Bringing the Internet of Things to life with Microsoft Azure IoT Services

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The IoT Revolution
The next wave of computing
IoT 2015

HOME
- Smart appliances
- Sleep tracking
- Home security

COMMUTE
- Cloud computing
- Internet

WORKPLACE
- Office equipment
- Smart vending machines
- Information capture

Garden, lawn and plant care

New devices and sensors

Beacons and proximity

Indoor navigation

Behavior modification

Object tracking

Trip tracking and car health

Sports and fitness

Pet tracking

Medication adherence

Child and elder monitoring

Food and nutrition tracking

Identity

Air conditioning and temperature control

Environmental sensors

Home automation

Leak detection

Home security

Entertainment systems
Defining Internet of Things

Things
Connectivity
Data
Analytics

10101
01010
00100
Internet of Things opportunity

25 billion
Connected “things” by 2020
—Gartner

$1.7 trillion
Market for IoT by 2020
—IDC

70%
of value enabled by IoT will come from B2B scenarios
McKinsey & Company
What can it do for my business?

What does it look like?
Organizations are benefiting from IoT today
# IoT Enabled Infrastructure

<table>
<thead>
<tr>
<th>City</th>
<th>Buildings</th>
<th>Energy</th>
<th>Health</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Protection</td>
<td>Lighting</td>
<td>Electricity Distribution</td>
<td>Patient Tracking</td>
<td>Traffic Flow</td>
</tr>
<tr>
<td>Pollution Control</td>
<td>Water</td>
<td>Wind/Solar/Geothermal</td>
<td>Vital Monitoring</td>
<td>Traffic Alerts</td>
</tr>
<tr>
<td>Flood Control</td>
<td>Energy Management</td>
<td>Gas Distribution</td>
<td>Implants</td>
<td>Rule Enforcement</td>
</tr>
<tr>
<td>Medical Emergency</td>
<td>Climate Control</td>
<td>Fuel Distribution</td>
<td>Disability Aids</td>
<td>Toll Collection</td>
</tr>
<tr>
<td>Drinking Water</td>
<td>Air Quality</td>
<td>Power Plants</td>
<td>OR Equipment</td>
<td>Bus/Tram/Train</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>Lifts and Escalators</td>
<td>Nuclear Waste</td>
<td>Lab Equipment</td>
<td>Taxi</td>
</tr>
<tr>
<td>Waste Water</td>
<td>Signage</td>
<td>Coal Mining</td>
<td>Radiology Equipment</td>
<td>Street Quality</td>
</tr>
<tr>
<td>Public Order</td>
<td>Safety Management</td>
<td>Oil/Gas Production</td>
<td>Mobile Care</td>
<td>Air Traffic Control</td>
</tr>
</tbody>
</table>

- Health Applications:
  - Diabetes
  - Vital Monitoring
  - OR Equipment
  - Lab Equipment
  - Radiology Equipment
  - Mobile Care
  - Air Traffic Control
  - Airports
However, IoT projects can be complex

- Long timelines
- Hard to scale
- Difficult to customize
Azure IoT Reference Architecture

**Devices and Data Sources**
- IP capable devices
- Existing IoT devices
- Low power devices

**Data Transport**
- Data and Event Processing
- Devices and Data Sources

**Device and Event Processing**
- Provisioning API
- Solution Portal
- Identity & Registry Stores
- Device State Store
- Stream Event Processor
- Storage
- Analytics/Machine Learning
- Control System Worker Role

**Presentation**
- Data Visualization & Presentation
Capture and analyze untapped data to transform your business

Connect and scale with efficiency

Analyze and act on new data

Integrate and transform business processes

Analytics
Device Registry
Rules and Actions
Dashboards & Visualization

Real-time operating systems
And more

SAP
salesforce
Microsoft Dynamics
Oracle
IBM
DB2
Informix software
WebSphere
Twitter
Office 365
Accelerate time to value with preconfigured solutions

Start quickly with preconfigured solutions

- Get started in minutes
- Modify existing rules and alerts
- Add your devices and begin tailor to your needs

Finish with your Internet of Things application

- Fine-tuned to specific assets and processes
- Highly visual for your real-time operational data
- Integrate with back-end systems
Solution types

Predictive maintenance
Anticipate maintenance needs and avoid unscheduled downtime by connecting and monitoring your devices for predictive maintenance.

Remote monitoring
Connect and monitor your devices to analyze untapped data and improve business outcomes by automating processes.
What does it look like?
Provisioning your Remote monitoring solution, in Southeast Asia region.

Provisioning states

- **MSDiOT8**
  - Microsoft.ActivatedDirectory.Applications

Provisioning log

- 06/20/2016 02:14 pm
  - Creating role assignments...
- 06/20/2016 02:14 pm
  - Creating service principal...
- 06/20/2016 02:14 pm
  - Creating application...
- 06/20/2016 02:14 pm
  - Starting Azure active directory application provisioning...

Modify your solution

See the provisioned Azure resources that make up your pre-configured solution in the Azure Management Portal.

View the Source Code for this Pre-Configured Solution on GitHub.

Resources

- Developer documentation

Actions

- Delete Solution
What you get with remote monitoring preconfigured solution

Azure IoT Suite Remote Monitoring

- Devices
  - C# simulator

- Back end systems and processes
  - IoT Hub
  - Stream Analytics
  - Event Hub
  - Storage blobs
  - DocumentDB
  - Web Jobs
  - Logic Apps
  - Power BI
  - Active Directory
What you get with predictive maintenance solution

Devices
- C# simulator

Web Job
- Simulated Device

IoT Hub
- Consumer Group
- Job 1 Device Info
- Job 2 Telemetry

Azure Stream Analytics
- Event Hub

Azure ML
- Training Data
- Trained Module

Web Job
- Event Hub

Web App
- Dashboard
- Device Portal

Document DB

Back end systems and processes

Azure Storage (Blog)
- RUL Output
- Telemetry History
- Input Dataset
Reference Resources


DIY ?
IoT Hub endpoints
Download the Microsoft Azure IoT Device SDK

git clone --recursive https://github.com/Azure/azure-iot-sdks.git
Get started
With
Azure IoT Hub for Node.js

* Simulator
* Physical device
Get started with Azure IoT Hub
For **C#** and **Node.JS**

- **NuGet Packages**:
  - Microsoft.Azure.Devices
  - WindowsAzure.ServiceBus

- **Npm**:
  - Npm install azure-iotdb --save
  - npm install amqp10 bluebird --save
  - npm install azure-iot-device-ampq --save

Reference:
Azure IoT Starter Kits
Get started quickly

Raspberry Pi 2 Kit
Windows 10 and Raspbian
Samples in C and C#

Feather M0 Wi-Fi Kit
RTOS
Samples in Arduino IDE and C

Feather Huzzah ESP8266 Kit
RTOS
Samples in Arduino IDE and C

Intel Edison Kit
Linux Yocto
Samples in JavaScript (Node.js)

ThingDev Kit
RTOS
Samples in Arduino and C

Start today: http://azure.com/iotstarterkits
Welcome to Visual Studio Dev Essentials!

Everything you need to build and deploy your app on any platform

Visual Studio Community
Full-featured, extensible IDE
Free for individuals, open source or small teams. Create apps for Windows, iOS, Android & more.
Download | Learn more

Visual Studio Code
Modern lightweight editor
A powerful, streamlined code editor for your favorite platform – Linux, Mac OSX, and Windows.
Download the beta | Learn more

Visual Studio Team Services
Basic level
Free Git repos, Agile planning tools and hosted builds, for any language – it’s the perfect complement to your IDE.
Get started | Learn more

Pluralsight
6-month subscription
Available while supplies last, with 3-month subscription available thereafter. World-class, cutting edge.
Get code | Take training

Azure
$25 monthly Azure credit
12 months of access to your own personal sandbox for dev/test. Provision virtual machines, cloud services, and

Microsoft R Server
Developer Edition
Build Advanced Analytics solutions in R on Windows, Hadoop, Teradata and Linux.

Xamarin University Training
Free on-demand access
Build native iOS and Android apps in C# with expert getting-started videos (subset of class videos and materials)

Microsoft SQL Server
Developer Edition
Build mission-critical data solutions with faster insights from any data and a platform for hybrid cloud (dev/test only)

Azure offering for learning, teaching and researching

Microsoft Azure for DreamSpark
- [http://fuju.org/?p=32402](http://fuju.org/?p=32402)

The Microsoft Educator Grant Program

Microsoft Azure for Researchers
Call to Action

• Check the Projects & Hackaton
  • https://github.com/Microsoft-Build-2016/CodeLabs-IoTDev/tree/master/Module4-OpenHack
  • Thinglabs.io
• MyDriving IoT Sample
• Windowsondevices.com

• Blog article: http://aka.ms/azureiotdevintro
• Azure IoT dev center: http://aka.ms/azureiotdev
• GitHub repo: http://github.com/azure/azure-iot-sdks
• Re-visit Build on Channel 9.
• Continue your education at Microsoft Virtual Academy online.
Thank you;
ขอบคุณครับ

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Appendix
## Remote Monitoring

How to approach a remote monitoring project

Imagine if you could monitor thousands of devices located around the world without physically inspecting them

<table>
<thead>
<tr>
<th></th>
<th>Establish monitoring objectives and requirements</th>
<th>Profile the devices involved</th>
<th>Determine additional solution components</th>
<th>Categorize the data</th>
<th>Define alerts and actions</th>
<th>Operationalize the solution and scale</th>
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Azure IoT Suite solutions come with pre-built sample scenarios that include:
- Background information on the business need and objectives
- Simulated devices and sample data
- Pre-set rules and alerts, pre-defined dashboards, and more
Predictive Maintenance

How to approach a predictive maintenance project

Imagine if you could automatically identify and fix potential problems before they happen

<table>
<thead>
<tr>
<th></th>
<th>Identify the target outcome</th>
<th>2</th>
<th>Inventory data sources</th>
<th>3</th>
<th>Capture &amp; combine data</th>
<th>4</th>
<th>Model, test and integrate</th>
<th>5</th>
<th>Validate model in a live operational scenario</th>
<th>6</th>
<th>Integrate into operations</th>
</tr>
</thead>
</table>

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