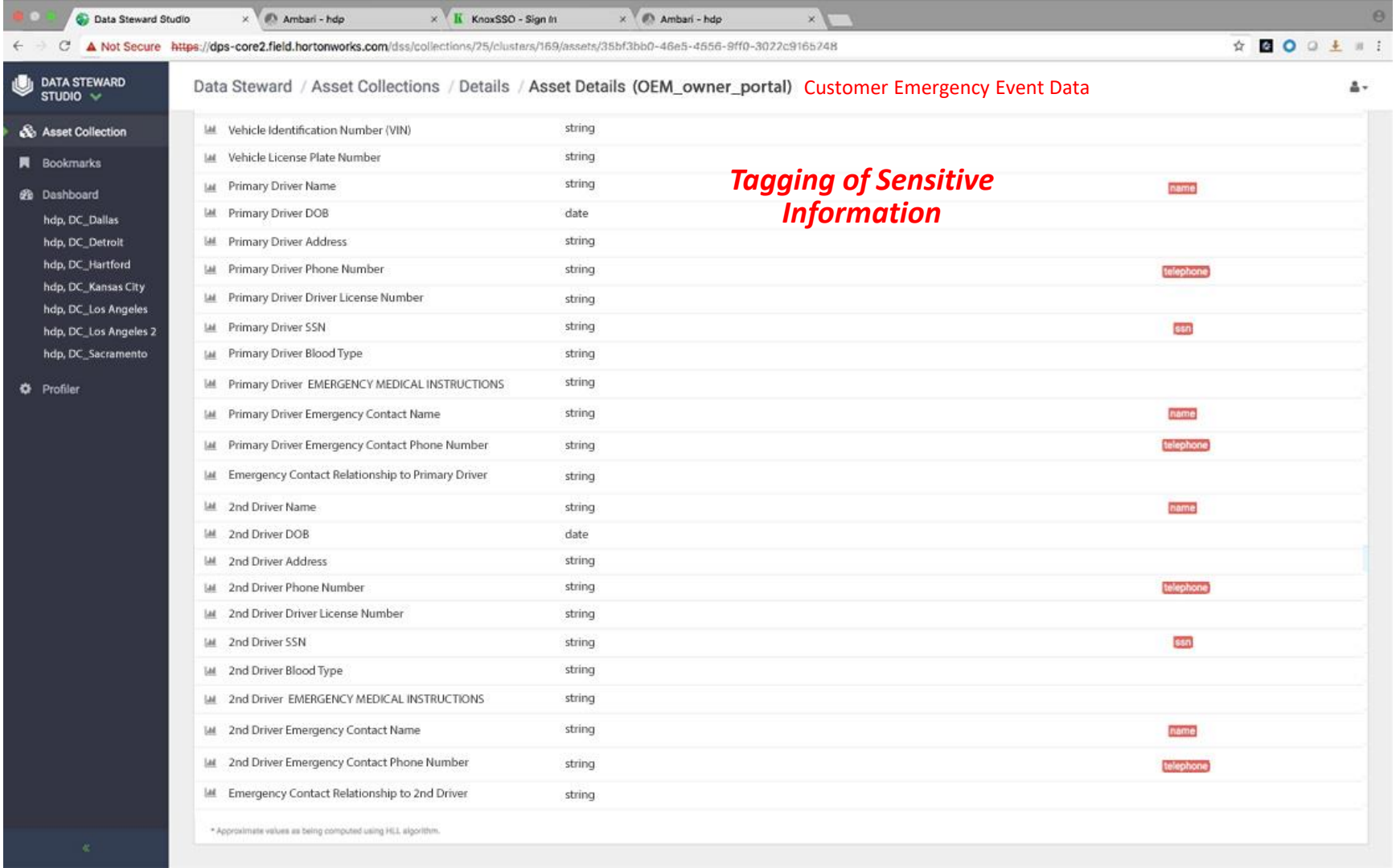
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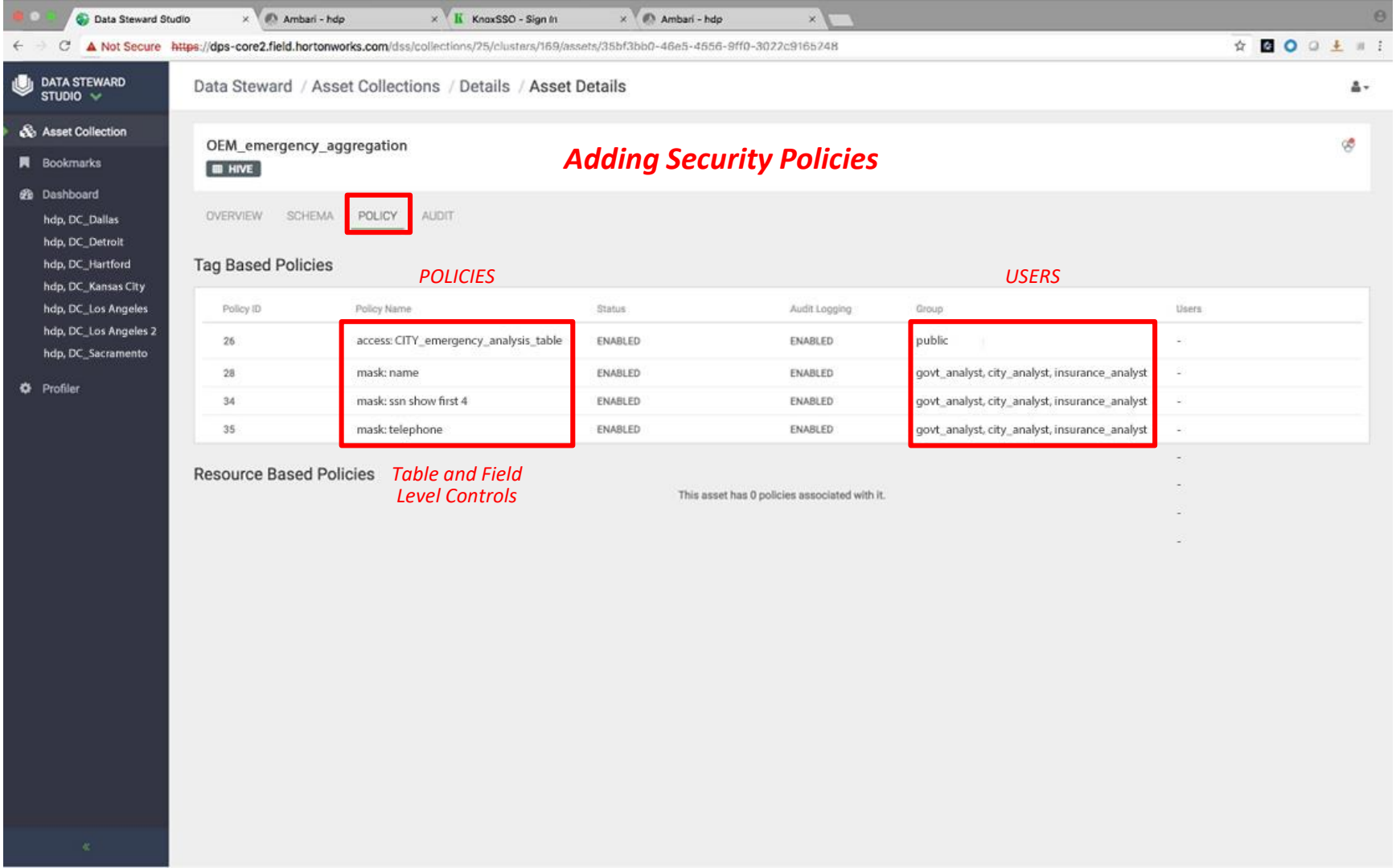
hdp, DC_Los Angeles 2
hdp, DC_Sacramento
Profiler
Data Steward / Asset Collections / Details / Asset Details (OEM_owner_portal) Customer Emergency Event Data
Tagging of Sensitive Information
Vehicle Identification Number (VIN) string
Vehicle License Plate Number string
Primary Driver Name string name
Primary Driver DOB date
Primary Driver Address string
Primary Driver Phone Number string telephone
Primary Driver Driver License Number string
Primary Driver SSN string ssn
Primary Driver Blood Type string
Primary Driver EMERGENCY MEDICAL INSTRUCTIONS string
Primary Driver Emergency Contact Name string name
Primary Driver Emergency Contact Phone Number string telephone
Emergency Contact Relationship to Primary Driver string
2nd Driver Name string name
2nd Driver DOB date
2nd Driver Address string
2nd Driver Phone Number string telephone
2nd Driver Driver License Number string
2nd Driver SSN string ssn
2nd Driver Blood Type string
2nd Driver EMERGENCY MEDICAL INSTRUCTIONS string
2nd Driver Emergency Contact Name string name
2nd Driver Emergency Contact Phone Number string telephone
Emergency Contact Relationship to 2nd Driver string
* Approximate values as being computed using HLL algorithm.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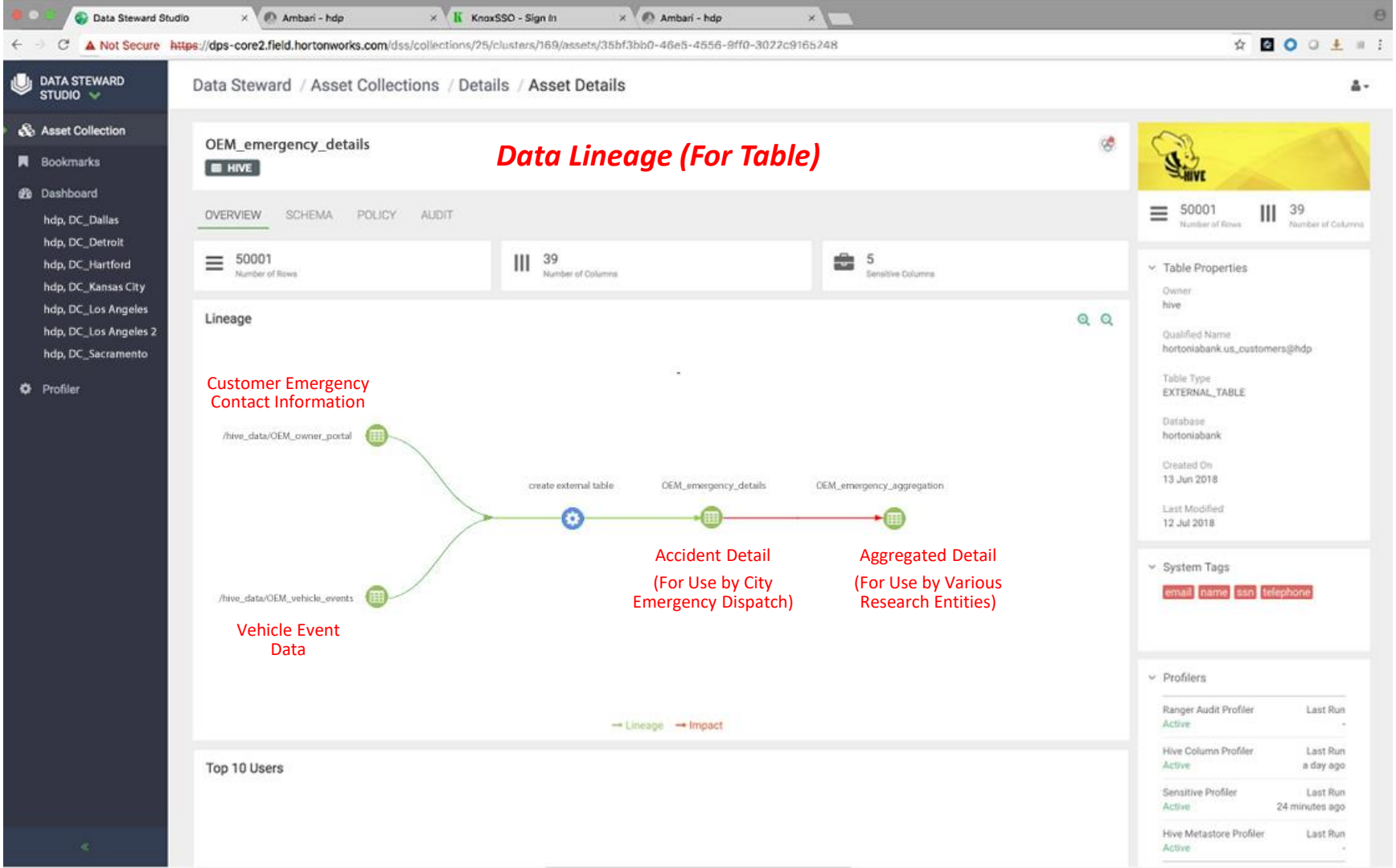
Data Steward / Asset Collections / Details / Asset Details
OEM_emergency_aggregation
HIVE
Adding Security Policies
OVERVIEW
SCHEMA
POLICY
AUDIT
Tag Based Policies
POLICIES
USERS
Policy ID
Policy Name
Status
Audit Logging
Group
Users
26
access: CITY_emergency_analysis_table
ENABLED
ENABLED
public
28
mask: name
ENABLED
ENABLED
govt_analyst, city_analyst, insurance_analyst
34
mask: ssn show first 4
ENABLED
ENABLED
govt_analyst, city_analyst, insurance_analyst
35
mask: telephone
ENABLED
ENABLED
govt_analyst, city_analyst, insurance_analyst
Resource Based Policies
Table and Field Level Controls
This asset has 0 policies associated with it.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/hive_data/OEM_vehicle_events
Vehicle Event Data
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OEM_emergency_details
OEM_emergency_aggregation
Accident Detail
(For Use by City Emergency Dispatch)
Aggregated Detail
(For Use by Various Research Entities)
Lineage
Impact
Top 10 Users
50001
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Number of Columns
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Owner
hive
Qualified Name
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EXTERNAL_TABLE
Database
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Created On
13 Jun 2018
Last Modified
12 Jul 2018
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email
name
ssn
telephone
Profilers
Ranger Audit Profiler
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Last Run
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Active
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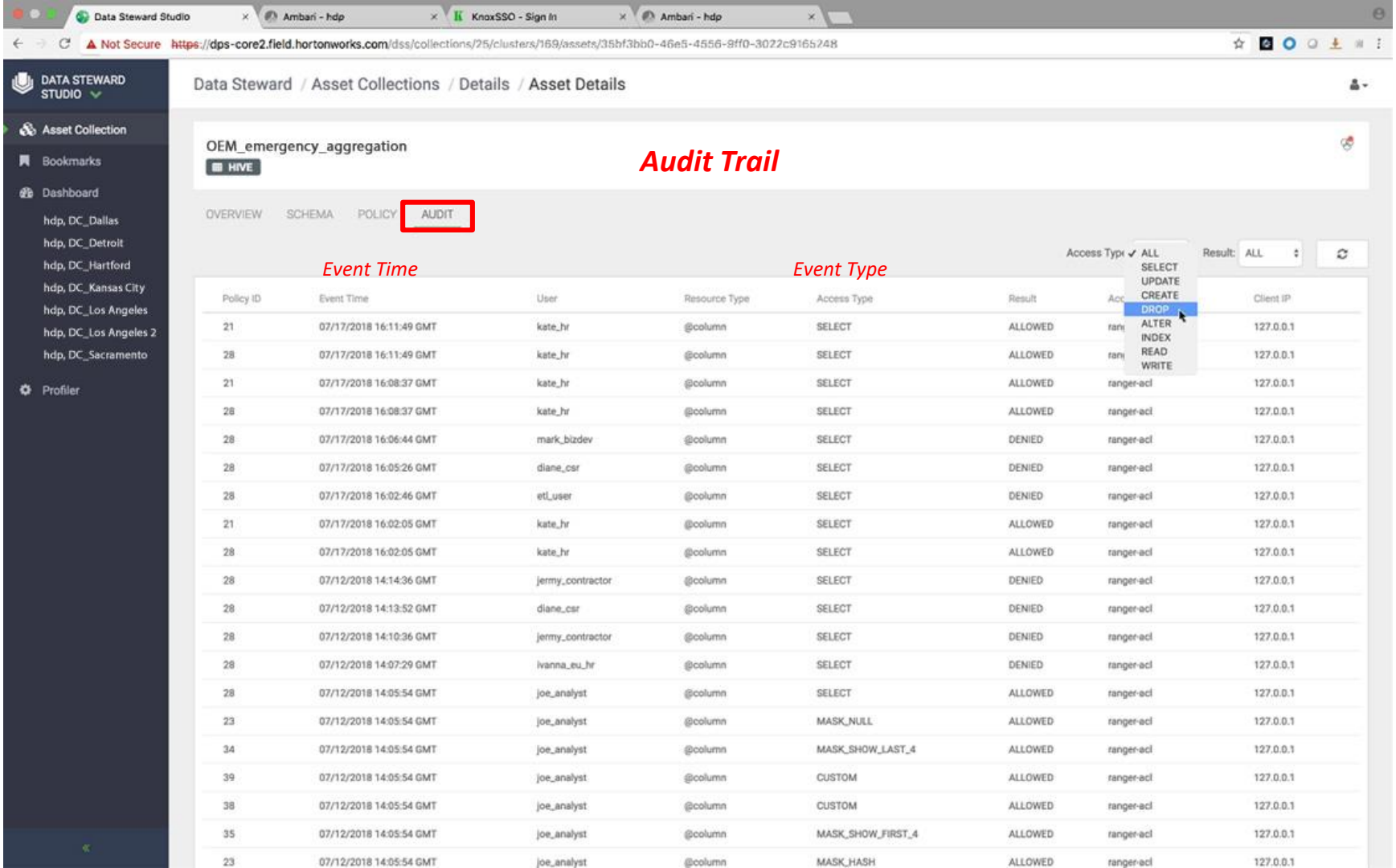
a day ago
Sensitive Profiler
Active
Last Run
24 minutes ago
Hive Metastore Profiler
Active
Last Run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DATA STEWARD STUDIO
Asset Collection
Bookmarks
Dashboard
hdp, DC_Dallas
hdp, DC_Detroit
hdp, DC_Hartford
hdp, DC_Kansas City
hdp, DC_Los Angeles
hdp, DC_Los Angeles 2
hdp, DC_Sacramento
Profiler
Data Steward / Asset Collections / Details / Asset Details
OEM_emergency_aggregation
HIVE
Audit Trail
OVERVIEW
SCHEMA
POLICY
AUDIT
Event Time
Event Type
Access Type: ALL
SELECT
UPDATE
CREATE
DROP
ALTER
INDEX
READ
WRITE
Result: ALL
Policy ID | Event Time | User | Resource Type | Access Type | Result | Client IP
21 | 07/17/2018 16:11:49 GMT | kate_hr | @column | SELECT | ALLOWED | 127.0.0.1
28 | 07/17/2018 16:11:49 GMT | kate_hr | @column | SELECT | ALLOWED | 127.0.0.1
21 | 07/17/2018 16:08:37 GMT | kate_hr | @column | SELECT | ALLOWED | ranger-acl | 127.0.0.1
28 | 07/17/2018 16:08:37 GMT | kate_hr | @column | SELECT | ALLOWED | ranger-acl | 127.0.0.1
28 | 07/17/2018 16:06:44 GMT | mark_bizdev | @column | SELECT | DENIED | ranger-acl | 127.0.0.1
28 | 07/17/2018 16:05:26 GMT | diane_csr | @column | SELECT | DENIED | ranger-acl | 127.0.0.1
28 | 07/17/2018 16:02:46 GMT | etl_user | @column | SELECT | DENIED | ranger-acl | 127.0.0.1
21 | 07/17/2018 16:02:05 GMT | kate_hr | @column | SELECT | ALLOWED | ranger-acl | 127.0.0.1
28 | 07/17/2018 16:02:05 GMT | kate_hr | @column | SELECT | ALLOWED | ranger-acl | 127.0.0.1
28 | 07/12/2018 14:14:36 GMT | jermy_contractor | @column | SELECT | DENIED | ranger-acl | 127.0.0.1
28 | 07/12/2018 14:13:52 GMT | diane_csr | @column | SELECT | DENIED | ranger-acl | 127.0.0.1
28 | 07/12/2018 14:10:36 GMT | jermy_contractor | @column | SELECT | DENIED | ranger-acl | 127.0.0.1
28 | 07/12/2018 14:07:29 GMT | ivanna_eu_hr | @column | SELECT | DENIED | ranger-acl | 127.0.0.1
28 | 07/12/2018 14:05:54 GMT | joe_analyst | @column | SELECT | ALLOWED | ranger-acl | 127.0.0.1
23 | 07/12/2018 14:05:54 GMT | joe_analyst | @column | MASK_NULL | ALLOWED | ranger-acl | 127.0.0.1
34 | 07/12/2018 14:05:54 GMT | joe_analyst | @column | MASK_SHOW_LAST_4 | ALLOWED | ranger-acl | 127.0.0.1
39 | 07/12/2018 14:05:54 GMT | joe_analyst | @column | CUSTOM | ALLOWED | ranger-acl | 127.0.0.1
38 | 07/12/2018 14:05:54 GMT | joe_analyst | @column | CUSTOM | ALLOWED | ranger-acl | 127.0.0.1
35 | 07/12/2018 14:05:54 GMT | joe_analyst | @column | MASK_SHOW_FIRST_4 | ALLOWED | ranger-acl | 127.0.0.1
23 | 07/12/2018 14:05:54 GMT | joe_analyst | @column | MASK_HASH | ALLOWED | ranger-acl | 127.0.0.1

CONCLUSION

- Connected Vehicle Data is Key to Industry Transformation
- Evolving Intelligence at Edge and Connected Community Use Cases
- Big Data Management Challenges on Multiple Levels
- Open Source Data Management Innovation Can Help!

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THANK YOU

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