IBM Internet of Things

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**IBM Internet of Things (IoT) Platform** service lets your apps communicate with and consume data collected by your connected devices, sensors, and gateways. IBM IoT Platform for Bluemix gives you a versatile toolkit that includes gateway devices, device management, and powerful application access.

- Super easy to get devices connected to IBM Internet of Things cloud. IBM provides a set of verified instructions, or 'recipes', for connecting devices, sensors and gateways from a variety of partners and individuals.
- Apps can use IBM real-time and REST APIs to communicate with your devices and consume the data you've set them up to collect. Communications between your devices and the cloud happen via the open, lightweight MQTT protocol.
- Consumption of unstructured data. Watson's artificial intelligence is used to parse the data obtained from the transactions between the devices.
- Advance analytics of aggregated data.
- Data more meaningful, device more impactful.

**Link:**
- [https://console.ng.bluemix.net/docs/services/IoT/index.html](https://console.ng.bluemix.net/docs/services/IoT/index.html)
IBM IoT Platform

Architecture:
Features: The IBM Watson IoT Platform is built on the following key areas.

- **Connect**
  Connecting devices, creating applications, controlling your devices, and interacting with third-party services are all available under Watson IoT Platform Connect.

- **Information Management**
  Watson IoT Platform Information Management controls the data that is sent by devices after it reaches your Watson IoT Platform service. Information management includes data storage and transformation.

- **Analytics**
  Dashboard cards monitor and display device data in real-time, which allows you to keep track of key devices or device data. These visualizations are displayed on the main Watson IoT Platform dashboard to give you rapid access to the context and status of real-time device data.

- **Risk Management**
  The architecture of the Watson IoT Platform is designed to prevent devices from impersonating other devices, which maintains the integrity of your device data. Devices connect to the Watson IoT Platform by using a combination of a client ID and authentication token, which only you know.
IBM IoT Platform

Connectivity flow:

Your device or gateway
We start with your device, be it a sensor, a gateway or something else. To find out how to get it connected, search our recipes.

MQTT
Your device data is sent securely up to the cloud using the open, lightweight MQTT messaging protocol.

api
REST & Real-time APIs
Use our secure APIs to connect your apps with the data coming from your devices.

IBM Watson IoT Platform
This is the hub of all things IBM IoT. This is where you can setup and manage your connected devices so that your apps can access their live and historical data.

Your application and analytics
Create applications within IBM Bluemix, another cloud, or your own servers to interpret the data you now have access to!
IBM IoT Platform

**Components:**

- **Configuration tool** that you can use to configure how you want the bot to respond to various types of requests.
- **Node-RED** the visual tool for wiring the Internet of Things
- **MTQQ message protocol** for communicating with devices
- **REST** and **real time API** facility
- **Watson Cognitive API** Very powerful APIs to make your apps more interactive e.g. Visual recognition, Tone analyzer, Personality Insights.
- **Weather company data** for making the devices aware of local weather.
Any hardware interacting with IBM IoT platform need to be registered and get a device ID.

Through some application sensor information will be sensed and send to the IoT server.

Now at IBM Bluemix IoT side we will have access of sensor information.
**Node-RED** is a visual tool that you can use to develop your applications, devices, and gateways on IBM Watson IoT Platform.

- Node-RED provides capabilities for connecting hardware devices, APIs, and online services in new and interesting ways.
- Node-RED is built on top of Node.js and takes advantage of the huge node module ecosystem to provide a tool that can integrate many different systems.

By using a **Node-RED** flow, Bluemix IoT app can process messages from the sensor and feed to some other application.

- Data can be visualized through available applications, or by own app created for this purpose
- Through API service can be extended
**API Connect**

**IBM API Connect** is an API management solution that addresses critical aspects of the API lifecycle for both on-premises and cloud environments providing the capability to create, run, manage and secure APIs and microservices.

*Link: [https://console.ng.bluemix.net/docs/services/apiconnect/index.html](https://console.ng.bluemix.net/docs/services/apiconnect/index.html)*

To manage connectivity we have to install IBM API Connect that includes:

- **API Connect Developer Toolkit**
  - API command-line tool. Command line interface has line by line app designing facility.
  - API Designer visual tool.
- **LoopBack Node.js framework**
- **API Connect Micro Gateway**

API call is supported via using curl command, and languages such as Ruby, Python, Java, and Node.
IBM IoT Platform Development

Application development:
You can build and manage applications by the supported protocols and standards:
- MQTT messaging protocol
- Python
- Node.js
- Java
- C#

Device development:
You can build and manage devices by the supported protocols and standards:
- MQTT messaging protocol
- Python
- Node.js
- Java
- C#
- Embedded C
- mBed C++

System requirements:

<table>
<thead>
<tr>
<th>Windows</th>
<th>Linux</th>
<th>MAC OS X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft .NET</td>
<td>Python v2.7 (v3.x is not supported)</td>
<td>Python Releases for Mac OS X</td>
</tr>
<tr>
<td>Framework 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Studio</td>
<td>make</td>
<td>Xcode</td>
</tr>
<tr>
<td>Python v2.7.10</td>
<td>A C/C++ compiler toolchain, for example GCC version 4.2 or later.</td>
<td></td>
</tr>
<tr>
<td>Microsoft Windows SDK for Windows 7</td>
<td>On Debian and Debian-derived distributions (Ubuntu, Mint etc), use the command:</td>
<td></td>
</tr>
</tbody>
</table>

Gateway development:
If your devices cannot directly connect to the internet, use the information provided to build a gateway device to retrieve and send data to applications in your Watson IoT Platform organization. The MQTT messaging protocol is supported for gateway development in Watson IoT Platform.
Use-cases:
IBM IoT service is applicable for literally everything e.g. production line, transportation, medical service. It has full operation cycle monitoring capability by that critical point of any service can be identified.

For example:
- In flower transportation if flowers get damage, from temperature sensor we can know when that happened or accelerometer sensor would tell us the bumpy road condition.
- Control lighting system of a house through a web application. Light sensors sends real-time data to web application server. The server analyzes this data, and instructs the web application to control the lighting.

Pricing:

<table>
<thead>
<tr>
<th>Standard Plan</th>
<th>Free Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>For data exchanged</td>
<td>Max 20 registered devices</td>
</tr>
<tr>
<td>1. $0.001 / MB up to 450GB</td>
<td>Max 10 application</td>
</tr>
<tr>
<td>2. $0.0007 / MB up to 7000GB</td>
<td>Max 100 MB of each data exchanged, data analysed and edge data analyzed</td>
</tr>
<tr>
<td>3. $0.00014 / MB for 7000GB +</td>
<td></td>
</tr>
<tr>
<td>Data analyzed</td>
<td></td>
</tr>
<tr>
<td>$0.02 / MB up to 450GB</td>
<td></td>
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<tr>
<td>Edge data exchanged</td>
<td></td>
</tr>
<tr>
<td>$0.005 / MB up to 450GB</td>
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</table>
IBM IoT services at IBM Bluemix

IBM Watson IoT **Context Mapping** Service brings the power to your application to analyze moving object trajectories by leveraging road network-based geospatial services. It provides real-time query interfaces to access road network data and search services by unique index structure and advanced cache mechanisms.

**Link:** [https://console.ng.bluemix.net/docs/services/IotMapInsights/index.html](https://console.ng.bluemix.net/docs/services/IotMapInsights/index.html)

**Has features:**

- **Map Data Query.** Context Mapping is a high performance, road network data access service, with an in-memory map data cache that has a unique index structure. The service provides road attributes, network topology, and other static map data information.

- **Geospatial Service.** This service includes a geospatial capability that provides REST API interfaces for map matching, shortest path search, and link search.
IBM Watson IoT Driver Behavior Service lets you analyze drivers' behavior from vehicle probe data and contextual data.

Link: https://console.ng.bluemix.net/docs/services/IotDriverInsights/index.html

Has features:

- *Driver behavior analysis.* You can analyze driver behavior such as harsh acceleration and harsh braking, frequent braking, speeding, sharp turn, and so on.
- *Big data analysis infrastructure.* Driver Behavior uses Hadoop as the back-end infrastructure. Hadoop enables Driver Behavior to realize high scalability for analyzing big data from vehicle probe data and contextual data.
- *REST API.* Developers can retrieve the analysis results by REST API and use them in Bluemix applications.
- *Configurability.* Some analysis-threshold parameters, such as speed range per road type and turn angle range, can be configured as you like.
IBM IoT services at IBM Bluemix

The **IoT for Electronics** service supports user and device registration and notifications. As part of the IoT for Electronics Starter, it is preconfigured with other services to help you connect your devices and get your IoT projects to market significantly faster. You can also deploy it separately and use it with an existing instance of IBM® Watson™ IoT Platform.

Link: [https://console.ng.bluemix.net/docs/services/IotElectronics/index.html](https://console.ng.bluemix.net/docs/services/IotElectronics/index.html)

Has features:

- **Get connected.** No device? No problem! Deploy the demonstration app and use simulated appliances to experience the power of IoT for Electronics firsthand.
- **View and analyze IoT data.** Your simulated data really flows into the IBM Watson IoT Platform. Use the Platform dashboard to explore device cards, status pages, and view how much data is consumed.
- **Experience IoT for Electronics as a manufacturer.** Create up to five simulated washers, connect them to the platform, cause device failures, even fix problems.
- **Experience IoT for Electronics as a consumer.** Download the sample consumer mobile app to experience IoT for Electronics from the point of view of an actual owner of a connected appliance. Register your own washer, monitor a load of wash, receive alerts and status updates.
IBM IoT services at IBM Bluemix

IoT for Insurance provides a full context view of the policy holder's assets and situation, including information such as location, security systems, weather, traffic, and overall wellness. In-depth analysis of this information allows the insurer to provide personalized risk assessment and real-time protection for the policy holder. Benefits for the policy holder include risk avoidance in the form of early alerts, personalized advice, and streamlined claims processing and settlement. Benefits for the insurer include expense reduction through claims avoidance and processing automation and customer satisfaction and loyalty.

Link: https://console.ng.bluemix.net/docs/services/IotInsurance/index.html
Useful Links

- **Developer’s Guide** https://www.coursera.org/learn/developer-iot
- **Tutorials** https://developer.ibm.com/recipes/tutorials
- **How to Register Devices in IBM Watson IoT Platform**
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