Azure IoT Hub with RUT routers

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1



Azure account creation

Visit <u>https://azure.microsoft.com/en-us/</u> and create an account that will suit your needs, for testing purposes we will be using free Azure account.

Managing Azure services

First you will want to create a Resource group for easier management of resources that you will add later. In Microsoft Azure home page:

- 1. Select Resource groups
- 2. If it is not in very first page, click **More services** and locate it there.

			𝒫 Search reso	urces, services, and	docs (G+/)				>_	₽	₽ ⊚	?	٢
Azure service	s 1								2				
+		P	+	Ţ	٠		άú	Æ	\rightarrow				
Create a resource	Resource groups	Monitor	Subscriptions	Digital Twins	Azure Active Directory	Activity log	Metrics	Network Watcher	More services				
Recent resou	rces												

In new window, select Add.

Home > Resource groups				
Resource groups				
+ Add ≡≣ Edit columns	🕐 Refresh	\downarrow Export to CSV	🖉 Assign tags	💙 Feedback

And then finish creating yours Resource group

- 1. Select your subscription, we are using **Free Trial** for this test.
- 2. Name your group
- Finally, choose server location for meta data. We will choose one of the closest available locations North Europe and will use it during test where available.

Project details			_
Subscription * 🛈	0	Free Trial V	
Resource group * 🛈	2	IoThubWithRUT955 🗸	j
Resource details Region * 🛈	3	(Europe) North Europe	

At this moment we will skip adding Tags since we will be able to do that later if needed, so simply press Review + create at the bottom of screen and then click Create to finish setup.



You will be redirected to Homepage, there click on **Resource groups.** You should see yours newly created group, select it, and press **Add.**

IoThubWithRUT955				\$ X
	≪ + Add == Edit columns i Delete resource group \bigcirc Refresh → Move \downarrow E	Export to CSV 🛛 🖉 Assign tags 📋 Delete 🛓 E	xport template 🛛 💙 Feedback	
() Overview	Subscription (change) : Free Trial Subscription ID : fe82bd02-eb97-49ee-870e-f55b3e668c08	Deployments : No deployment	s	
Activity log	Tags (change) : Click here to add tags			
Tags	Filter hy name	*		
Events	Showing 0 to 0 of 0 records. Show hidden types 0			No grouping 🗸 🗸
Settings	Name 1	Туре ↑↓	Location ↑↓	

Select Internet of Things or simply search IoT Hub and press Create.

We leave default subscription and resource group and choose:

- 1. Region North Europe as before
- 2. Create a name for IoT Hub
- 3. Then go to Size and scale tab

IoT hul	0		
Basics	3 Size and scale	Review + create	
Create an	IoT Hub to help yo	ou connect, monitor, and manage billions of your IoT assets. Learn More	

PROJECT DETAILS

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * 🛈	Free Trial	\sim
Resource Group * ()	IoThubWithRUT955 Create new	\sim
Region * 🕕 🚺	North Europe	\sim
IoT Hub Name * 🛈 🛛 🙎	IoThubRUT955	~

For testing purposes, we are using F1: Free tier

Basics Size and scale Review + create

Each IoT Hub is provisioned with a certain number of units in a specific tier. The tier and number of units determine the maximum daily quota of messages that you can send. Learn more

3

SCALE TIER AND UNITS

Pricing and scale tier * 🛈

F1: Free tier	~
	Learn how to choose the right IoT Hub tier for your solution

And finally, at the bottom of the screen Review + create >> Create

Wait until resource deploys and press Go to resource



Inside IoT Hub list:

- 1. Scroll down to Explorers and select IoT devices
- 2. Press New
- IoThubRUT955 IoT devices

IoT Hub								
, Search (Ctrl+/)] 🔦 🕂 New 🖒 Refresh 🏾 🕅 Del	ete						
- · ·	*							
Explorers	View, create, delete, and update	devices in your IoT Hub.						
🔎 Query explorer	Field			Operator	Value			
1 IoT devices	+ × select or enter	a property name	\sim	=	✓ specify co	nstraint value		
Automatic Device Management	+ Add a new clause							
🔮 IoT Edge	Query devices						> Switch to query edito	r
😤 IoT device configuration								
Messaging	DEVICE ID	STATUS	LAST A				AUTUENTICATION TYPE	CLOUD TO DEVICE MESSAGE COUNT
File upload		318103			LAST STATUS U	DATE (OTC)	AUTHENTICATION TITE	

In new device creation

2.

1. Enter Device ID

Save

Leave everything else on default and press Save	
💦 Create a device	
Find Certified for Azure IoT devices in the Device Catalog	ď
Device ID * 🛈	
RUT955	~
Authentication type ①	
Symmetric key X.509 Self-Signed X.509 CA Signed	
Primary key * 🛈	
Enter your primary key	
Secondary key * (i)	
Enter your secondary key	
Parent device ()	
No parent device	
2	



After you finish creation, you will be redirected back to IoT devices select yours newly created Device ID

V DEVICE ID	STATUS	LAST ACTIVITY TIME (UTC)	LAST STATUS UPDATE (UTC)	AUTHENTICATION TYPE	CLOUD TO DEVICE MESSAGE COUNT
✓ RUT955	Enabled			Sas	0

In your device window you will find information needed to connect RUT devices to Azure IoT Hub. For now, we will only need connection string. Copy Primary Connection string by pressing copy icon next to it.

RUT955 IoThubRUT955		\$ ×
🔄 Save 🖾 Message to Device 🗲	Direct Method 🕂 Add Module Identity 🔲 Device Twin 🔍 Manage keys 🗸 🕐 Refresh	
Device ID	RUT955	٥ ا
Primary Key 🚯		۵ آر
Secondary Key 🌘		 Image: A set of the set of the
Primary Connection String		 Image: A set of the set of the
Secondary Connection String		۰ ا
Enable connection to IoT Hub	Enable Disable	

Configuring RUT955 Azure IoT Hub

First open router WebUI, go to System > Package Manager and install Azure IoT Hub package

Azure IoT Hub	-	0.0.2 (372 KB)	Available	Install	

Now navigate to **Services > IoT Platforms**

- 1. Select Enable Azure IoT Hub monitoring
- 2. Paste previously copied Connection String (For this test we leave other values as default)
- 3. Select what kind of information you want to send to Azure IoT Hub
- 4. Press Save

LaT Hub					
e IOT HUD			_		
	1 Enable Azure I	oT Hub monitoring			
	2	Connection string	HostName=IoThubRUTS		
		Messages Type	GSM values 🗸		
	Message sen	ding interval (sec.)	300]	_
	IP address	\checkmark		PIN state	
	Number of bytes sent	V		GSM signal 🗹	
	Number of bytes received	\checkmark		WCDMA RSCP	
	Mobile connection state	\checkmark			
	Network link state			LTE RSRP	
	IMEI (LTE SINR	
3	ICCID (LTE RSRQ	
	Model (CELL ID	
	Manufacturer [Operator 🗌	
	Serial (Operator number 🗌	
	Revision [Connection type	
	IMSI [Temperature	
	SIM state			PIN count	



Checking if Data reaches Azure IoT Hub

From router side, connect to it with SSH client and write in command *azure_iothub* and press Enter root@Teltonika:~# azure_iothub

You should get answer that looks something like that, depending on what information you chose to send.:

root@Teltonika:~# azure_iothub This sample simulates a Chiller device connected to the Remote Monitoring solution accelerator
{
"ip": "84.15.123.1",
"bytes_sent": "11316700",
"bytes_received": "664240493",
"connection_state": "connected",
"signal": "-57"
}Confirmation callback received for message 1 with result IOTHUB_CLIENT_CONFIRMATION_OK
Device Twin reported properties update completed with result: 204
^C
root@Teltonika:~#

From Azure IoT Hub side you can check if it receives data. Go to IoT Hub that you created previously. Select **Overview**, there you can see:

- 1. How many devices are connected to hub, and how many messages it sent during chosen period of time.
- 2. Device to cloud messages, that your router is sending.

It should look something like that if IoT Hub is receiving data.

Search (Cb1+/) C → Move Delete NetFeah Nor read univer informationing service individuality of the right (of how who or reading human intervention. Nor read univer informationing service individuality of how who or reading human intervention. Activity log Access control (IAM) Tags We'd love your feedback! Diagnose and solve problems We'd love your feedback!	Active security for for USL for forty is a united security management arrive. It provide end-fa- end threat analysis and protection across hybrid doud invitable and your Active ist solution.	billions of internet of Things assets.
Vice Hau over a rounding any array entrance area Overview Coverview Coverv	Auter excuting on the UASC on the 7 at a written security imanagement enters. It provides end-to- end threat analysis and protection across hybrid cloud worklaads and your Auter lof solution.	billions of internet of Things assets.
Access control (IAM) Tags Diagnose and solve problems We'd love your feedback! Your valuable feedback will help us to better understand your requirements in order to improve	Need to simulate IoT Devices?	
Internet Internet Internet	IoT Device Simulation accelerates solution development using simulated devices to help build and text your project throughout the development lifecycle.	
Shared access policies		
Pricing and scale		
IP Filter	W data for last 1 Hour 6 Hours 12 Hours 1 Day 7 Days	2
Certificates		
Built-in endpoints	Device twin operations	Device to cloud messages
Failover	~	
Properties Locks Messages: 332 / 8000 Daily		
Export template IOT Devices: 1	_15	3
orers		_2
Query explorer		
IoT devices		05
matic Device Management	0 11 AM 12 PM 1 PM 2 PM 3 PM 4 PM	0 11.AM 12.PM 1.PM 2.PM 3.PM 4.PM
IoT Edge	Successful twin reads from back end (Count) iothubrut955	Telemetry messages sent (Count) iothubrut955
the design of the section of the sec	5	54



To capture logs you will need Device Explorer for IoT Hub Devices. For Windows you can get here: <u>https://github.com/Azure/azure-iot-sdk-csharp/releases/tag/2019-1-4</u>

Scroll down to Assets, download and install SetumpDeviceExplorer.msi

▼ Assets 12	
T Microsoft.Azure.Devices.1.17.2.symbols.nupkg	876 KB
Microsoft.Azure.Devices.Client.1.19.0.symbols.nupkg	1.28 MB
Dicrosoft.Azure.Devices.Provisioning.Client.1.2.2.symbols.nupkg	46.7 KB
T Microsoft.Azure.Devices.Provisioning.Security.Tpm.1.1.4.symbols.nupkg	39.6 KB
Dicrosoft.Azure.Devices.Provisioning.Service.1.3.1.symbols.nupkg	174 KB
Microsoft.Azure.Devices.Provisioning.Transport.Amqp.1.1.5.symbols.nupkg	89.3 KB
Microsoft.Azure.Devices.Provisioning.Transport.Http.1.1.4.symbols.nupkg	82.3 KB
Microsoft.Azure.Devices.Provisioning.Transport.Mqtt.1.1.6.symbols.nupkg	78.8 KB
Microsoft.Azure.Devices.Shared.1.15.2.symbols.nupkg	103 KB
SetupDeviceExplorer.msi	2.4 MB
L Source code (zip)	
Source code (tar.gz)	

Now you will need connection string of yours Azure IoT Hub, **Not device**. Navigate to IoT hub in your browser, then:

- 1. Click Shared access policies
- 2. Next choose iothubowner
- 3. And copy Connection string primary key

IoThubRUT955 - Shared	access policies		IoThubRIJT955
• • Ior Hub	- Add		Save X Discard ···· More
P Search (Ctrl+/)	- NO		Access policy name
X Overview			iothubowner
Activity log	IoT Hub uses permissions to grant access to each IoT hub endpoint. Permissions limit the access to an IoT hub based o	n functionality.	Permissions
Access control (IAM)			Registry read ①
Tags	Search to filter items		Registry write ①
Diagnose and solve problems	Policy	Permissions	Service connect ①
Events	2 iothubowner	registry write, service connect, device connect	Device connect ①
Settings	service	service connect	
1 ? Shared access policies	device	device connect	
Pricing and scale	registryRead	registry read	Shared access keys Primary key ①
∃+ IP Filter	registrykeadwrite	registry write	······································
Certificates			Secondary key ①
Built-in endpoints			👁 陷
- Failover			Connection string—primary key ①
Properties			<u> </u>
🗠 Locks			Connection string—secondary key ①
V Export template			



After that co back to Device Explorer:

- 1. In Configuration tab paste in Connection string that you just copied
- 2. Copy HostName part from connection string and paste it in Protocol Gateway HostName
- 3. Click Update

💀 Device Explorer Twin		_	\times
Configuration Management Data Messages To Device Call Method on Device			
Connection Information			
IoT Hub Connection String:			
HostName=loThubRUT955.azure-devices.net.SharedAccessKeyName=iothubowner.SharedAccessKey=	-		
Protocol Gateway HostName:			
2 IoThubRUT955.azure-devices.net			
3 Update			
Shared Access Signature			

Open Management tab

- 1. Click Update
- 2. You should see your device in the list below and Connection state

Configu	ration Manager	ment Data	Messages To Device	Call Method on De	vice				
Actior	reate	Refresh	1 Update	Delete	SAS Token	Twin Props.			
Devic Total	es 1								
Filter:							2		
	ld	PrimaryKey	SecondaryKey	PrimaryThumbPrin	SecondaryThum	ConnectionString	ConnectionState	LastActivityTime	LastConnectionStateL
۱.	RUT955					HostName=IoThubRUT9	Connected	11/29/2019 11:25 AM	11/29/2019 11:12 AM
*									

Go to Data tab

- 1. Click monitor, and wait for Event Hub Data to update (Depends on yours chosen interval)
- 2. Messages like this should start appearing.

C	guration Management Data Messages To Device Call Method on Device	
	nitoring	
	Event Hub: Io ThubRUT955	
	Device ID: RUT955	\sim
	Start Time: 11/29/2019 12:01:15	
	Consumer Group: SDefault 🔲 Enable	
1	Monitor Cancel Clear Show system properties	
	MessageSchema'' 'dynamic-information;v1' ContentType': 'JSON' CreationTimeUtc': '2019-11-29T11:34:20Z'	^
2	29/2019 1:34:51 PM> Device: [RUT955]. Data: {{ "ip": "84:15 123.r." "bytes_serceived": "87975317". "bytes_received": "87975317". "connection_state": "-639" "signal": "-53" "bestageSchema': 'dynamic-information.v1' ContentType': USON' Creation TimeUtc: '2019-11:29111:34:512'	





Setting router to Forward MQTT messages/commands to Azure IoT Hub

First you will need MQTT broker to subscribe to, for testing purposes we will set MQTT Broker in same router, and will use PC from LAN to sent MQTT messages.

Go to Services > MQTT

- 1. Click Enable
- 2. Use same port in MQTT Broker and Azure IoT Hub settings.
- 3. Press Save

Broker	Publisher	
МQTT В	roker	
	Enable Enable Local Port 8883 Enable Remote Access	
Broker se	ttings	
Security	Bridge Miscellaneous	
	Use TLS/SSL	
		3 Save

Go to Service > IoT Platforms

- 1. Enable monitoring
- 2. Use same Connection string as before (GSM values configuration)
- 3. Messages Type choose MQTT messages
- 4. Enter MQTT Host address, we are using 127.0.0.1 since our broker is set up on same router.
- 5. Port Same as MQTT Broker
- 6. And Topic under which router will subscribe to MQTT Broker
- 7. Press Save, we will not need username or password.

Azure	loT	Hub	Settings	
-------	-----	-----	----------	--

Azure IoT Hub
Enable Azure IoT Hub monitoring 🗹
2 Connection string HostName=IoThubRUT
3 Messages Type MQTT messages 🗸
4 MQTT Host 127.0.0.1
5 MQTT Port 8883
6 Topic test
Username
Password 💋
7 Save



Checking if MQTT messages are being forwarded to Azure IoT Hub

Connect to router with SSH, in logread you should see Router establishing connection to Azure IoT Hub:

ot@Teltonika-RUT955:~# logread -f	
i Nov 29 14:17:03 2019 user.info Azure IoThub: Creating IoTHub handle	
i Nov 29 14:17:03 2019 user.info Azure IoThub: Subscribing to: test	
i Nov 29 14:17:04 2019 local1.info gsmd[2331]: gsmd send: 'AT+QCSQ' (8)	
i Nov 29 14:17:04 2019 local1.info gsmd[2331]: gsmd get: '+QCSQ: "LTE",58,-89,157,-12' (27)	
i Nov 29 14:17:04 2019 local1.info gsmd[2331]: gsmd send: 'AT+CREG?' (9)	
i Nov 29 14:17:04 2019 locall.info gsmd[2331]: gsmd get: '+CREG: 2,1,"0078","0126A16",7' (29)	
i Nov 29 14:17:04 2019 user.info Azure IoThub: The device client is connected to iothub	
i Nov 29 14:17:06 2019 local1.crit luci-reload[21778]: START==1	
i Nov 29 14:17:06 2019 local1.crit luci-reload[21778]: IF	

Open terminal and publish to MQTT Broker message with previously chosen topic. For our example we are using example: *mosquito_pub -h 192.168.1.1 -p 8883 -m 'testing Azure MQTT messages' -t test*

where a start of the s

If everything was configured correctly in Device Explorer Data tab you should receive message like:



This means our router Forwards MQTT messages to Azure IoT Hub.

Setting Modbus Data to Server to Azure IoT Hub

First go to Services > IoT Platforms and disable it.

Second you will need to configure Modbus Master and Slave, for this example we already setup TCP Master and Slave to send data to IoT Hub.

After that go to Services > Modbus > Modbus Data to Server and add New modbus data sender

- 1. Choose Azure MQTT Protocol
- 2. Paste device Connection String from Azure IoT Hub
- 3. And enter Period, how often data will be sent
- 4. Click Add





In Advanced Sender Settings

- 1. Sellect Enable
- 2. Enter Device ID as Name (copy it from Connection String)
- 3. Leave everything else on default and press Save

Advanced sender settings

lere you can configure advanced settings for the d	ita sender
Data sender configuration	
1 Enabled 2 Name Protocol	Z RUT955 Azure MQTT V
JSON format	<pre>{'ID":"%6I", 'TS":"%6I", ST":"%6S", "VR", "%6a"} Modbus slave ID - %6I Modbus slave ID - %6I Date (Linux timestamp) - %t Date (Linux timestamp) - %t Date (Linux timestamp) - %t Register data - %a</pre>
Segment count	1 🗸
URL / Host / Connection string	HostName=IoThubRUT§
Period	20
Data filtering	All data 🛛 🗸
Retry on fail	
Back to Overview	3 Save

Checking if Modbus Data to Server is sent to Azure IoT Hub

Open SSH client and connect to router, write in command *azure_iothub* and you should receive confirmation when Dada is sent to Azure IoT Hub:

root@Teltonika-RUT955:~# azure_iothub This sample simulates a Chiller device connected to the Remote Monitoring solution accelerator
{ }Confirmation callback received for message 1 with result IOTHUB_CLIENT_CONFIRMATION_OK Device Twin reported properties update completed with result: 204
Confirmation callback received for message 2 with result IOTHUB_CLIENT_CONFIRMATION_OK
Confirmation callback received for message 3 with result IOTHUB_CLIENT_CONFIRMATION_OK

Open Device explorer and open Data tab, you should see that data is coming to IoT Hub:

Event Hub Data 11/29/2019 2:59:39 PM> Device: [RUT955], Data:[{ }]Properties: '\$\$MessageSchema': 'dynamic-information:v1' '\$\$ContentType': 'JSON' '\$\$CreationTimeUtc': '2019-11-29T12:59:38Z' 11/29/2019 3:04:37 PM> Device: [RUT955], Data:[{ }]Properties: '\$\$MessageSchema': 'dynamic-information:v1' '\$\$ContentType': 'JSON' '\$\$ContentType': 'JSON' '\$\$CreationTimeUtc': '2019-11-29T13:04:36Z'