Building an Industrial Unified Namespace with HiveMQ and MongoDB

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HOSTED BY: HIVEMQ

In Collaboration with: MongoDB.

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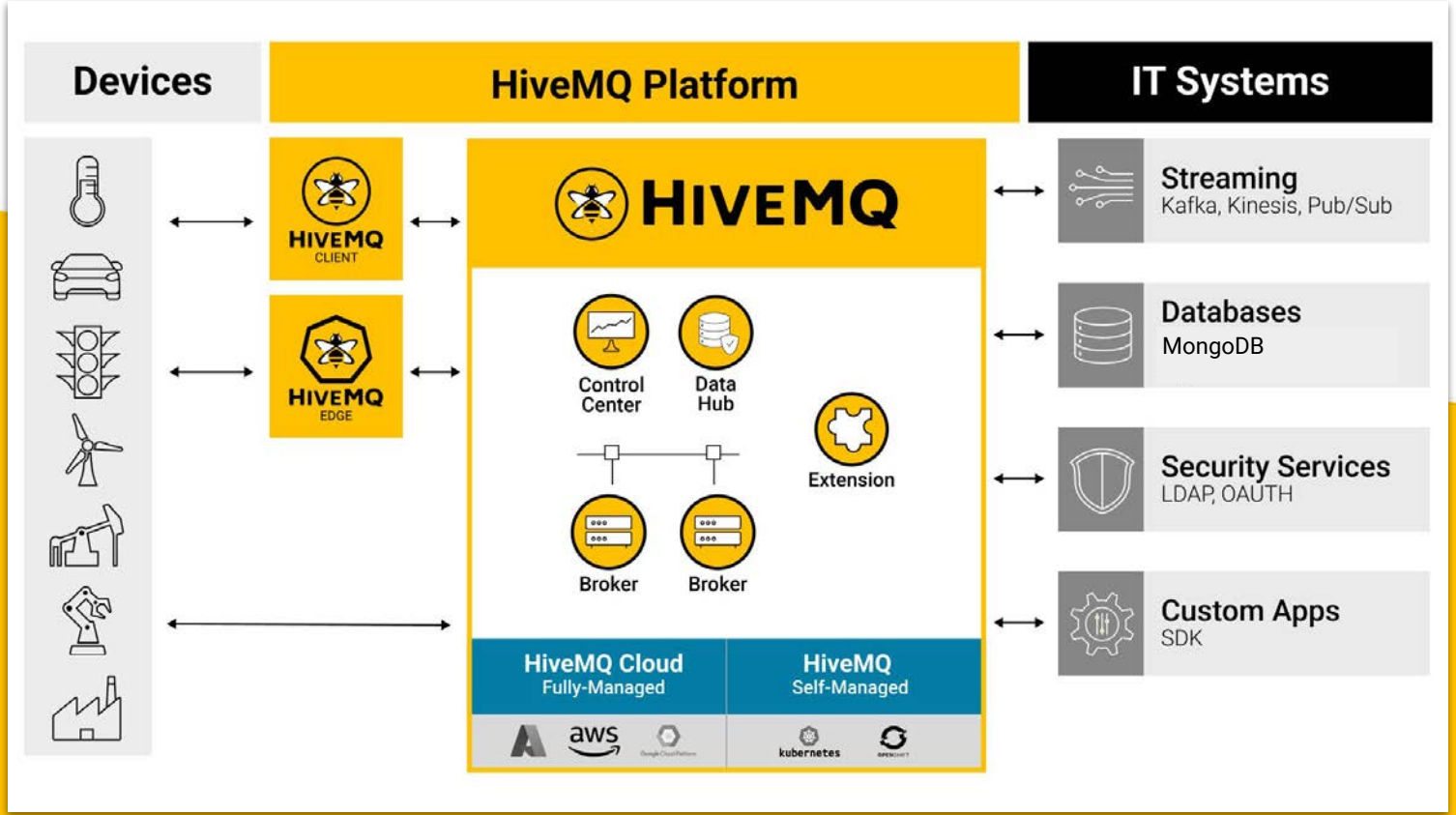
Agenda

- Problem Statement
- HiveMQ usage in industries
- What is a Unified Namespace
- Logical blocks of building a UNS
- HiveMQ MongoDB Extension
- MongoDB Introduction
- Building UNS with HiveMQ and MongoDB
- Demo
- Q&A

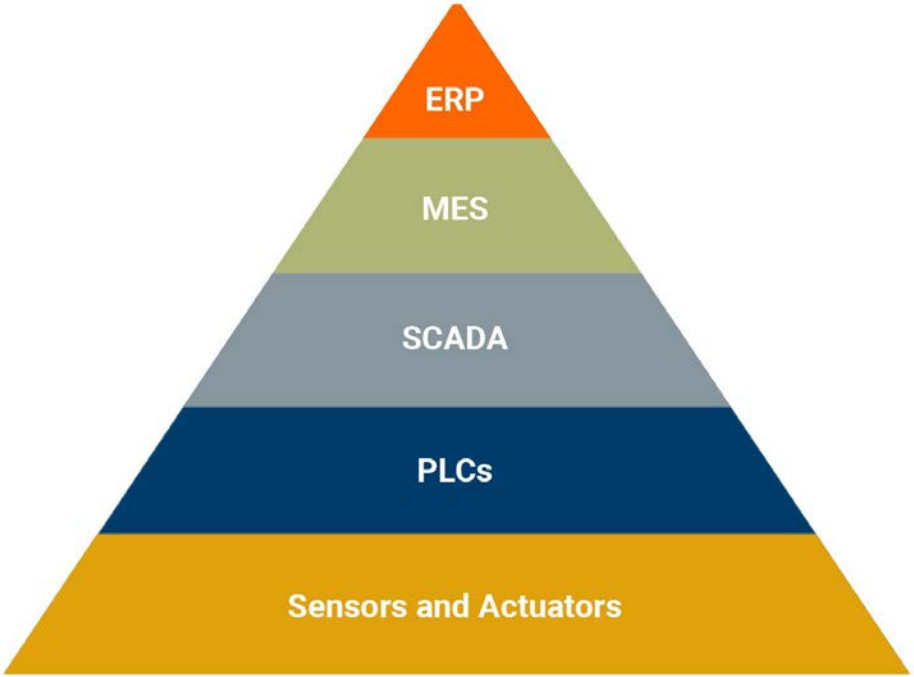
Key Industries

The HiveMQ Platform

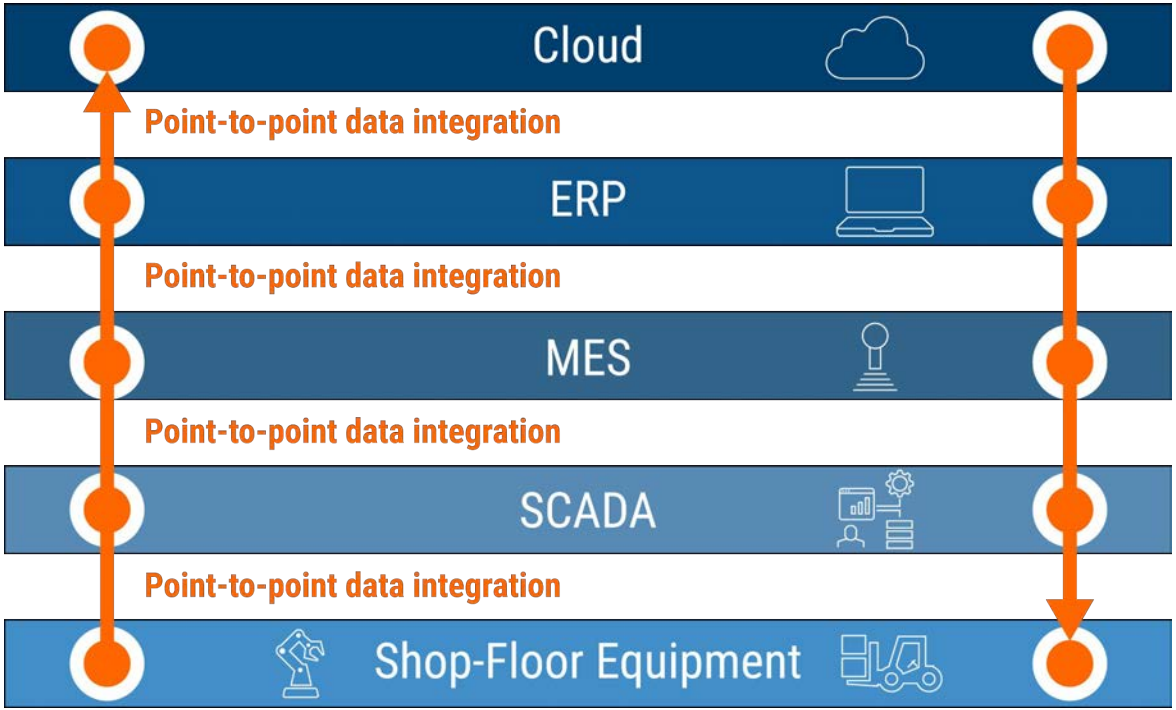
Enterprise Solution



Computer Integrated Manufacturing (CIM) pyramid



Traditional Industrial Data Integration



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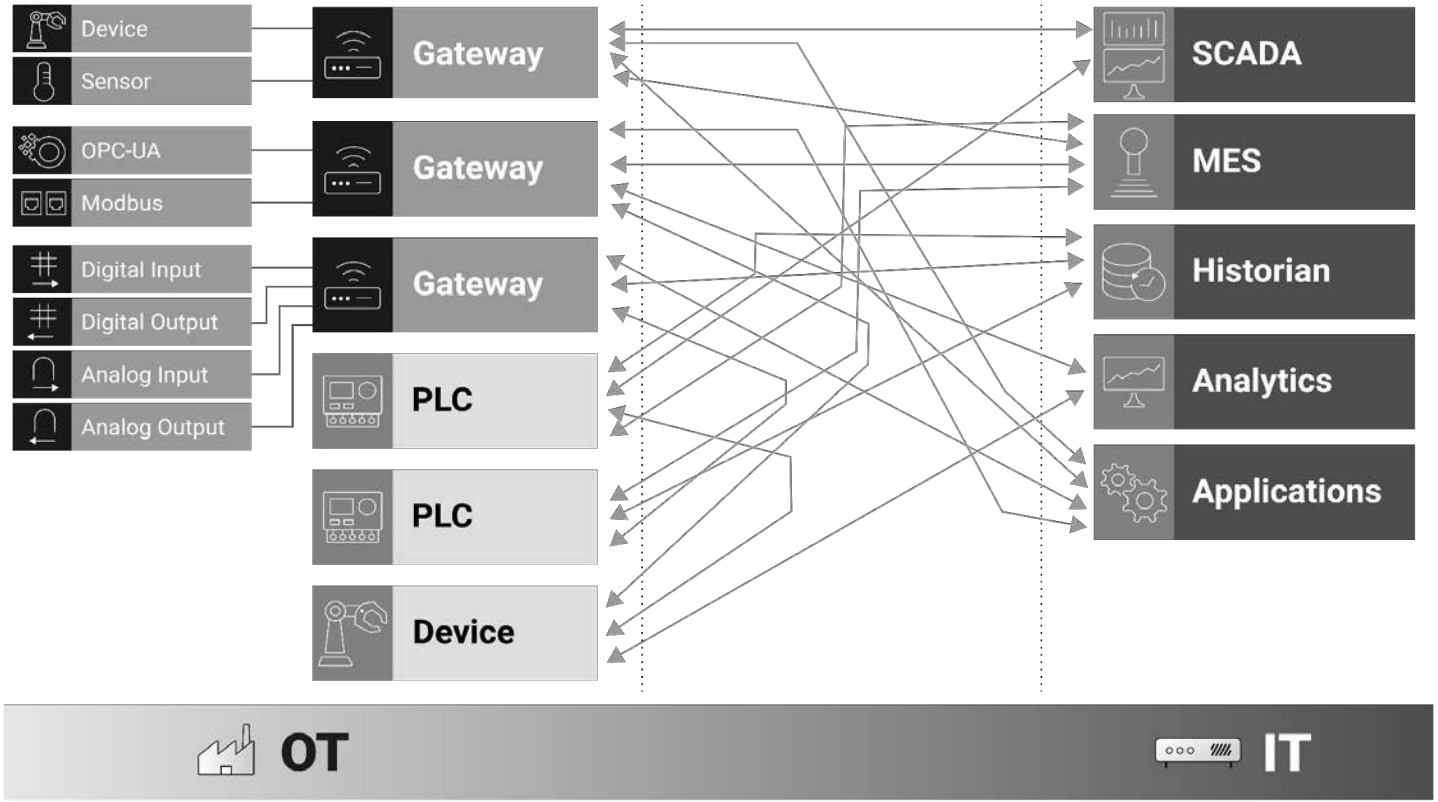

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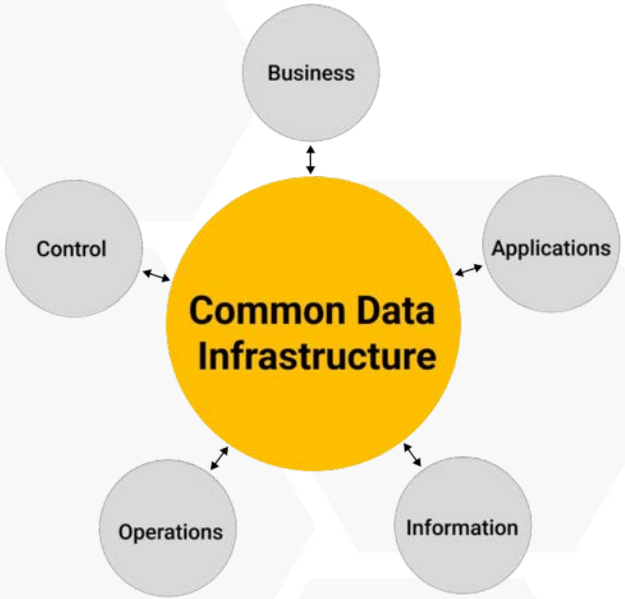
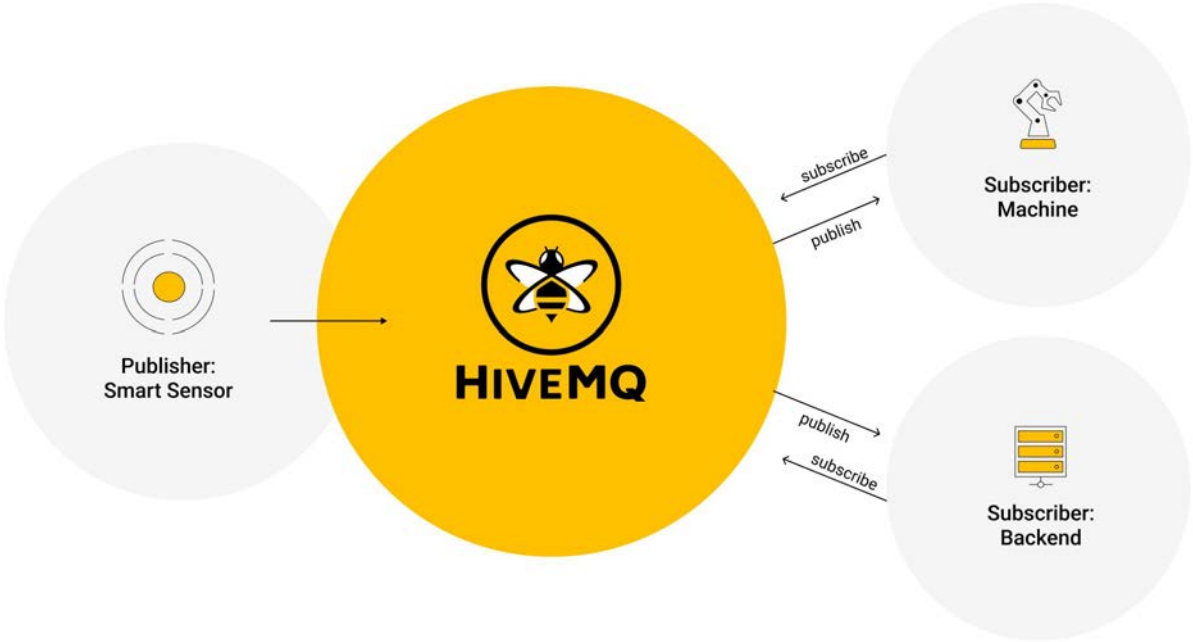
Foundations of Unified Namespace

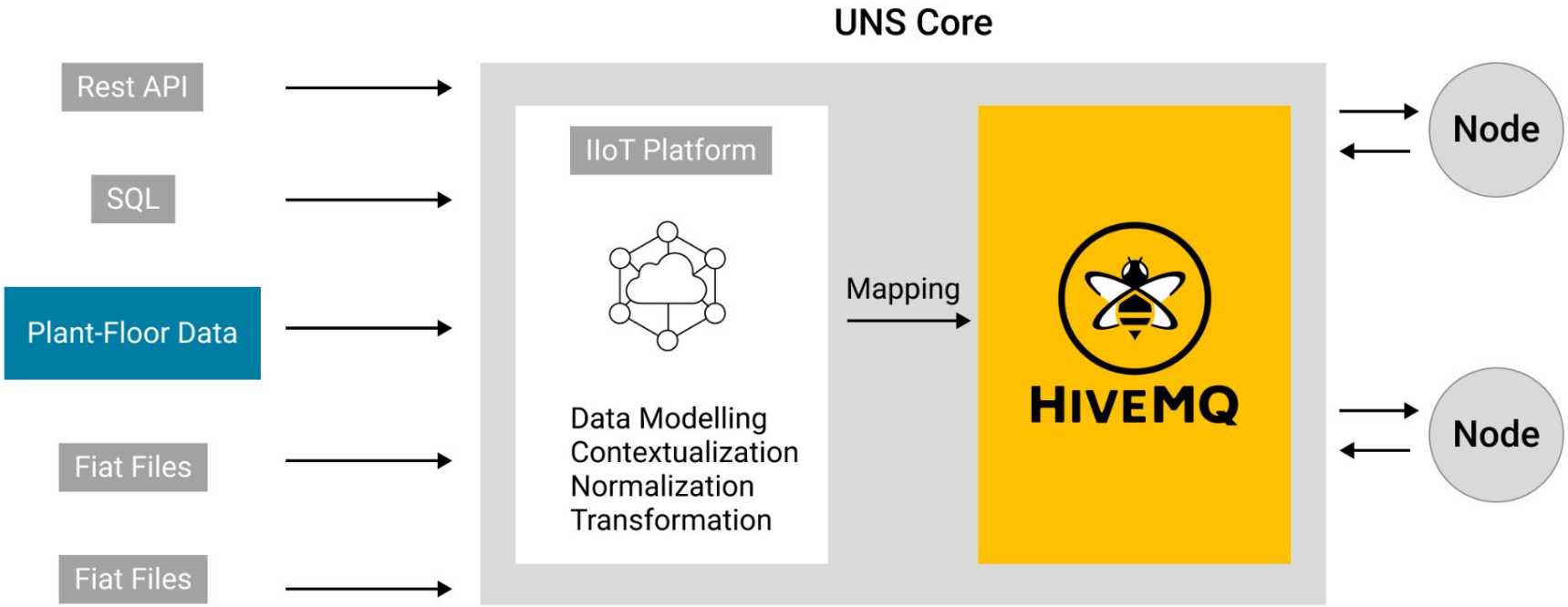


- Edge Driven
- Open Architecture
- Lightweight
- Report by Exception

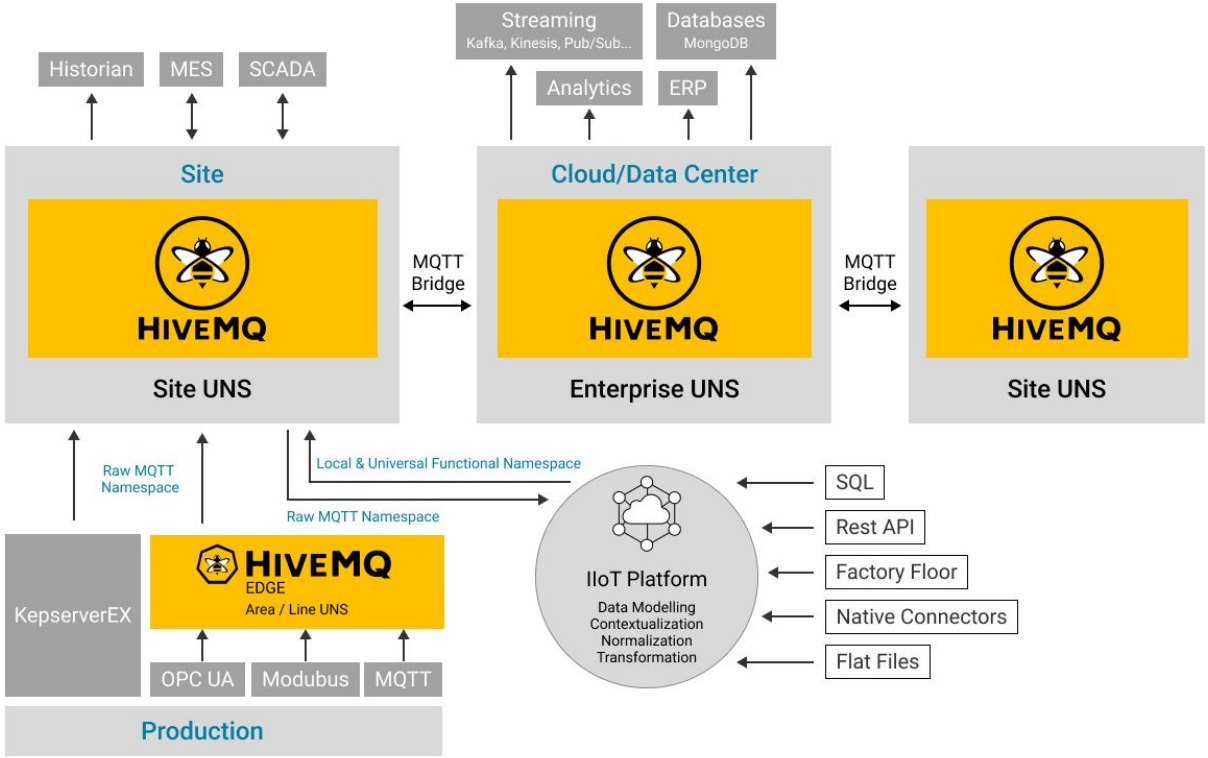
MQTT Protocol



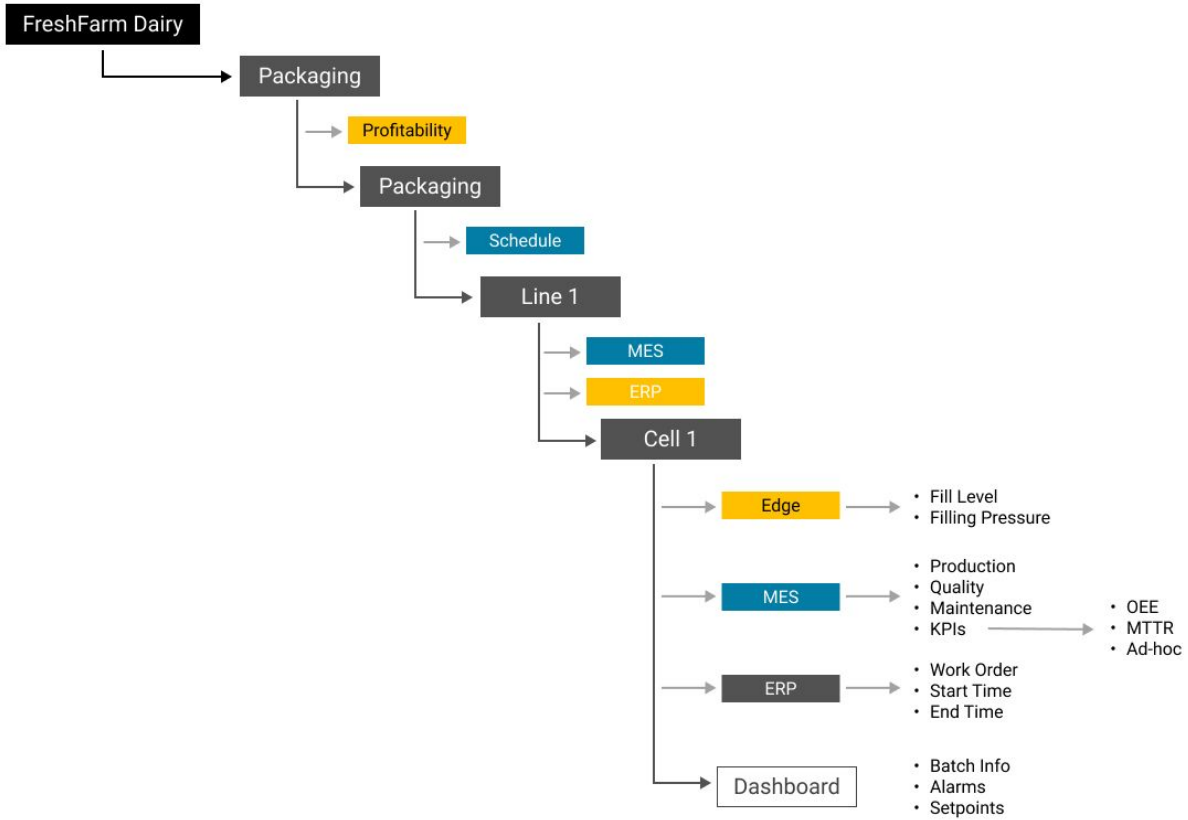
The Core of Unified Namespace



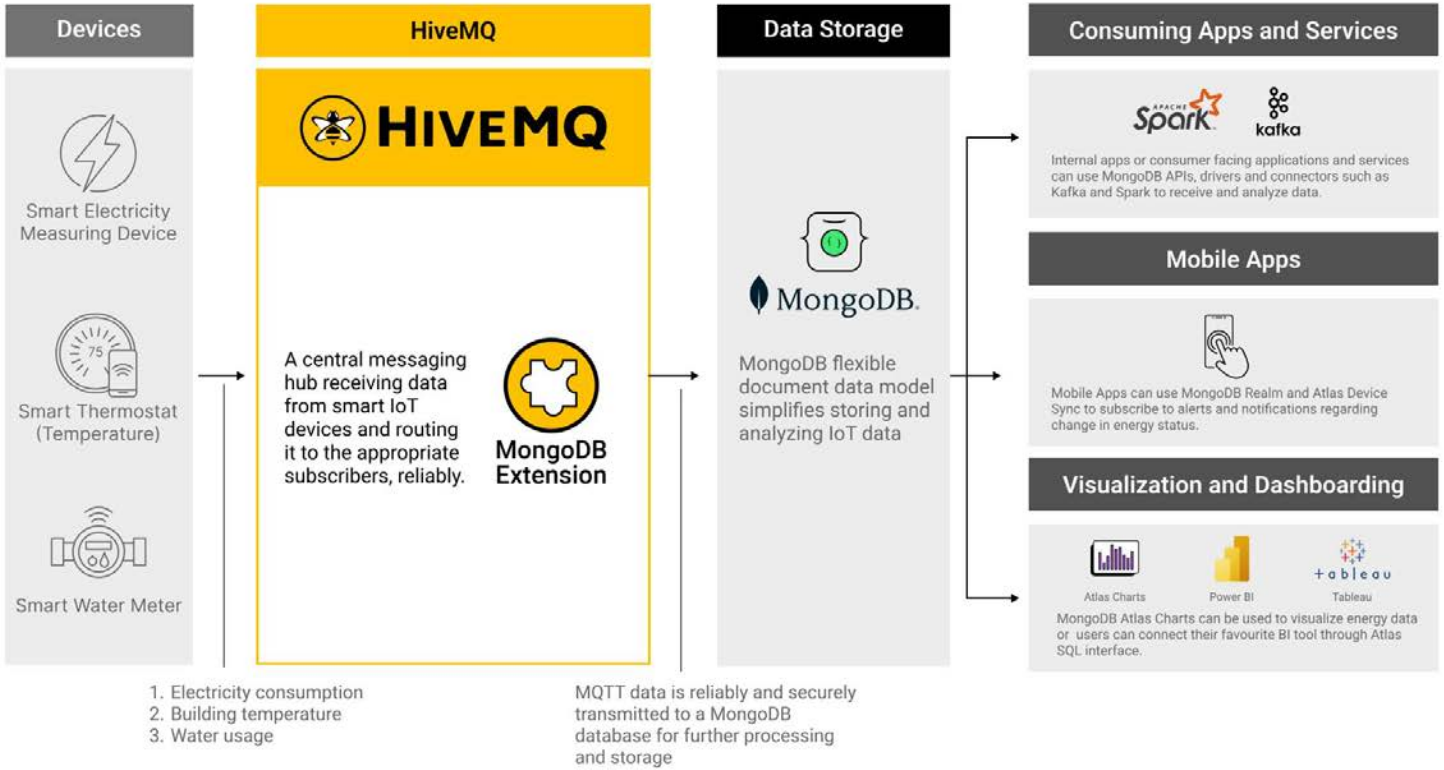
Unified Namespace Reference Model



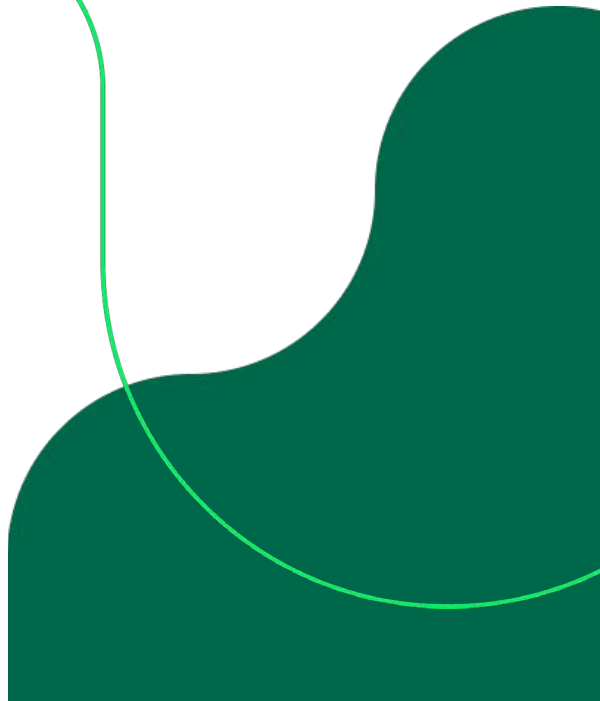
UNS Semantic Information Hierarchy



HiveMQ + MongoDB Integration



MongoDB Developer Data Platform



MongoDB

The data platform for modern applications and solution landscapes

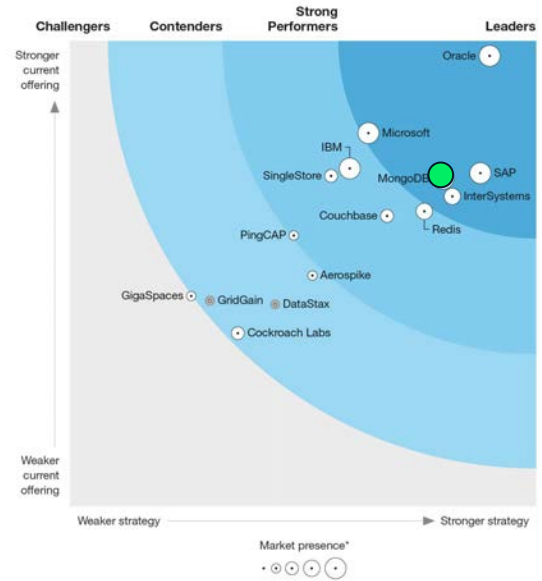
MongoDB is the general purpose, document-based, distributed data platform built for mission critical applications and the design of the multi-cloud era.

No data platform makes you more productive

43,000+ clients

5,000+ employees ~1k in engineering

130+ countries and fast growing



MongoDB named **a leader** in Forrester Wave™ Translytical Data Platform - Q4 2022

MongoDB for Manufacturing:
Driving Innovation from Factory to Customer

Smart Supply Chain

Customer:

Rebus Longbow Advantage, Inelo, GEP

Use Cases:

Track and Trace, Inventory Management, Logistics Optimization, Planning and Forecasting

Smart Factory

Customer:

Bosch, Toyota Material Handling, Dongwha, ArcelorMittal, Thermo Fisher

Use Cases:

Connected Equipment, Connected Workforce, IIoT Enabled Operations, Manufacturing Intelligence, Virtual Factories

Smart Commerce

Customer:

American Tire Distributors, Renault

Use Cases:

Customer 360, Product Catalogs, Inventory Management

Smart Products and Services

Customer:

Volvo, GE Healthcare, THL Digital, Vaillant, TFS, Cox Auto, EnBW, Noodoe, SHARE NOW

Use Cases:

Connected Products Digital Customer Services, Support and Maintenance Services, Fleet Management

MongoDB Atlas Developer Data Platform

MongoDB Atlas address a range of application use cases and removing complexity

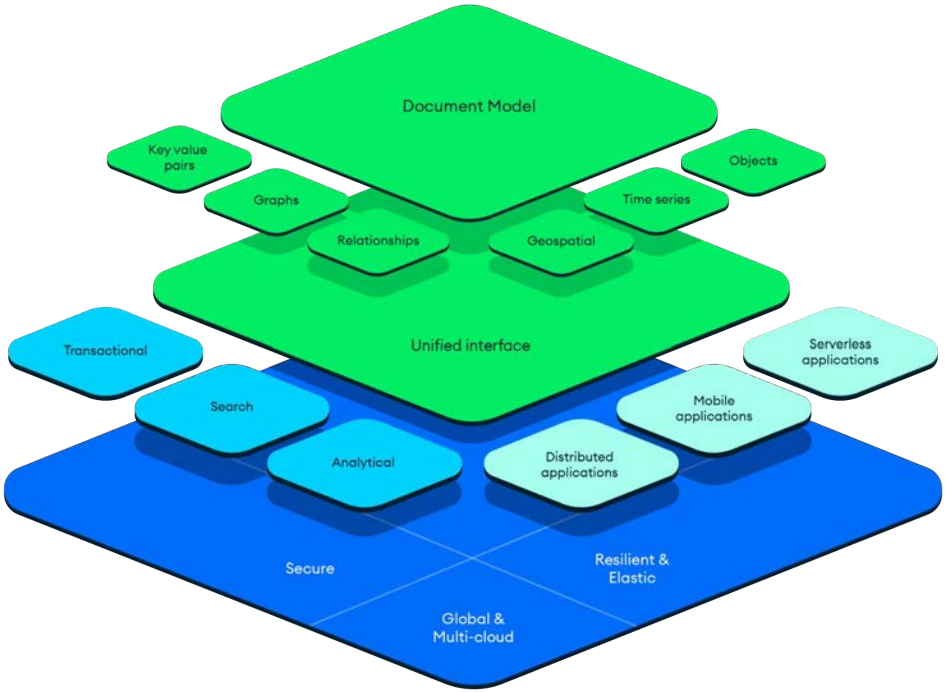
Data model that maps to how developers think/code; flexible while allowing data governance when needed

Strongly consistent, support for ACID transactions

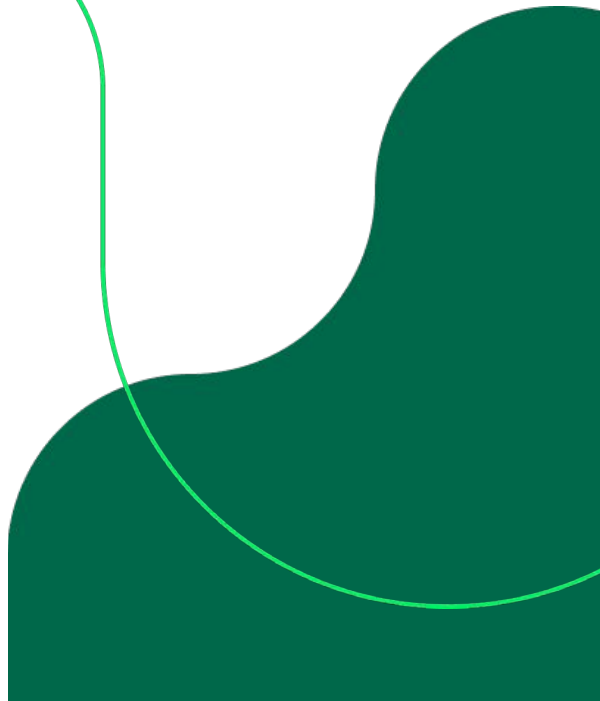
Able to support full-text search functionality for delivering a great user experience

Able to support data on mobile devices at the edge w/o having to manually sync data

Able to deliver real-time analytics on live data w/o having to move data back & forth



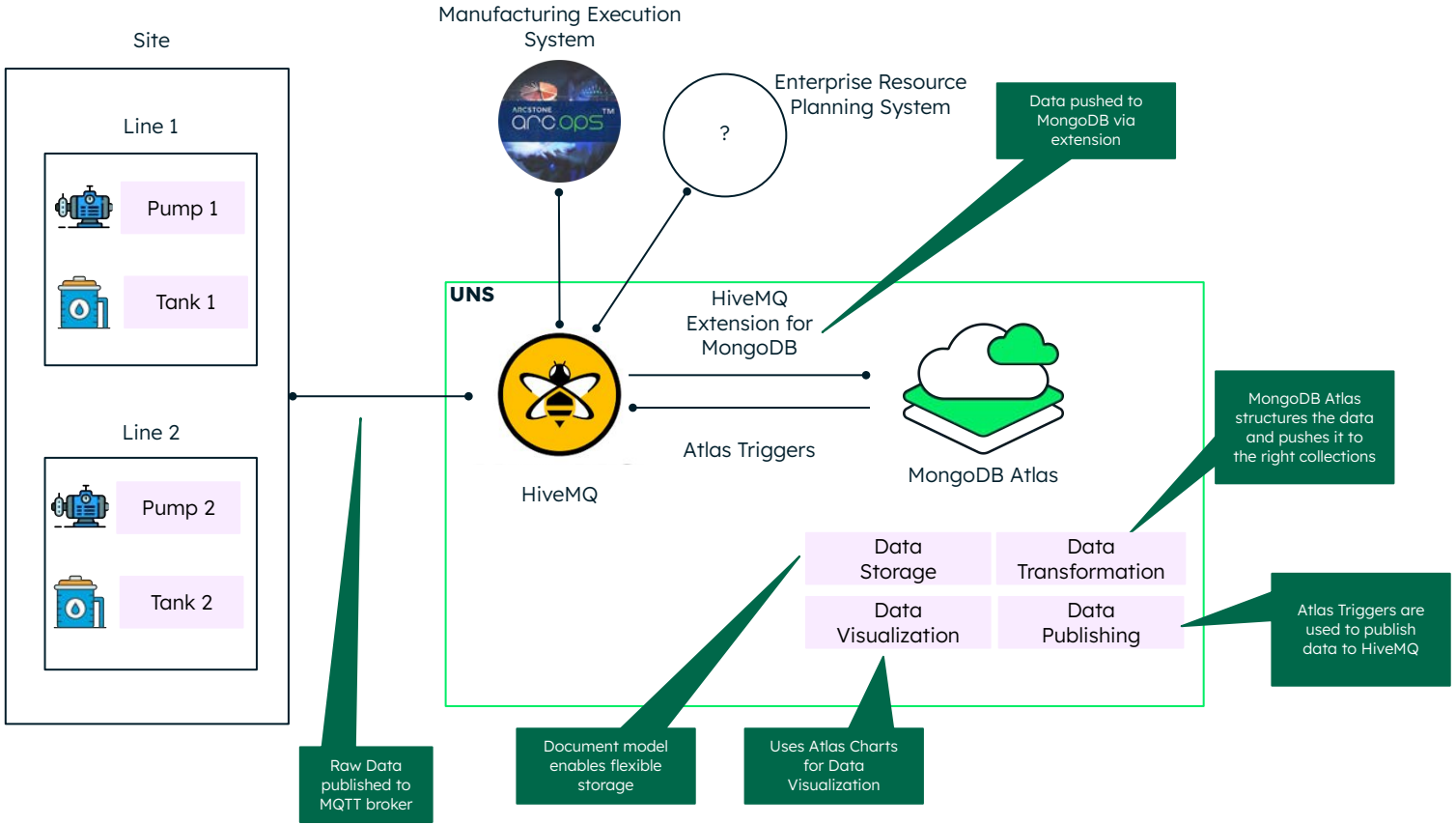
Building a Unified Namespace



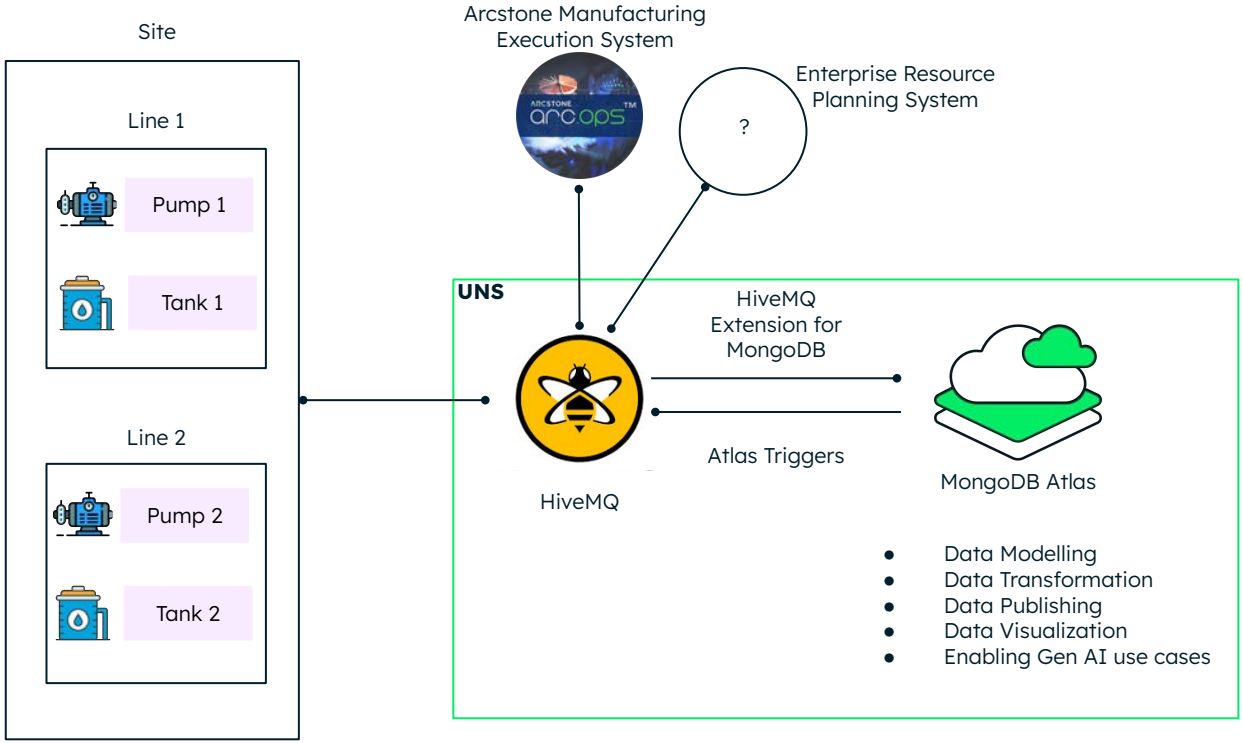
Requirements

1. Connectivity to data producers and consumers
2. Data modelling flexibility to represent data in ISA95 structure
3. Data transformation capability
4. Time series data historian

End to End Data Flow

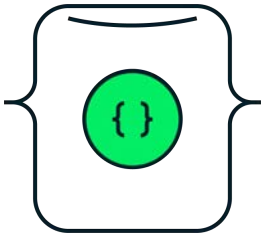


End to End Data Flow



- Document Model for flexible data storage
- Aggregation Framework for data transformation
- $graphlookup for data traversal
- Atlas Charts for data visualization
- Atlas Triggers to respond to events
- Atlas Vector Search for semantic search

MongoDB®



Document Model

Flexible

Scalable

Always On

Freedom to run anywhere

Documents Are Objects

Related data contained in a single, rich document

```
{
  "_id": ObjectId("765346574544354532"),
  "metadata": {
     "sensorId": "BAT001",
     "type": "temperature",
     "parent_equipment": ObjectId("12345678910102345678")
      },
  "temp": 3100,
  "unit": "C",
  "ts": ISODate("2021-05-18T00:00:00.000Z")
 }
```

```
{
  "_id": ObjectId("6169c74f54bb7b97fb104530"),
  "equipment_id": "MA002",
  "alert_type": "Emergency Shutdown",
  "alert_description": "Shut down due to critical failure",
  "ts": ISODate("2022-03-23T16:45:00.000Z")
}
```

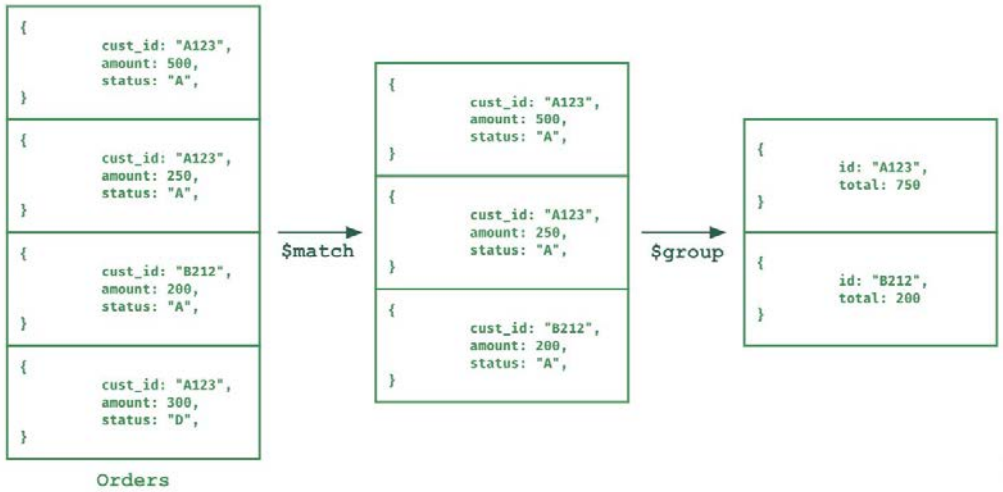
Aggregations

Advanced data processing pipeline for transformations and analytics

Multiple stages

Similar to a unix pipe
- Construct modular, composable processing pipelines

Rich Expressions



Example Aggregation Command on the Orders Collection:

$match stage
$group stage

```
db.orders.aggregate( [
     {$match: { status: "A" } },
       {$group: { _id: "$cust_id", total: { $sum: "$amount" } } }
] )
```

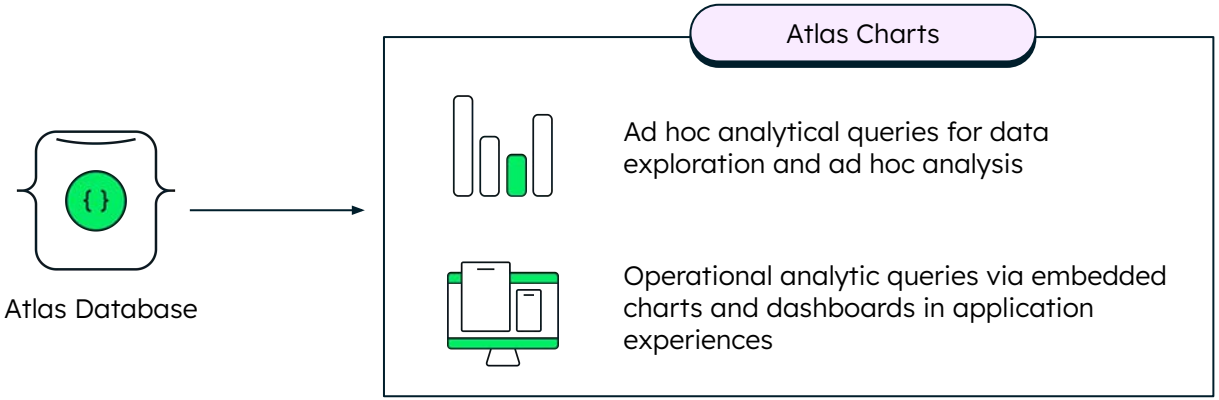
Atlas Charts: real time data visualizations

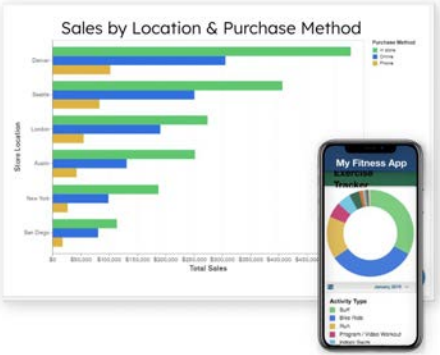
Made for JSON

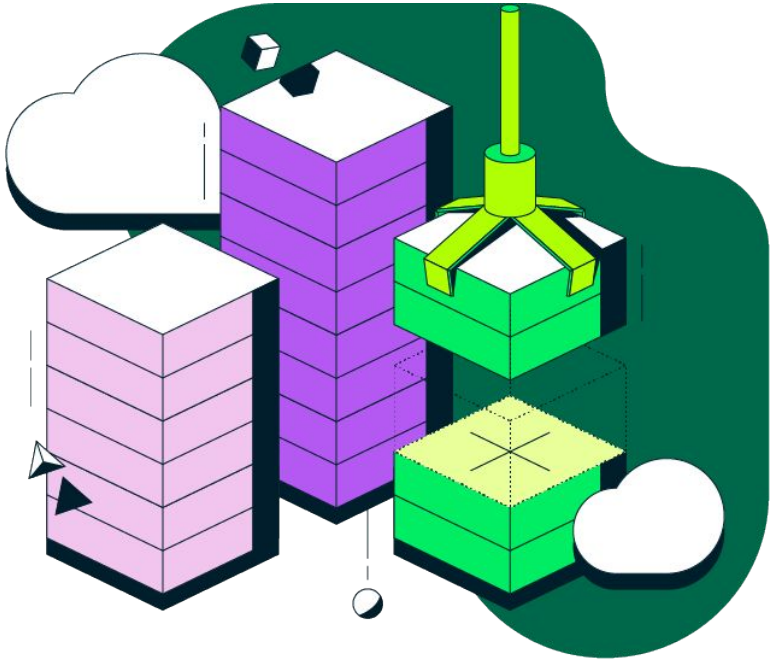
Integrated with Atlas

Embed via iFrame or SDK

Built for collaboration



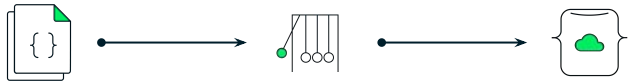




Atlas Triggers

Execute serverless **application and database logic** in response to events or on a predefined schedule with Triggers –

- **Database Triggers**: Respond to document inserts, changes, or deletions
- **Scheduled Triggers**: Execute functions according to a predefined schedule (e.g. every x hours, days, weeks)



1) A document is added, updated, or removed

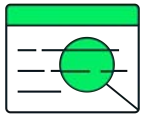
2) The trigger fires its linked serverless function with the change event

3) Data transformation is stored in Atlas or pushed to third party services

PUBLIC PREVIEW

Atlas Vector Search

Store vector embeddings right next to your source data and metadata. Vectors inserted or updated in the database are automatically synchronized to the vector index



Query the database and Vector Search via the unified MongoDB Query API, providing developers with a consistent experience

Remove operational heavy lifting with the battle tested, fully managed Atlas platform

Leveraging Power of Atlas Vector Search for Root Cause Diagnostics

"Why did the **pump failure** happen on my pump during Job_001?"

"Pump failure during Job_001 on your pump machine likely occurred due to high vibrations and worn bearings."

RAG

No context prompt

Proprietary Data → **With Context Prompt**

LLM

Specific, well informed answer

Collections in Atlas

- Job Information ..... Collection
- Failure Logs ..... Collection
- Pump/ Sensor Data ..... Collection
- Technical Manuals ..... [0.713, 0.453 ...]
- Pump Sounds ..... [0.124, 0.321 ...]

Flexibly adapt to rapidly changing manufacturing data

Giant brain of general knowledge

Demo

Any Questions?

Resources

- MQTT Essentials – The Ultimate Guide to MQTT for Beginners and Experts
- Unified Namespace Essentials (UNS)
- Real-Time Energy Monitoring for Smart Buildings with MongoDB and HiveMQ
- Building an Industrial Unified Namespace Architecture with MongoDB and Arcstone
- MongoDB for Manufacturing
- MongoDB Atlas for Industries

Try HiveMQ

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HIVEMQ

Evaluate for Free

Try MongoDB Atlas

Sign-up for Free Cluster

Thank you