



IoT in Action

#IoTinActionMS



Architecting the Intelligent Edge

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IoT Solution Architect

IoT in Action



IoT Signals

SUMMARY OF RESEARCH LEARNINGS
2019





Reasons for IoT adoption



IoT Signals

SUMMARY OF RESEARCH LEARNINGS
2019

Additional top use case by industry

 RETAIL/ WHOLESALE	 TRANSPORTATION	 GOVERNMENT	 HEALTHCARE
Supply chain optimization 64%	Fleet management 56%	Public Safety 48%	Tracking patient, staff, and inventory 66%
Inventory optimization 59%	Security, surveillance, and safety 51%	Infrastructure and facilities management 40%	Remote device monitoring and service 57%
Surveillance and security 48%	Manufacturing operations efficiency 40%	Regulations and compliance management 38%	Remote health monitoring and assistance 55%
Loss prevention 44%	Vehicle telematics and infotainment 38%	Fleet and asset management 37%	Safety, security, and compliance 53%
Energy optimization 40%	Predictive maintenance 33%	Incident response 29%	Facilities management 42%

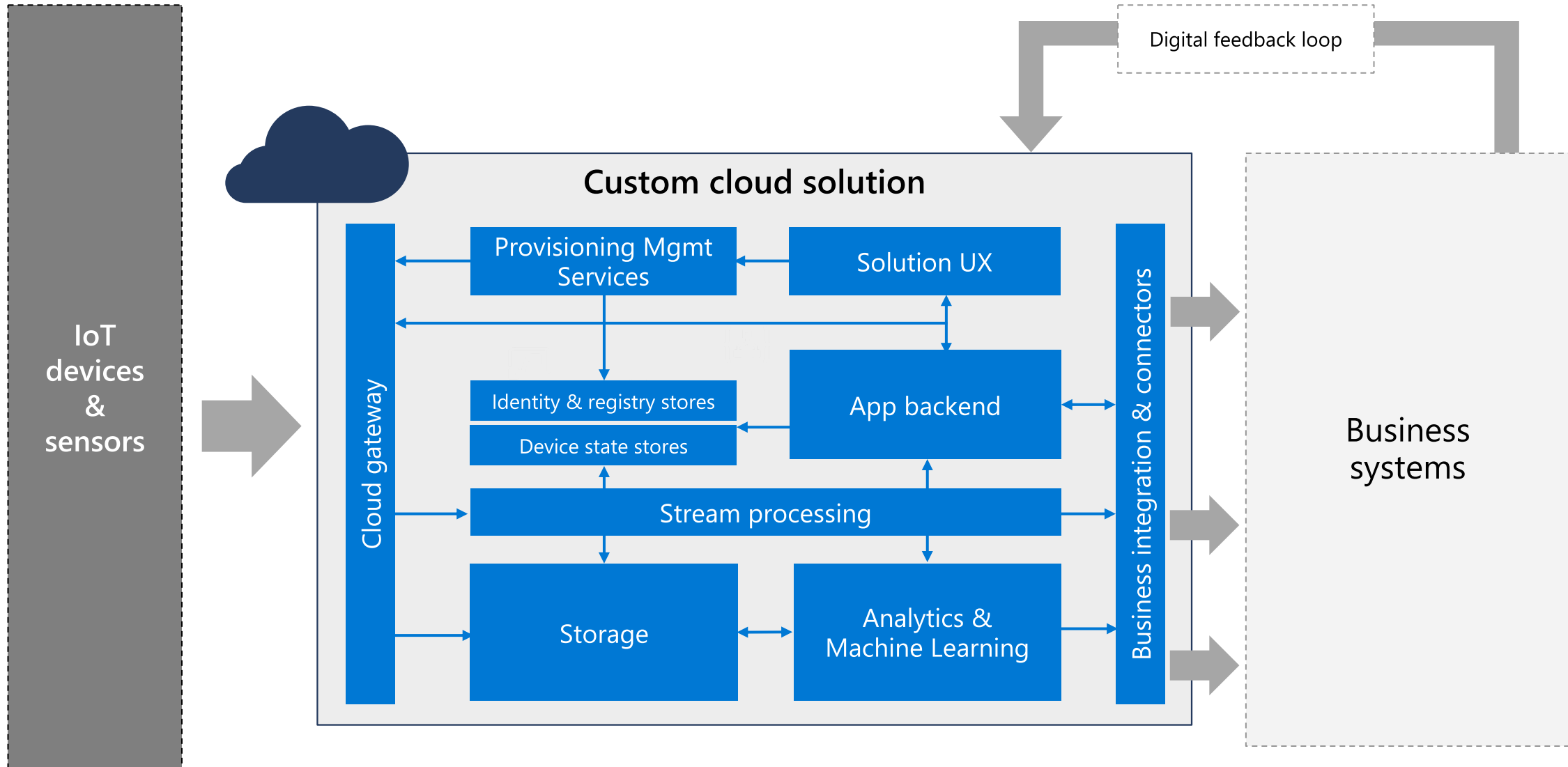
IoT Signals

SUMMARY OF RESEARCH LEARNINGS
2019

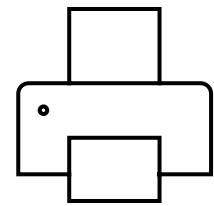
Top challenges



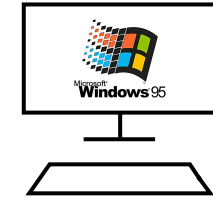
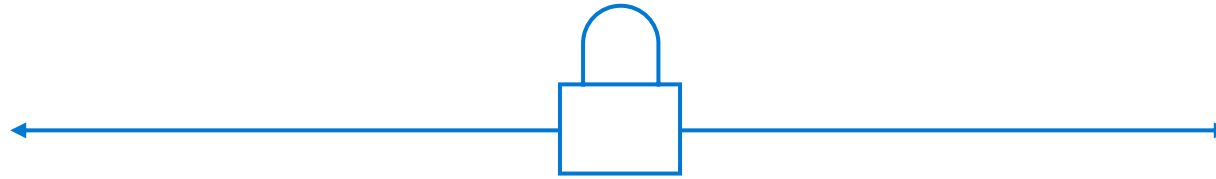
Solution architecture—DIY



We had a similar challenge in the past...

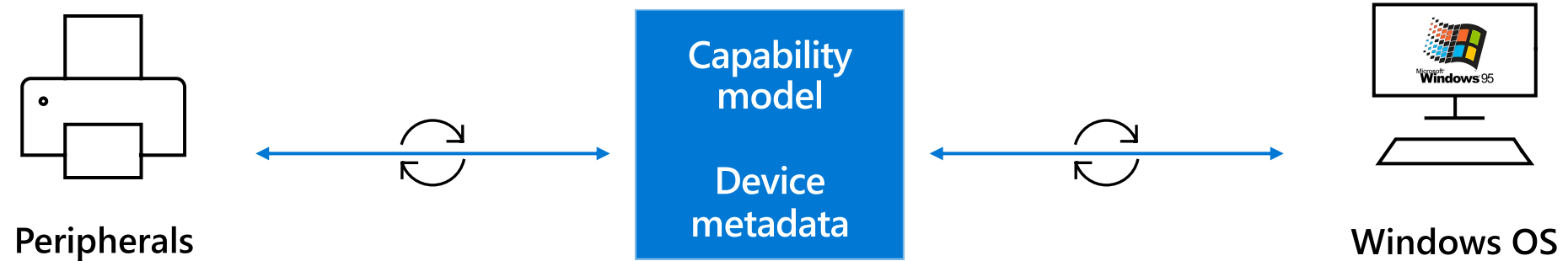


Peripherals



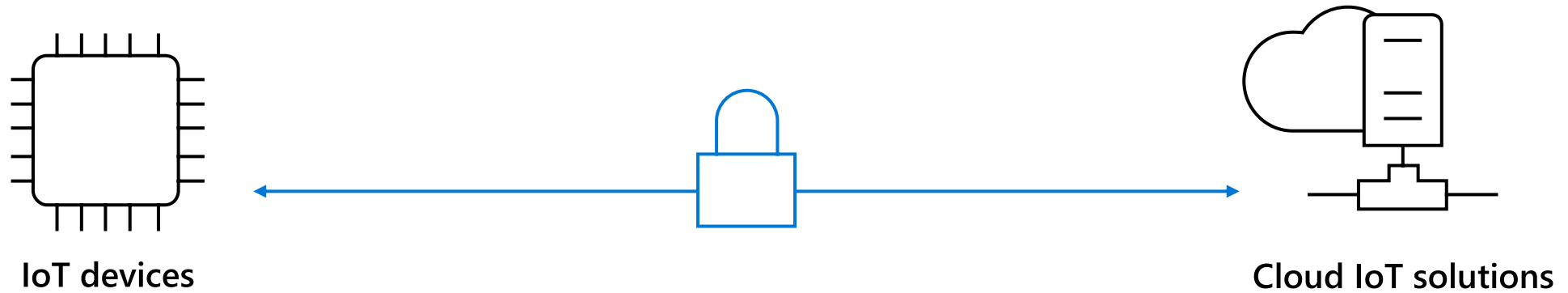
Windows OS

That was solved with Windows Plug and Play



Devices published their capability models and adhered to them
Windows used the capability model to know how to interact with them

IoT today



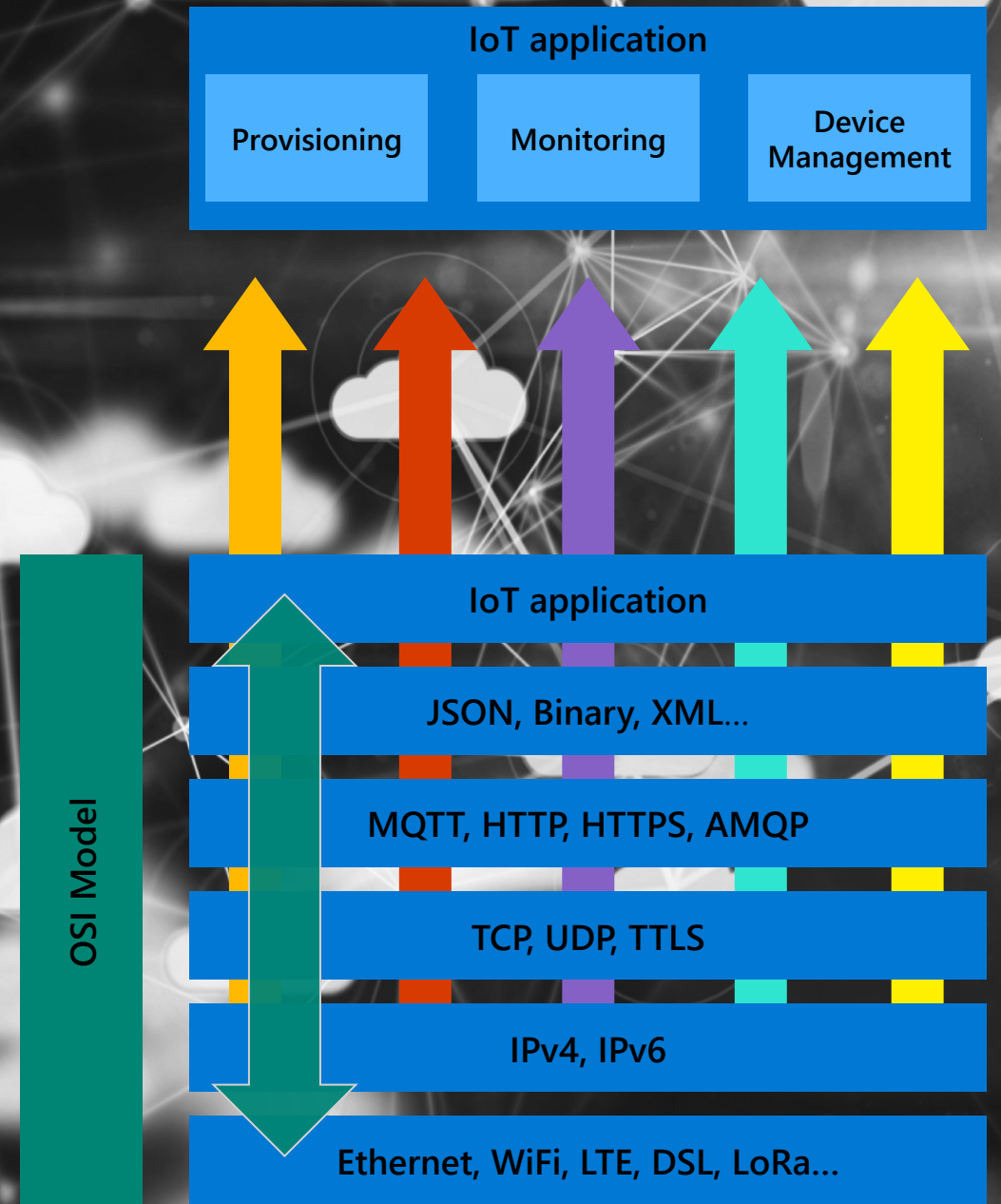
Tight coupling between software on device and IoT solution in the cloud

IoT Plug and Play + Azure IoT Central



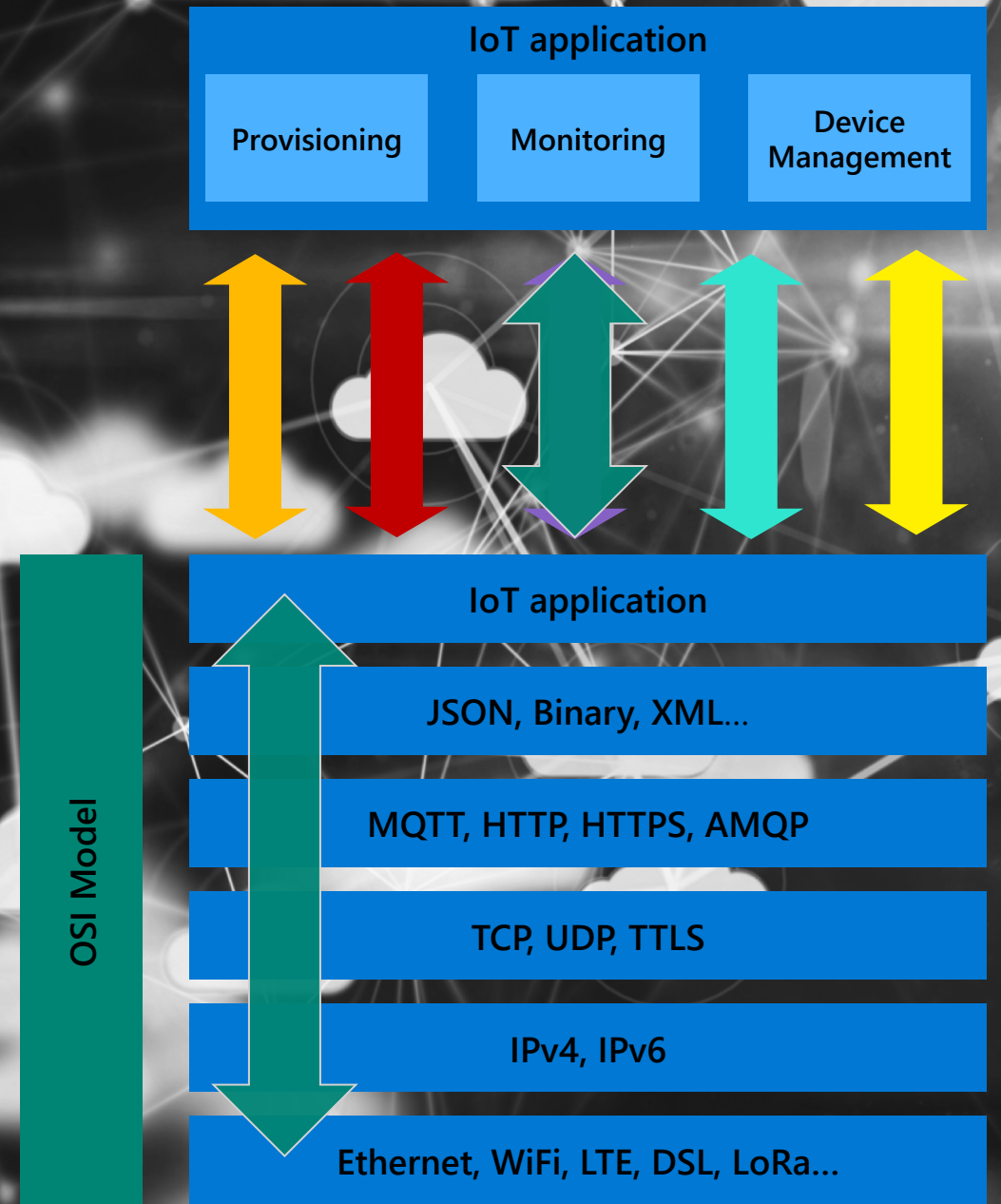
Connecting hardware is very “hard”

- Provisioning
- Configuration
- Device management
- Deployment
- Monitoring



IoT Plug and Play defines common language

- A platform feature to describe models and capabilities to Cloud
- Based on Digital Twin definition language
 - Open source based on open standards (JSON-LD, RDF)



Benefits

Solution developers

Dramatically reduces the effort needed to build software on devices

Customers and partners

Large ecosystem of devices that just work with Azure IoT solutions, without any development required

Device builders

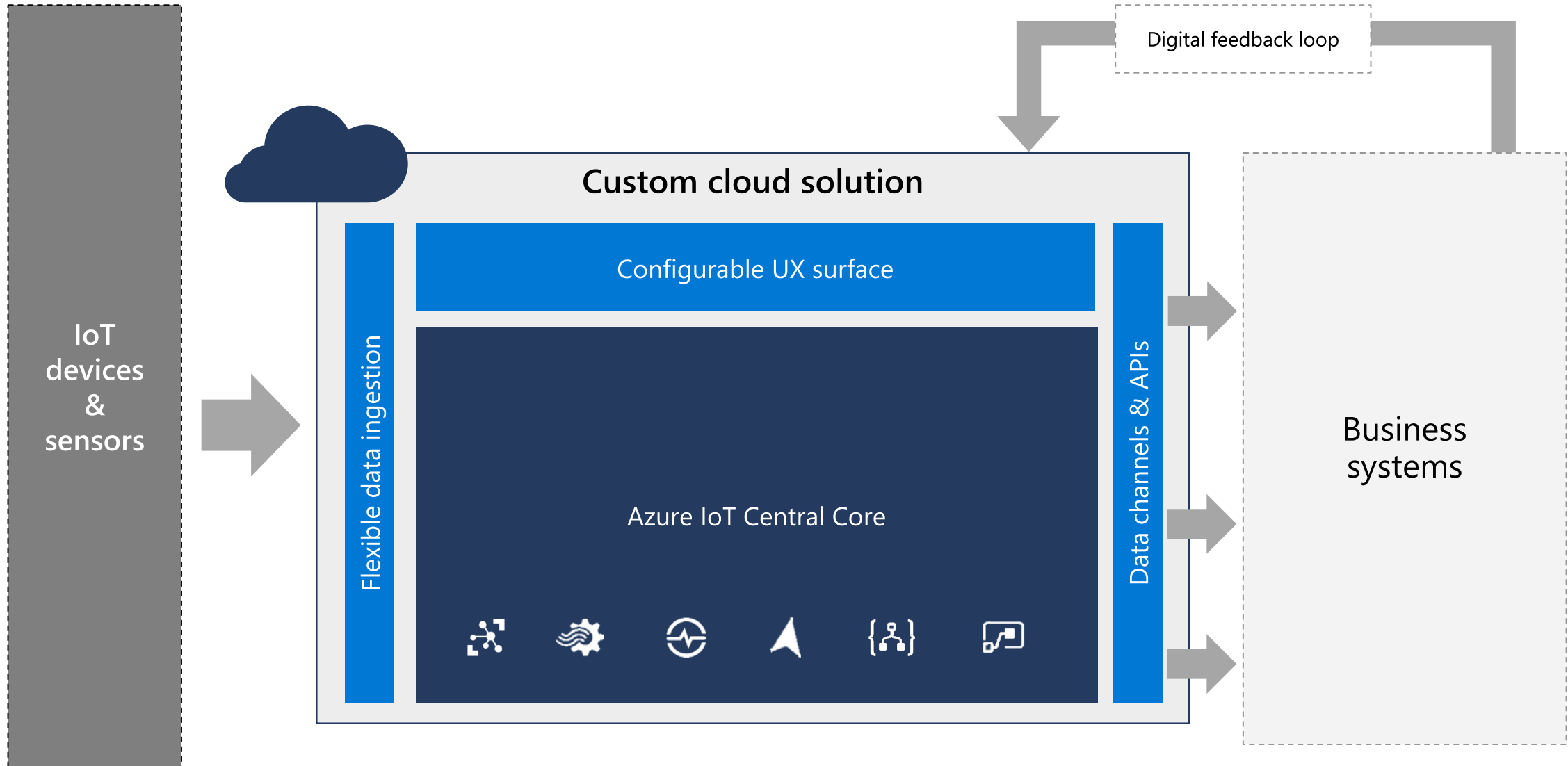
Certify your device for IoT Plug and Play and it can be used with thousands of Azure IoT solutions

In public preview

<http://aka.ms/IoTPlugandPlay>



Solution architecture—IoT Central



Azure IoT central

IoT app platform with security, global scale, high availability, disaster recovery built in



Device connectivity
and management



Telemetry ingestion and
command and control



Monitoring rules
and triggered actions



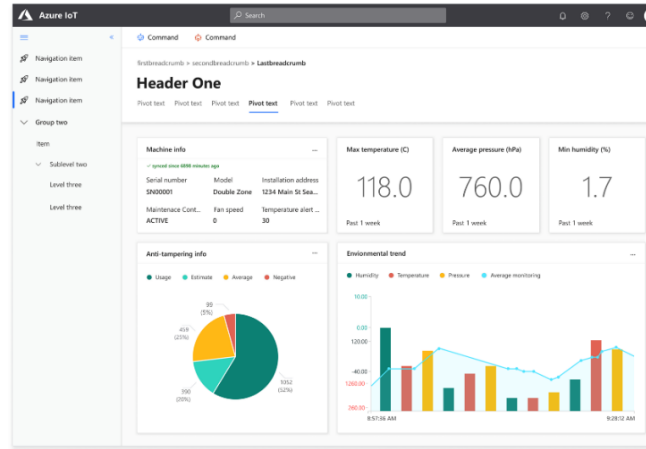
User roles
and permissions



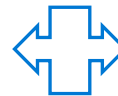
Dashboards, visualization
and insights



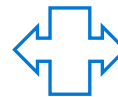
Fully hosted and
managed by Microsoft



Maps, location telemetry
and geofencing



Device Bridge
Ingest data from other clouds



Continuous Data Export
Bring data into downstream
business applications



White labeling
Your SaaS—your brand



IoT Plug and Play
Public preview

Challenge #1

Getting connected

Challenge #2

Making it easier to combine services to “do something”

Challenge #3

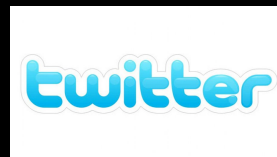
Making it easier to use the data; it's massive

“We’ve been here before”

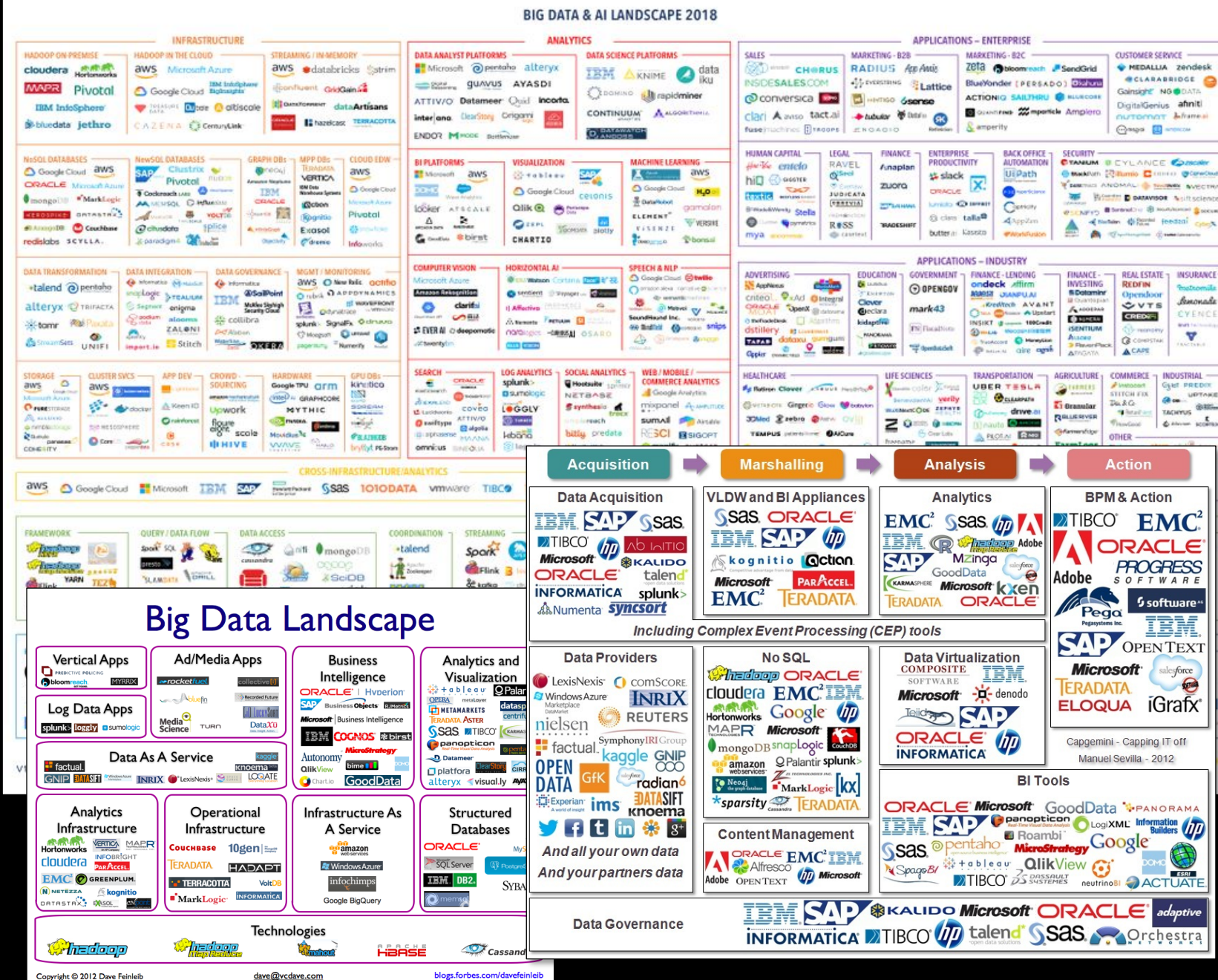


“Big Data”
started with
Web 2.0

Web 2.0 technologies

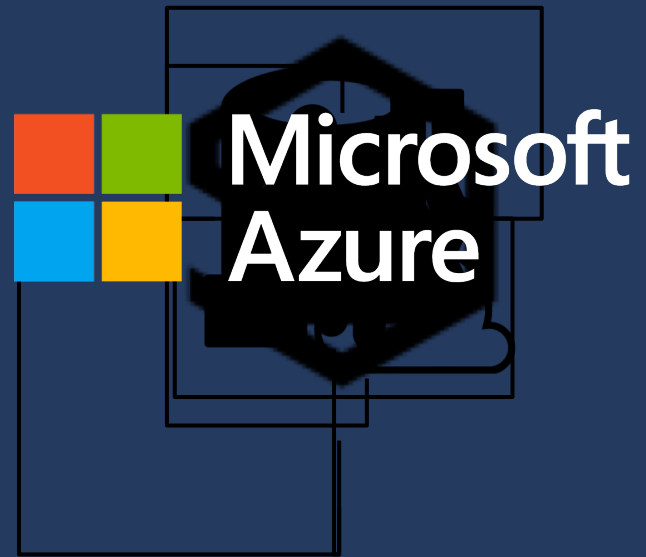


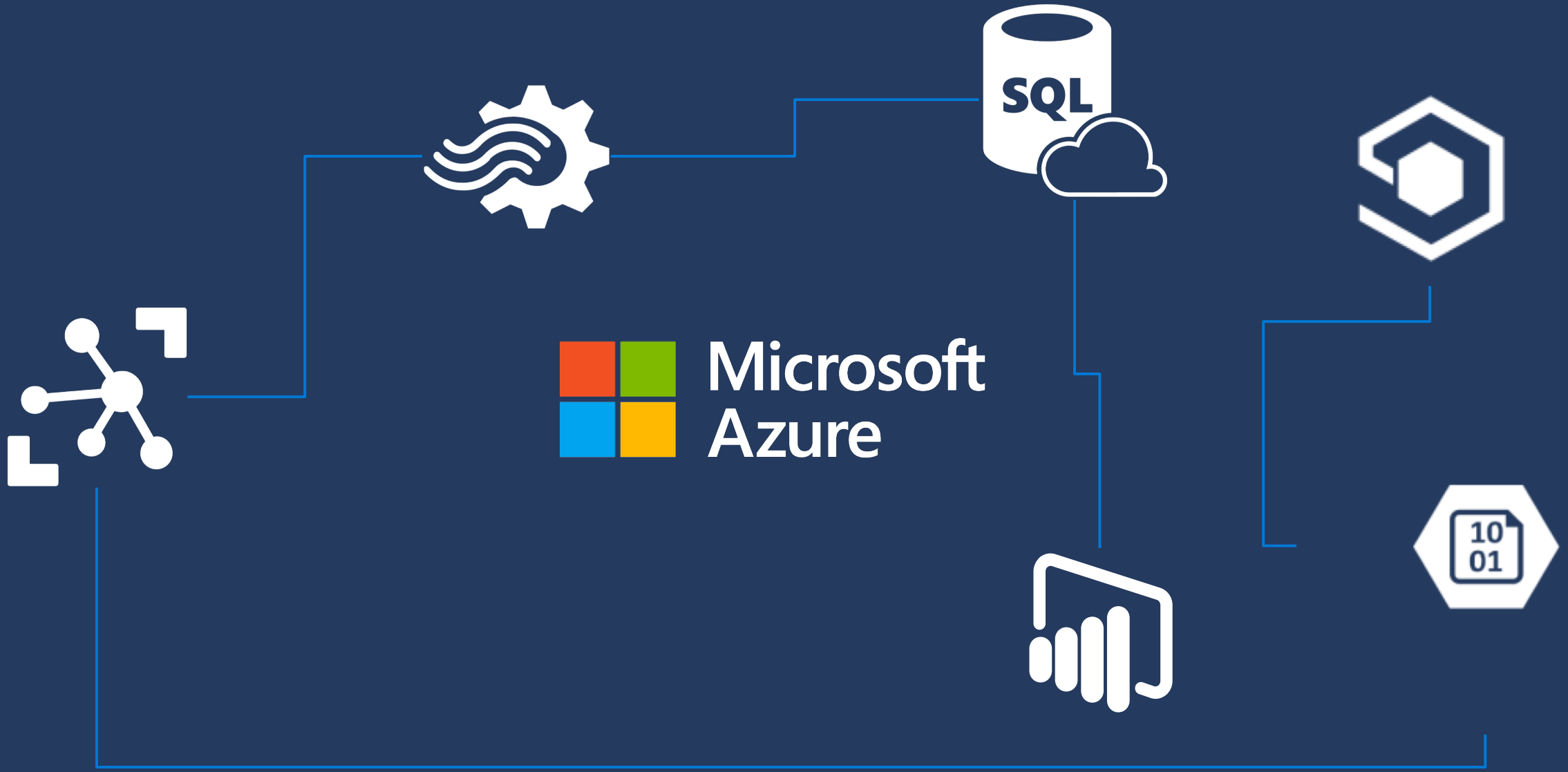
Remember these?




















“Big Data” challenge 2.0





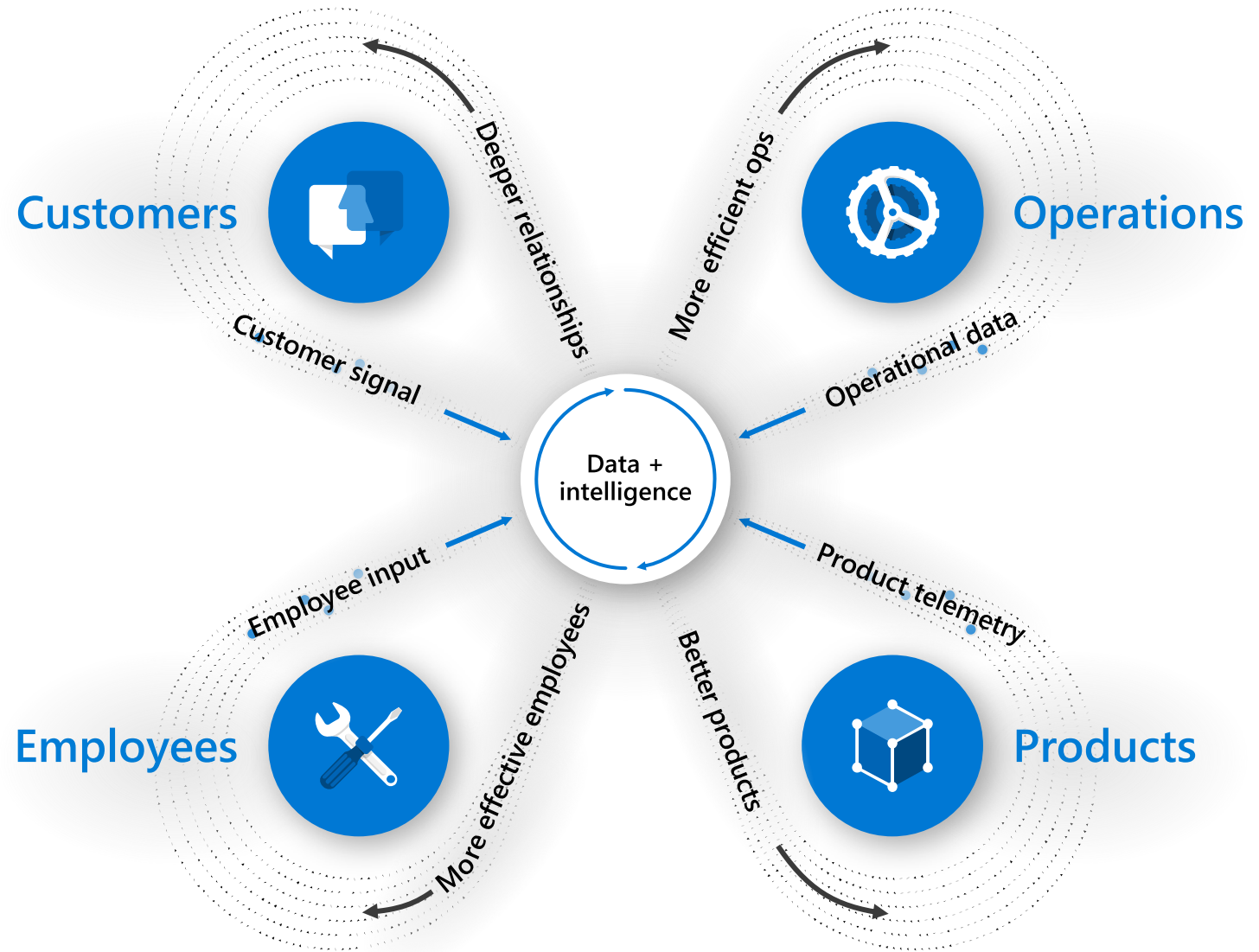


Microsoft's comprehensive IoT product portfolio

 Azure Security Center for IoT	Azure IoT priority verticals	 Manufacturing	 Retail	 Agriculture	 Energy	 Smart Cities	 Healthcare	 Transportation
	Azure IoT solutions	 Azure IoT Central (SaaS)	 Azure IoT reference architecture and accelerators (PaaS)			 Dynamics Connected Field Service (SaaS)		
	Azure Services for IoT	 <ul style="list-style-type: none">Azure IoT HubAzure IoT Hub Device Provisioning ServiceAzure Active DirectoryAzure AIAzure Cognitive Services	 <ul style="list-style-type: none">Azure Cosmos DBAzure Data ShareAzure DevOpsAzure Digital TwinsAzure Logic AppsAzure Maps			 <ul style="list-style-type: none">Azure MLAzure MonitorAzure Spatial AnchorsAzure Stream AnalyticsAzure Time Series InsightsPower BI		
	IoT and Edge device support	 <ul style="list-style-type: none">Azure IoT Device SDKAzure IoT EdgeAzure SphereWindows IoT	 <ul style="list-style-type: none">Azure Certified for IoT device catalogAzure Cognitive ServicesAzure FunctionsAzure ML			 <ul style="list-style-type: none">Azure SQLAzure StorageAzure Stream AnalyticsData Box Edge		

The digital feedback loop

- 1 Data: Capture digital signal across business
- 2 Insight: Connect and synthesize data
- 3 Action: Improve business outcomes



What is confidential computing?

The ability to store, transport,
and act on compute workloads
without compromising privacy
of data and intellectual property

Why confidential computing in IoT

Intelligent edge computing creates the need to protect code and data in use in addition to protection in storage and transit

Code and data confidentiality



Proprietary code and algorithms

Sensitive data like patient information and ML models

Actions from insights



Safe actions from insights out of intelligent edge processing

Trustworthy I/O for command and control of critical infrastructure

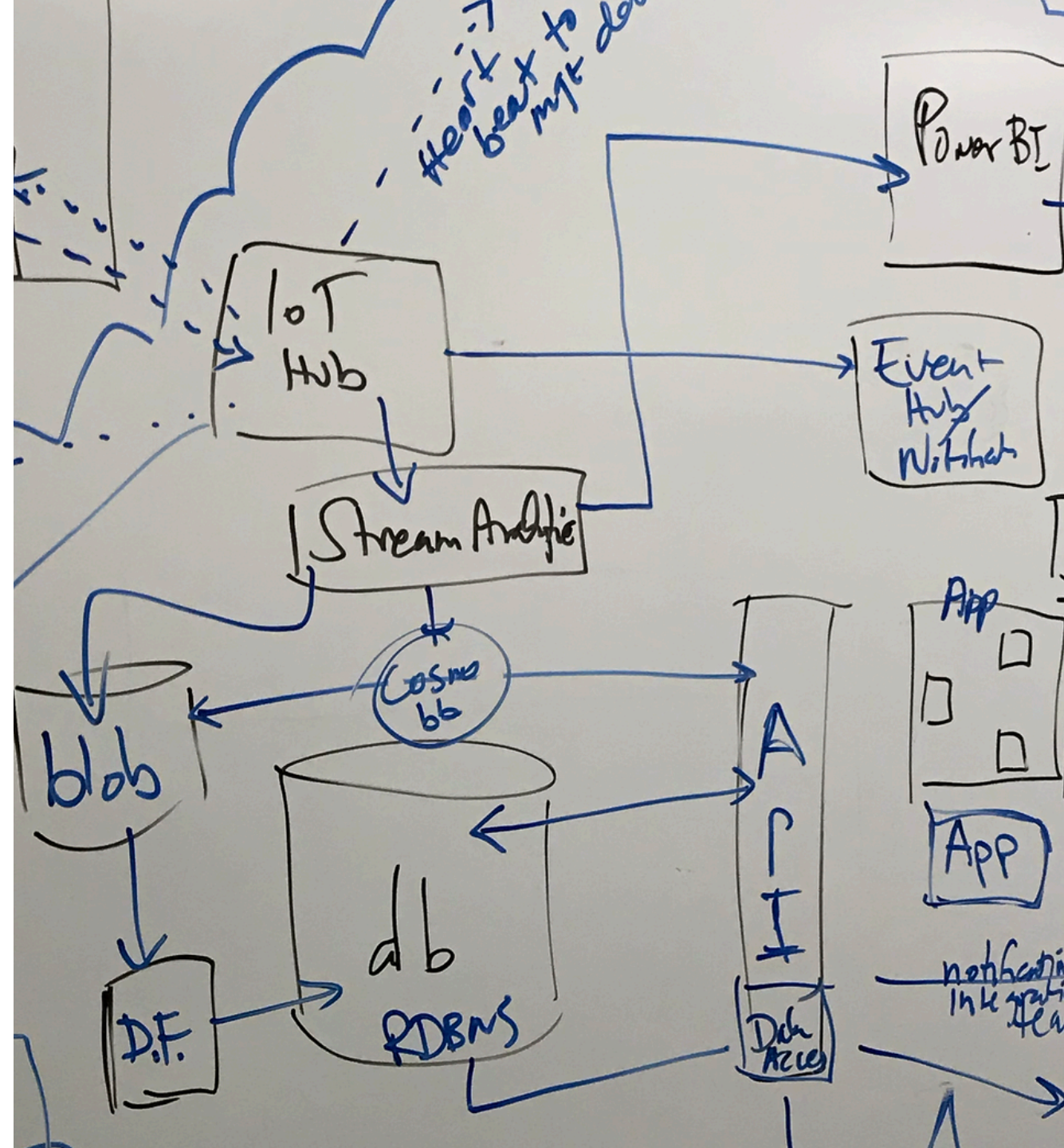
Valued transactions



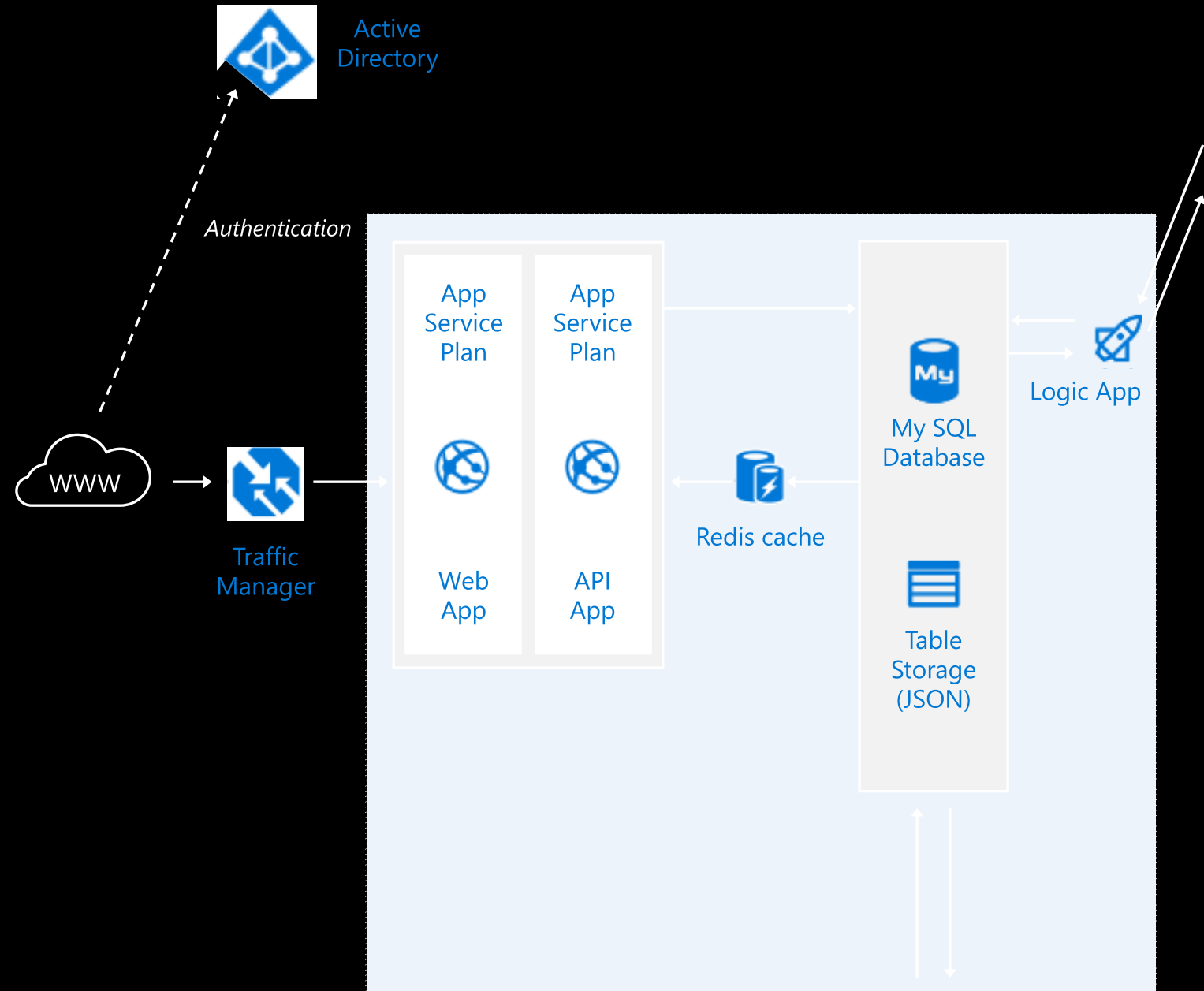
Metering actions for billing

Events tracking e.g., violations for warranty management

The anatomy of the architectural design session



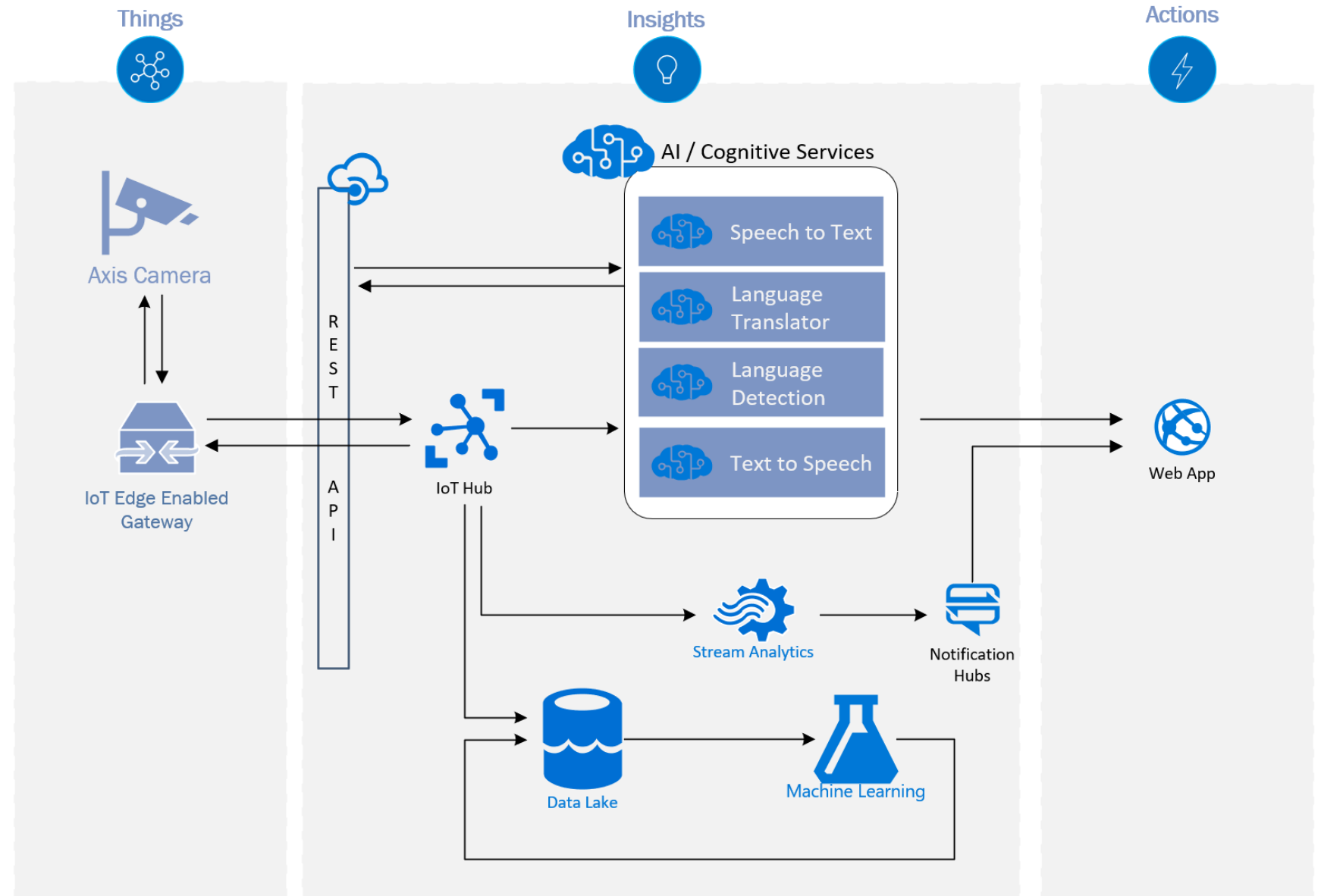
The output



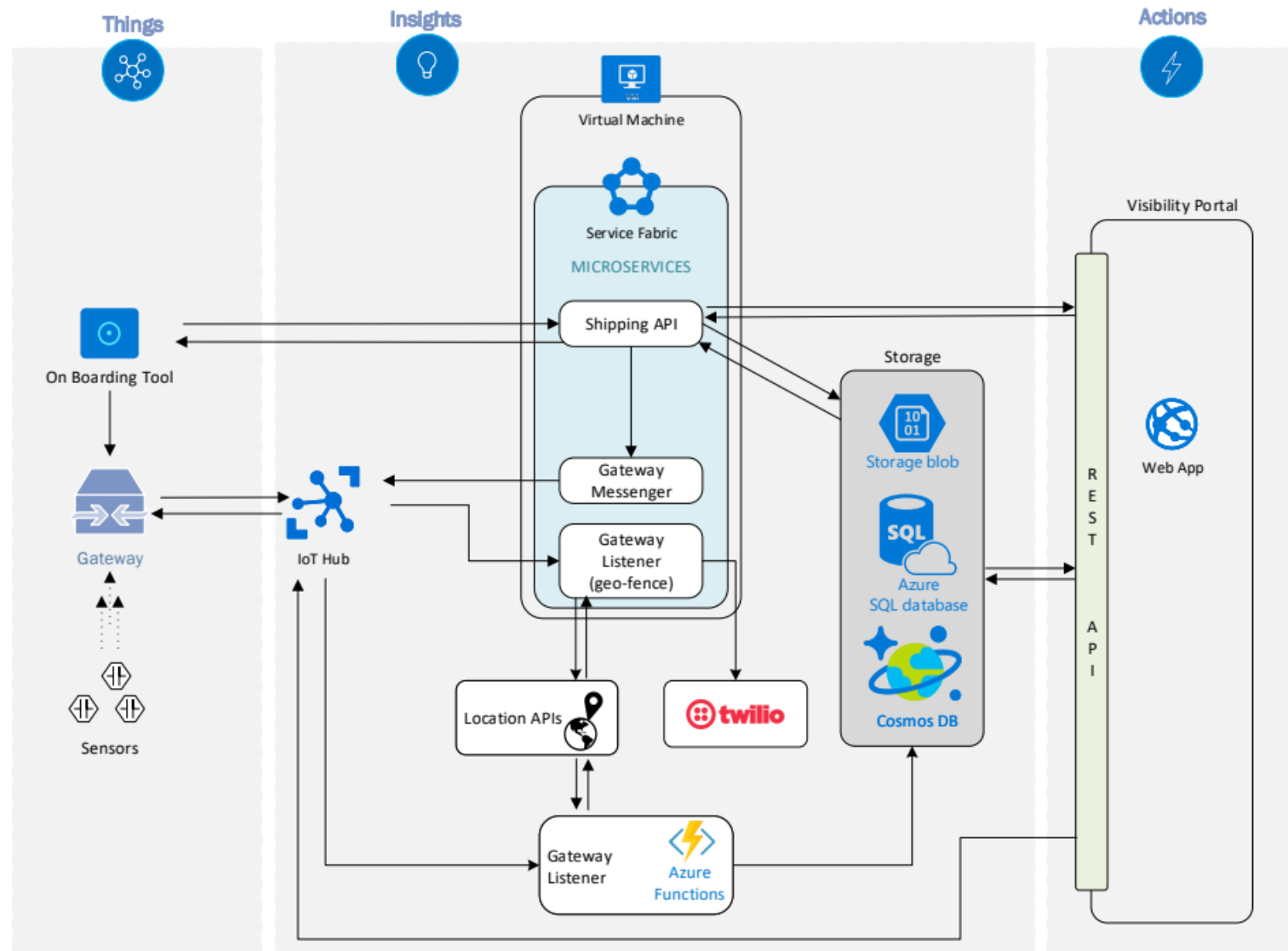


more

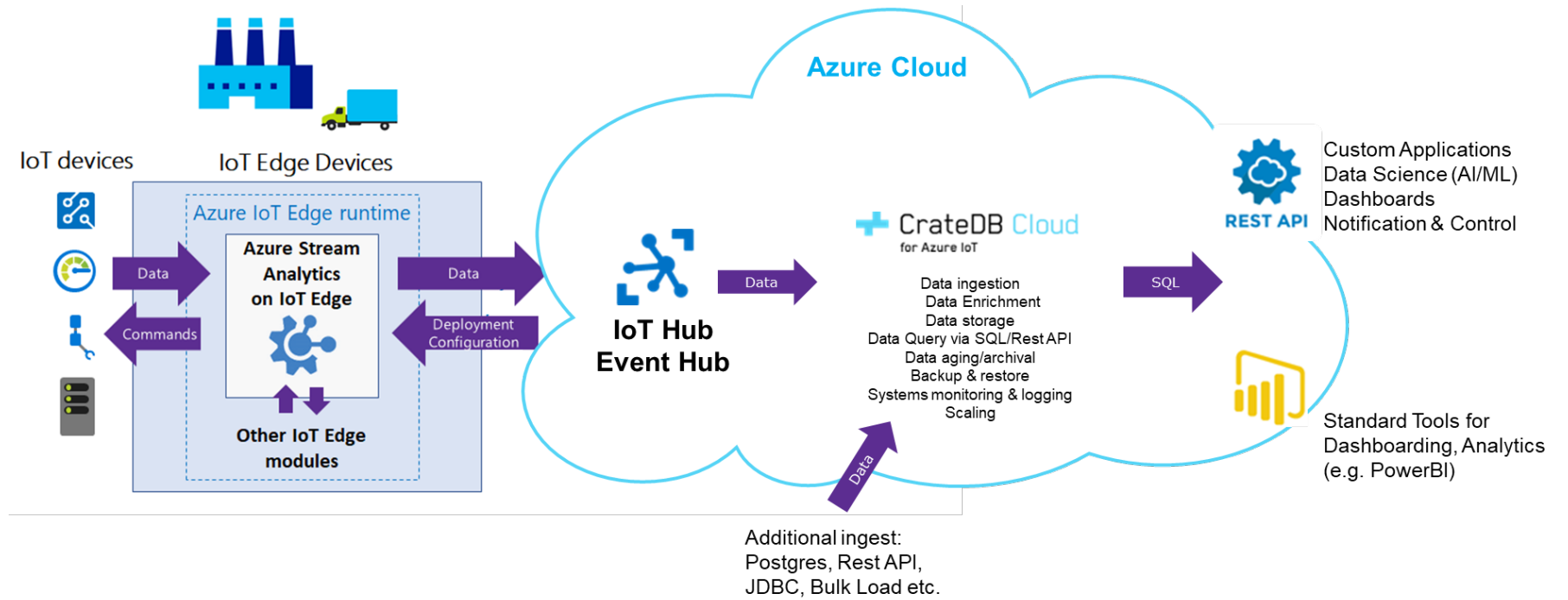




And even one more



Industrial Automation Use case





Partner Crate.io

CEO Christian Lutz

IoT in Action



CrateDB for Azure IoT

Powerful, fast, scalable and
purpose-built for industrial IoT



Built for industrial environments



Unlimited data scaling



Real-time insights and optimization





Built for industrial environments

Get a time series database that delivers the sub-second speed, scalability, and cost efficiency required for industrial use cases.



Handle massive amounts of data quickly with 10x faster performance than traditional time series databases.

Integrates easily with existing systems (e.g. ERP, QA, Procure) to enable issue tracking throughout the supply chain.

Ensure data availability 24x7 with built-in active-active replication, self-healing failover, and rolling software updates.

Protect data with enterprise-grade security, including the ability to establish individual identities and credentials for each connected device and application.



Unlimited data scaling

Meet the most demanding machine data requirements with the ability to collect and query millions of data points per second.



Sub-second, Industry 4.0 query speed (from 4 minutes on a relational database, e.g., Oracle or Db2, to 0.3 seconds on CrateDB).

Scale automatically and cost effectively without limits using automatic data rebalancing and a shared-nothing, masterless architecture.

Easily integrate and use CrateDB with BI, ETL, and other data tools via an ANSI SQL interface.



Real-time insights and optimization

Analyze and act on data from factory equipment in real time to continuously improve operations and drive efficiency.



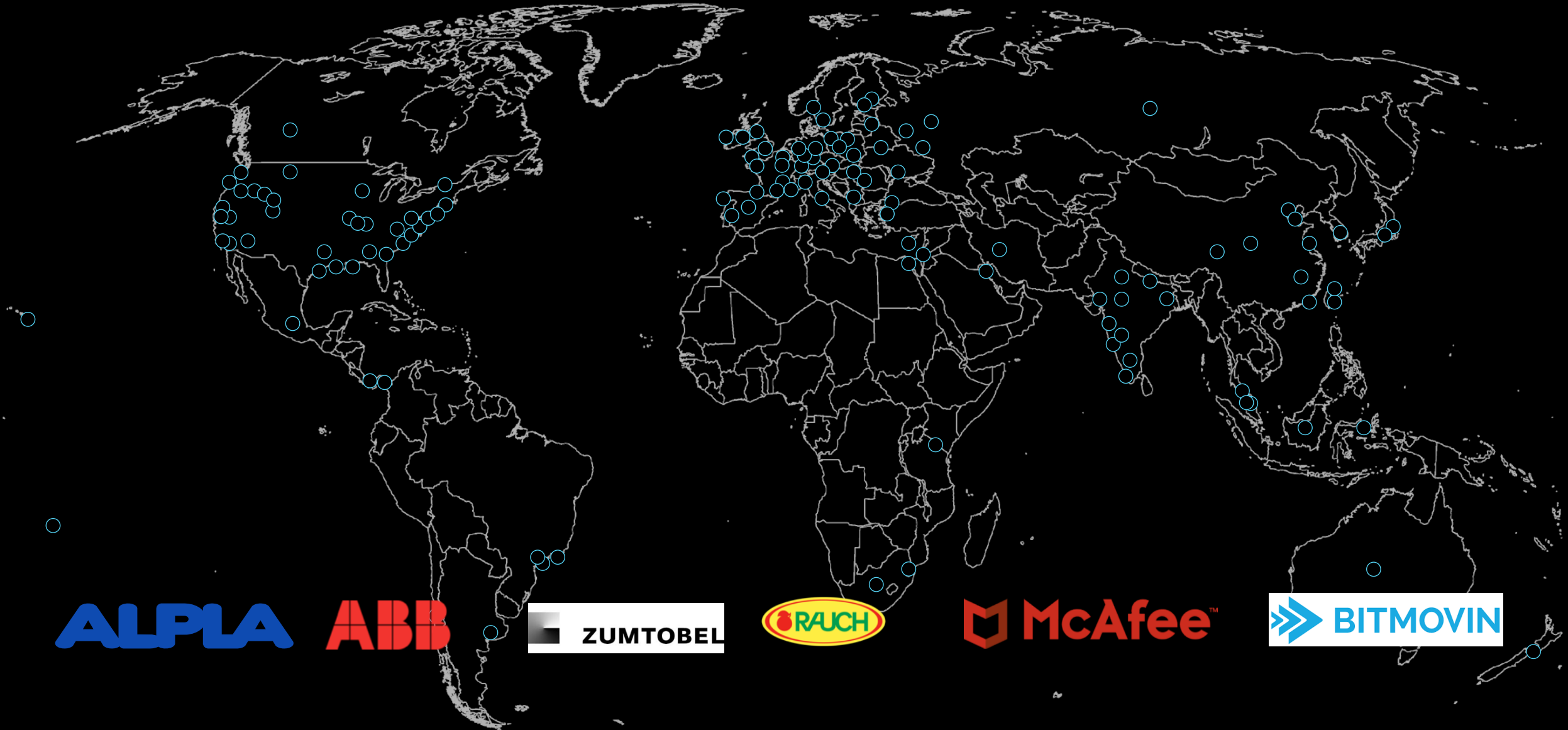
Improve equipment performance with the ability to instantly identify issues and take corrective action right on the factory floor.

Enable real-time decision making through sub-second queries, distributed processing and in-memory columnar indexes.

Create complex analytics with the full power of ANSI SQL, search, and user-defined functions.

Partition data by time intervals to speed up queries and make data aging policies easy to administer.

1600 customers use CrateDB already globally





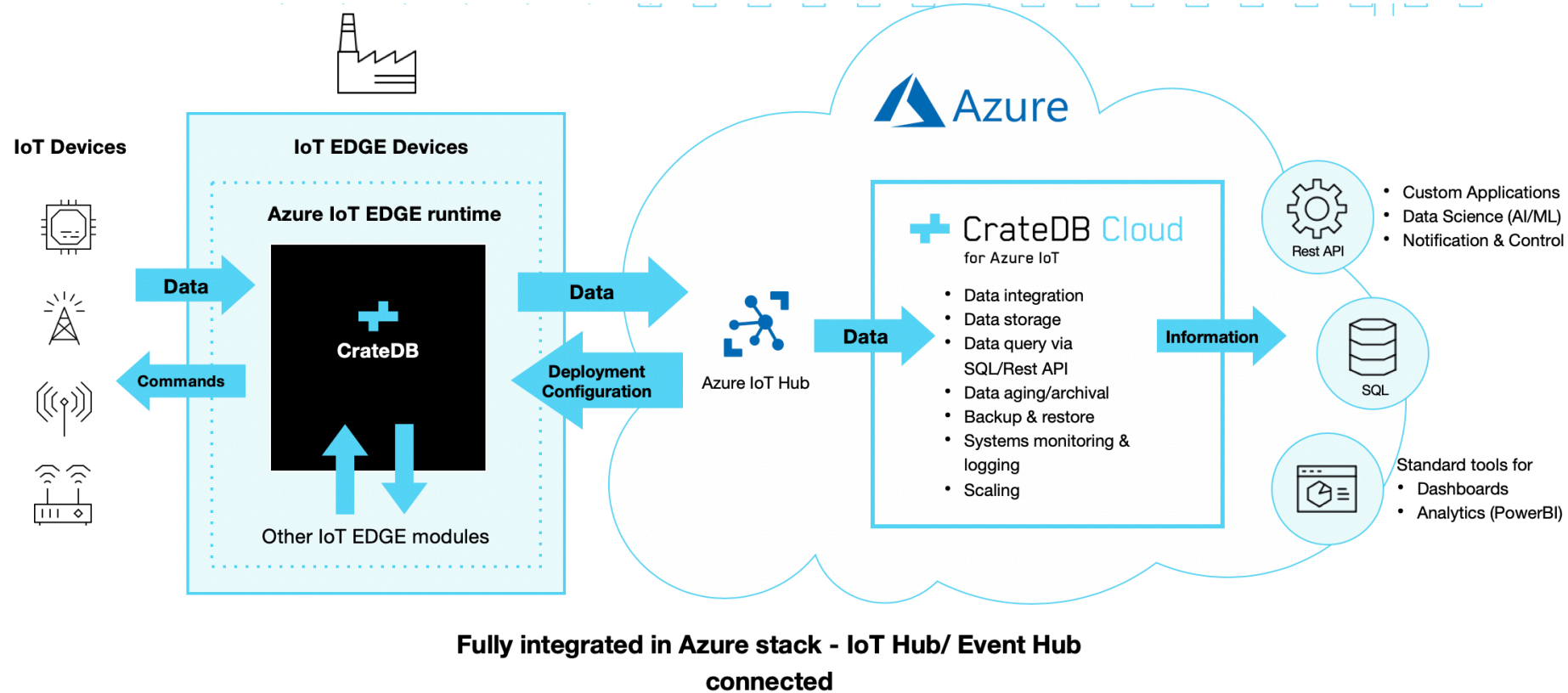
Demo: Realtime Analytics from Edge to Cloud

CEO Christian Lutz

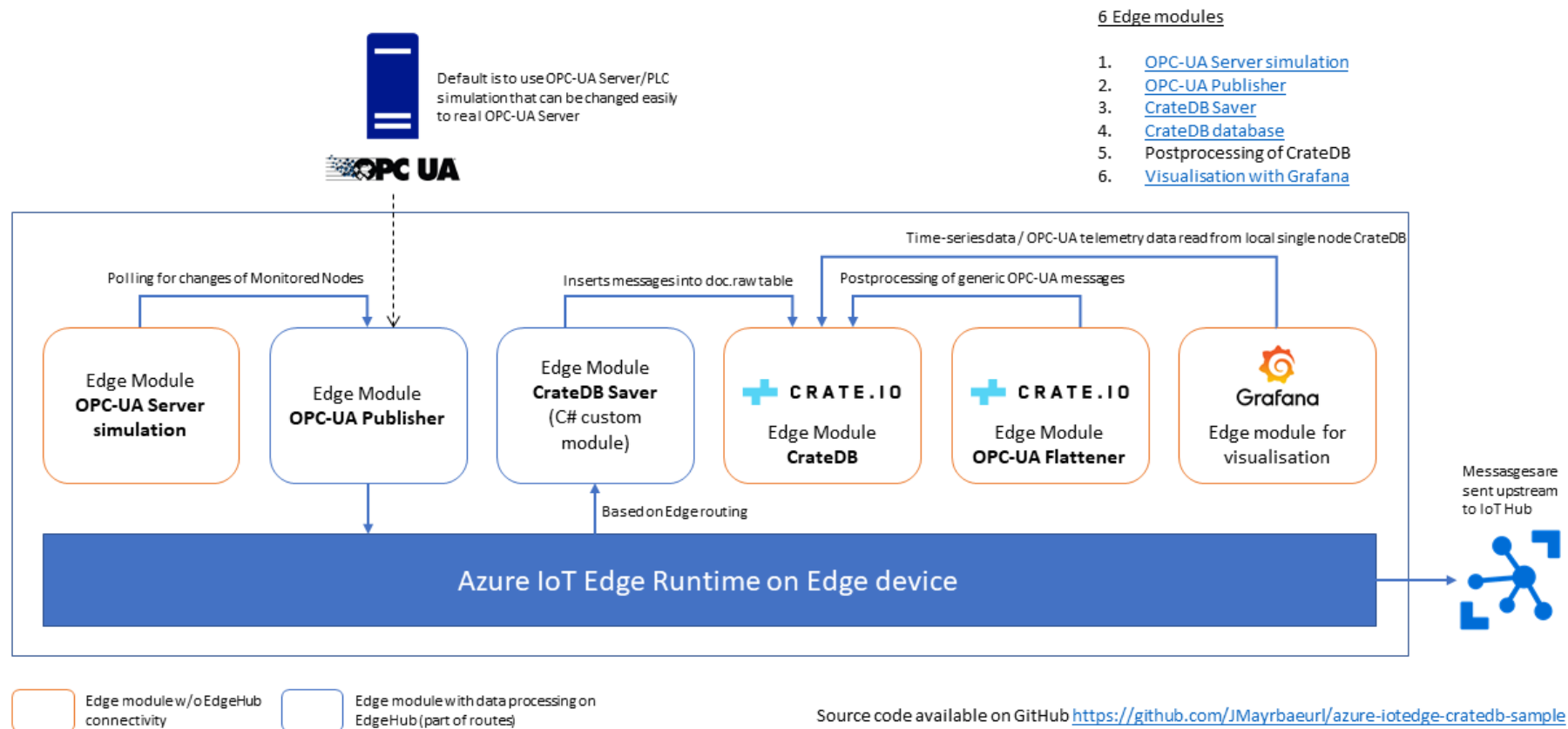
IoT in Action



Microsoft IoT Hub & CrateDB Cloud for Azure IoT



Microsoft IoT Edge and CrateDB



Raw OPC-UA Data on CrateDB

Licensed to: Trial-crate

Max nodes: 3 Expires: ∞

Cluster: crate

Version: 3.3.5

Nodes: 1

Health: ● Data ● Checks

Load: 2.38/ 1.76/ 0.73

crate

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Console

Enter a select statement to query CrateDB

☒ Format results
 ☒ Store console history persistently
 ☐ Show error trace

🗑️ Clear History

```
SELECT "g_ts_week","insert_ts","iothub_connection_device_id","iothub_enqueuedtime","payload" FROM "doc"."raw" LIMIT 100;
```

SELECT OK, 100 rows in set (0.204 sec)

Hint: Press ⇧ + ↵ to submit query.

EXECUTE QUERY

📄

Result from query

<

1 / 2



>










g_ts_week	insert_ts	iothub_connection_device_id	iothub_enqueuedtime	payload
1011200000 (2019-10-14T00:00:00.000Z)	1571061991385 (2019-10-14T14:06:31.385Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	▼ Object data : ▶ Array[31]
1011200000 (2019-10-14T00:00:00.000Z)	1571061991435 (2019-10-14T14:06:31.435Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	▼ Object data : ▶ Array[29]
1011200000 (2019-10-14T00:00:00.000Z)	1571061991471 (2019-10-14T14:06:31.471Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	▼ Object data : ▶ Array[33]

Enriched OPC-UA Data on CrateDB

CrateDB


Licensed to: Trial-crate
Max nodes: 3 Expires: ∞

Cluster: crate Version: 3.3.5 Nodes: 1 Health: ● Data ● Checks Load: 1.84/ 1.70/ 0.74  crate 





Console


Enter a select statement to query CrateDB

☒ Format results ☒ Store console history persistently ☐ Show error trace  Clear History

```
SELECT
"applicationur","displayname","g_ts_week","insert_ts","iothub_connection_device_id","iothub_enqueuedtime","nodeid","source_ts","value" FROM
"doc"."opcdata" LIMIT 100;
```

SELECT OK, 100 rows in set (0.034 sec)

Hint: Press  +  to submit query.

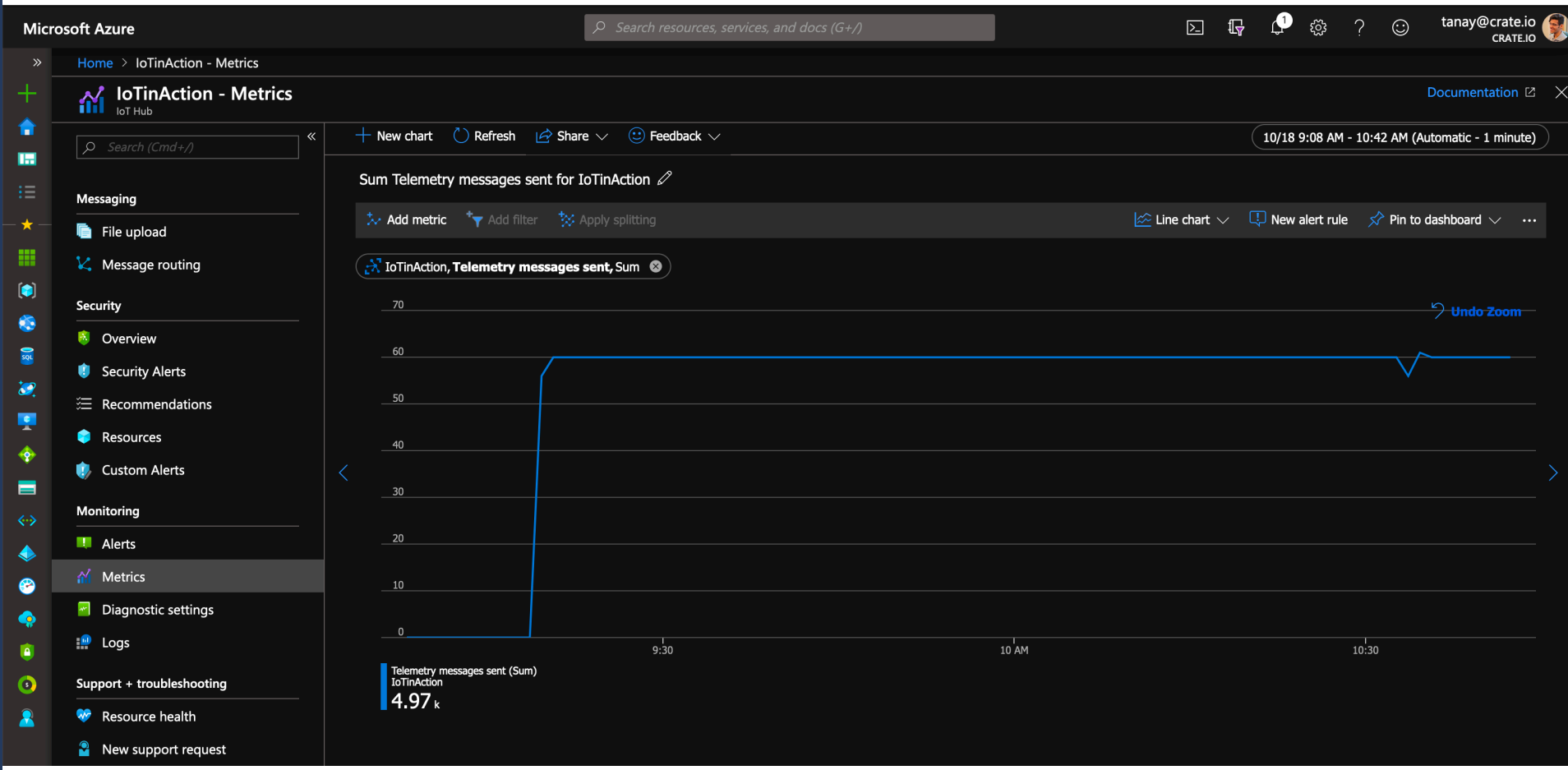
EXECUTE QUERY

Result from query

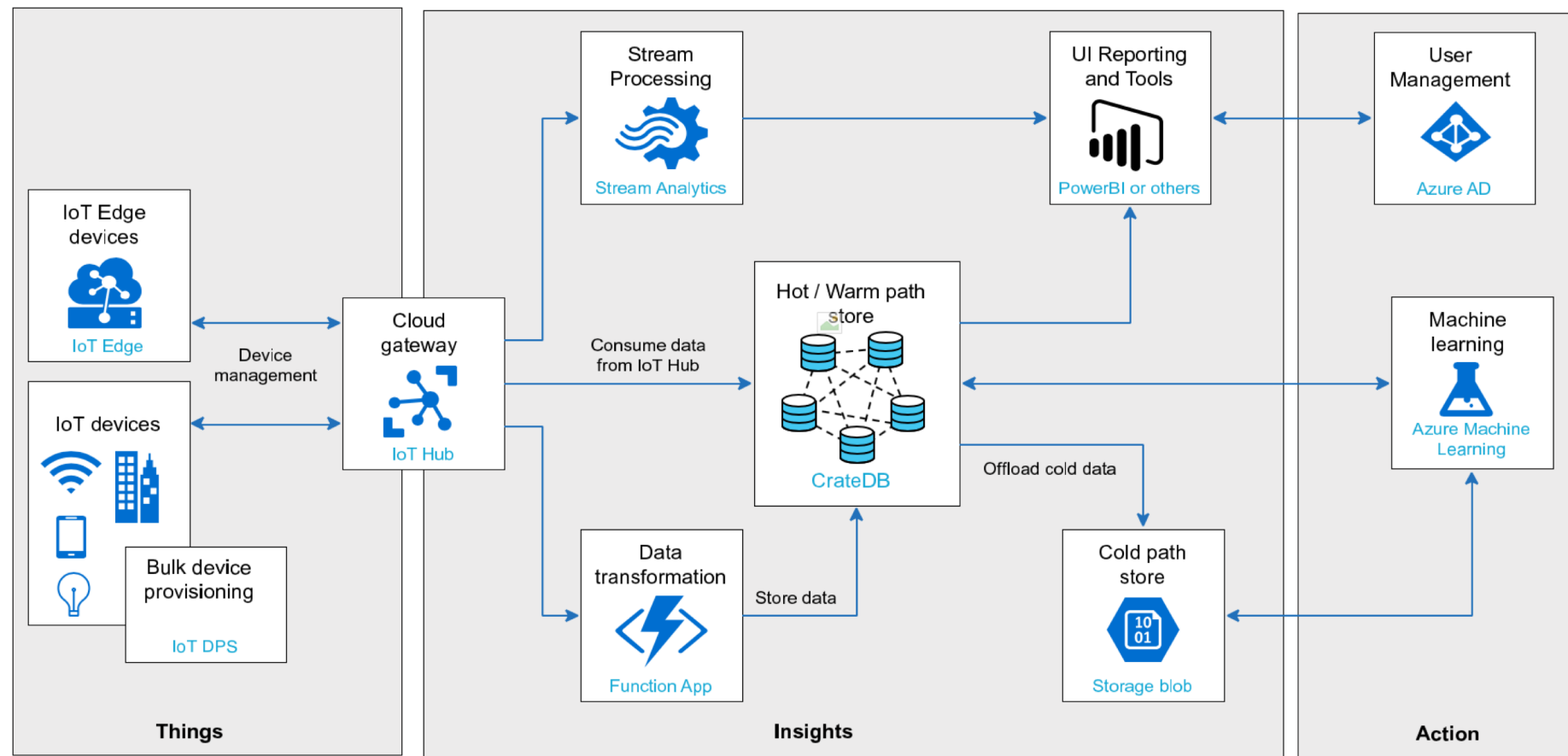
< 1 / 2 >

	iothub_connection_device_id	iothub_enqueuedtime	nodeid	source_ts	value
1Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	nsu=http://microsoft.com/Opc/OpcPlc /;s=SpikeData	1571061989892 (2019-10-14T14:06:29.892Z)	-77.051324
1Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	nsu=http://microsoft.com/Opc/OpcPlc /;s=DipData	1571061989891 (2019-10-14T14:06:29.891Z)	-77.051324
1Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	nsu=http://microsoft.com/Opc/OpcPlc /;s=RandomUnsignedInt32	1571061989890 (2019-10-14T14:06:29.890Z)	1035571806
2Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	nsu=http://microsoft.com/Opc/OpcPlc /;s=SpikeData	1571061989994 (2019-10-14T14:06:29.994Z)	-84.432792
2Z)	kontron-pc	-62135596800000 (Invalid Timestamp)	nsu=http://microsoft.com/Opc/OpcPlc	1571061989995 (2019-10-14T14:06:29.995Z)	-1000

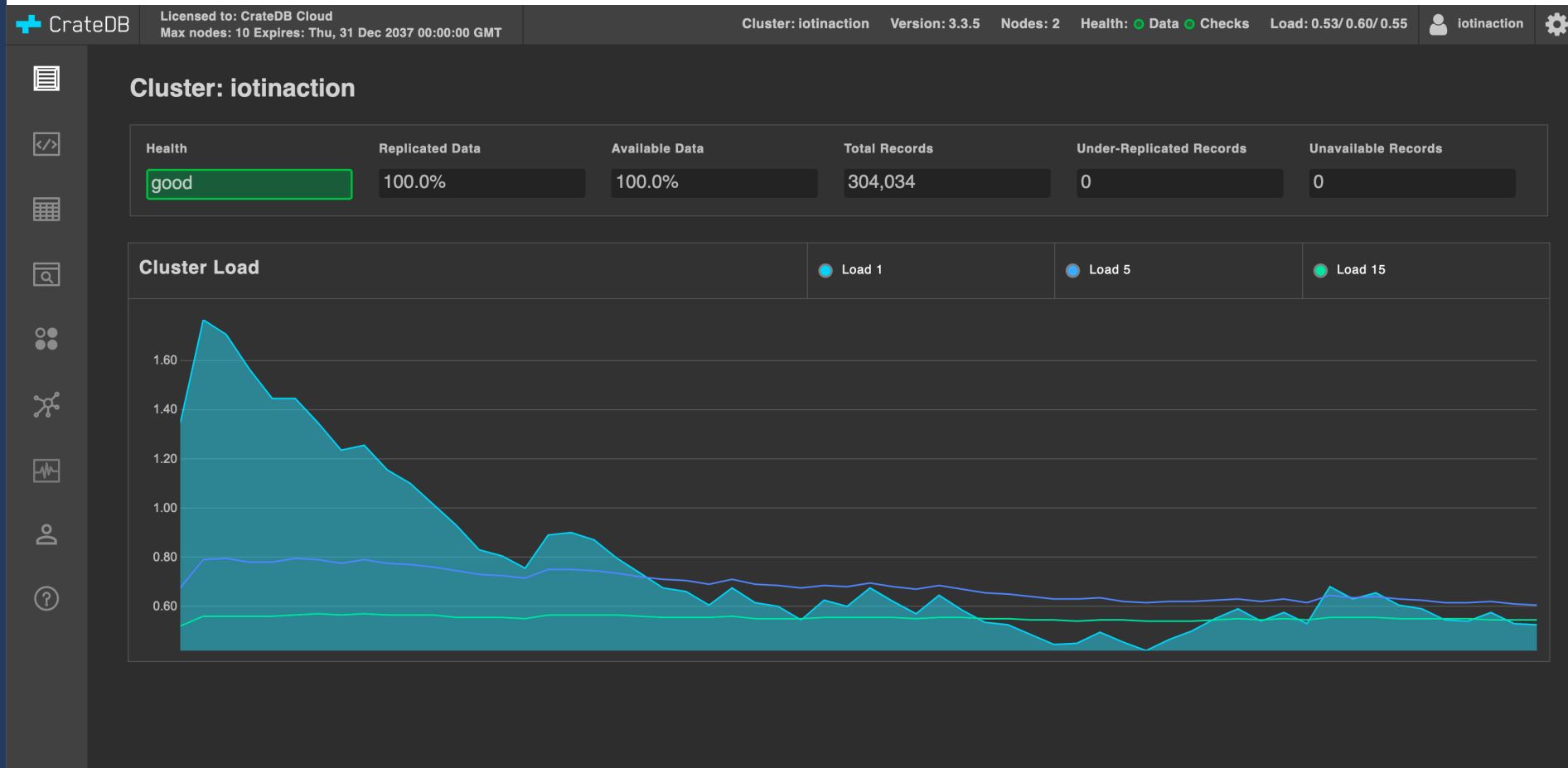
Enriched Data in IoT Hub



CrateDB Cloud on Microsoft Azure

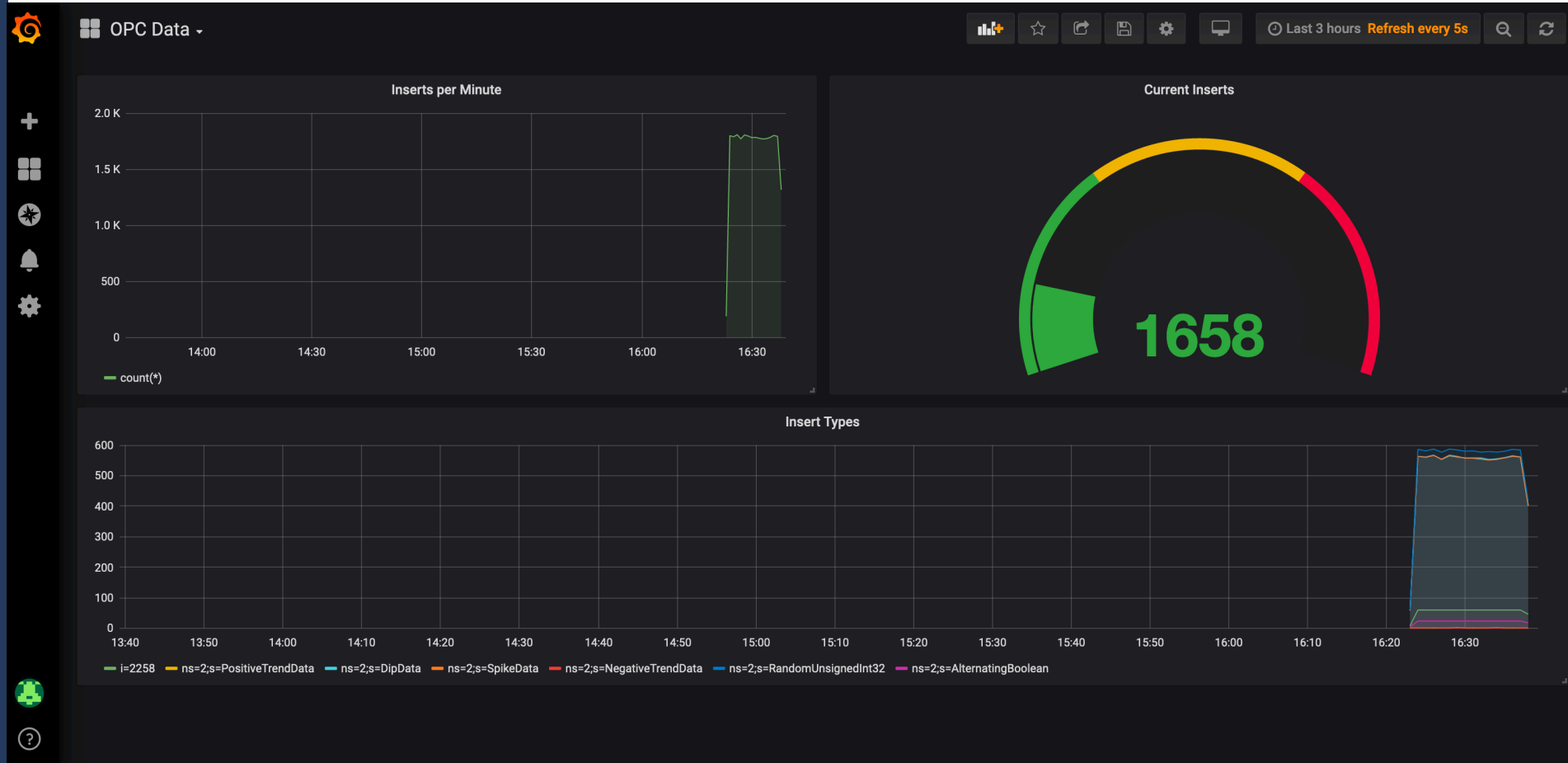


Enriched Data on CrateDB Cloud



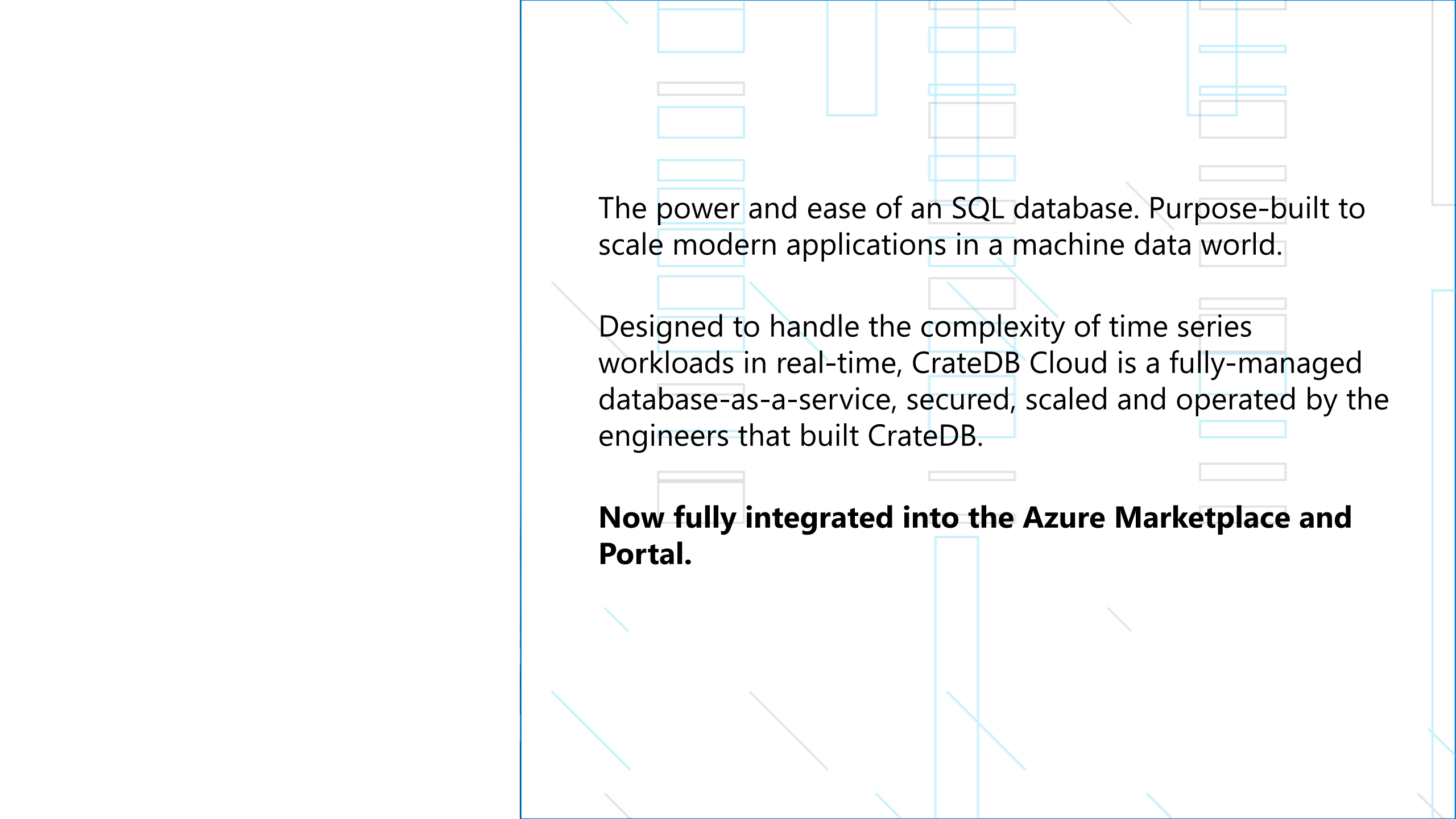
<https://iotinaction.westeurope.azure.cratedb.net:4200/>

Visualizing Data from CrateDB Cloud with e.g. Grafana



<https://westeurope.azure.cratedb.cloud/grafana/?orgId=a4e0a543-ef7b-49bb-8e89-4fb28c60204>





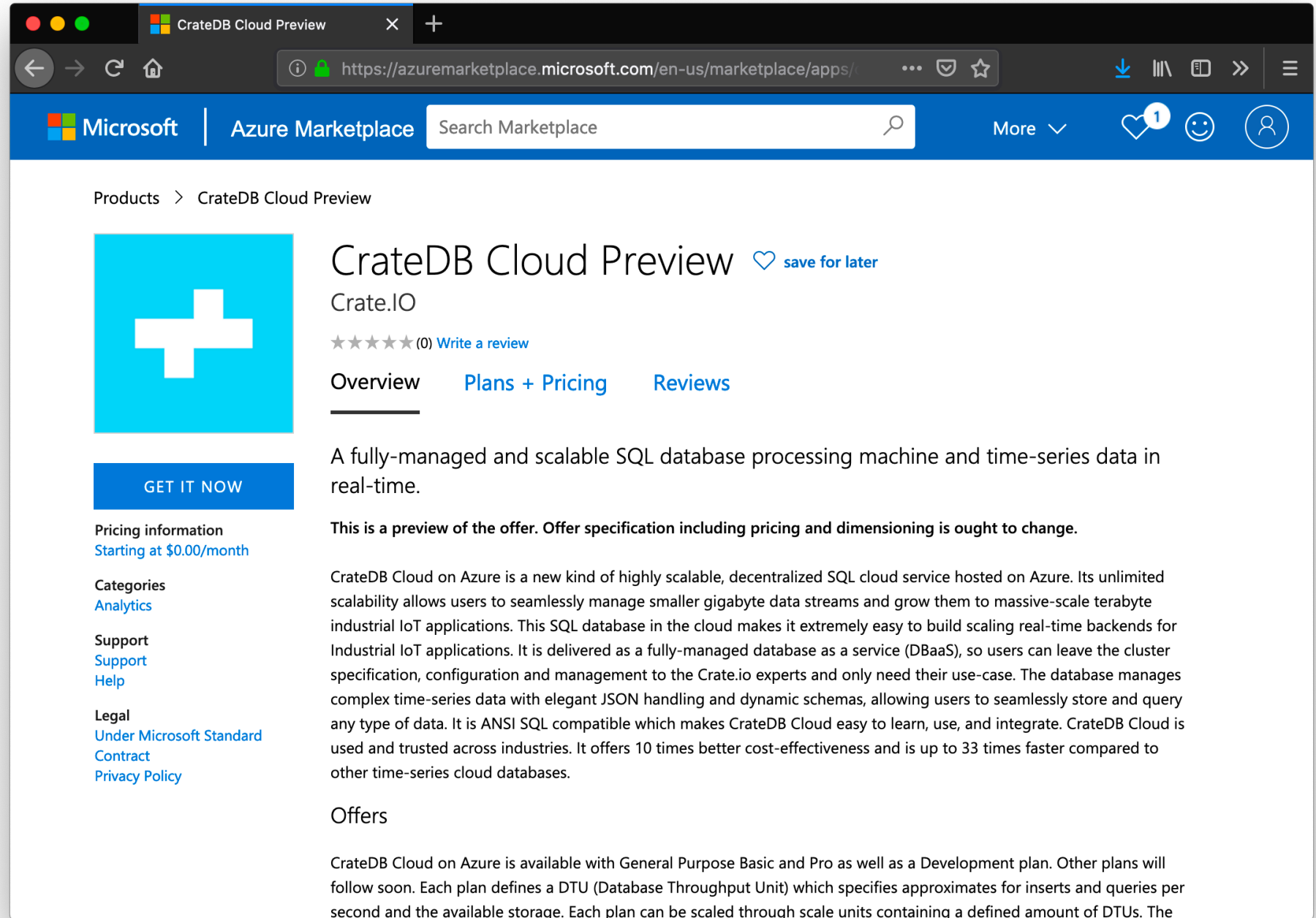
The power and ease of an SQL database. Purpose-built to scale modern applications in a machine data world.

Designed to handle the complexity of time series workloads in real-time, CrateDB Cloud is a fully-managed database-as-a-service, secured, scaled and operated by the engineers that built CrateDB.

Now fully integrated into the Azure Marketplace and Portal.

- Built as Cloud native DBaaS
- Dimensioning and cost defined by capacity and throughput
- Comes in three flavours:
 - General Purpose
 - Storage Optimised (soon)
 - IO Optimised (soon)
- General Purpose starting at \$500 for 500 Inserts and 100 queries per second
- Move from Preview to General Available in late November.

Available in the Azure Marketplace



The screenshot shows a web browser window with the URL <https://azuremarketplace.microsoft.com/en-us/marketplace/apps/>. The page header includes the Microsoft logo, "Azure Marketplace", a search bar, and navigation links. The main content area displays the "CrateDB Cloud Preview" product page. On the left, there is a blue square icon with a white plus sign, a "GET IT NOW" button, and links for "Pricing information" (Starting at \$0.00/month), "Categories" (Analytics), "Support" (Support, Help), and "Legal" (Under Microsoft Standard Contract, Privacy Policy). The right side of the page features the product name "CrateDB Cloud Preview" with a "save for later" link, the provider "Crate.IO", a star rating, and tabs for "Overview", "Plans + Pricing", and "Reviews". The "Overview" tab is selected, showing a description of the service as a fully-managed and scalable SQL database processing machine and time-series data in real-time. It also includes a disclaimer: "This is a preview of the offer. Offer specification including pricing and dimensioning is ought to change." and a detailed paragraph about the service's capabilities and benefits. The "Offers" section is partially visible at the bottom.

Products > CrateDB Cloud Preview

CrateDB Cloud Preview [save for later](#)

Crate.IO

★★★★★ (0) [Write a review](#)

[Overview](#) [Plans + Pricing](#) [Reviews](#)

[GET IT NOW](#)

Pricing information
[Starting at \\$0.00/month](#)

Categories
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A fully-managed and scalable SQL database processing machine and time-series data in real-time.

This is a preview of the offer. Offer specification including pricing and dimensioning is ought to change.

CrateDB Cloud on Azure is a new kind of highly scalable, decentralized SQL cloud service hosted on Azure. Its unlimited scalability allows users to seamlessly manage smaller gigabyte data streams and grow them to massive-scale terabyte industrial IoT applications. This SQL database in the cloud makes it extremely easy to build scaling real-time backends for Industrial IoT applications. It is delivered as a fully-managed database as a service (DBaaS), so users can leave the cluster specification, configuration and management to the Crate.io experts and only need their use-case. The database manages complex time-series data with elegant JSON handling and dynamic schemas, allowing users to seamlessly store and query any type of data. It is ANSI SQL compatible which makes CrateDB Cloud easy to learn, use, and integrate. CrateDB Cloud is used and trusted across industries. It offers 10 times better cost-effectiveness and is up to 33 times faster compared to other time-series cloud databases.

Offers

CrateDB Cloud on Azure is available with General Purpose Basic and Pro as well as a Development plan. Other plans will follow soon. Each plan defines a DTU (Database Throughput Unit) which specifies approximates for inserts and queries per second and the available storage. Each plan can be scaled through scale units containing a defined amount of DTUs. The

Three optimised
plans in two
scale
approximates
each

CrateDB Cloud Preview

https://azuremarketplace.microsoft.com/en-us/marketplace/apps/

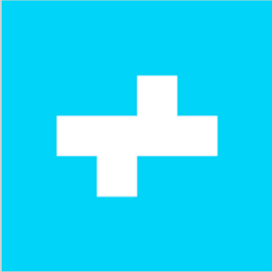
Microsoft | Azure Marketplace

Search Marketplace

More

1

Products > CrateDB Cloud Preview



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Pricing information
Starting at \$0.00/month

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CrateDB Cloud Preview

save for later

Crate.IO

★★★★★ (0) [Write a review](#)

Overview

Plans + Pricing

Reviews

Plan	Description	Monthly Price
General Purpose Basic	<p>This plan balances compute, memory, and cloud storage for the optimal blend of ingestion and query performance. The Basic plan ranges from 256–2,560GB of storage, 500–5,000 inserts per second, and 100–1,000 queries per second for the basic plan.</p> <p>General Purpose Basic DTU: 50 inserts per second, 10 queries per second, 25,6 GB storage, ~0.13 \$/hour</p> <p>During preview each general purpose plan can be scaled in 3 scale units each adding 10DTU.</p>	<p>\$0.00/month</p> <p>Plus: Cost per DTU minute: \$0.001</p>
General Purpose Pro	<p>This plan balances compute, memory, and cloud storage for the optimal blend of ingestion and query performance. The pro plan ranges from 2,048–20,480GB of storage, 2,000–20,000 inserts per second, 400 to 4,000 queries per second.</p>	<p>\$0.00/month</p> <p>Plus: Cost per DTU minute: \$0.004</p>

Listed as Resource in the Azure Portal

The screenshot shows the Microsoft Azure portal interface. The left sidebar contains navigation options: 'Create a resource', 'Home', 'Dashboard', 'All services', 'FAVORITES', 'All resources', 'Resource groups', 'App Services', 'SQL databases', 'Azure Cosmos DB', 'Virtual machines', 'Load balancers', 'Storage accounts', 'Virtual networks', 'Azure Active Directory', 'Monitor', 'Advisor', 'Security Center', and 'Cost Management + Billing'. The main content area is titled 'Home > iotinaction' and shows the 'iotinaction' resource as 'Software as a Service (SaaS)'. A search bar is present. Below the search bar, there are links for 'Overview', 'Access control (IAM)', and 'Support + troubleshooting'. The 'Support + troubleshooting' section includes a link for 'New support request'. On the right side, there is a warning banner: 'Action required: Please complete subscription signup by clicking "Configure Account". Billing'. Below the banner, the 'Offer details' section shows 'CrateDB Cloud Preview - General Purpose Basic by Crate.IO'. It includes links for 'Microsoft Standard Contract' and 'privacy policy'. A table displays the 'Term' as 'Monthly' and the 'Offer renew date' as 'Pending account configuration'. At the bottom, there are links for 'Publisher' (Crate.IO), 'Useful Links' (CrateDB Cloud), and 'Support' (https://crate.io/support/).

Microsoft Azure

Search resources, services, and docs (G+)

Home > iotinaction

iotinaction
Software as a Service (SaaS)

Search (Cmd+)

Configure Account Refresh Delete

Action required: Please complete subscription signup by clicking "Configure Account". Billing

Offer details
CrateDB Cloud Preview - General Purpose Basic
by Crate.IO

[Microsoft Standard Contract](#) | [privacy policy](#)

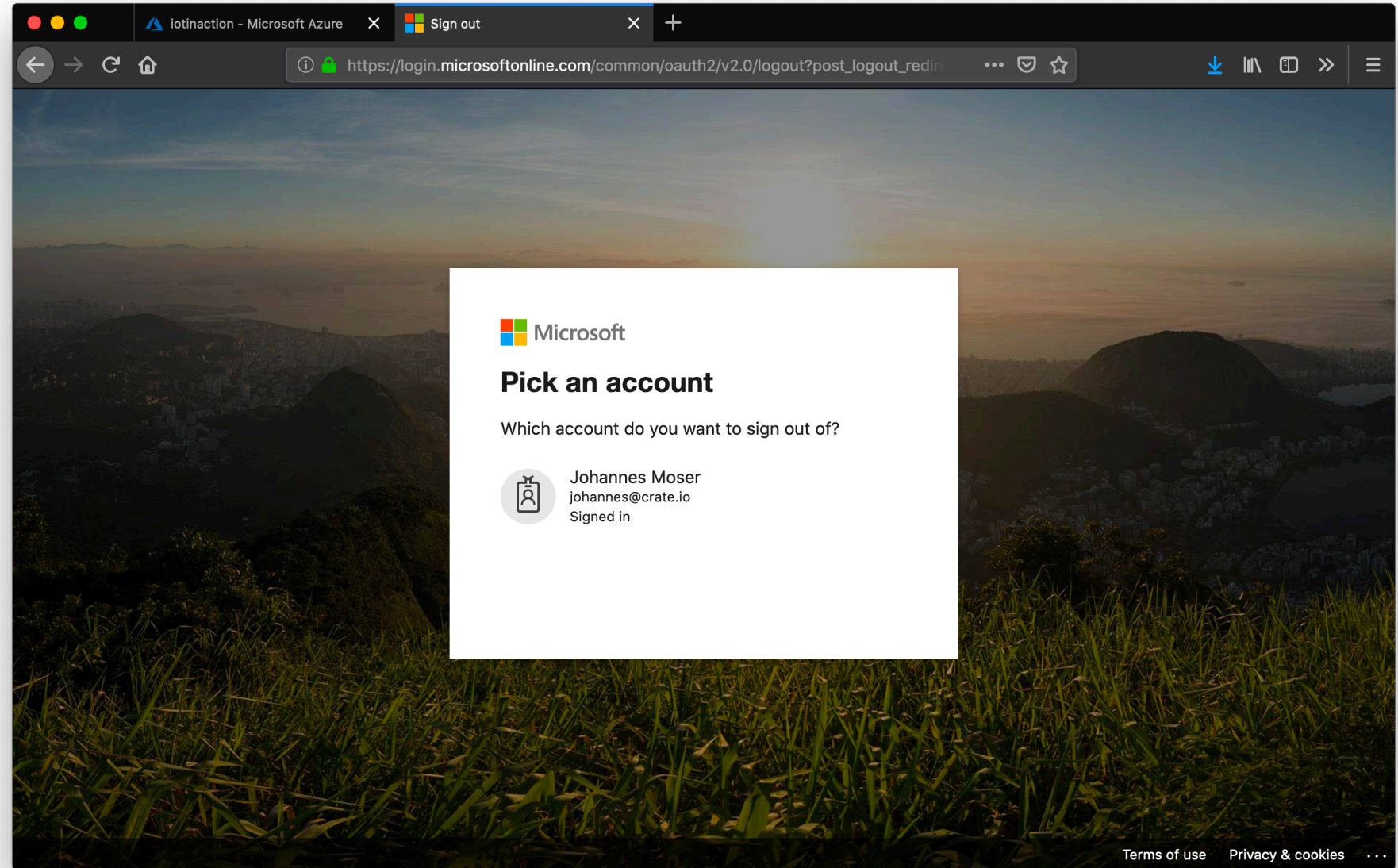
Term	Offer renew date
Monthly	Pending account configuration

Publisher: Crate.IO

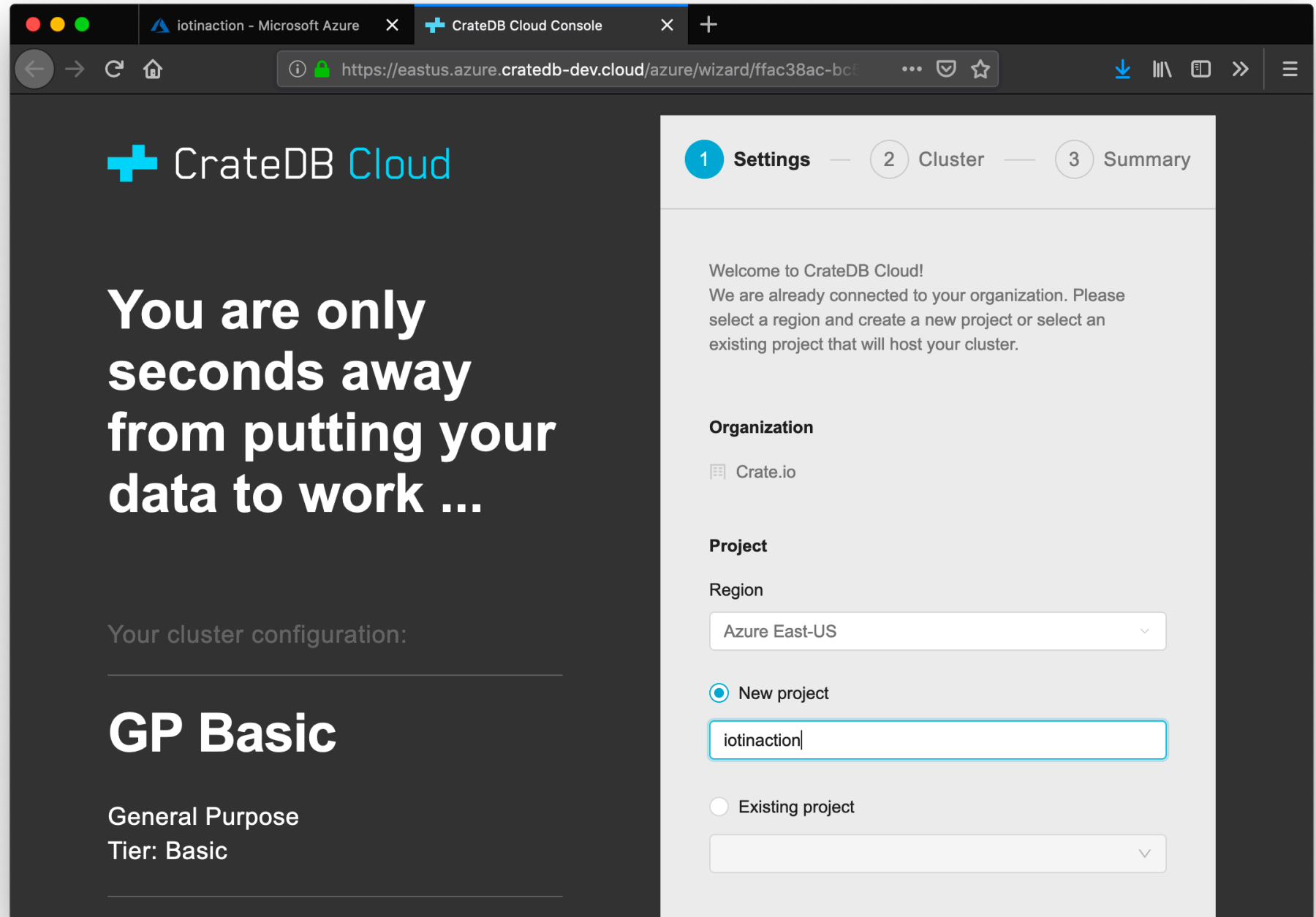
Useful Links: [CrateDB Cloud](#)

Support: <https://crate.io/support/>

Login through Azure AD



Setting up CrateDB Cloud



CrateDB Cloud

You are only seconds away from putting your data to work ...

Your cluster configuration:

GP Basic

General Purpose
Tier: Basic

1 Settings — **2 Cluster** — **3 Summary**

Welcome to CrateDB Cloud!
We are already connected to your organization. Please select a region and create a new project or select an existing project that will host your cluster.

Organization

Crate.io

Project

Region

Azure East-US

☒ New project

iotinaction

☐ Existing project

Dimensioning the cluster

The screenshot shows the CrateDB Cloud console interface. The browser tabs include 'iotinaction - Microsoft Azure' and 'CrateDB Cloud Console'. The address bar shows the URL 'https://eastus.azure.cratedb-dev.cloud/azure/wizard/ffac38ac-bc57-4d37-9603'. The main content area has a dark background with the CrateDB Cloud logo and a large text block: 'You are only seconds away from putting your data to work ...'. Below this, it says 'Your cluster configuration:' followed by 'GP Basic' and 'General Purpose Tier: Basic'. On the right, a light gray sidebar contains a progress bar with three steps: 'Settings', 'Cluster' (current), and 'Summary'. The 'Cluster' step includes instructions to enter a cluster name, username, password, and scale. The 'Cluster name' field contains 'iotinaction', the 'Username' field contains 'iotinaction', and the 'Password' field is masked with dots. The 'Scale of cluster' is shown as a slider. Below the slider is a table with the following data:

Scale unit	Storage	Ingests/s	Queries/s	Price / hour (month)
2x	512 GB	1,000/s	200/s	\$1.31 (~\$959.11) i

At the bottom of the sidebar, there are three buttons: 'Cancel', 'Previous', and 'Next'.

Ready to go

The screenshot shows the CrateDB Cloud Console interface. The browser address bar displays the URL: <https://eastus.azure.cratedb-dev.cloud/account/organizations/90d6f103-e45c-4>. The left sidebar contains the following navigation items: Overview (selected), Settings, Users, and Settings. The main content area is titled "Overview" and displays the following cluster details:

Cluster name	Plan	DB Username
iotinaction	General Purpose Basic	iotinaction

Cluster ID	RAM / Heap size
febd705c-e19d-428c-b523-4db15a7b6433	5 GB

Cluster URL	Number of cores
iotinaction.eastus.azure.cratedb.cloud	5

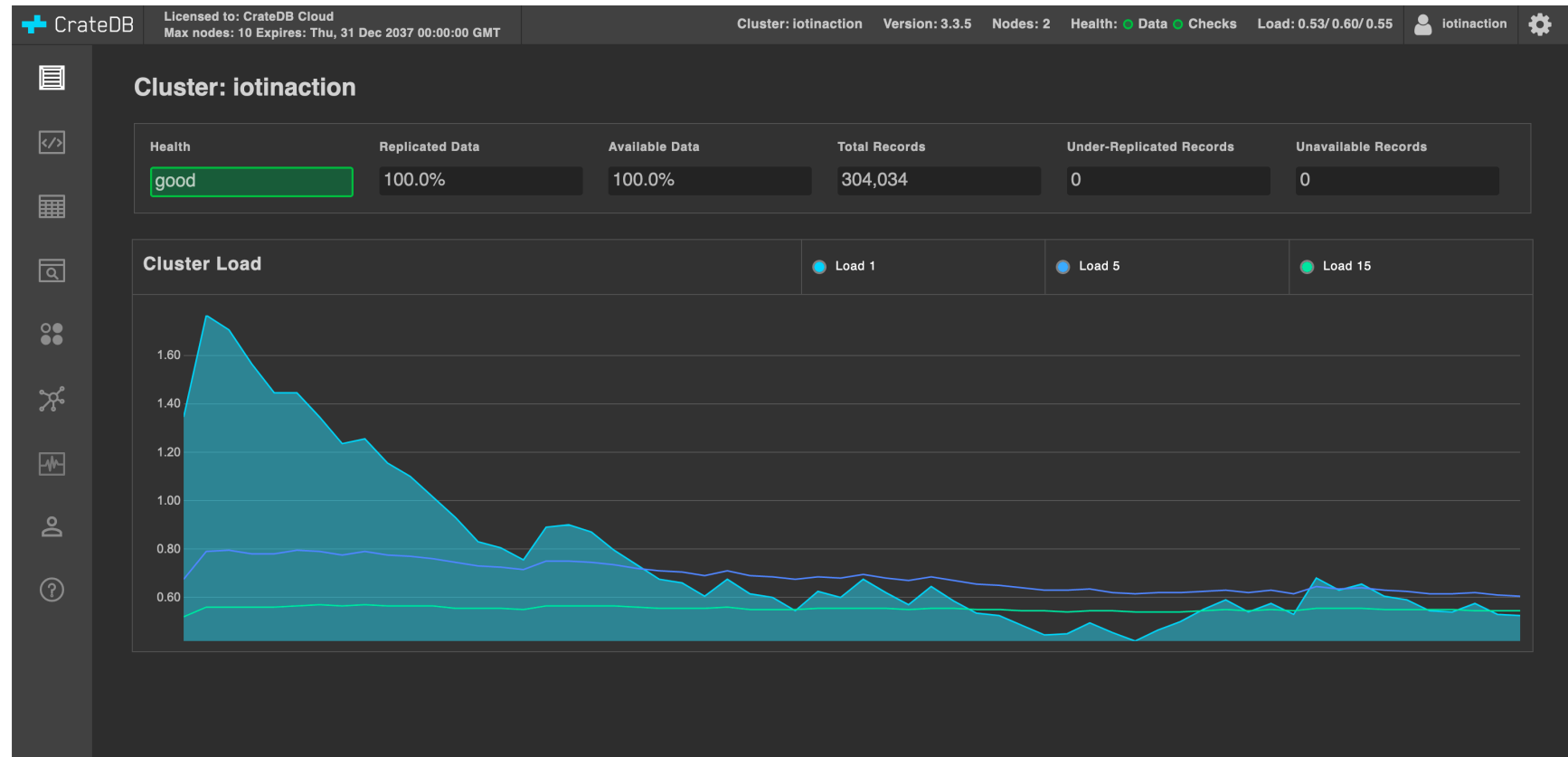
Cluster channel	Storage
stable	512 GB

Version	Throughput
4.0.6	~1000 Inserts per second ~200 queries per second

Created	Region
Oct 19, 2019, 11:52:01 AM	Azure East-US

A blue chat bubble icon is visible in the bottom left corner of the main content area.

Cluster
deployed and
ready for
IoT in Action



CrateDB – integrated Management Console

Dynamic Cluster Sizing and Scaling

*Full availability
late November.*

The screenshot displays the CrateDB Cloud management interface. On the left is a dark sidebar with the 'CrateDB Cloud' logo and navigation links: 'My project', 'Overview' (selected), 'mycluster', 'Users', 'Settings', 'Organization', 'Account', 'Logout', and a 'Collapse' button. The main content area is divided into two panels. The left panel, titled 'Overview', shows 'Deployed services' with a table containing one entry: 'mycluster'. The right panel, titled 'Create new cluster', features a three-step progress bar (Plan, Settings, Summary) and a 'Configurator' button. Below this are four sliders for configuration: 'Ingests / Second' (set to 30,000), 'Queries / Second' (set to 2,000), 'Package size' (set to 20kb), and 'Data retention' (set to > 2 years). At the bottom of this panel is a 'Cancel' button. The rightmost panel shows a cluster diagram with four nodes labeled 'Development', 'General purpose', 'Storage optimized', and 'IO optimized'. A tooltip for 'IO Standard 3' is overlaid on the 'IO optimized' node, displaying the following specifications:

IO Standard 3	
I/O optimized Tier: Standard Scale unit: 3	
Storage	300 GB
Ingests	18,000/s
Queries	450/s
Price/hour	\$20.00
Price/month	\$12,000

A 'Next' button is located at the bottom right of the cluster configuration panel.



And now: try it out in Azure Marketplace :-)

See you at our booth !
Christian Lutz, CEO

IoT in Action






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Time
investment
expectation

Microsoft.com/learn



Azure fundamentals

8 hr 17 min remaining • Learning Path • 1 of 12 modules completed

Beginner Developer Solution Architect Administrator AI Engineer Business Analyst Business User

Data Engineer Data Scientist Azure Azure Portal Azure Resource Manager Storage Virtual Machines

Interested in the cloud, but aren't quite sure what it can do for you? This path is the place to start.

In this learning path, you will:


- Learn cloud concepts such as High Availability, Scalability, Elasticity, Agility, Fault Tolerance, and Disaster Recovery
- Understand the benefits of cloud computing in Azure and how it can save you time and money
- Compare and contrast basic strategies for transitioning to the Azure cloud
- Explore the breadth of services available in Azure including compute, network, storage and security

Once you complete this learning path, you will have the necessary knowledge to take the [AZ900 Microsoft Azure Fundamentals Exam](#).

Prerequisites
None

12300 XP

Modules in this learning path



Cloud Concepts - Principles of cloud computing

1 hr 2 min • Module • 10 Units

★★★★★ 4.8 (23350)

Explore the core concepts of cloud computing and how it can help your business.

Overview ▾

1100 XP



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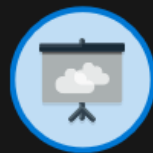
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Prerequisites
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12300 XP

Total XP=
12,300

Modules in this learning path



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Overview ▾

✓ 1100 XP

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12300 XP

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Data Scientist

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Overview ▾

✓ 1100 XP

Module XP=
1,100

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the badgez!



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Complexity
IoT PnP, IoT Central

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Solution == Partners

IoT in Action



Thank you!