# How to Build a Public Cloud with MX-AOPC UA Server and Logger

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#### About Moxa

Moxa is a leading provider of edge connectivity, industrial networking, and network infrastructure solutions for enabling connectivity for the Industrial Internet of Things. With over 30 years of industry experience, Moxa has connected more than 50 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industry with reliable networks and sincere service for industrial communications infrastructures. Information about Moxa's solutions is available at <a href="https://www.moxa.com">www.moxa.com</a>.

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## How to Build a Public Cloud

## **Connecting Your Devices to the Cloud**

Public clouds provided by third-party cloud service providers, such as Microsoft Azure, give companies ready access to online servers, data storage, and applications.

Moxa's MX-AOPC UA Server and MX-AOPC UA Logger employ a tag-centric service that makes it easy to connect I/O devices to a public cloud. A tag-centric service represents each I/O value and the status of each I/O device with a unique tag. Tags can be easily sent to the MX-AOPC UA Server for use by a SCADA system, or to a private or public cloud for storage and further analysis.

With MX-AOPC UA Server and MX-AOPC UA Logger, connecting remote field site I/O devices to the cloud can be done easily.



Take the following five steps to build your own cloud service:

- 1. Install MX-AOPC UA Server and UA Logger on your PC
- 2. Configure your Moxa I/O device to send tags to MX-AOPC UA Server
- 3. Apply for an Azure account
- 4. Send data to Azure
- 5. Process data in Azure and create a Power BI dashboard

## **1.** Install MX-AOPC UA Server and Logger on your PC

The MX-AOPC UA Server and MX-AOPC UA Logger software can be downloaded for free from Moxa's website:

<u>Software download page</u>: <u>http://www.moxa.com/product/MX-AOPC\_UA\_Suite.htm</u>

Latest software versions:

- MX-AOPC UA Server v1.6
- MX-AOPC UA Logger v1.1

Refer to the user's manuals for MX-AOPC UA Server and MX-AOPC UA Logger for step-by-step installation instructions:

<u>User's manual download page</u>: <u>http://www.moxa.com/support/sarch\_result.aspx?prod\_id=3049&type\_id=7&type=doc</u>

User's manual titles:

- MX-AOPC UA Server User's Manual
- MX-AOPC UA Logger User's Manual

## 2. Configure your Moxa I/O device to send tags to MX-AOPC UA Server

Since there are minor differences in how different Moxa I/O devices are configured, refer to the user's manual for your Moxa I/O device for information on how to configure the device to send tags to MX-AOPC UA Server.

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## 3. Apply for an Azure account

Take the following steps to apply for a free Microsoft Azure account.

Step 1. Click <u>https://azure.microsoft.com/en-us/free/?b=17.09c</u> to link to the Microsoft Azure website and then click the **Start free** button near the bottom of the page.



Step 2. Sign in with an existing "Microsoft account" or click **Create a new Microsoft** account to proceed.



## How to Build a Public Cloud

Microsoft Azure	Free trial sign up	@hotmail.com   Sign Out
One month trial	1 O About you	
\$200 Azure credit	* Country/Region 🛈 United States	
No commitment – trial does not	* First Name	
automatically upgrade to a paid subscription	* Last Name	
Frequently asked questions >	Lee * Email address for important notifications 💿	
	Moxaautomation@moxa.com	
	* Work Phone 886-289-191230	
	Organization	
	- Optional -	
	Next	
	2 (+) Identity verification by phone	θ

Step 3. Enter the required information under "About you" and then click **Next**.

Step 4. Input your phone number under "Identity verification by phone" and then click Send text message or Call me to proceed. In this example, we are using the Send text message option.

Microsoft Azure	Free trial sign up	@hotmail.com	Sign Out
One month trial	About you	✓	
\$200 Azure credit	2	0	
No commitment – trial does not automatically upgrade to a paid subscription	United States (+1) • (910) 000-000 Ser	nd text message Call me	
Frequently asked questions 🕨	511707 Ver	rify code I did not receive a code	_
10 C	$\Theta \oplus$ Identity verification by card	0	
	4 ⊕ Agreement		
	Sign up 🧿		

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Step 5. Microsoft will send a verification code to your phone. Enter the code in the box provided, and then click **Verify code**.



Step 6. Provide the required information under "Identity verification by card" and then clickNext. Microsoft will not charge your credit card during the one-month trial period.

Microsoft Azure	Free trial sign up	otmail.com   Sign Out
One month trial	3 O Identity verification by card	0
\$200 Azure credit	Please enter valid credit card information so we can verify your identity. You will not be charged u you explicitly transition to a paid offer.	inless
No commitment – trial does not automatically upgrade to a paid subscription	Payment method New Credit/Debit Card v	
Frequently asked questions 🕨	VISA Card number	
	* Expiration date * CVV ()	
	* Name on card	
	* Address line 1	
	Address line 2 - Optional -	
	* City * State * ZIP code	
	* State * ZIP code CA * 23145	
	Next	

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Step 7. Read the subscription agreement, and then select the "I agree to the subscription agreement, offer details, and privacy statement" checkbox. Click the **Sign up** button to request activation of your trial account.

Note: Do not close or refresh the browser while your request is being processed.



Step 8. When your subscription request has been approved, the browser should display a "Your subscription is ready for you!" message. Click the **PORTAL** button on the top toolbar to open your personal Azure page.

Microsoft Azure	PORTAL MY ACCOUNT
Welcome to Microsoft Azure! Your subscription - Free Trial	
Your subscription is ready for you! Get started with your Azure subscription >	
Take a tour of the management experience while you wait	it. Tutorials Get started with Web Apps Virtual Machines SQL Database Storage
4 London Martin Control Contro	Get Support

#### How to Build a Public Cloud

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+ New			
😐 Dashboard	All resources ALL SUBSCRIPTIONS	Get started	
All resources	No resources to display	Virtual Machines	
😥 Resource groups		Provision Windows and Linux virtual machines in minutes	
App Services		App Service	
📓 SQL databases		Create web and mobile apps for any platform and device	
🗣 SQL data warehouses		SQL Database	
NoSQL (DocumentDB)		Managed relational database-as-a-service	
Virtual machines		Storage	
🚸 Load balancers		Durable, highly available and massively scalable storage	
Storage accounts	Service health 🖸 🕅	Azure Portal	
Virtual networks	-9.40 @ 63	Learn about how to use the Azure Portal	
Azure Active Directory	ર્જેં જે જે	Marketplace	
Monitor	8	La manequee	

## 4. Send data to Azure

In order to send data to Azure, you need to create an "IoT Hub" service to receive the data, and then configure your MX-AOPC UA Server and MX-AOPC UA Logger to send data to the IoT Hub. Take the following steps to send your data to Azure.

Step 1. Search for "IoT" to locate Azure's **IoT Hub** service.



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Step 2. Click the +Add button in the upper left corner of the browser window to add a new IoT Hub service, and then select the F1 Free pricing option under "Choose your pricing and scale tier."

Click the **Create** button near the bottom of the window to proceed.



Step 3. Click **Device Explorer** in the left menu of your newly created IoT Hub Service, and then add a new device. The "Add Device" section is located on the far right side of the browser window.

Click the **Save** button at the bottom of the window to save your settings.



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Step 4. Your new device will be listed under "DEVICE ID" in the middle panel of the browser window. Select the checkbox in front of the device name, and then copy the "Connection string—primary key" located in the right panel. You will need this connection string when you configure MX-AOPC UA Logger to send data to your Azure account.

Azure is now ready to receive tags from MX-AOPC UA Server.

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+	Search (Ctrl+/)	+ Add ≣≣ Columns 🖏 Refresh 🛍	] Delete				Devic	e ld 🛛		
	X Overview							XATest		i k
	Activity log	You can use this tool to view, crea	ite, update, and delete devices on your IoT Hub. You may view up	to 1000	device	s in th	Prima	ny key (	•	
<b>(*)</b>	Access control (IAM)	> Filter by Device Id				_		iBrOQrt	iQFZkDO2loTMphsYrDlgVfyqC	i i
8	S Device Explorer	DEVICE ID	STATUS					ndany ke iFzMnU	ry ® JiBJqzFOCSafGFHi0NfpcJjFl+W	<b>F</b>
8	SETTINGS	MOXATest	enabled				Conn	ection s	tring—primary key 🛙	-
-	Shared access policies						Hos	:tName:	=MOXAloThub.azure-devices.r	F)
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-	Properties									
<>	Locks									
•	Automation script									
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Step 5. Run MX-AOPC UA Server from your PC's start menu, and then click the "Get Configuration from Server" icon on the menu bar. Devices that are uploading tags to the server will be listed in the left panel, and the tags you configured in Step 2 above will be listed in the right panel.

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- In Active Device List	Tag Name	Data Type	Access Rights	Description
AOPC-01 (00:90:e8:00:11:28) Server 00 (00:90:e8:25:12:84)	🁒 Server 00.DI-00	Boolean	Read-only	Desc
- Modbus Device Group List	👒 Server 00.DI-01	Boolean	Read-only	Desc
DeviceGroup1	👒 Server 00.DI-02	Boolean	Read-only	Desc
	🧐 Server 00.DI-03	Boolean	Read-only	Desc
	👒 Server 00.SysMAC	String	Read-only	Device MAC Address
	👒 Server 00.SysIPAddress	String	Read-only	Device IP Address
	🧐 Server 00.SysConnect-00	Boolean	Read-only	System Connection

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Step 6. Run MX-AOPC UA Logger from your PC's start menu, and then click
Help → Logger Help from the top menu bar. Follow the instructions in the "Server Management" section to connect MX-AOPC UA Logger to MX-AOPC UA Server.



Step 7. Click the **Connect** icon on the top menu bar to connect to MX-AOPC UA Server.

MX-AOPC UA Logger		
File Server Logger Tools Runtime He	lp	
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🖃 🗝 🗾 Server Group		
Server 1(192, 168, 127, 100:53192)	Server Endpoint: opc.tcp://192.168.127.100	:53192/MXAOPC/UAServer
	Security Policy: None	
R Land Count link	Security Mode: None	
😝 Logger Group List	Subscription Settings	Monitored Item Settings
	Publish Interval: 1000 ms	Sampling Interval: 500 ms
	Keep Alive Count: 10	Queue Size: 10
	Lifetime Count: 1000	Discard Oldest: Yes

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Step 8. Click Help → Logger Help on the top menu, and then follow the instructions in the "Logger Management" section to create a logger to send tags to your Azure public cloud.



Step 9. Select the "Azure IOT" option in the Logger Settings dialog and then paste in the connection string of the devices that you created in the Azure IoT Hub Service in Step 4.

MX-AOPC UA Logger		And a second	- 0 X
File Server Logger Tools Runtime He			
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🖃 – IJ Server Group	Logger Name Type Output		
ស Server 1(192. 168. 127. 100: 53 192)			
	Logger Settings	X	Ĵ
Logger Group List     LoggerGroup1	Logger Name	Logger 1	
ag cogger croup 2		(max. length = 30)	
	Excel File		
	Root Pa	th: C:\Users\Public\Documents\Moxa\MXAOPCLogger\Logger	
	Access F	le:	
	Root Pa	th: C:\Users\Public\Documents\Moxa\MXAOPCLogger\Logger	
	Database	e:	
	Source	Name: Setting	
	Azure IO	π:	
	Connec	tion String:	
		< Back Next > Cancel	
	C		
Parta Para			
Service Status : Stopped Time: 22:51:36			

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Step 10. Refer to the Help section discussed in Step 8 above for instructions on how to select tags and on how to start the service and recording function. If Logger is successfully connected to Azure, "[Logger Group Name] [Logger Name] successfully connected to database!" should appear in the event log in the bottom panel of the MX-AOPC UA Logger window.

File Server	JA Logger		
	Logger Tools Ru		
	<b>1</b>		
⊡-≅ Logger ( ⊡-≅ Logg	erver1(192.168.127.1 Group List	7.100:531920 Recording Start Stop Autobackally start necording when service starts numing Tag Selection Available Tags Selected Tags Tag Name Pag N	
		Server Name Tag Name Description	
		Server 1 V ACPC-0.12.1022 Dec Server 1 ACPC-0.15/vc/Servec1-00 System Connection Server 1 ACPC-0.15/vc/Servec1-00 System Connection Server 1 ACPC-0.15/vc/Servec1-00 Servec1-00	
		Property	
		Type: IOT	
	Time	Event	
2017/04/05	22:56:13	Event Start recording logger 1 logger 1	
2017/04/05 2017/04/05	22:56:13 22:56:09	Event Start records logger 1 Logger 11 Logger@roup.Logger 1 saccessfuly connected to databaset	
2017/04/05 2017/04/05 2017/04/05	22:56:13 22:56:09 22:56:08	Event Start recording logger Logger 1' Logger Orsup Logger 1 Logger 1 Logger Couple Logger 1 Logger Logger 1 Logger 2 Lo	
2017/04/05 2017/04/05 2017/04/05 2017/04/05	22:56:13 22:56:09	Event Start records logger 1 Logger 11 Logger@roup.Logger 1 saccessfuly connected to databaset	
2017/04/05 2017/04/05 2017/04/05 2017/04/05 2017/04/05	22:56:13 22:56:09 22:56:08 22:56:02	Event Start recording lagger 1 Lagger 1 Lagger 1 sacessfully connected to databaset Installing database MA-APC FLU Alogger rutimus exvica is running.	
Date 2017/04/05 2017/04/05 2017/04/05 2017/04/05 2017/04/05 2017/04/05 2017/04/05	22:56:13 22:56:09 22:56:08 22:56:02 22:44:57	Event Start room logger 1.ogger 1 Logger 1.ogger 1.ogger 1.m Logger Group Logger 1.m Logger Group Logger 1.m Mr. APAC UAL Logger runnes service is running. Connect to Servir a Locass 1.	

#### Note: Open Source "Device Explorer" Utility

An open source utility named "Device Explorer" can be used to monitor the updated tags in real time. The utility can be downloaded from the following web page: <a href="https://github.com/Azure/azure-iot-sdk-csharp/tree/master/tools/DeviceExplorer">https://github.com/Azure/azure-iot-sdk-csharp/tree/master/tools/DeviceExplorer</a>

## 5. Process data in Azure and create a Power BI dashboard

Use the "Stream Analytics jobs" and "Power BI" services to process the uploaded data and create a customized dashboard. "Stream Analytics jobs" is used to stream data from your IoT Hub to other services, such as the Power BI service, SQL Server, etc. The data can be stored in the cloud and then reused by other services. Below, we describe how to use "Power BI" to create a customized dashboard for displaying the data uploaded by MX-AOPC UA Logger. Take the following steps to configure the "Stream Analytics jobs" and "Power BI" services:

Step 1. Search for "Stream Analytics" to locate the Stream Analytics jobs service.



Step 2. Create a new Stream Analytics job.

licrosoft Azure Stream Analytics jobs	> New Stream Analytics Job	ク 🗘 🏶 🙂 🛛
New Stream Analytics Job		
* Job name		
MXAOPCUALogger	✓	
* Subscription		
Free Trial	▼	
<ul> <li>* Resource group ●</li> <li>         ○ Create new ● Use existing     </li> </ul>		
Test	×	
* Location		
East Asia	v	
V Pin to dashboard		
Validating O Automation optic	ons and the second s	
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## How to Build a Public Cloud

Step 3. Click **Inputs** under "Job Topology" to assign your IoT Hub service as the data input source.



Step 4. Choose "IoT hub" from the "Source" dropdown list, and then select the IoT hub service you created from the "IoT hub" dropdown list.

Micro	osoft Azure MX	AOPCUALogger > Inputs	> New input			م	<b>(</b> 3 🔅	0	
	Inputs MXAOPCUALogger			∎ ×	New input	□ ×			
+	+ Add				* Input alias	×			
	NAME	SOURCE TYPE	SOURCE		test * Source Type 🛛				
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<ul><li></li><li></li></ul>					Create				
	4				1				,

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Step 5. Before configuring the Outputs for the Stream Analytics job, you first need to create a Power BI account in Azure. Click the following link and follow the onscreen instructions to sign up for Power BI:

https://powerbi.microsoft.com/en-us/get-started/.



Step 6. Select Outputs under "Job Topology" to assign the data output sink. The data output sink is the Power BI service you will use to create your web dashboard.

Micr	osoft Azure MXAOPCUALogger				오 🗳 🕸 😳 🕐	
=	MXAOPCUALogger Stream Analytics job					* ×
+		🖨 Settings 🕨 Start 🔳	Stop 🛍 Delete			
	Overview	Created				·
	Activity log	Resource group (change)			Send feedback	
<b>()</b>	Access control (IAM)	Test			UserVoice Created	
۲	🛷 Tags	Created			Wednesday, April 5, 2017, 11:23:12 PM Started	
3	✗ Diagnose and solve problems	East Asia Subscription name (change)			- Last output	
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	Locks		2301015108			
<b>Q</b>	JOB TOPOLOGY	Job Topology				
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	600 Functions	1 🗄	<>	1 ✑		
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  Power Bl ٦ ~ Empty **Q** Authorize Connection You'll need to authorize with Power BI to configure your output settings. . Authorize • Don't have a Microsoft Power BI account yet? 0 ou are granting this o tent access to your Po rî. revoke this access in the ful can do one of the following 0 1. Chan
- Step 7: Click Authorize and then log in with your Power BI account.

Step 8. Check the "Notifications" section in the right panel. If Power BI is configured correctly, you should see "Connection to output [Name of output] succeeded" under "Successful conection test."

Microsoft Azure мхаоро	CUALogger > Outputs > Output details			م	0 😳 🌣	
		□ ×	Output details PowerBI	■ > <sub>Not</sub>	ifications	
+ Add			🚯 Test  🗊 Delete			
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Power81	Power BI		Dataset Name     AcureloT     If the dataset or table air     Indice     Table     Currently authorized as KenVTI     (KenVTI_Lee@moa.com)     Click the button below if you     authorization     Click the button below if you     authorization     Click the workspace.     Swe	ady axists in your methods in your methods, it will be be be be be been been been been be		11-48 РМ

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Step 9. Select **Query** under "Job Topology" to define the query between inputs and outputs. In this step, you will use the data fields you defined (e.g., SOURCE\_UTC\_TIMESTAMP) when you configured the Logger to send data to Azure.

Micr	DSOFT AZURE MXAOPCUALogger				𝒫 ↓ ♥ ↔ ⊕ ①	9
≡	MXAOPCUALogger     Stream Analytics job					* ×
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	Overview	i Created				
	Activity log	Essentials ^				
۲	Access control (IAM)	Resource group (change) Test Status			Send feedback UserVoice Created	
۵	🛷 Tags	Created			Wednesday, April 5, 2017, 11:23:12 PM Started	
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-	SETTINGS	Free Trial Subscription ID				
	Locks	5df0da2a-e5fe-47ea-8ef5-7	c23c1bf5fd8			
	JOB TOPOLOGY	Job Topology		-		
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	Functions	1 🗉	<>	1 ₽		
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Step 10. Click **Save** to save your Query settings. To view additional instructions on how to define a Query, click the **here** link above the Query listing.

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	MXAOPCUALogger <sub>Query</sub>			×
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	← <sub>El</sub> Inputs (1) ∂ <sup>2</sup> test ···· ← <sub>D</sub> . Outputs (1) ⓐ) PowerBi	Need help with your query? Check out some of the most common Stream Analytics query pattern 1 SELECT 2 [cTAC_IDD] AS [cTAC_IDD], 3 cast[[CALUED] as float) AS [cVALUED], 4 [cVINT] AS [cVINT], 5 [cSGURCE_ITUEZONE] AS [cSGURCE_UTC_TIMESTAMP], 6 [cSGURCE_ITUEZONE] AS [cSGURCE_ITUEZONE], 7 [cOATA_TYPE] AS [cOATA_TYPE], 8 [cSENVER_UTC_TIMESTAMP] AS [cSENVER_UTC_TIMESTAMP], 9 [cSENVER_UTC_TIMESTAMP] AS [cSENVER_UTC_TIMESTAMP], 9 [cSENVER_UTC_TIMESTAMP] AS [cSENVER_UTC_TIMESTAMP], 10 [cQUALITY] AS [cQUALITY] 11 INTO 12 PowerBI		
• • • • •		12     PowerBI       13     FROM       14     Test   Your query could be put in logs that are in a potentially different geography. Missing some language construct? Let us know (Powered by UserVocc - Prinacy Policy)		
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The sample Query shown in the above screenshot is listed below. Note that the content of the SELECT statement depends on the data field you chose when you configured your logger. Before saving the Query, first remove parts of the statement that are not needed. For example, if you do not want to display the <server time zone> field on your dashboard, remove the line

[<SERVER\_TIMEZONE>] AS [<SERVER\_TIMEZONE>], from the Query statement.

#### SELECT

```
[<TAG_ID>] AS [<TAG_ID>],
cast([<VALUE>] as float) AS [<VALUE>],
[<UNIT>] AS [<UNIT>],
[<SOURCE_UTC_TIMESTAMP>] AS [<SOURCE_UTC_TIMESTAMP>],
[<SOURCE_TIMEZONE>] AS [<SOURCE_TIMEZONE>],
[<DATA_TYPE>] AS [<DATA_TYPE>],
[<SERVER_UTC_TIMESTAMP>] AS [<SERVER_UTC_TIMESTAMP>],
[<SERVER_TIMEZONE>] AS [<SERVER_UTC_TIMESTAMP>],
[<QUALITY>] AS [<QUALITY>]
INTO
PowerBI
FROM
test
```

**Note:** The VALUE data field needs to be converted from string data type to floating data type to allow Power BI to recognize the value as a floating data type.

Step 11. Click **Start** to run the Stream Analytics job.

Micro	DSOFT AZURE Stream Analytics jobs > MXAOP	CUALogger		م	\$ \$ © 0	summer19738@hotm SUMMER19738HOTMAIL
≡	Stream Analytics jobs 💉 🗙 summer19738hotmail (Default Directory)	MXAOPCUALogger Stream Analytics job				* ×
+ * • • • •	Add = EE Columns & Refresh Subscriptions: Free Trial Filter by name 1 items NAME ~  MXAOPCUALogger ···	Search (Col+-)      Search (Col+-)      Corriev      Activity log      Activity log      Access control (IAM)      Tags      Diagnose and solve problems	Start  Start  Start  Start  Start  Start  Start  Start  Start  Created  Location  Est Add  Subscription  same (change)  free Trid  Subscription  Start  Sub	op 👼 Delete	Send feedback UserVoice Created Wednesday, April 5, 201' Started Last output	2 7, 11-23-12 PM
<ul> <li>•</li> <li>•&lt;</li></ul>		SETTINGS    Locks  JOB TOPOLOGY    Inputs   Locks   JOB Query    Outputs	Inputs Inputs Itest Itest Itest Inputs Itest Ite	Query	Outputs 1 - PowerBI	
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Step 12. Click **Streaming datasets** in the left panel of the Power BI console to view the item you are streaming, and then click the **Create report** icon under "ACTIONS" to create the dashboard charts.



Step 13. Select the "Visualizations" you would like to display from the menu in the right panel, and then select which data fields you would like to match to the available domains. For example, to show a time-value relationship, you could match <source\_utc\_timestamp> to the Axis domain, <tag\_id> to the Legend domain, and <value> to the Values domain.



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Step 14. Use the "Filters" tool to select which <tag\_id> items will be shown on the chart.

Step 15. Click **Save** to save the report. Once saved, the report will appear under "Reports" in the left menu.

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## How to Build a Public Cloud

Step 16. Under "Reports" in the left menu, click the name of the report you just saved, and then click "Pin to dashboard" to pin the report to the dashboard that will be accessible from your public cloud.

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Step 17. To complete the configuration of your web dashboard, repeat Steps 11 to 15 for each of the reports you would like to pin to the dashboard.

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#### Note: Information for Advanced Users

Azure supports various built-in services, such as Web App + SQL Server, that can be used to design customized dashboards accessible via your public cloud. Click the following link to view Microsoft Azure's Web Apps Documentation:

https://docs.microsoft.com/en-us/azure/app-service-web/