# LEVERAGING CLOUD SERVICES TO GET MORE FROM YOUR CYGNET DATA

**Kevin Rowley**
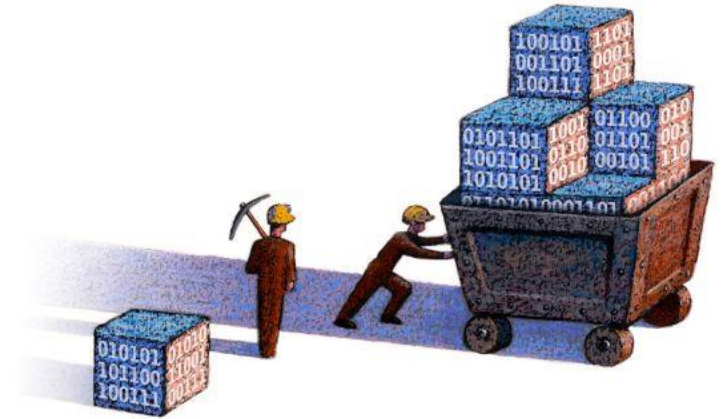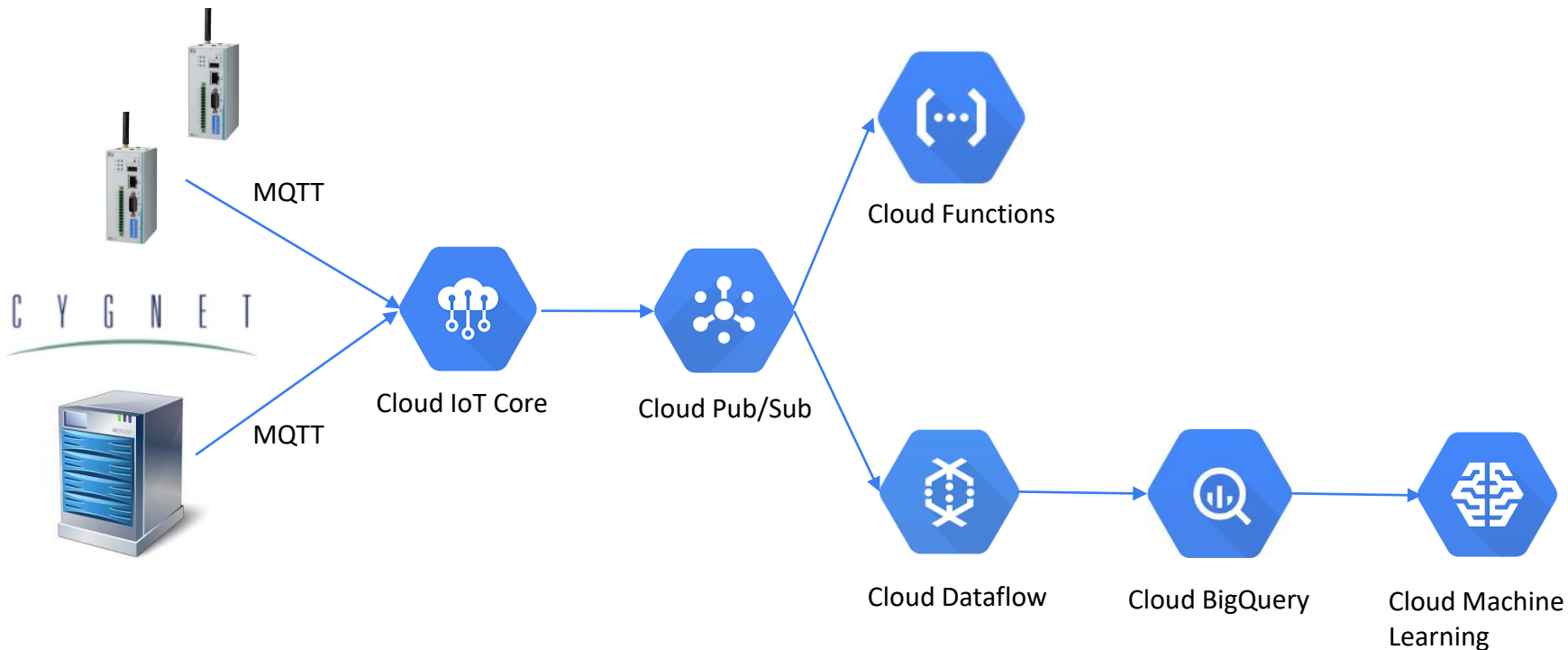Product Line R&D Director

November 5-6, 2018

# Data is Valuable

## Today's Challenge:

*How do you fully exploit the value of your Data?*

# TODAY'S DEMOS



Google Cloud Platform Services

# What do we mean by Serverless Computing?

**Serverless Computing**

- Compute

- IoT

- Messaging

- Database

- Data processing

- Machine Learning

- Analytics

- Allows you to create and run software applications without worrying about provisioning and managing servers.

- Benefits include:

  – Flexible scaling

  – Built-in high availability and fault tolerance

  – No server or hardware management

  – Focus on your application logic

  – Built-in security & access control (ISO 27001 compliant)

  – Pay for usage model

# CYGNET INTEGRATION WITH CLOUD IOT HUBS

- With the new IoT Gateway capability, CygNet® SCADA hosts and the new ForeSite® Edge device can now be easily integrated with key Cloud IoT Service providers, such as:
  - Amazon AWS
  - Google GCP
  - Microsoft Azure

- Please attend the following 2 breakouts for further details on MQTT and Edge:
  - CygNet IoT Enablement and MQTT Support
  - CygNet IIoT: Collect, Manage and Distribute at the Edge
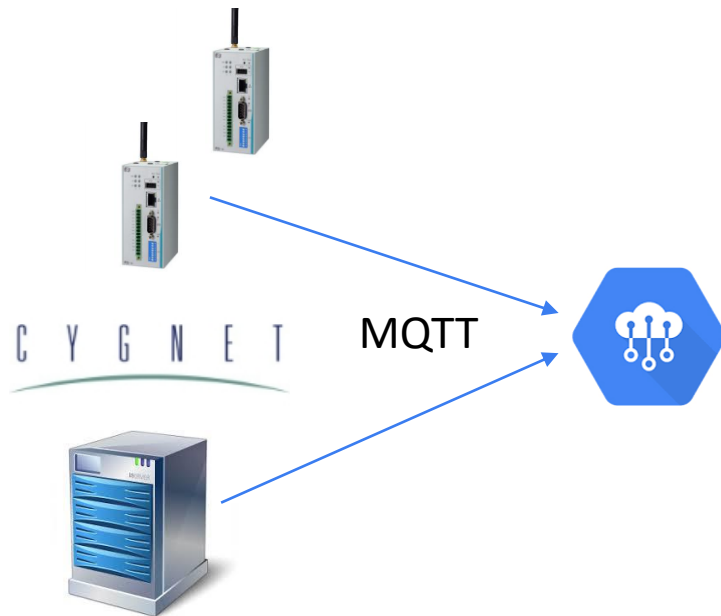
MQTT

# IOT DEVICE INTEGRATION: CLOUD IOT CORE

- Fully Managed Service
- Connect and ingest data from devices.
- MQTT or HTTP protocol support
  - MQTT: listens to port mqtt.googleapis.com:8883
    - TLS transport;   requires JWT to connect securely.
- End-to-end security with *asymmetric key authentication* and *encryption*.
- Routes all device messages to Cloud Pub/Sub for consumption downstream.
- Amazon, Microsoft comparables:
  - AWS IoT
  - Azure IoT

# MESSAGING WITH CLOUD PUB/SUB
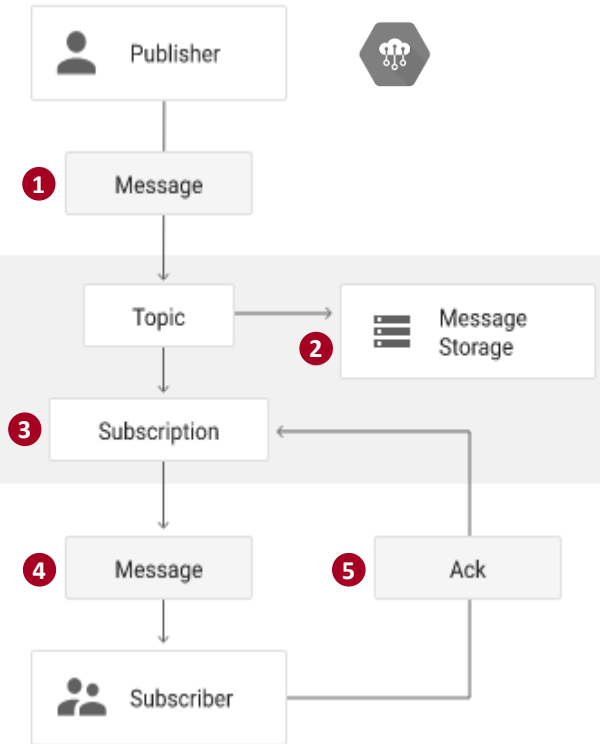


- Global Messaging Service
  – Connect services anywhere in world
- Publishers send messages to a *topic*
- Subscribers receive messages from *topic*
- Data security: encryption on wire and at rest.

- Amazon, Microsoft comparables:
  – AWS Kinesis
  – Azure Service Bus

# Cloud IOT Core and Cloud Pub/Sub demo

# CLOUD FUNCTIONS

Emit events

Writes back

Cloud Services

Invokes other services

Cloud Functions
Responds to events

Other APIs

- Simplest way to run your code in cloud
- Code runs in response to event trigger
- In this demo, the event is a PubSub message originating from IoT device.
- Good for real-time stream processing
- Pay only when function is executed
- JavaScript or Python

- Amazon, Microsoft comparables:
  – AWS Lambda
  – Azure Functions

# CLOUD FUNCTION JAVASCRIPT EXAMPLE

```javascript
/**
 * Cloud Function to be triggered by Pub/Sub.
 * This function is exported by index.js, and executed when
 * the trigger topic receives a message.
 */
exports.WESCPubSub = (event, callback) => {
  const pubsubMessage = event.data;
  const name = pubsubMessage.data ? Buffer.from(pubsubMessage.data,
'base64').toString() : 'Missing';

  console.log(`Message rcvd: ` + name); /* simply log a message */

  callback();      /* signal successful completion of function */
};
```
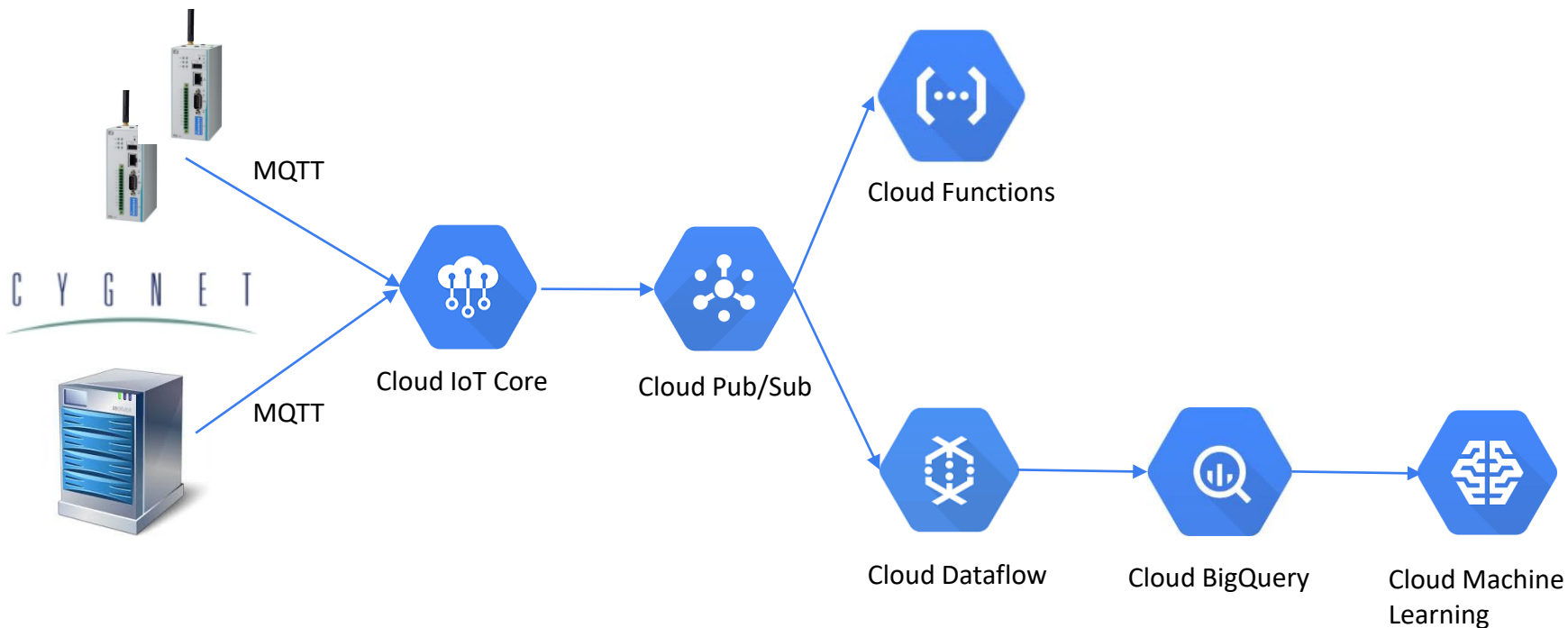
- Using gCloud sdk command line, deploy the code and define how triggered:

```
C:\ gcloud functions deploy WESCPubSub --runtime nodejs6 --trigger-resource krdevtopic --trigger-
event google.pubsub.topic.publish
```
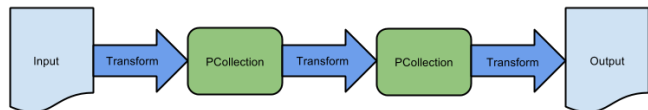
# Cloud Function demo
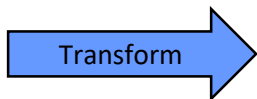
# Today's Demos – Serverless Computing



Google Cloud Platform Services

# DATA PROCESSING WITH CLOUD DATAFLOW



Cloud Pub/Sub          Cloud BigQuery

- Fully managed service for **transforming** and **enriching** data in stream (real-time) and batch (historical modes).
- Create **data pipelines** using Apache Beam SDK.
- Strong integration point for machine learning.
- Dynamic work rebalancing.
- Fault-tolerant, exactly once processing.
- Integrates with BigQuery and ML Engine.

- Amazon, Microsoft comparables:
  - AWS Kinesis
  - Azure Stream Analytics
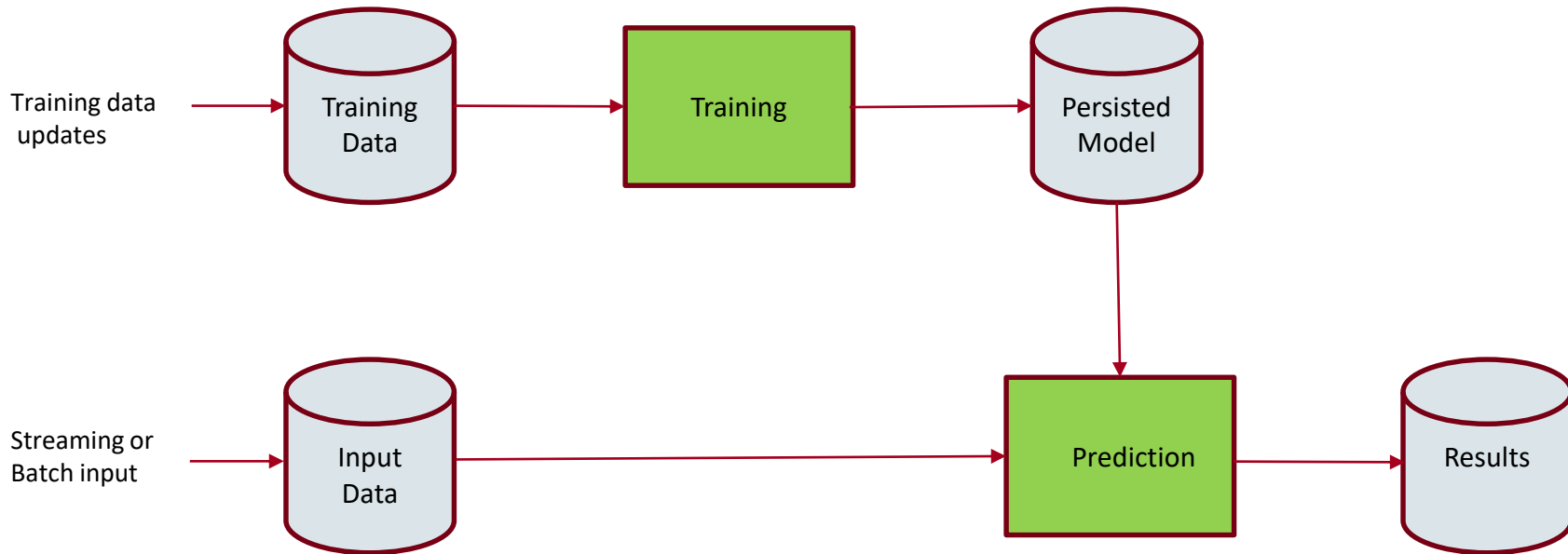
# DATA WAREHOUSING WITH CLOUD BIG QUERY

- SQL Data warehouse – petabyte scale
- ANSI-compliant SQL
- High –performance streaming ingestion capability (100,000 rows per second)
- Elastic capacity scaling
- High-available, multi-geography replication
- Encrypted data at rest and in transit.
- BigQuery ML – build ML models directly in SQL.
- Integrates with Cloud ML Engine and TensorFlow.

- Amazon, Microsoft comparables:
  – AWS Redshift
  – Azure Data Lake

# Cloud DataFlow and Cloud BigQuery Demo

# MACHINE LEARNING BASICS

Training data updates → Training Data → Training → Persisted Model

Persisted Model → Prediction

Streaming or Batch input → Input Data → Prediction → Results

# BigQuery ML Demo

# ADVANCED MACHINE LEARNING: CLOUD ML ENGINE

- Fully managed service to build and run custom machine learning models.
- <u>Train</u> models
- <u>Predict</u> in streaming or batch mode.
- Supports TensorFlow, Keras, Scikit-learn.
- *Automatic* environment setup
  - Write your ML code in Python (or C++)
  - Test locally
  - Deploy your training job to Cloud ML Engine
    - Create and Save the Model
  - Deploy / schedule your prediction jobs to Cloud ML Engine

- Amazon, Microsoft comparables:
  - AWS SageMaker
  - Azure ML

# What is TensorFlow?

Released in Nov. 2015
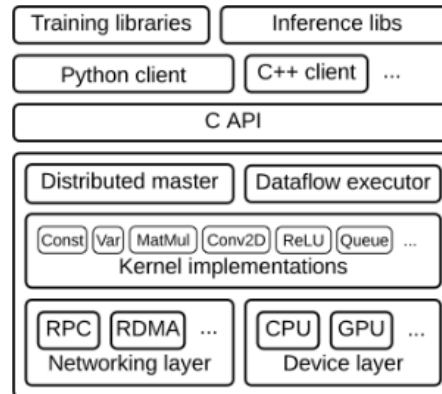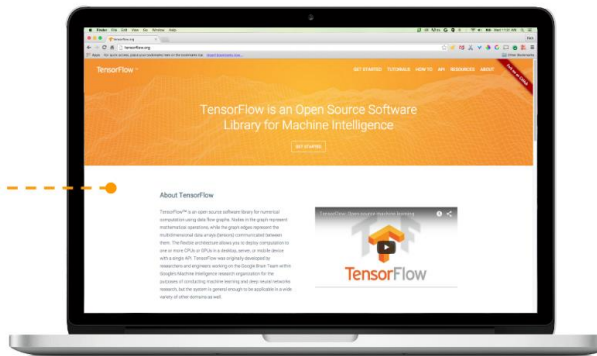


- Highly scalable and flexible.
- Example of TensorFlow code: Getting Started.
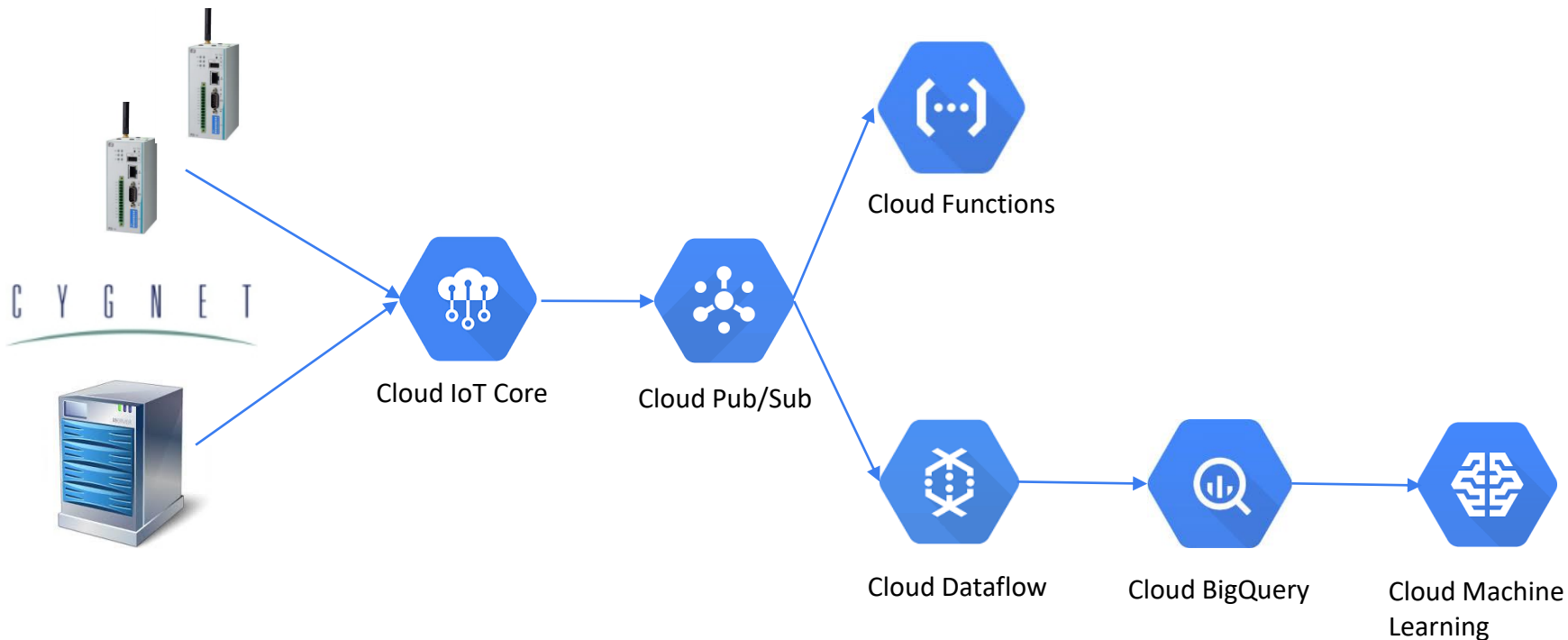
# CLOUD ML ENGINE

- Some Common Use Cases and ML Algorithms in IoT and ML
  - Detect anomalies in behavior of processes
    - AutoEncoder, Anomaly MASF
  - Predict failures and maintenance needs
    - Recurrent Neural Networks (RNN)
    - Deep Neural Networks (DNN)
    - Random Forest (RF)
    - Decision tree
  - Predict measurements – when sensors are bad or unavailable
    - Regression
- Would you rather roll your own ML environment?
  - set up a single node Hadoop cluster

# **Cloud ML Engine: Quick Look**

# Recap



Cloud IoT Core

Cloud Pub/Sub

Cloud Functions

Cloud Dataflow

Cloud BigQuery

Cloud Machine Learning

CYGNET

Google Cloud Platform Services

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# THANK YOU