From Sensors to Insights: How IoT is Transforming Fundamental Industries

Kyle Seaman, Sentenai

Digital Transformation

Digital Transformation

Analog→Digital→Data→Information→Transformation

Aaron Levie

@levie

Following

Digital transformation is ultimately about getting closer to the value proposition any customer wants: solving a problem better than before, with greater convenience, at a lower price. Any digital strategy that doesn't advance this is just distraction.

11:48 PM - 25 Sep 2018

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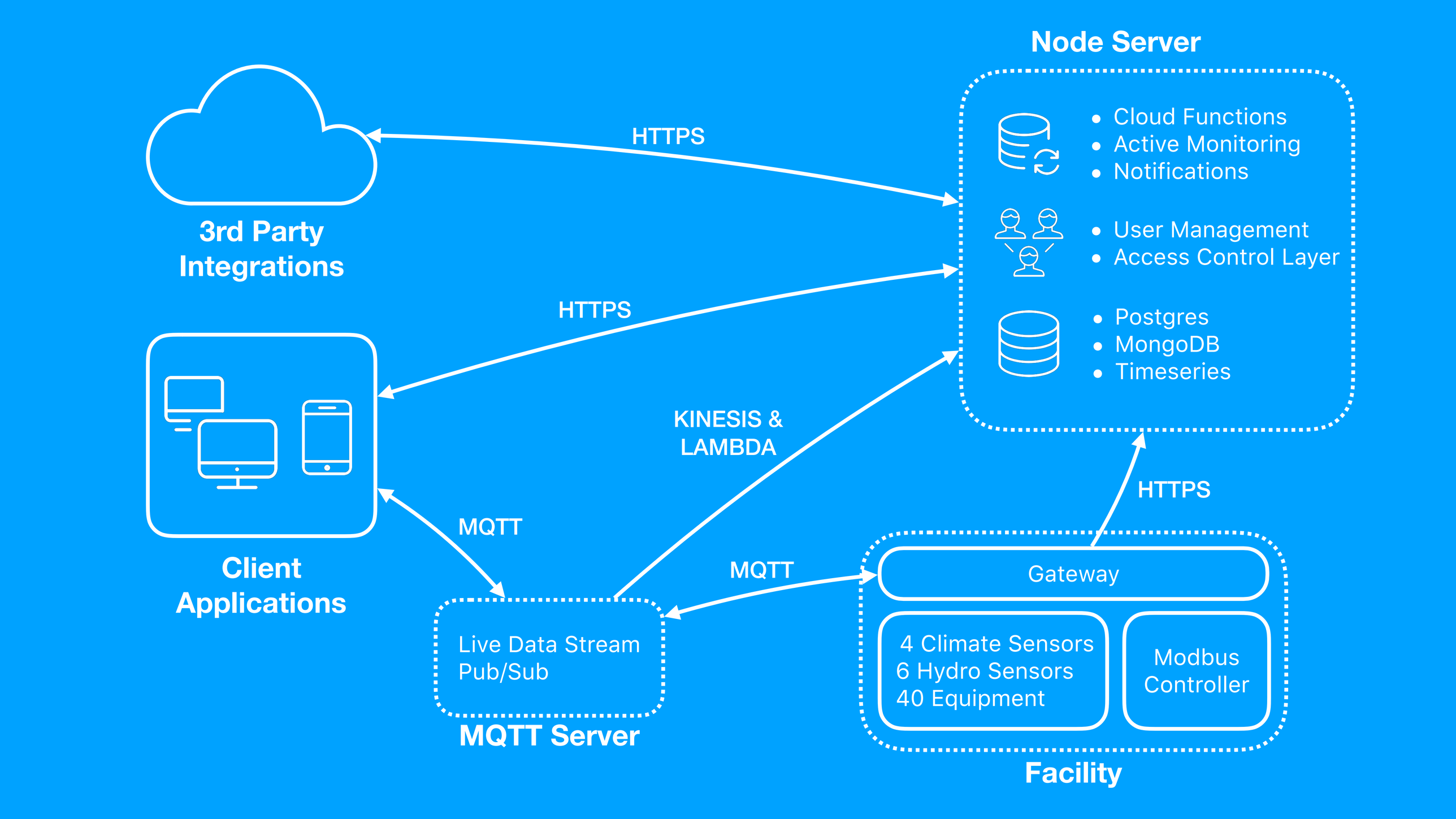
Internet of Things

Impact on Digitization

- Adding new context across the enterprise
- Completing the loop from real-time data to taking action


Node Server
Cloud Functions
Active Monitoring
Notifications
User Management
Access Control Layer
Postgres
MongoDB
Timeseries
3rd Party Integrations
HTTPS
HTTPS
KINESIS & LAMBDA
Client Applications
MQTT
MQTT
HTTPS
Live Data Stream Pub/Sub
MQTT Server
Gateway
4 Climate Sensors
6 Hydro Sensors
40 Equipment
Modbus Controller
Facility

Digitization

IoT infrastructure is generalized up to the point that data is interpreted

Digitization

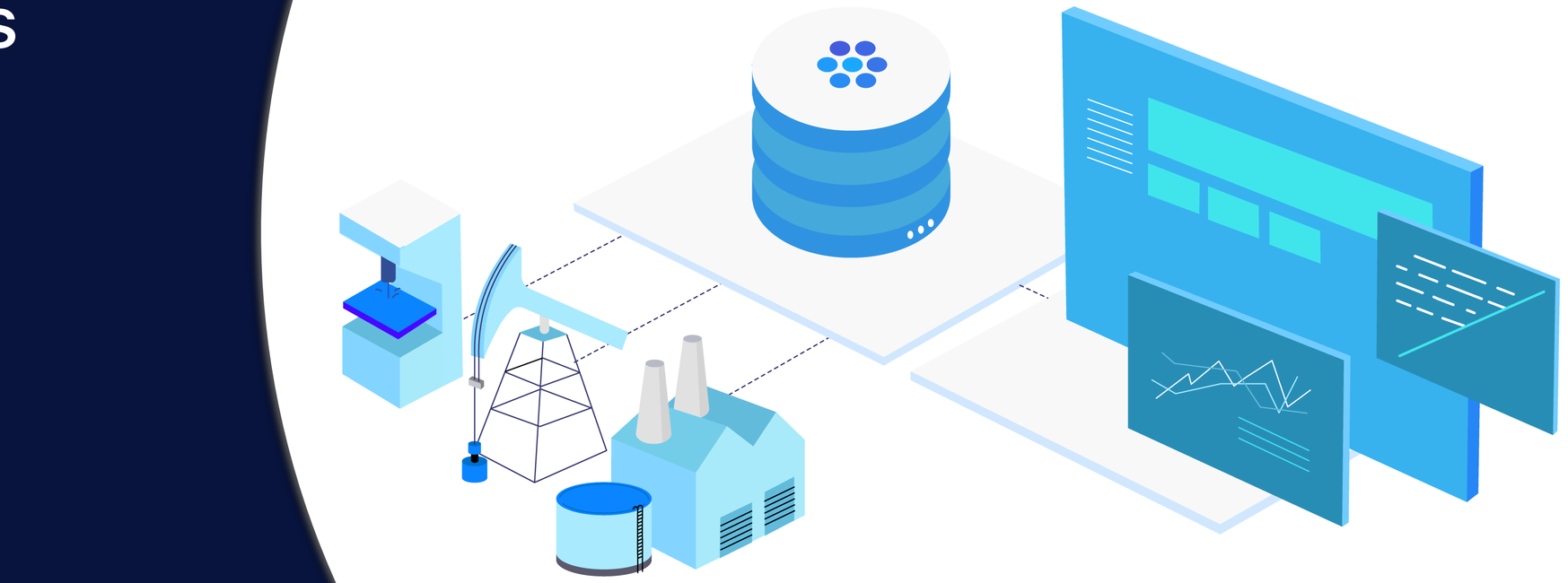
Enterprise Data

Continuously generated data that provides a pulse of your company

Digitization

Enterprise Data

- Maintenance Logs
- Historians
- CRMs
- ERPs
- Excel Files



Digitization

Uniqueness of Time Series Data

- Write once
- Non-Transactional
- Rarely Deleted
- Non-Relational

Digitization

Uniqueness of Time Series Data

- Uneven Intervals
- Different Event Sizes and Formats
- Unique Access Patterns

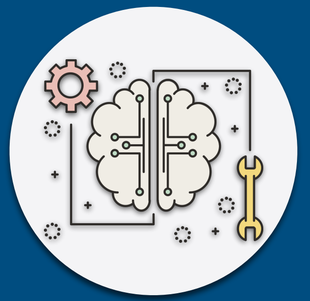
Digitization

Core Applications

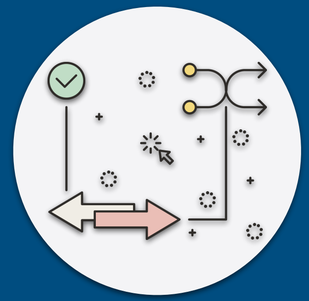
Advanced Reporting

Anomaly Classification

Exploratory Analysis



Condition Based Maintenance



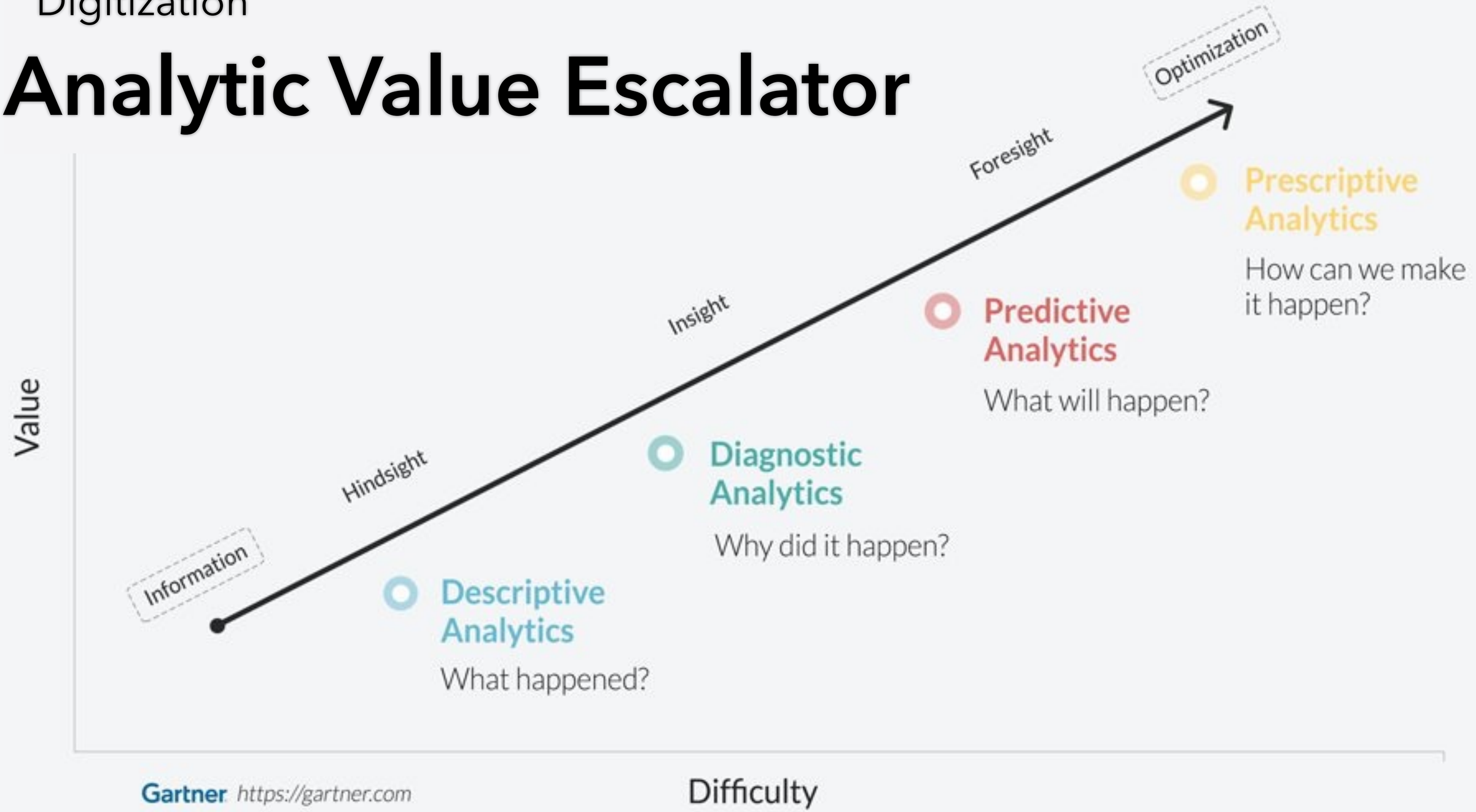
Continuous Optimization

Trends

- Adjusting to Aging Workforce Realities - Codifying Domain Knowledge
- Enabling Global Scale of Best Practices - Getting full context in near real-time and sharing broadly

Digitization

Analytic Value Escalator



Digitization

Use Cases

creating a network

instrumenting existing environments

data mining

FREIGHT
FARMS

Freight Farms

LGM

INPUT

125 kWh / day
Electricity

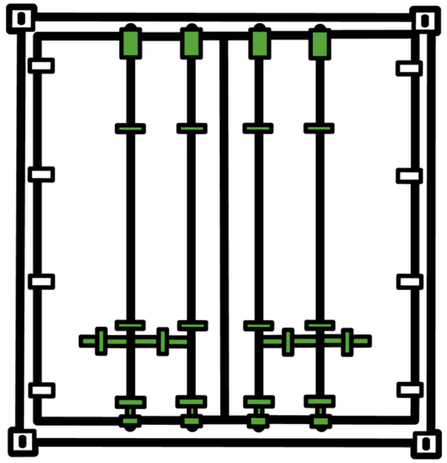
5 gal / day
Water

$300 / month
Nutrients

15-20 hrs / week
Labor

365 day
Season extension

R-16
Insulation



50-80°F
Internal temperature

7,424 PPF
LED array

500 Full Head /week
1,000 Mini Head /week
Lettuce

or

60-100 lbs /week
Hearty Greens

or

35-80 lbs /week
Herbs

OUTPUT

Freight Farms

LGM

Lights
168 LED
Red & Blue
Strips

Hydro
Nutrient
Dosers

Air
Circulation &
Cooling

Hydro
Drip Irrigation

Entertainment
Wireless
Speakers

Automated Environment

Climate Sensors

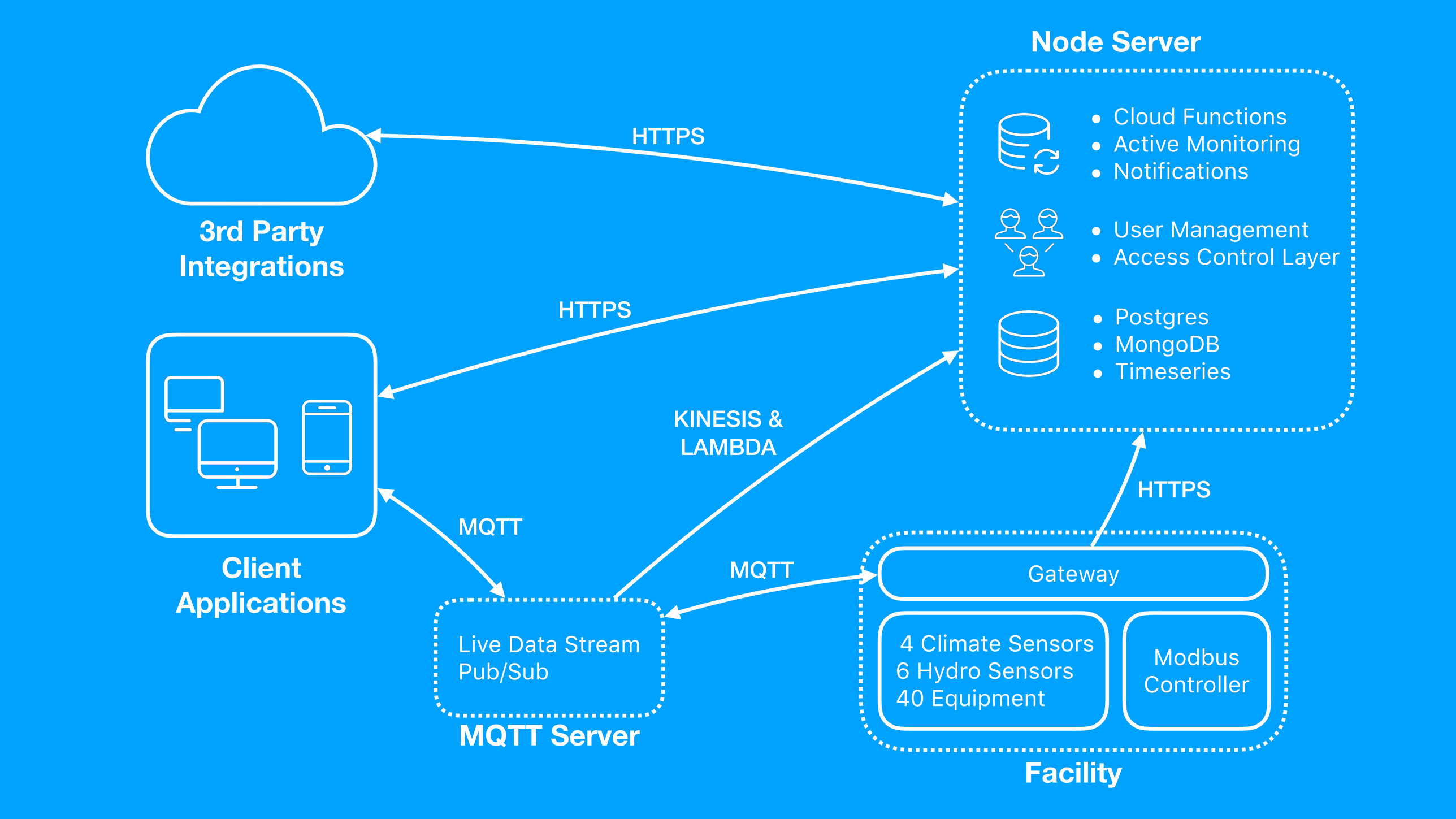
- CO2
- Humidity
- Air Temp

2X Hydro Sensors

- pH
- Electro Conductivity
- Water Temp

Continuous Sensing

Sprint
1:40 PM
64%
HQ Farm
updated at 1:39 PM
Camera
Controls
Air Indoors
61.6°
61.7%
1754.0ppm
Main Tank
61.5°
5.96
1774.0µS/cm²
Connect
Track
Shop
Settings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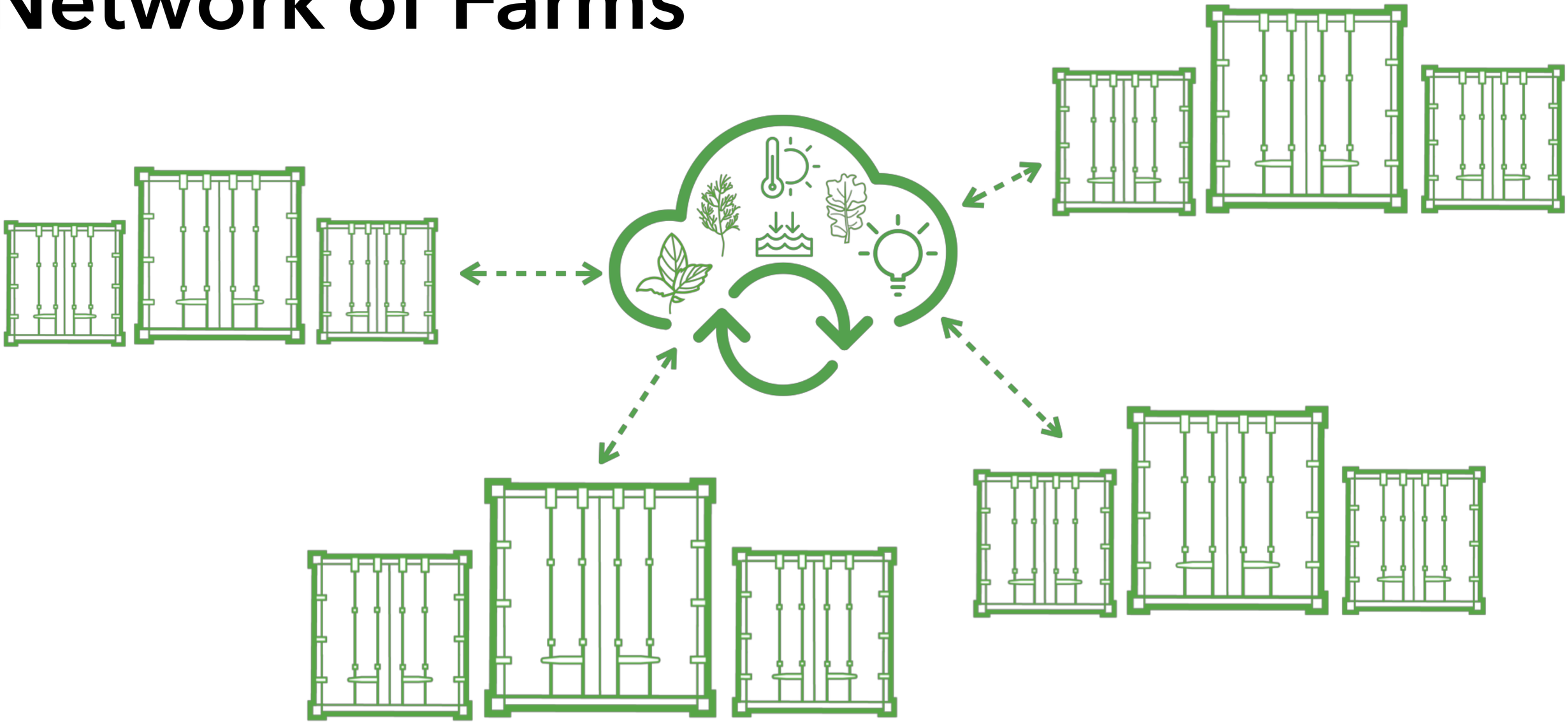
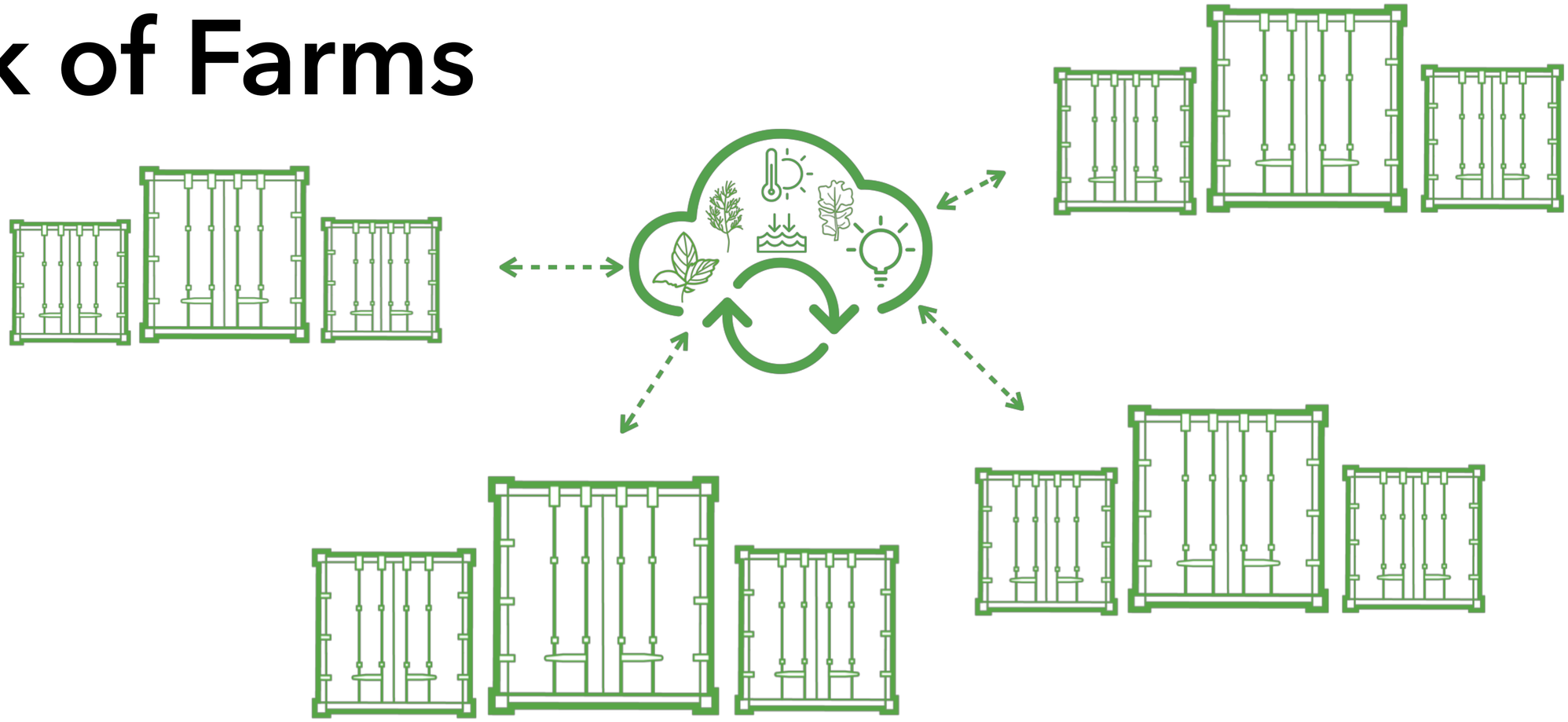
Use Case

Network of Farms



Use Case

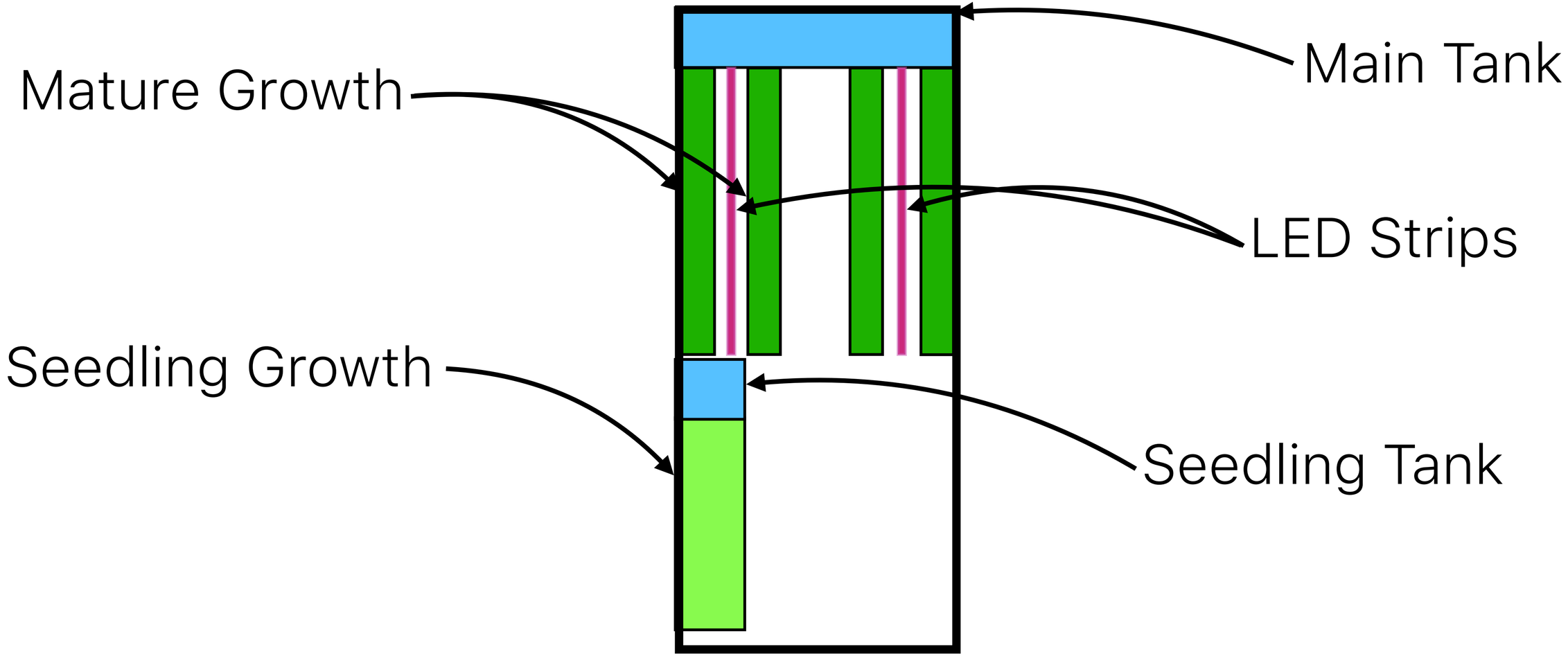
Network of Farms



Recipe & Climate Optimization
Usage Analytics
Product Development & Validation

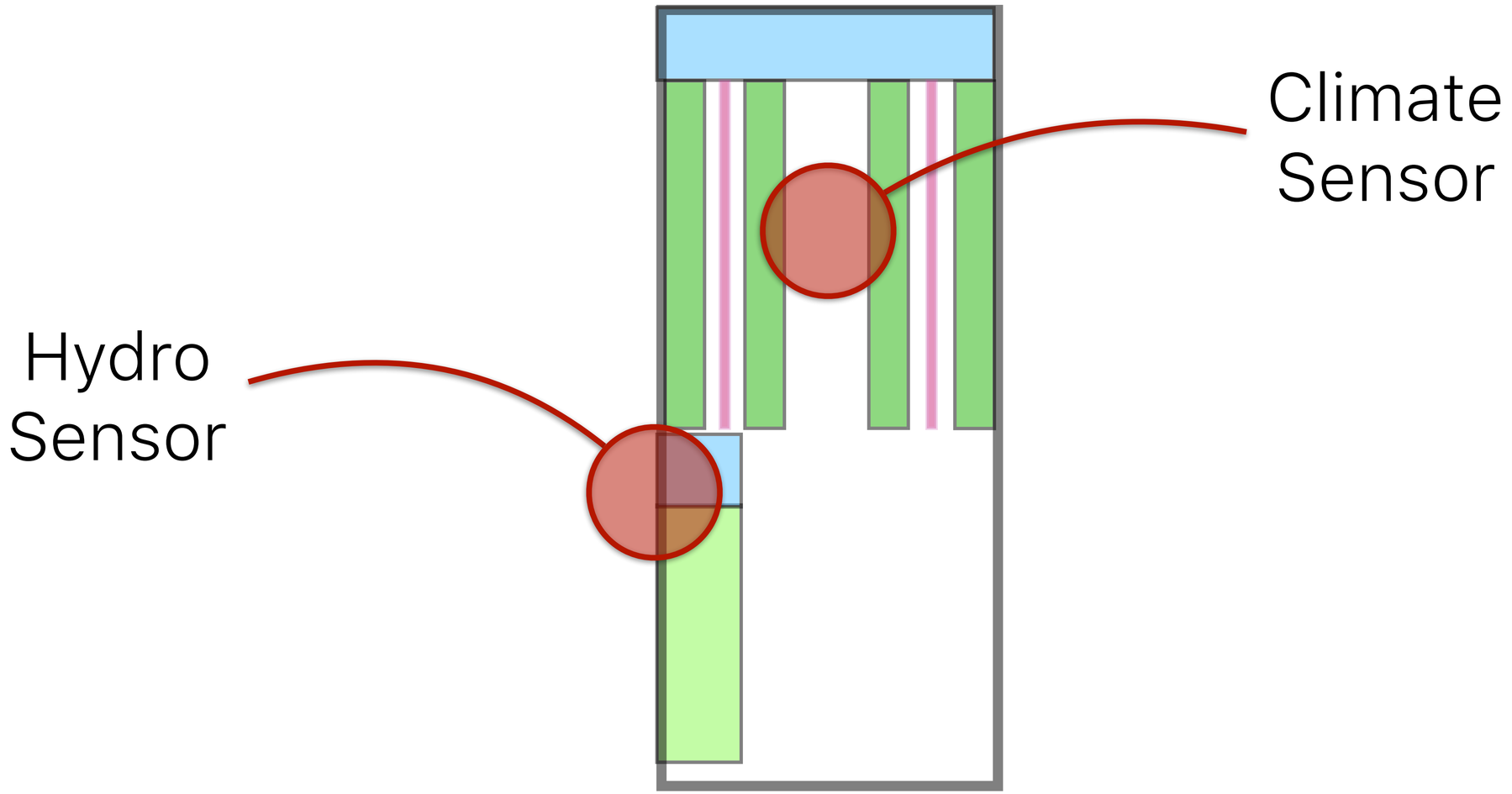
Use Case

Increasing Sensor Coverage



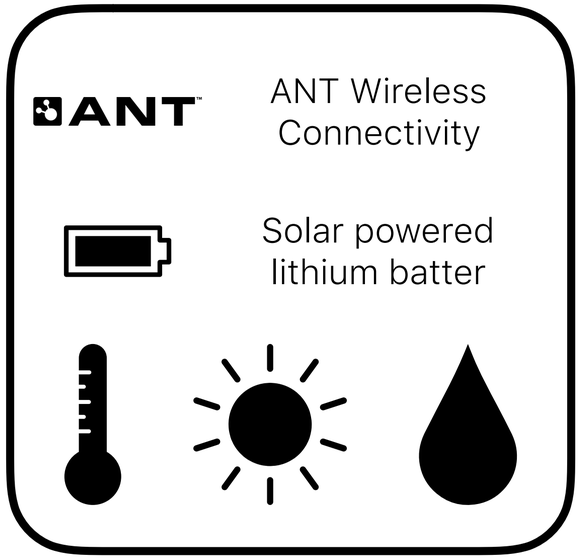
Use Case

Increasing Sensor Coverage



Use Case

Increasing Sensor Coverage

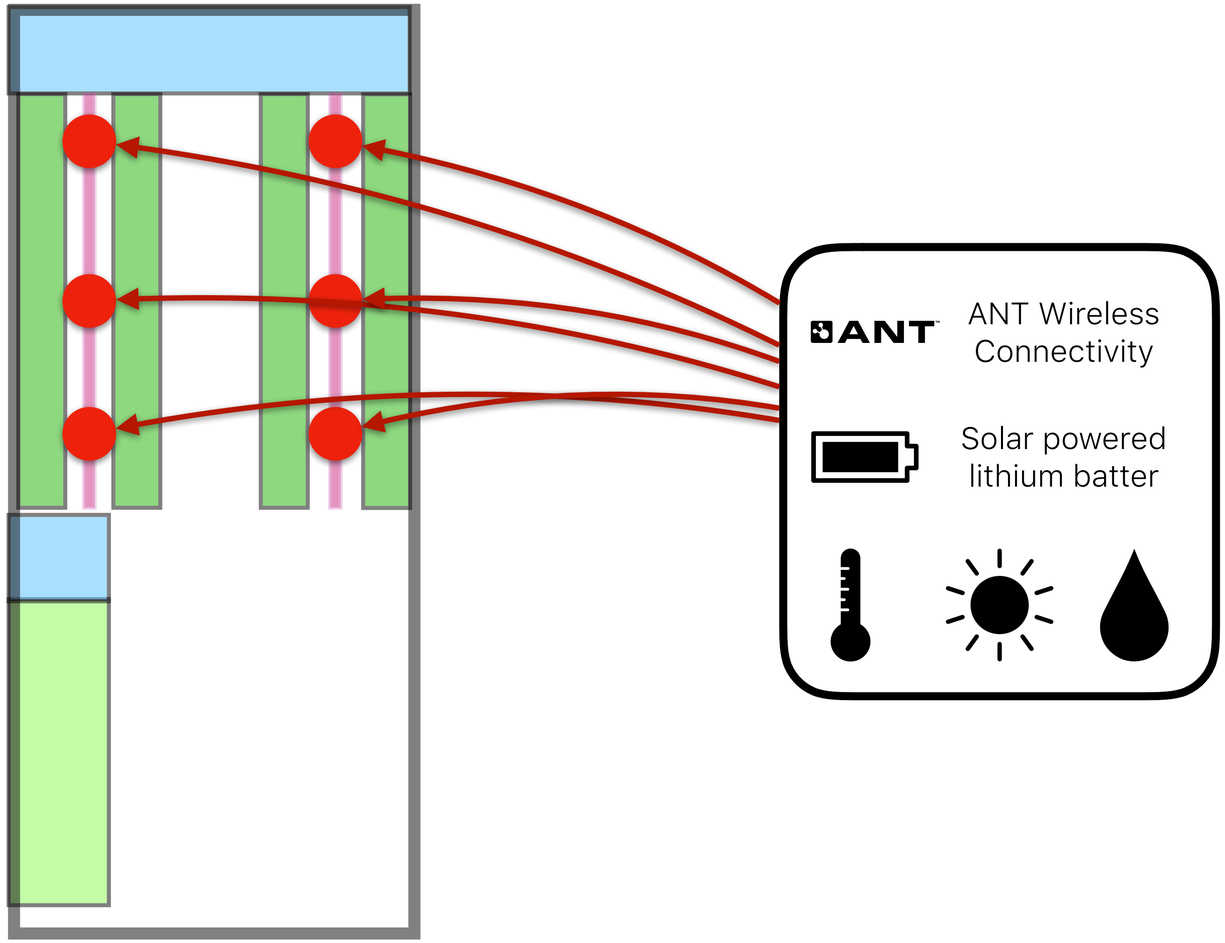


- Edge Data Collection via Gateway
- Sensor decided when to send data
- Small battery with solar power harvester
- Support for 4 sensor inputs

Use Case

Increasing Sensor Coverage

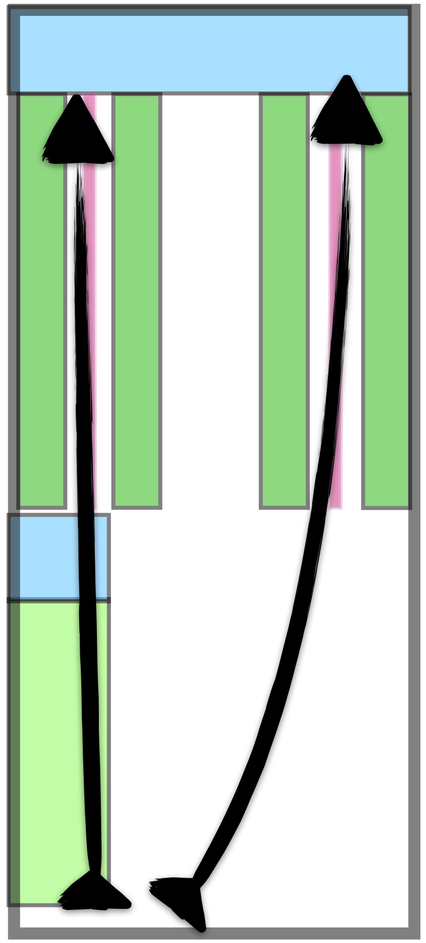
Higher Resolution
of Climate Data



Use Case

Increasing Sensor Coverage

Sensor fusion to
map air flow



FREIGHT
FARMS

TruLeaf
Farming. Anywhere.®

Digitization
High Value Crops

Cannabis Digitization

Connected Operations

Gateway to read & write all PLCs via modbus

Automatic monitoring and remote access

Cannabis Digitization

Expanded Sensing

Digitization

Oil & Gas

Oil & Gas Digitization

Characteristics

- Not a lot of actual failures
- Time drift across systems
- Proprietary production data
- Few equipment variants
- Decades of Operational Data

Digitization

Data Mining

Build Equipment Profiles from Historic Data
Modeling SME Behavior
Actuarial Data Modeling

Digitization

Traditional Ag

Traditional Farming

Characteristics

- Low Bandwidth and Cellular Requirements
- Cost Sensitive
- Highly Variable Across Locations
- Slow Reaction to Inputs & Adjustments

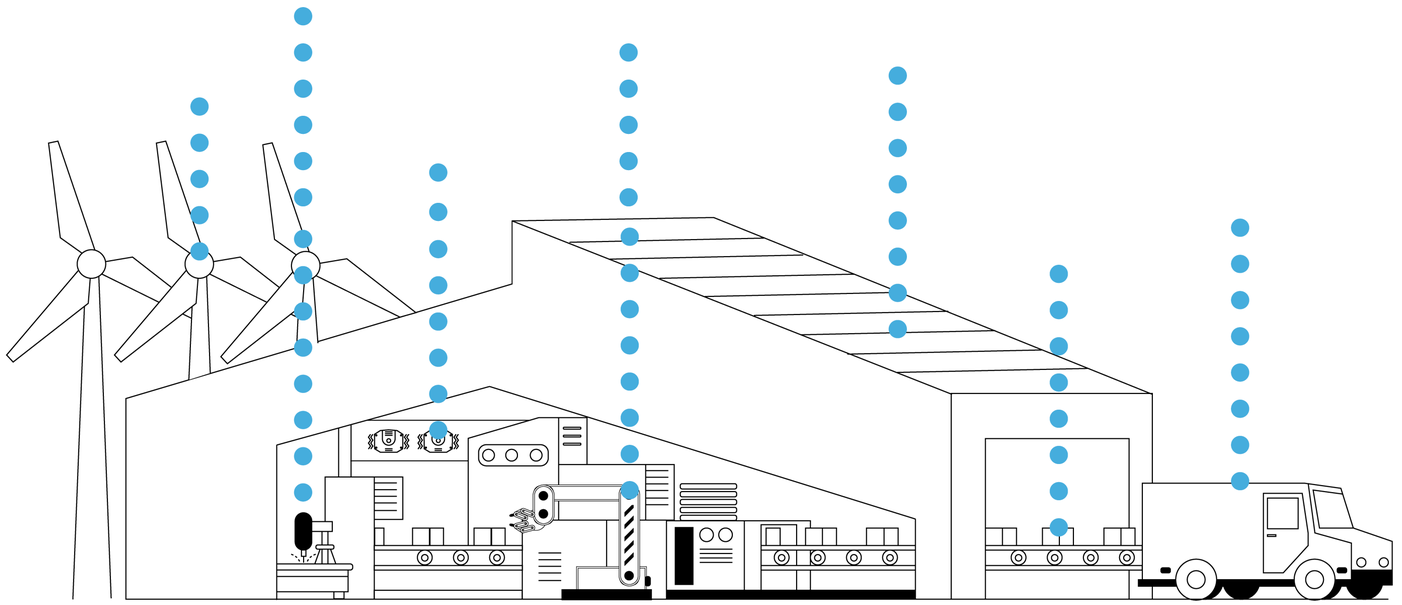
Traditional Farming

Opportunities

- Mesh Networking Devices
- Tractor Data Harvester
- Data Share Co-ops
- Using Predictions To Smooth Operations

Digitization

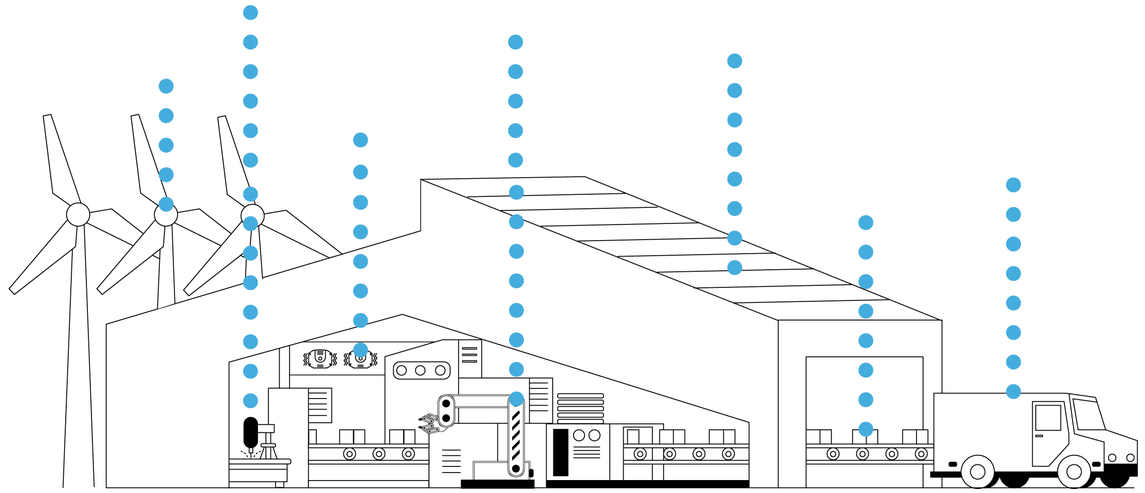
Finding ROI



Finding ROI

Business Model & Operations

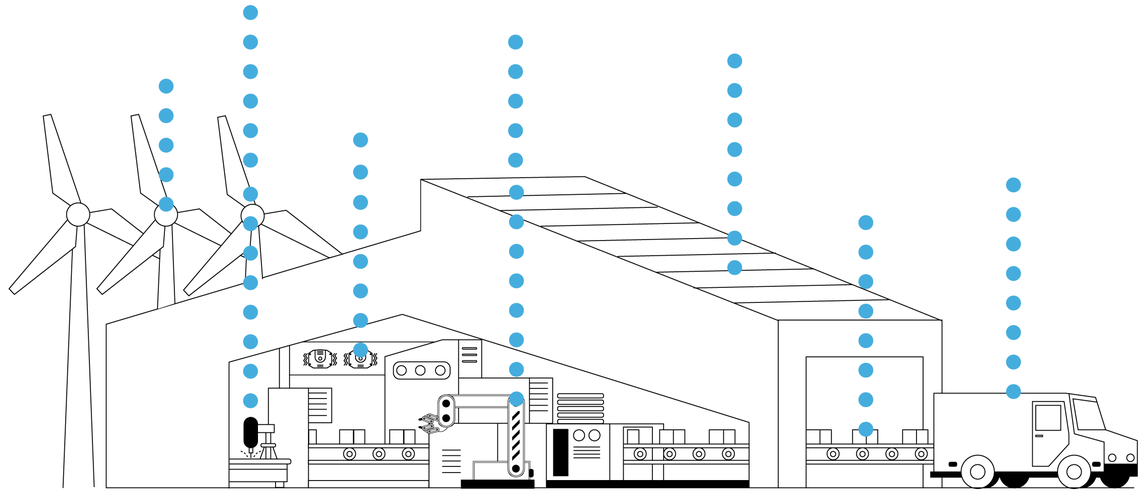
- Bottom line via reduced service costs & Opex
- Top line with higher value add contracts



Finding ROI

Customer Experience

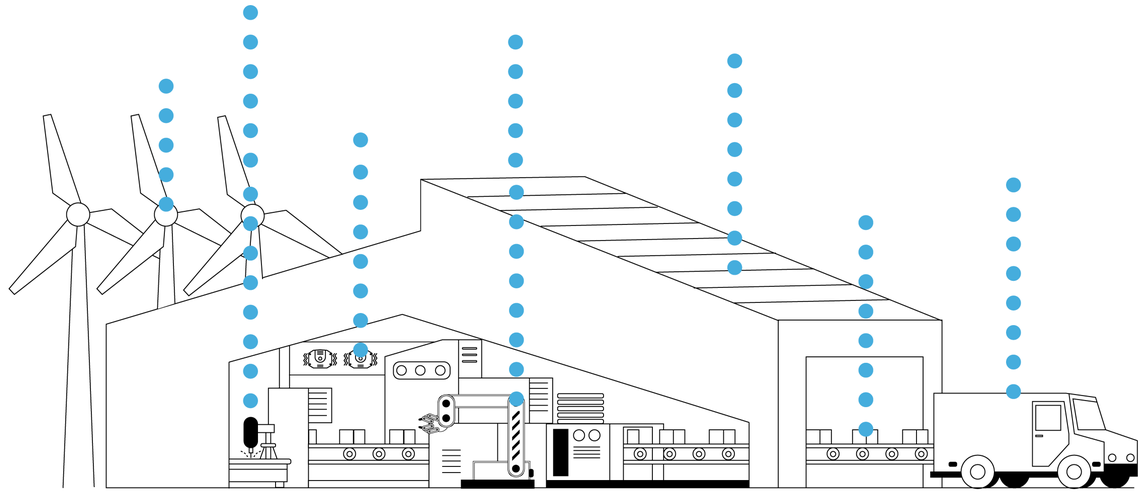
- Physical product analytics to indicate usage and failures
- Mass personalization for experience and support



Finding ROI

Product Innovation

- Analytics to drive and validate product decisions
- Continuous improvements and differentiation

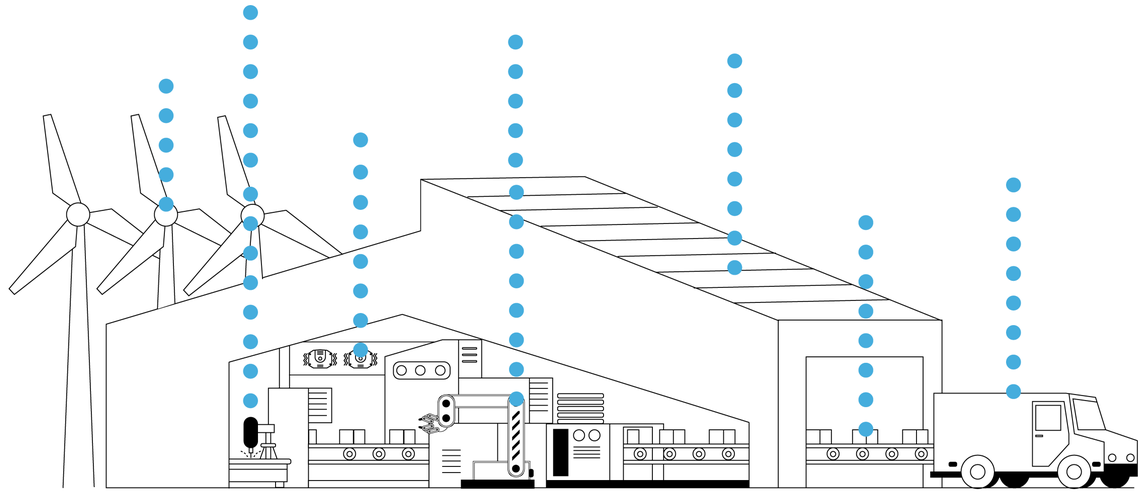


Digitization

Finding ROI

Finding Data Multipliers

Future Proofing with Data Collection Today



Not all data is created equal

Not all data is created equal

```
ROI = (Failure – (Data Acquisition + Storage + Processing)) * Instances
```

Digitization

Where things are going

Laying the ground work for ML/AI driven applications

Increased sensing capabilities with flexible deployments

Moving to recurring/subscription business models

Thank you