Architecting the Intelligent Edge

Kevin Hilscher
IoT Solution Architect, Microsoft

Chad Lich
IoT Solution Architect, Microsoft
The evolution of IoT in Action

Year 1 2017
The evolution of IoT in Action
The Evolution of IoT in Action
### Reasons for IoT adoption

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations optimization</td>
<td>56%</td>
</tr>
<tr>
<td>Employee productivity</td>
<td>47%</td>
</tr>
<tr>
<td>Safety and security</td>
<td>44%</td>
</tr>
<tr>
<td>Supply chain management</td>
<td>40%</td>
</tr>
<tr>
<td>Quality assurance</td>
<td>40%</td>
</tr>
<tr>
<td>Asset tracking</td>
<td>33%</td>
</tr>
<tr>
<td>Sales enablement</td>
<td>31%</td>
</tr>
<tr>
<td>Energy management</td>
<td>26%</td>
</tr>
<tr>
<td>Condition-based maintenance</td>
<td>25%</td>
</tr>
<tr>
<td>Health and wellness</td>
<td>18%</td>
</tr>
</tbody>
</table>
## Additional top use case by industry

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


Top challenges

- Complexity/technical challenges: 38%
- Lack of budget/staff resources: 29%
- Lack of knowledge: 29%
- Haven’t found the right IoT solutions: 28%
- Security: 19%
Solution architecture—DIY

Custom cloud solution

- Provisioning Mgmt Services
- Identity & registry stores
- Device state stores
- Stream processing
- Storage
- Analytics & Machine Learning
- App backend
- Solution UX
- Business integration & connectors

Digital feedback loop

IoT devices & sensors

Business systems
We had a similar challenge in the past...
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
Daisuke Nakahara

Principal IoT Solution Architect, Microsoft
Connecting hardware is very “hard”

Collect data
Send data
Consume data
Provision & Manage device
Evolution in Personal Computer world

With PC
- Define industry standards
  - USB, PCI, OSI, ....
- Define software model
  - Windows Driver Model, ....
- Define data model
  - File format, Protocol,

IoT Plug and Play
- Digital Twin Definition Language
- Device Capability Model
  - Interface, model definition, ....
- Follow IoT standards
  - MQTT, HTTPS, AMQP, ....

Common Language to simplify IoT
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
Making IoT seamless

The total effort to build and operate an IoT Solution is rapidly decreasing.
Solution architecture—IoT Central

IoT devices & sensors

Flexible data ingestion

Configurable UX surface

Azure IoT Central Core

Data channels & APIs

Business systems

Digital feedback loop
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

- White labeling
  Your SaaS—your brand
- IoT Plug-and-Play
  Public Preview
- IoT Edge support
  Incl. Module Management
- Multi-tenancy & RBAC
- Extensibility
  APIs
- Solution Builder App Templates

- Maps, location telemetry and geofencing
- Device Bridge
  Ingest data from other clouds
- Continuous Data Export
  Bring data into downstream business applications
IoT Central App Templates

App templates for Priority Industry Verticals

<table>
<thead>
<tr>
<th>App Templates for Industries</th>
<th>Retail</th>
<th>Healthcare</th>
<th>Energy</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital distribution center</td>
<td>Continuous patient monitoring</td>
<td>Smart meter analytics</td>
<td>Water quality monitoring</td>
<td>Water consumption monitoring</td>
</tr>
<tr>
<td>In-store analytics</td>
<td></td>
<td>Solar power monitoring</td>
<td>Connected waste management</td>
<td></td>
</tr>
</tbody>
</table>
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
“Big Data” challenge 2.0
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
Partners make more possible
The anatomy of the architectural design session
The output
IoT in Action

Ben Kotvis
Chief Architect, IoT
Enter: the Super Solution Integrator

(n.) a single team with expertise across all aspects of modern IT solutions to architect, manage and execute initiatives from end-to-end
Emergency IoT notification system piloted in Houston’s Aldine School District

Connects students, staff and first responders with a variety of devices, sensors, alerts and interactive floorplans

Lead with Digital Innovation’s digital strategy capabilities to uncover pain points and develop solutions

Engaged with BeSafe Technologies and Microsoft, leveraging the strength of our deep partner relationships
How can these devices be used in other ways? How can we scale this into a broad and repeatable solution?
Insight Connected Platform

The journey to a repeatable, scalable solution
Secure, scalable & flexible

Insight Connected Platform

Platform High Level Architecture

Cloud

Edge

Devices & People

Platform Functionality

- Mobile friendly
- Alerts & Notifications
- Identity management
- Mapping engine
- Roles & Permissions
- Rules engine
- Branding / White label
- Automated workflows
- HW Device Integrations
- Communications service
- SW App Integrations
- Data analytics
- Device & Data Management

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Insight Connected Platform

Visualizes and triggers workflows from any IoT data source

Empowers real time, persona based, operational control through a single pane of glass

Utilizes cloud AI models deployed to the edge for true business insights
<table>
<thead>
<tr>
<th>Smart manufacturing</th>
<th>Inventory &amp; asset insight</th>
<th>Predictive maintenance &amp; field service</th>
<th>Employee safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase throughput.</td>
<td>Increase throughput.</td>
<td>Optimize spare parts inventory.</td>
<td>Reduce response times.</td>
</tr>
<tr>
<td></td>
<td>Minimize costs.</td>
<td>Improve service delivery and customer satisfaction.</td>
<td>Enhance communications and coordination.</td>
</tr>
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</table>
Connected Platform demo
IoT integrations
Building blocks for any scalable solution

Temperature sensors
PLCs
RFID tags & readers
Cameras
Other data sources
GPS/Location Tracking
Visual displays
Interactive floorplans
Vibration sensors
Smart buttons

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Insight Connected Platform architecture
Repeatable, enterprise-wide deployment model
Thank you.

Contact connectedsolutions@insight.com to learn more.
Managing the operational expense of machinery and equipment is of paramount importance for asset-intensive industries, such as manufacturing, oil & gas, logistics & transportation and equipment rental. Avnet’s Smart Asset Monitoring solution, built on Microsoft Azure, uses sensors, mobile apps and cloud-based analytics to help you monitor machine performance, better manage inventory, and improve productivity.

**INSTANT ASSET LOCATION**
Supervisors can see which tools are in use by a particular department or employee at any given time.

**PREDICTIVE MAINTENANCE**
Push notifications alert managers to potential issues so they can take action to prevent breakdowns and production loss.

**DEEPER INSIGHTS**
An interactive dashboard shows usage history and other metrics with the ability to generate detailed, customizable reports.

**EMPLOYEE TIME SAVED**
Employees can use a mobile app to quickly obtain and return equipment, freeing up time for more critical tasks.
Azure Sphere for Brownfield IoT

Guardian

USB power and Serial Port
FTDI for onboard management
External LED indicators
Downstream device interface (Ethernet in this sample)
Azure Sphere MCU

Brownfield
Existing devices and equipment
Common use cases:
- Food services
- Refrigeration
- Industrial equipment
- HVAC Controls
Powered by Microsoft Azure

Built on Azure services, IoTConnect includes the enterprise-grade security, connectivity and powerful analytics needed for a best-in-class IoT solution.

- Connectivity
- Scalability
- Powerful analytics
- Artificial intelligence
- Security and management
Industrial Motor Pumpjack Demo

powered by Smart Asset Monitoring Solution, IoTConnect and Avnet’s Guardian enabled by Azure Sphere
Reference Architecture – End to End Common Fabric

1. Sensor Connection
   - ML - 3D / VR / AR
   - Technologies: Zigbee, BLE, LTE, Wi-Fi

2. Gateway
   - Device Attestation
   - Protocols: MQTT, HTTP

3. Device Attestation
   - Gateway
   - Attestation Services

4. Device Management System
   - SQL Elastic Pool
   - Technologies: SQL, Power BI

5. Analytics
   - Stream Analytics
   - Technologies: Databricks, Azure ML

6. Database
   - Time Series

7. Data Ingestion
   - AI-ML Pdx
   - Technologies: Event Hub, Function

8. API Management
   - Data as a Service (DaaS)

9. Service Orchestration
   - Services Orchestration

10. Cloud Management – Smart Portal
    - Cloud Management System, Monitoring, Auto-scaling, Logging, Eventing

11. Edge Analytics

New Service Offerings
Integration with Systems

Operations Manager
Equipment and Asset Manager
Maintenance Engineer
Navigate the complex landscape with a partner

End-to-end capabilities to help you realize business outcomes from your solution initiatives faster.
Avnet IoT Partner Program

A program that enables partners to build and scale their IoT solution businesses by leveraging Avnet’s IoTConnect Platform and our ecosystem of experts.

Enablement  Automated Billing  Solution “Play Zone”  Analytics  Collaboration

Devices, Solutions and Apps

Devices > Gateways > IOTCONNECT Platform > AI > Value

Avnet IoT Marketplace

Access trusted and certified IoT devices and Smart Applications through a curated experience. Developers can write to and sell from our Marketplace.

*Coming spring 2020
Next steps

See the demo in action today and connect with us!

Contact the Avnet team to learn more about the IoTConnect platform, Guardian and how we can help – **iot@avnet.com**

Learn more about our IoT solutions and partner program

[Avnet.com/iot](Avnet.com/iot)
[Avnet.com/iotpartnerprogram](Avnet.com/iotpartnerprogram)
Chad Dirks
Director IoT Americas

Let’s connect

chad.dirks@softwebsolutions.com
LinkedIn: linkedin.com/in/chaddirks/
Welcome to Microsoft Learn
Azure fundamentals

Time investment expectation

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

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
Azure fundamentals

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

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Overview
Leveling up your Azure skillz with Microsoft Learn

I can haz **ALL** the badgez!
Microsoft Certified: Azure IoT Developer Specialty

Exam AZ-220: Microsoft Azure IoT Developer
Top challenges

**Complexity**
IoT PnP, IoT Central

**Knowledge**
MS Learn

**Security**
Confidential Computing

**Solution == Partners**
Project 15 from Microsoft
An Animal Conservation Initiative