



THE DEVELOPER'S CONFERENCE

**Azure Sphere, Azure IoT Edge e modelos de IA em
microcontroladores: avanços tecnológicos da
Microsoft em IoT.**

Walter Silvestre Coan

Mestre em Sistemas Distribuídos, MCSA, MCP C#, MCP ASP.NET MVC Web App,
AWS Certified Developer e SCP Java.

Walter Silvestre Coan

walter.coan@gmail.com – www.faltoupontoevirgula.com.br

- Microsoft Certified Solutions Associate – Web Applications
 - MCP em programação em C#
 - MCP em desenvolvendo aplicações Web ASP.NET MVC
- Participação com projeto finalista da etapa nacional do Microsoft Imagine Cup 2016 – Projeto Omni
- AWS Certified Developer Associate
- Sun Certified Programmer em Java 5.0
- Mestre em Ciência da Computação na área de Sistemas Distribuídos e Redes de Sensores sem Fio - PUCPR
- Pós-Graduado em Engenharia de Software - PUCPR
- Bacharel em Informática - UNIVILLE
- Professor no Bacharelado em Sistemas de Informação e do Bacharelado em Engenharia de Software da UNIVILLE
- Desenvolvedor de software na RDX – RDornel Data Experts



THE
DEVELOPER'S
CONFERENCE



Microsoft
CERTIFIED
Professional

Microsoft
CERTIFIED
Solutions Associate
Web Applications



Agenda



- Avanços tecnológicos da plataforma Azure IoT
- Azure Sphere
- Azure IoT Edge
- Modelos de IA em microcontroladores
 - Embedded Learning Library (ELL)

Agradecimento



- Esta apresentação é um resumo das apresentações realizadas por:
 - **Olivier Bloch**
 - Principal Program Manager at Microsoft in the Azure IoT team
 - The Things Conference: LoRaWAN and the Intelligent Cloud Powerful solutions with Azure IoT - <https://youtu.be/SivnPqqbWsc>
 - **Ed Nightingale**
 - Partner Product Architect (Azure Sphere)
 - Introducing Azure Sphere - <https://youtu.be/wJgCzaiRz9w>
 - **Juliano Viana**
 - CTO da Kunumi
 - Redes Neurais Dinâmicas usando PyTorch - <https://youtu.be/3fqWMhu32mM>

Microsoft investe \$5B em IoT




THE
DEVELOPER'S
CONFERENCE

Microsoft | Microsoft Internet of Things About

Microsoft will invest \$5 billion in IoT. Here's why.

Apr 4, 2018 | Julia White, CVP Microsoft Azure

[f](#) [t](#) [in](#)



Related Stories

May 7, 2018 | [Sam George](#)

Unlocking the IoT promise—from the intelligent cloud to the intelligent edge >

Sep 24, 2018 | [Sam George](#)

Microsoft Ignite 2018: Build and secure next-generation IoT and edge solutions at scale >

Jun 5, 2018 | [Bert Van Hoof](#)

Smart buildings, built on Azure IoT >

<https://blogs.microsoft.com/iot/2018/04/04/microsoft-will-invest-5-billion-in-iot-heres-why/>

Um ano depois...



THE
DEVELOPER'S
CONFERENCE

Microsoft | Official Microsoft Blog | Microsoft On the Issues | The AI Blog | Transform

All Microsoft ▾ 🔍 🛒

One Year In: How our \$5B investment in IoT and intelligent edge is accelerating customer, partner and solution innovation

Apr 4, 2019 | [Julia White - Corporate Vice President, Microsoft Azure](#)



One year ago, we [announced](#) our commitment to invest \$5B in IoT (Internet of Things) and intelligent edge – technology that is accelerating ubiquitous computing and bringing unparalleled opportunity for transformation across industries. Our commitment is to a build trusted, easy to use platform for our customers and partners to build solutions – no matter where they are starting in their IoT journey.

Our customers are embracing IoT as a core strategy to drive better business outcomes, improve safety and address social issues – from predicting and preventing equipment failures, optimizing smart buildings for space utilization and energy management and improving patient outcomes and worker safety. From the intelligent cloud to the intelligent edge, this year has been one of tremendous growth – in IoT technology portfolio, partner ecosystem and customer momentum – and we are only just beginning.

Accelerating customer innovation in IoT from cloud to edge across industries

What's truly exciting is seeing our customers achieve real business outcomes with Azure IoT and intelligent edge-based solutions. Our IoT platform is powering customer solutions with

Related Stories

Mar 28, 2019 | [Sajayan Arkan](#)

Manufacturing a better future: Microsoft announces intelligent industry innovations >

Apr 18, 2018 | [Sam George](#)

Partners make industrial IoT factories more capable than ever at Hannover Messe 2018 >

Jul 23, 2018 | [Kevin Scott](#)

The next wave of computing is the intelligent edge and intelligent cloud >

Um ano depois...



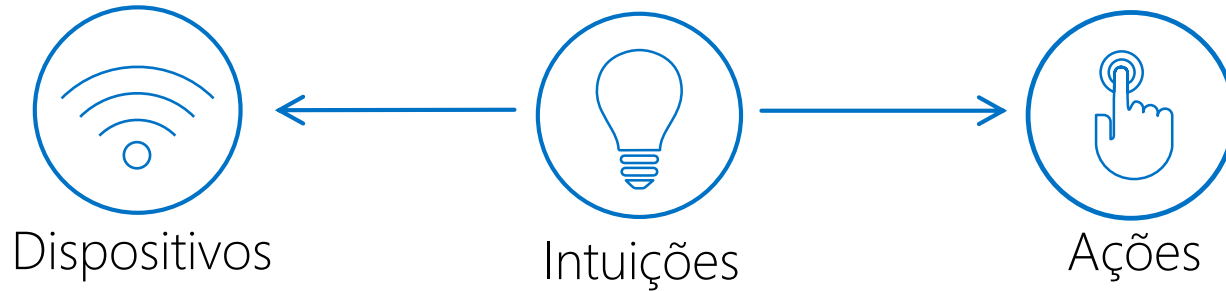
THE
DEVELOPER'S
CONFERENCE

- Azure Sphere
- Mais de 100 novos serviços e funcionalidades na plataforma Azure IoT
 - Azure IoT Central
 - Windows 10 IoT Core Services
 - Azure Security Center
 - Azure Digital Twins
 - Azure Maps
 - Azure Spatial Anchors
 - Azure Remote Rendering
 - Azure IoT Edge - Azure Cognitive Services
 - Windows Server IoT 2019
 - Azure IoT Edge VM on Azure Marketplace
 - Azure IoT Hub Device Streams
 - Embedded Learning Library (ELL)
 - Device Simulation Azure IoT
 - Time Series Insights
 - RBAC (Role Based Access Control) Azure IoT

Azure IoT



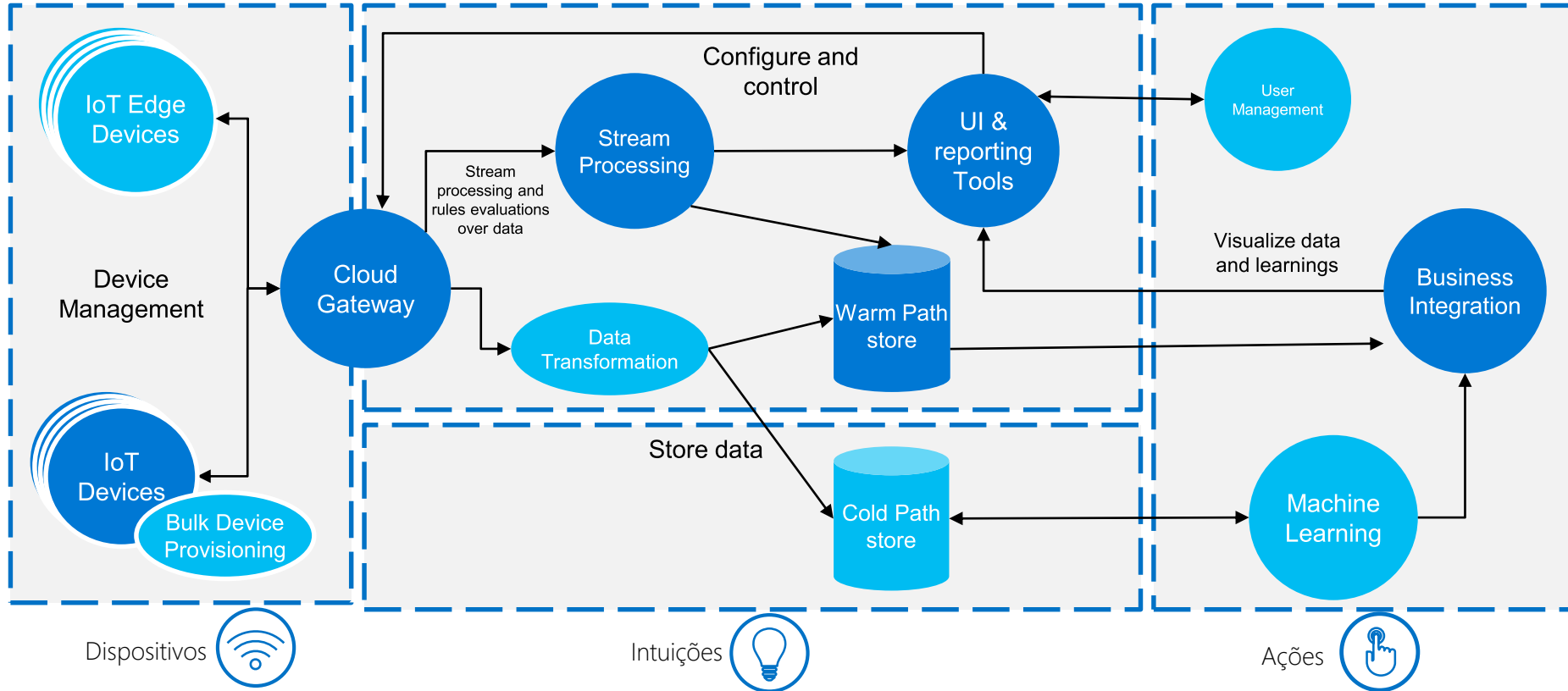
THE
DEVELOPER'S
CONFERENCE



Azure IoT



THE
DEVELOPER'S
CONFERENCE



Azure IoT



THE
DEVELOPER'S
CONFERENCE

Use | Solutions

SaaS

Managed
Solutions

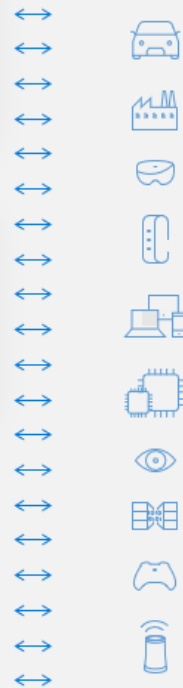


Azure IoT
Central



Dynamics 365
Connected Field Service

Edge



Build your own | Platform

PaaS

Solution
Accelerators



Remote
monitoring



Predictive
maintenance



Connected
factory

...

Device Support



Azure IoT Hub

Data & Analytics



Azure Time Series
Insights

Visualization & Integration



Azure Logic Apps





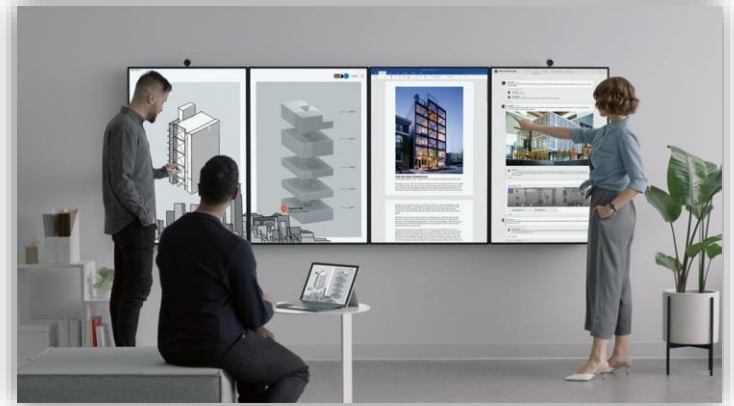
THE
DEVELOPER'S
CONFERENCE

Azure Sphere

Azure Sphere



- Segunda transformação digital
 - Primeira onda 1970
 - Primeiros Microcontroladores MCU
 - Segunda onda 2010 – 2020
 - Conectividade pela Internet dos MCU
- Consequências
 - Mudança drástica nas experiências de uso dos dispositivos.
 - Maior preocupação com a segurança.



Microsoft Surface Hub 2



THE
DEVELOPER'S
CONFERENCE

Nenhuma empresa lançaria um produto
com problemas de segurança



HACKADAY

HOME BLOG HACKADAY.IO TINDIE HACKADAY PRIZE SUBMIT ABOUT

March 23, 2019

DON'T TOSS THAT BULB, IT KNOWS YOUR PASSWORD

by: Tom Nardi

f t 8+

68 Comments

January 29, 2019



THE DEVELOPER'S CONFERENCE



<https://limitedresults.com/2019/01/pwn-the-lifx-mini-white/>

The Seven Properties of Highly Secure Devices: the new standard for securing MCU powered IoT experiences

<https://www.microsoft.com/en-us/research/wp-content/uploads/2017/03/SevenPropertiesofHighlySecureDevices.pdf>



Hardware Root of Trust



Seu dispositivo é identificável e a integridade do software é confirmada por hardware?



Defense In Depth



Seu dispositivo se mantém seguro se um mecanismo de segurança for destruído?



Small Trusted Computing Base



O seu dispositivo está protegido de erros em outros códigos fonte?



Dynamic Compartments



As proteções de segurança do seu dispositivo podem melhorar após a implantação?



Certificate-Based Authentication



Seu dispositivo utiliza certificados digitais ao invés de senhas para autenticação?



Failure Reporting



Seu dispositivo reporta falhas e anomalias?



Renewable Security



Seu dispositivo atualiza o software de forma automática?



Suporte do Hardware



Suporte do Sistema Operacional



Suporte do Serviço de Nuvem

Algumas necessidades dependem do suporte do hardware



Hardware Root of Trust

Chave criptográfica que não pode ser excluída e protegida pelo hardware. Dispositivos contadores físicos impedem ataques do tipo *side-channel*.

A identidade do dispositivo e o software seguro dentro do hardware



Hardware protege a **Identidade do Dispositivo**



Hardware protege a **Inicialização com Segurança**



Hardware atesta a **Integridade do Sistema**

Algumas necessidades dependem do suporte do hardware e do software



Dynamic Compartments

Barreiras internas limitam o alcance de qualquer falha



Hardware cria **Barreiras de Segurança**

Hardware firewall ou unidades de memória gerenciadas



Software **cria Compartimentos** Isolamento de processos

Algumas necessidades dependem do suporte do hardware e do software



Small Trusted Computing Base

Chave criptográfica são armazenadas em uma carteira protegida pelo hardware, inacessível pelo software.



Hardware protege as **chaves criptográficas de acesso**



A arquitetura de software é **concebida no formato de camadas** impedindo o acesso direto.

Algumas necessidades dependem do suporte do hardware, do software e da nuvem



Renewable Security

A segurança do dispositivo é renovada para superar as ameaças em evolução e as violações de segurança.



Nuvem provê as **atualizações**



Software **aplica as atualizações**



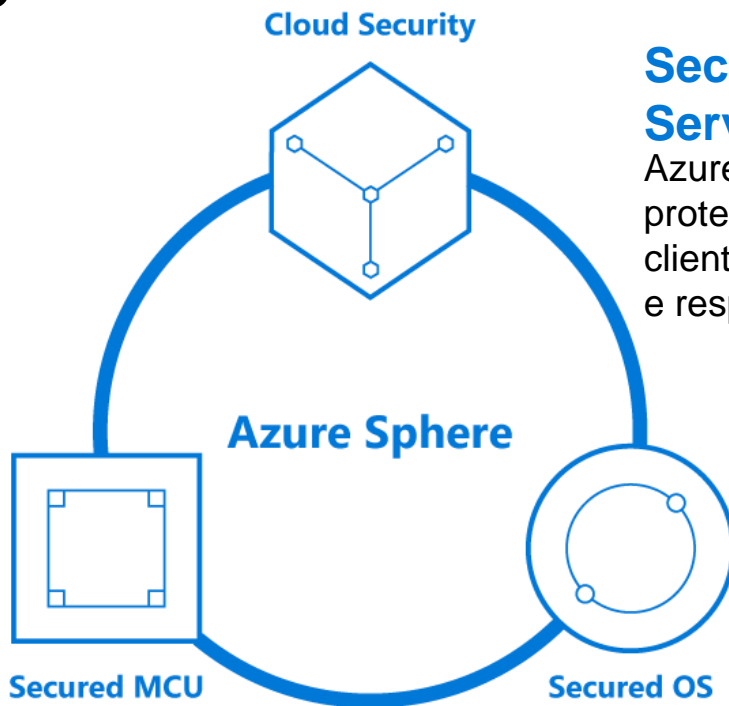
Hardware **previne rollback attacks**

Três pilares de segurança do Azure Sphere



Secured MCUs

Uma nova categoria de MCU's chamado Azure Sphere, produzidos por empresas parceiras, com tecnologia de segurança da Microsoft, que fornece conectividade, alto desempenho e características de segurança no hardware.



Secured by our Cloud Service

Azure Sphere Security Service protege cada dispositivo e os clientes, detecta falhas de segurança e responde de forma proativa.

Secured Operating System

Sistema operacional seguro Azure Sphere OS que combina as melhores práticas da Microsoft e da comunidade Open Source, criando uma plataforma confiável para uma nova experiência em IoT.

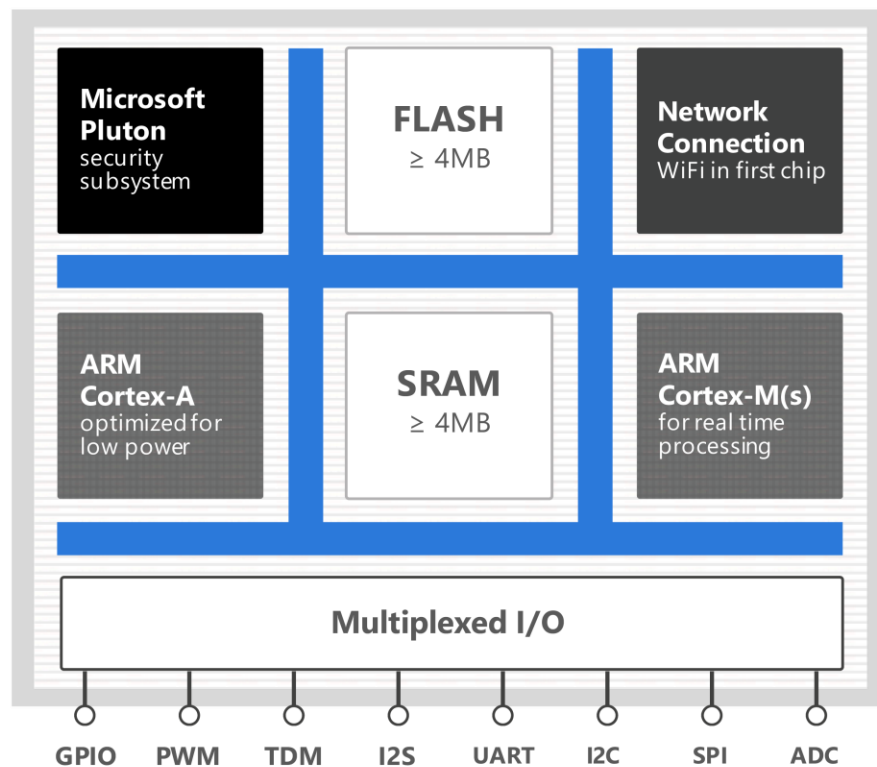
Arquitetura do Azure Sphere MCU



Microsoft Pluton Security Subsystem –
Root of Trust

ARM Cortex-A provê isolamento de processos através do gerenciamento de unidades de memória. Azure Sphere OS cria containers para as aplicações que utilizam espaços de memória reservados.

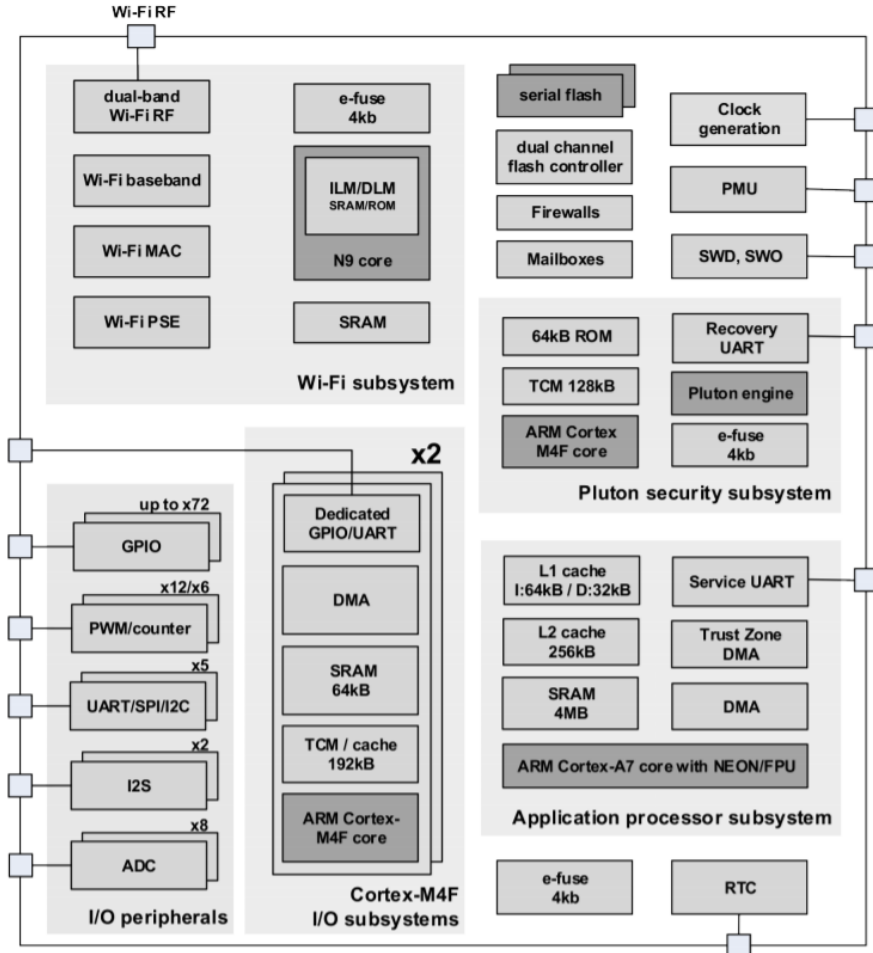
2x ARM Cortex-M é o MCU, que executa o processamento em real time.



Microsoft I/O
Firewalls



THE DEVELOPER'S CONFERENCE



➤ ARM Cortex A7 NEON FPU

- 64kB L1 instruction cache
- 32kB L1 data cache
- 256kB L2 cache,
- 4MB system memory for the Azure Sphere operating system and user applications

➤ 2x ARM Cortex M4 cores

- 192kB TCM (Tightly-Coupled Memory)
- 64kB SRAM
- FPU Floating Point Unit

➤ Pluton Security Subsystem

- ARM Cortex-M4F security processor
- 128kB secured TCM
- 64kB secured mask ROM bootloader

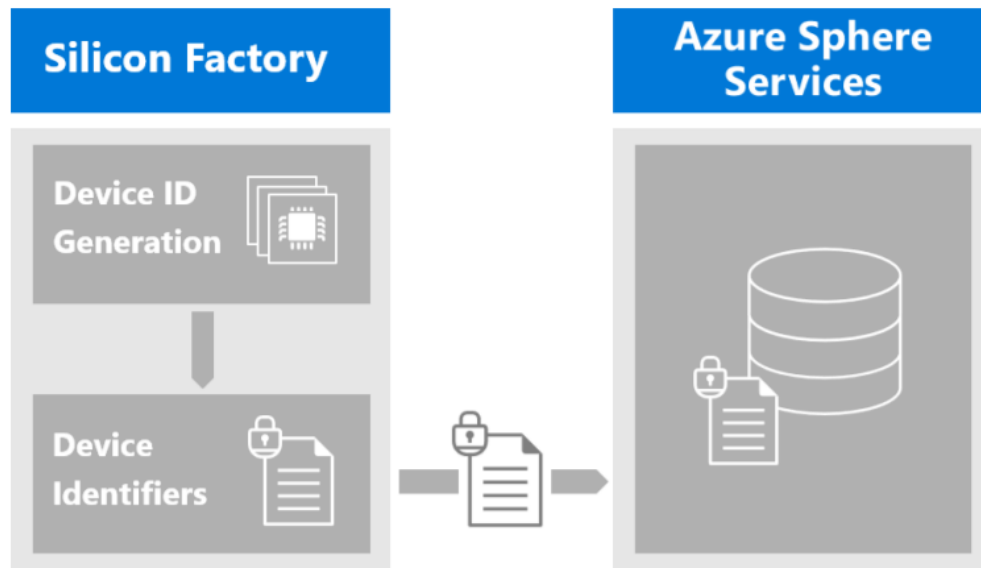
➤ Wi-Fi

- Processador dedicado N9 32-bit RISC core
- IEEE 802.11 a/b/g/n
- Bandas de 2.4GHz e 5GHz

Geração do Device ID no Azure Sphere



- Cada dispositivo possui um identificador único;
- O ID é gerado no processo de fabricação do MCU;
- Microsoft possui o controle de todos os IDs dos dispositivos produzidos.



https://azure.microsoft.com/mediahandler/files/resourcefiles/azure-sphere-device-authentication-and-attestation-service/Device_Authentication_and_Attestation_Service.pdf?v=cba244cabba1e2c8d7ceb8f3389d4c7eb8a97d1eacae2cdc e17d73dc686a476b

Comprovação remota

- Ocorre durante o processo de autenticação
- Azure Sphere assina digitalmente um conjunto de informações para provar que o dispositivo é original;
- Dados são enviados para o Device Authentication and Attestation no Azure;
- Retorna um certificado de curta duração atestando que é um dispositivo original.



THE
DEVELOPER'S
CONFERENCE

Device Authentication and Attestation

Is this device genuine?
Is this device trusted?



Status de Suporte MT3620

<https://docs.microsoft.com/pt-br/azure-sphere/hardware/mt3620-product-status>



THE
DEVELOPER'S
CONFERENCE

- **Suportado**
 - 76 GPIO mapeados apenas para o ARM Cortex-A7
 - Serial UART 1.200 a 2.000.000 bauds + 32 bytes de buffer
 - SPI 40 MHz – 2 dispositivos subordinados
 - I2C 100kHz a 1 MHz
 - Subsistema Wi-Fi
 - 5MB RAM – 4MB flash para o ARM Cortex-A7 (pode ser solicitado com 16MB flash SPI)
- **Não suportado** (por enquanto)
 - PWM e contadores de pulso
 - I2S (Inter-IC Sound)
 - ADC – 8 pinos
 - 2x ARM Cortex-M4F
 - Controle de energia
 - Detecção de Brownout

Azure Sphere MT3620 Dev Kit



THE
DEVELOPER'S
CONFERENCE

Azure Sphere MT3620 Developm x +

https://www.seeedstudio.com/Azure-Sphere-MT3620-Development-Kit-EU-Version-p-3134.html

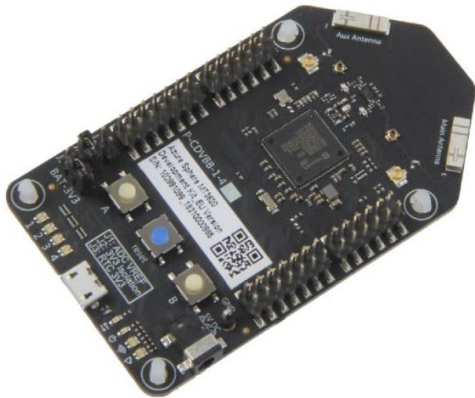
March Sales: 20% off for over 200 Raspberry Pi and Arduino Products for the whole month. Apply code **【SEED20】**.

Seeed Global USD

seeed
The IoT Hardware Enabler

Shop Fusion PCB/PCBA Community *What are you looking for?* Q Sign in

Home / Development Platform / Others / Azure Sphere MT3620 Development Kit_EU Version



Azure Sphere MT3620 Development Kit_EU Version

SKU 102991099

\$84.90 In Stock
170+ Available

- 1 + Add to Cart

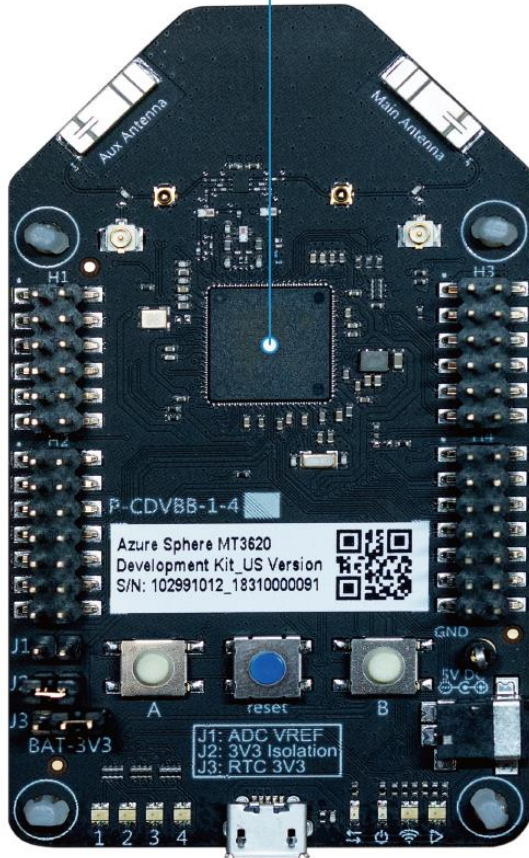
I accept the restriction

Qty Discount available ▾

\$82.90 /10pcs+	\$80.90 /50pcs+
\$81.90 /20pcs+	

Contact Support

Extension Header Pinmap											
H1											
			SYS_RST_B	1		2			GND		
	I2S0_RX		GPIO 59	3		4			GPIO0		
	I2S0_TX		GPIO 56	5		6			GPIO1		
	I2S0_FS		GPIO 58	7		8			GPIO2		
	I2S0_MCLK		GPIO 57	9		10			GPIO3		
	I2S0_BCLK		GPIO 60	11		12			GPIO4		
H2											
DATA0	RXD0	MISO0	GPIO 28	1		2			GND		
	TXD0	SCLK0	GPIO 26	3		4			GPIO 5		
	CTS0	CSA0	GPIO 29	5		6			GPIO 6		
CLK0	RTS0	MOSI0	GPIO 27	7		8			GPIO 7		
		CSB0	GPIO 30	9		10			ADC_VREF		
		ADC0	GPIO 41	11		12			GPIO 43	ADC2	
		ADC1	GPIO 42	13		14			GPIO 44	ADC3	



Extension Header Pinmap												
H3												
			5V_OUT	1		2			GND			
			3.3V	3		4			WAKEUP			
	TXD3	SCLK3	GPIO 66	5		6			IO0_TXD			
CLK3	RTS3	MOSI3	GPIO 67	7		8			IO1_TXD			
DATA3	RXD3	MISO3	GPIO 68	9		10			PMU_EN			
	CTS3	CSA3	GPIO 69	11		12			GPIO 70	CSB3		
H4												
			SWDIO	1		2			GND			
			SWCLK	3		4			SWO			
DATA1	RXD1	MISO1	GPIO 33	5		6			GPIO 38	MISO2	RXD2	DATA2
	TXD1	SCLK1	GPIO 31	7		8			GPIO 36	SCLK2	TXD2	
	CTS1	CSA1	GPIO 34	9		10			GPIO 39	CSA2	CTS2	
CLK1	RTS1	MOSI1	GPIO 32	11		12			GPIO 37	MOSI2	RTS2	CLK2
		CSB1	GPIO 35	13		14			GPIO 40	CSB2		

Note: [2018/09/10] The current Azure Sphere software release does not support all features of the MT3620 hardware. The following are not yet supported in software:

- 2 x ARM Cortex-M4 with FPU
- ADC, I2C, I2S, PWM and SPI peripheral interfaces (GPIO and UART are supported)
- Wi-Fi 802.11a (b/g/n are supported)
- RTC with clock selection and battery backup

Azure Sphere MT3620 Mini Dev Board



THE
DEVELOPER'S
CONFERENCE

MT3620 Mini Dev Board - Seeed

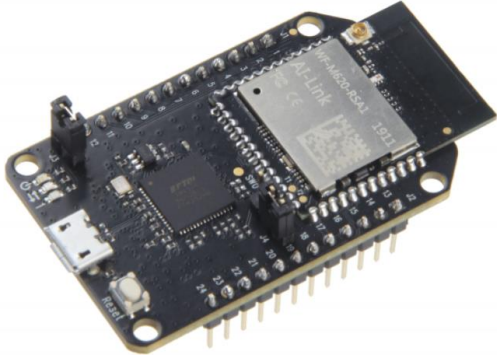
https://www.seeedstudio.com/MT3620-Mini-Dev-Board-p-2919.html

March Sales: 20% off for over 200 Raspberry Pi and Arduino Products for the whole month. Apply code **【SEED20】**.

Seeed Global USD

seeed The IoT Hardware Enabler Shop Fusion PCB/PCBA Community What are you looking for? Sign in

Home / Development Platform / Single Board Computer / Azure Sphere / MT3620 Mini Dev Board



MT3620 Mini Dev Board

SKU 102110267

\$34.90 In Stock
90+ Available

- 1 + Pre Order

Estimated availability Date: May 13, 2019

Qty Discount available

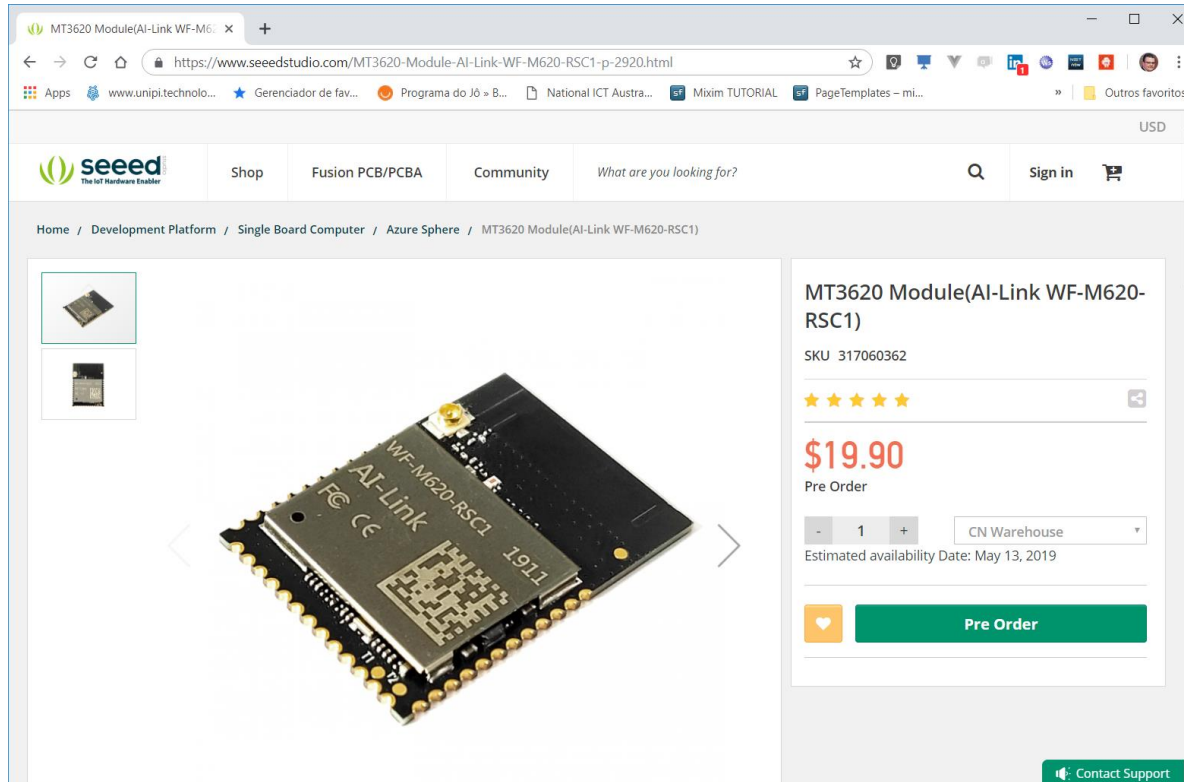
\$34.50 /10pcs+	\$33.90 /50pcs+
\$34.10 /20pcs+	

GOT QUESTIONS? ASK US Contact Support

Azure Sphere MT3620 Module



THE
DEVELOPER'S
CONFERENCE



MT3620 Module(AI-Link WF-M620-RSC1)

SKU 317060362

★★★★★


\$19.90


Pre Order

- 1 +

CN Warehouse

Estimated availability Date: May 13, 2019

 [Pre Order](#)

 [Contact Support](#)



THE
DEVELOPER'S
CONFERENCE

Demonstração



THE
DEVELOPER'S
CONFERENCE

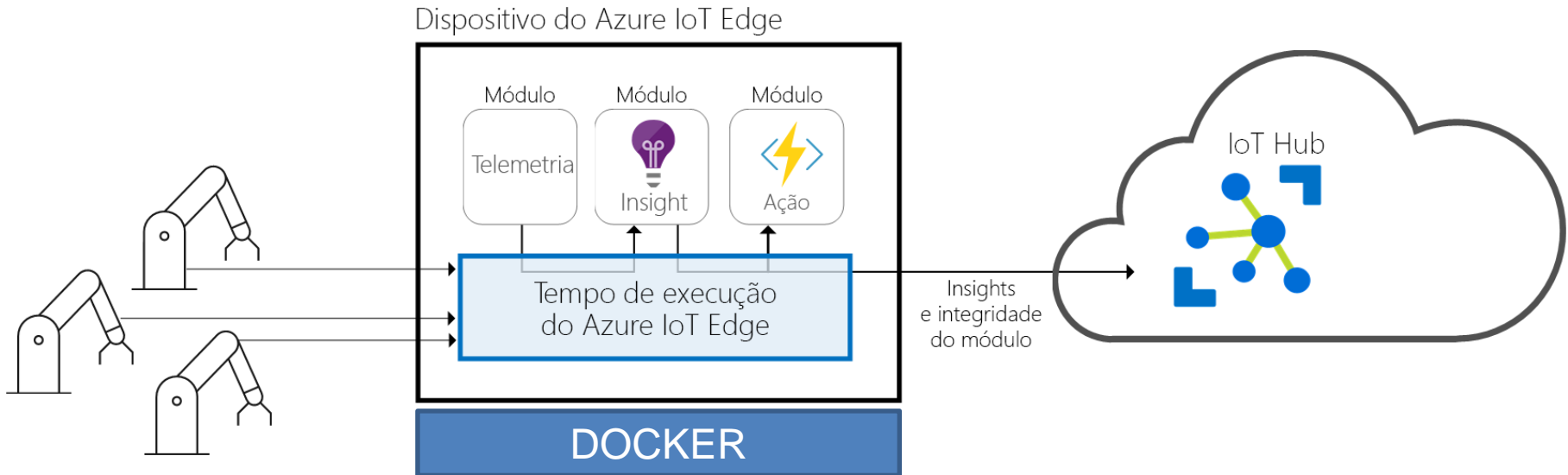
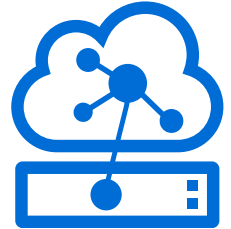
Azure IoT Edge

Azure IoT Edge



THE
DEVELOPER'S
CONFERENCE

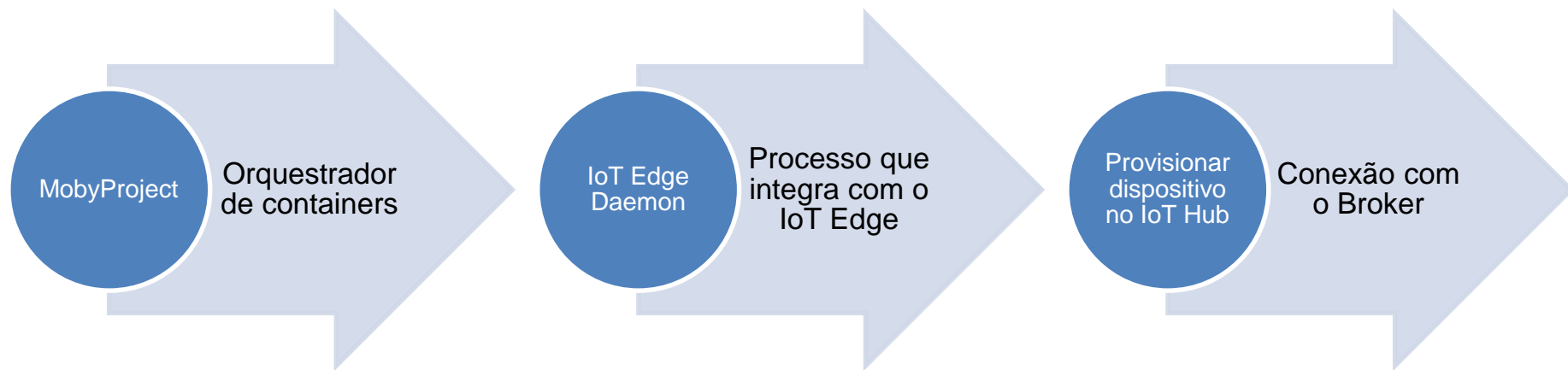
- O Azure IoT Edge move análises de nuvem e lógica de negócios personalizada para dispositivos, de modo que sua organização pode se concentrar em ideias de negócios em vez de gerenciamento de dados.



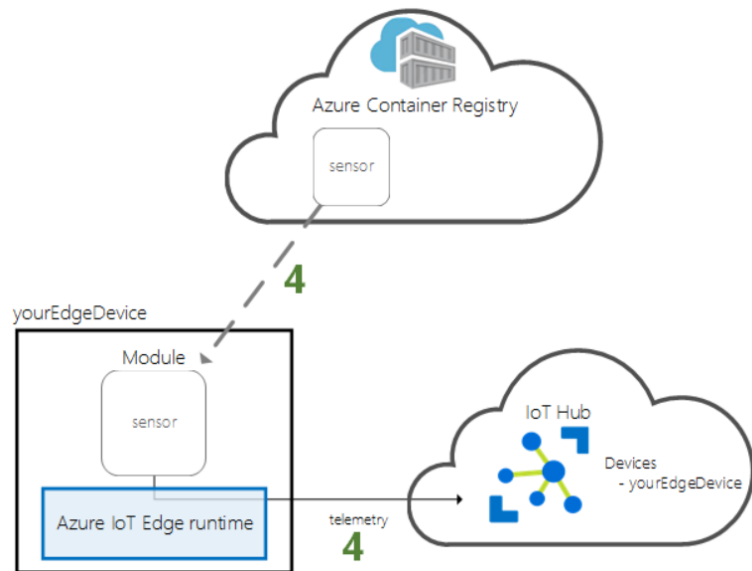
Install Azure IoT Edge runtime on Linux (ARM32v7/armhf)



<https://docs.microsoft.com/en-us/azure/iot-edge/how-to-install-iot-edge-linux-arm>



Publicar módulo nos dispositivos



Codificação

- Desenvolvimento do módulo do IoT Edge

Container

- Compilação
- Geração da imagem do container Docker

Publicação da Imagem

- Imagem copiada para um Container Registry

Deploy

- Azure IoT Edge aciona publicação nos dispositivos.

Monitoramento real de um CLP



THE
DEVELOPER'S
CONFERENCE



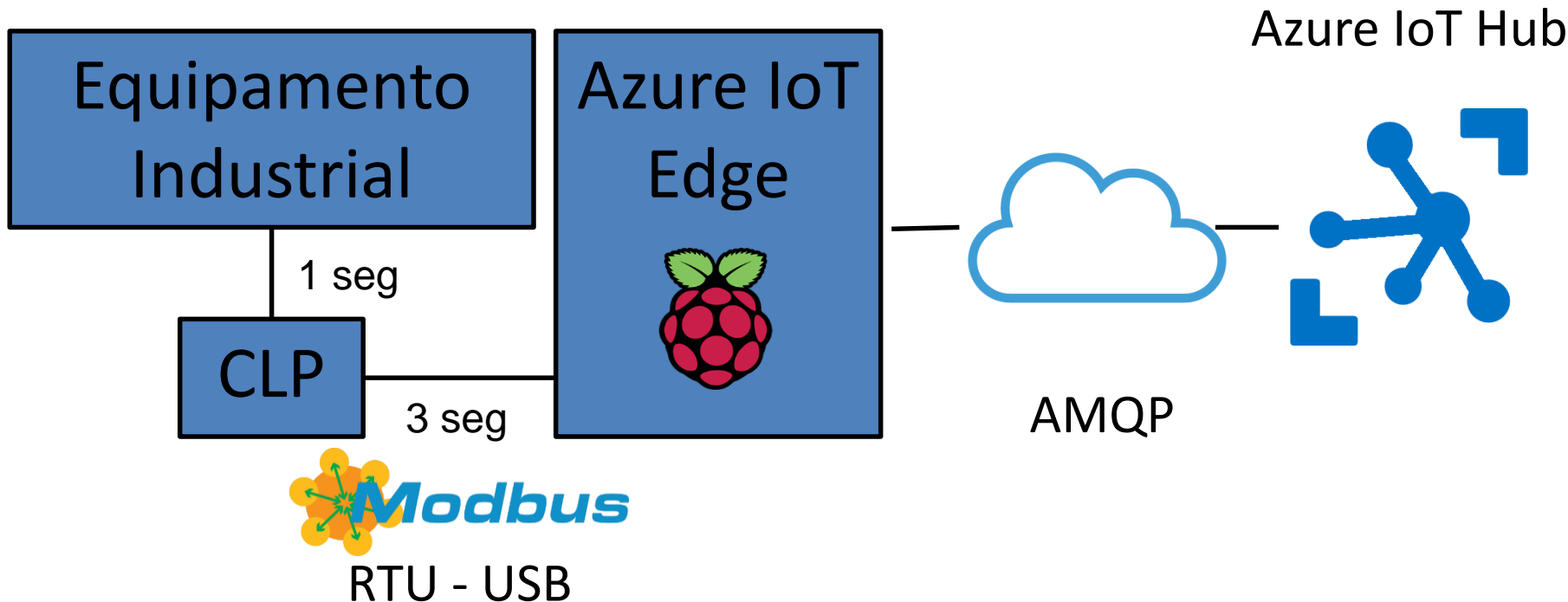
CLP (Controlador lógico programável)

➤ Empresa ProXSys

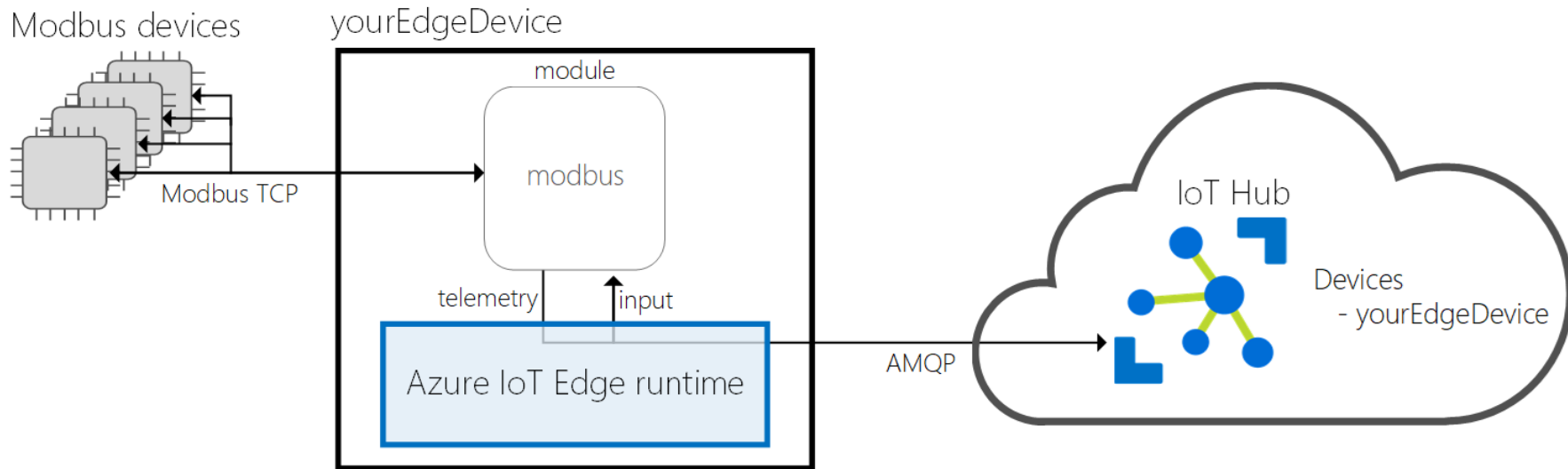
- CP-WS11/4DO4DI USB RS485
- Alimentação em 24Vcc ou 12Vcc
- Duas (02) saídas digitais para RELE
- Quatro (04) entradas digitais a transistor tipo PNP
- Porta de comunicação RS 485
- Porta de comunicação/gravação USB
- Protocolo MODBUS RTU



Monitoramento real de um CLP

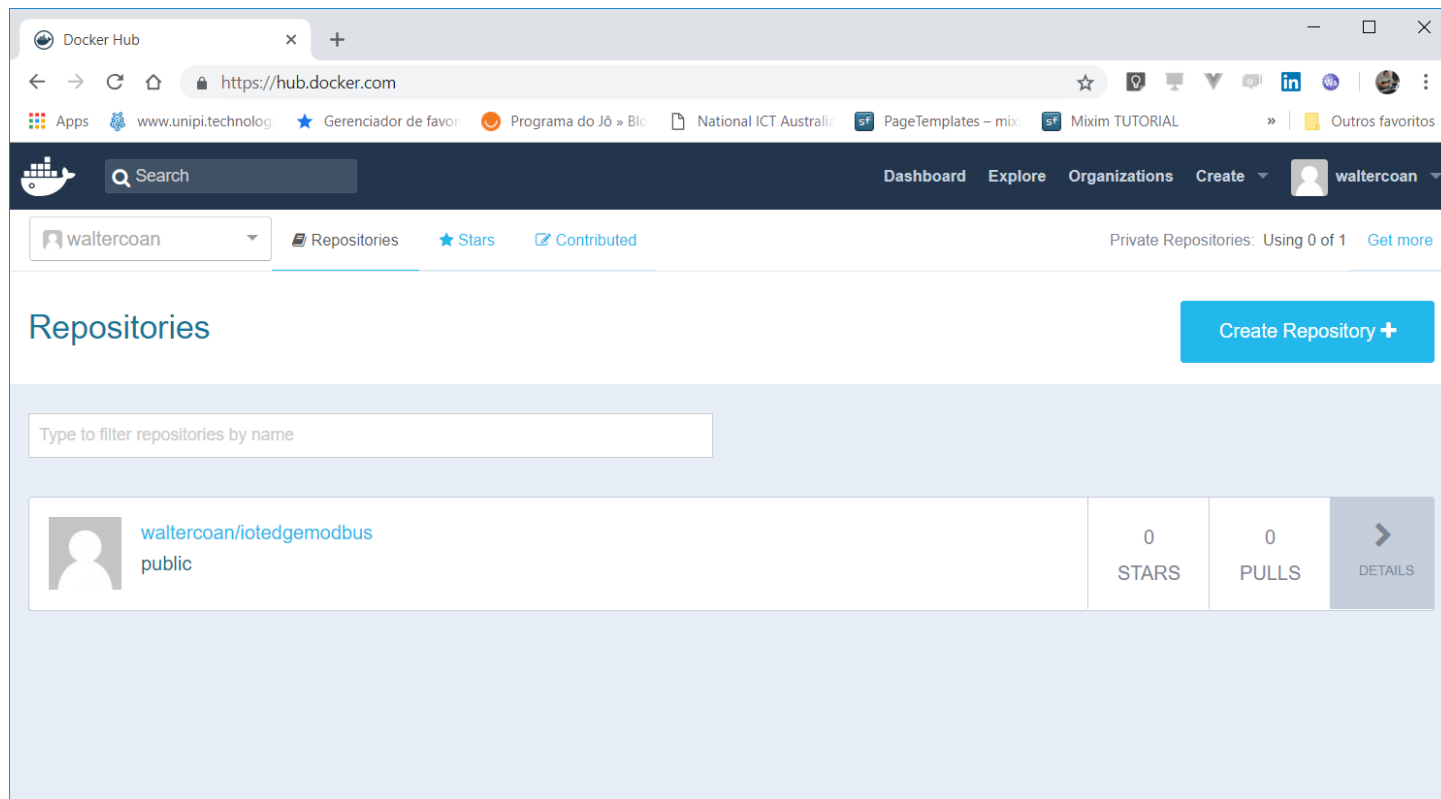


Monitoramento real de um CLP



<https://github.com/Azure/iot-edge-modbus>

Monitoramento real de um CLP



The screenshot shows a web browser window displaying the Docker Hub profile for the user 'waltercoan'. The browser's address bar shows 'https://hub.docker.com'. The page header includes navigation links like 'Dashboard', 'Explore', 'Organizations', and 'Create', along with the user's name 'waltercoan'. Below the header, there are tabs for 'Repositories', 'Stars', and 'Contributed'. The main content area is titled 'Repositories' and features a search input field with the placeholder text 'Type to filter repositories by name'. A blue button labeled 'Create Repository +' is positioned in the top right corner of the repository list. The list itself contains one entry: 'waltercoan/iotedgemodbus public', which has 0 stars and 0 pulls. A 'DETAILS' button with a right-pointing arrow is located to the right of the repository entry.

Repository Name	Stars	Pulls	Action
waltercoan/iotedgemodbus public	0	0	DETAILS



THE
DEVELOPER'S
CONFERENCE

Demonstração

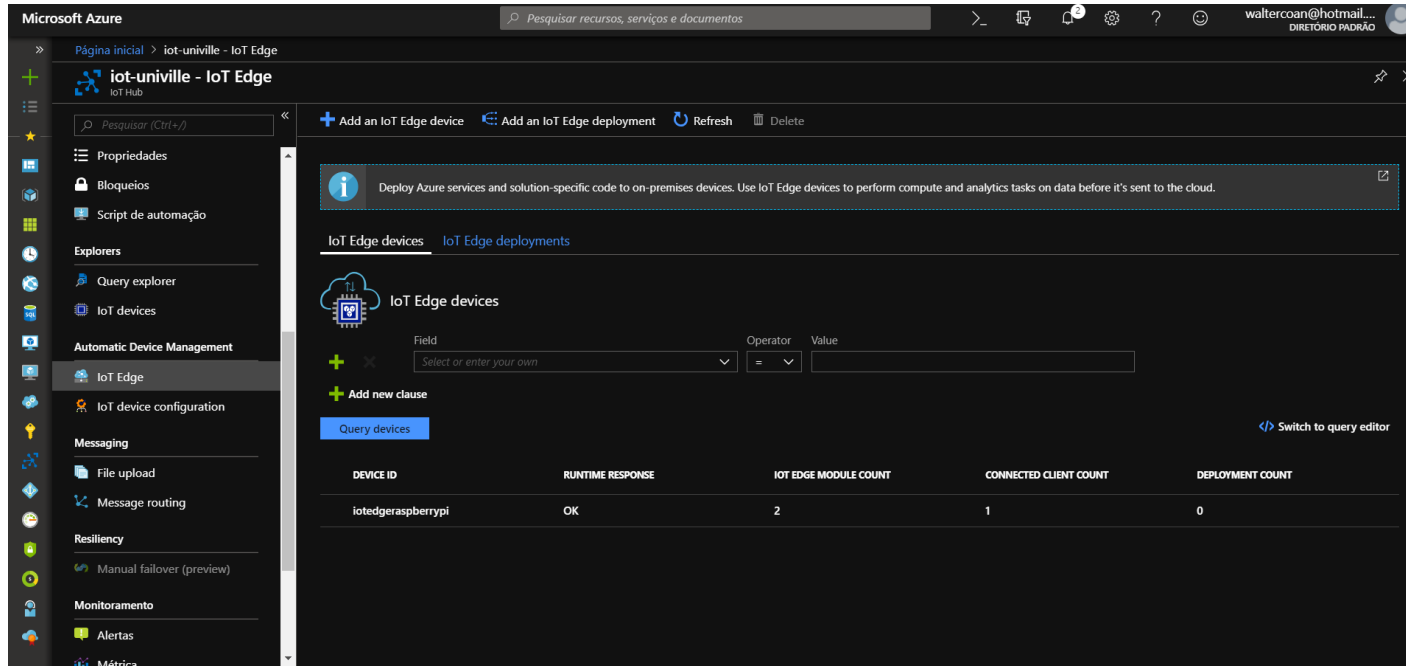
Monitoramento real de um CLP



Antes de habilitar o módulo

```
pi@raspberrypi: ~  
root@raspberrypi:/home/pi# docker ps  
CONTAINER ID        IMAGE                                     COMMAND  
CREATED            STATUS    PORTS  
NAMES  
b0ce650a90a2      mcr.microsoft.com/azureiotedge-hub:1.0  "/bin/sh -c 'echo  
\"$...\" 27 hours ago    Up 2 hours    0.0.0.0:443->443/tcp, 0.0.0.0:8  
883->8883/tcp, 5671/tcp    edgeHub  
eb40d7f5caad      mcr.microsoft.com/azureiotedge-agent:1.0  "/bin/sh -c 'echo  
\"$...\" 28 hours ago    Up 2 hours  
edgeAgent  
root@raspberrypi:/home/pi# █
```

Monitoramento real de um CLP



The screenshot displays the Microsoft Azure IoT Hub interface for the 'iot-univille - IoT Edge' instance. The left sidebar shows the navigation menu with 'IoT Edge' selected. The main content area shows the 'IoT Edge devices' section with a search bar and a table of device status.

Deploy Azure services and solution-specific code on on-premises devices. Use IoT Edge devices to perform compute and analytics tasks on data before it's sent to the cloud.

IoT Edge devices | IoT Edge deployments

IoT Edge devices

Field: Operator: [=] Value:

+ Add new clause

Query devices [Switch to query editor](#)

DEVICE ID	RUNTIME RESPONSE	IOT EDGE MODULE COUNT	CONNECTED CLIENT COUNT	DEPLOYMENT COUNT
iotedgeraspberry1	OK	2	1	0

Monitoramento real de um CLP



Microsoft Azure

Página inicial > iot-univille - IoT Edge > Device details

Device details

iotedgeraspberry

Save **Set modules** Manage child devices (Preview) Device twin Regenerate keys Refresh

HostName=iot-univille.azure-devices.net;Deviceld=iotedgeraspberry;SharedAccessKey=wrdG9tm8Eid2m9jDZe3uuq4O+ieYmjZsK58Sjb+Vk=

Connection string (secondary key)

HostName=iot-univille.azure-devices.net;Deviceld=iotedgeraspberry;SharedAccessKey=fyEgZ102Lsjc0fIE0M1RIO89Hh/leKv1Wieg24O9Yec=

Connect this device to an IoT hub

Enable Disable

Edge runtime response

N/A

Modules IoT Edge hub connections Deployments

Verify that your modules are included in the deployment, and whether your modules have been reported by the device. Click Set modules to change the modules that appear. Each device can host a maximum of 20 modules.

NAME	TYPE	SPECIFIED IN DEPLOYMENT	REPORTED BY DEVICE	RUNTIME STATUS	EXIT CODE
\$edgeAgent	IoT Edge System module	✓ Yes	✓ Yes	running	-
\$edgeHub	IoT Edge System module	✓ Yes	✓ Yes	running	-

Monitoramento real de um CLP



Microsoft Azure

Pesquisar recursos, serviços e documentos

waltercoan@hotmail...
DIRETORIO PADRÃO

Página inicial > iot-univille - IoT Edge > Device details > Set modules

Set modules

Set modules

- 1 Add Modules (optional)
- 2 Specify Routes (optional)
- 3 Review Deployment

i You can specify credentials to container registries hosting module images. Listed credentials are used to retrieve modules with a matching URL. The Edge Agent will report error 500 if it can't find a container registry setting for a module.

Container Registry Settings

NAME	ADDRESS	USER NAME	PASSWORD

i An IoT Edge module is a Docker container you can deploy to IoT Edge devices. It communicates with other modules and sends data to the IoT Edge runtime. Using this UI you can import Azure Service IoT Edge modules or specify the settings for an IoT Edge module. Setting modules on each device will be counted towards the quota and throttled based on the IoT Hub tier and units. For example, for S1 tier, modules can be set 10 times per second if no other updates are happening in the IoT Hub.

Deployment Modules

+ Add **🗑** Delete

IoT Edge Module	DESIRED STATUS
Azure Stream Analytics Module	
Azure Machine Learning Module	

Previous **Next** Submit

Monitoramento real de um CLP



THE
DEVELOPER'S
CONFERENCE

The screenshot shows the Microsoft Azure portal interface for configuring IoT Edge Custom Modules. The main window is titled "IoT Edge Custom Modules" and is divided into two main sections: "Set modules" on the left and "IoT Edge Custom Modules" on the right.

Set modules section:

- Progress steps: 1. Add Modules (optional), 2. Specify Modules (optional), 3. Review Deployment.
- Information: An IoT Edge module is a Docker container you can deploy to IoT Edge devices. It communicates with other modules, import Azure Service IoT Edge modules or specify the settings for an IoT Edge module. Setting modules on each the IoT Hub tier and units. For example, for S1 tier, modules can be set 10 times per second if no other updates.
- Deployment Modules table:

NAME	DESIRED STATUS
No Modules Found	
- Buttons: "Add", "Delete", "Configure advanced Edge Runtime settings", "Previous", "Next".

IoT Edge Custom Modules section:

- Form fields (highlighted with red boxes):
 - Name:
 - Image URI:
 - Container Create Options:
 - Restart Policy:
 - Desired Status:
 - Set module twin's desired properties:
 - JSON input: `"properties.desired": {}`
- Buttons: "Save".

Monitoramento real de um CLP



Name: iotedgemodbus

Image URI: waltercoan/iotedgemodbus

Container Create Options:

```
{
  "HostConfig": {
    "User": "root",
    "Privileged": true,
    "Devices": [
      {
        "PathOnHost": "/dev/ttyACM0",
        "PathInContainer": "/dev/ttyACM0",
        "CgroupPermissions": "mrw"
      }
    ]
  }
}
```

Monitoramento real de um CLP



THE
DEVELOPER'S
CONFERENCE

Module Twin's desired properties:

```
{
  "properties.desired":{
    "PublishInterval": "3000",
    "SlaveConfigs": {
      "Slave01": {
        "SlaveConnection": "/dev/ttyACM0",
          "TcpPort": "0",
        "RetryCount": "10",
        "RetryInterval": "50",
        "HwId": "CLP",
        "BaudRate": "9600",
        "DataBits": "8",
        "StopBits": "1",
        "Parity": "ODD",
        "FlowControl": "NONE",
        CONTINUA NO PRÓXIMO SLIDE!!!
      }
    }
  }
}
```


Monitoramento real de um CLP



```
"Operations": {
  "Op01": {
    "PollingInterval": "1000",
    "UnitId": "1",
    "StartAddress": "100002",
    "Count": "1",
    "DisplayName": "disjuntor1"
  },
  "Op02": {
    "PollingInterval": "1000",
    "UnitId": "1",
    "StartAddress": "100003",
    "Count": "1",
    "DisplayName": "disjuntor2"
  }
}
}
```

Monitoramento real de um CLP



Microsoft Azure

Página inicial > iot-univille - IoT Edge > Device details > Set modules

Set modules

Set modules

- 1 Add Modules (optional)
- 2 Specify Routes (optional)
- 3 Review Deployment

You can set routes between modules, which gives you the flexibility to send messages where they need to go

```
{
  "routes": {
    "route": "FROM /messages/* INTO $upstream"
  }
}
```

Previous Next

```
{
  "routes": {
    "route": "FROM /messages/* INTO $upstream"
  }
}
```

Monitoramento real de um CLP



```
pi@raspberrypi: ~  
root@raspberrypi:/home/pi# docker ps  
CONTAINER ID        IMAGE                                     COMMAND  
CREATED            STATUS    PORTS  
NAMES  
5e9c263fe2cf       waltercoan/iotedgemodbus              "dotnet iotedgeMo  
dbu..." About a minute ago Up About a minute  
iotedgemodbus30  
b0ce650a90a2       mcr.microsoft.com/azureiotedge-hub:1.0  "/bin/sh -c 'echo  
\"$...\" 8 days ago Up 21 minutes 0.0.0.0:443->443/tcp, 0.0.0.0:  
8883->8883/tcp, 5671/tcp edgeHub  
eb40d7f5caad       mcr.microsoft.com/azureiotedge-agent:1.0  "/bin/sh -c 'echo  
\"$...\" 8 days ago Up 3 hours  
edgeAgent  
root@raspberrypi:/home/pi# █
```

Monitoramento real de um CLP



THE
DEVELOPER'S
CONFERENCE

Device Explorer Twin

Configuration Management Data Messages To Device Call Method on Device

Monitoring

Event Hub:

Device ID:

Start Time:

Consumer Group: Enable

Show system properties

Event Hub Data

```
{["DisplayName":"disjuntor2","Address":"100003","Value":"1"]}]]]]]]Properties:  
'content-type': 'application/edge-modbus-json'  
  
14/04/2019 20:40:24> Device: [iotedgeraspberryi]. Data:[{"PublishTimestamp":"2019-04-14 23:40:24","Content":  
[{"HwId":"CLP","Data":[{"CorrelationId":"DefaultCorrelationId","Source Timestamp":"2019-04-14 23:40:22","Values":  
[{"DisplayName":"disjuntor1","Address":"100002","Value":"1"},  
{"DisplayName":"disjuntor2","Address":"100003","Value":"1"}],  
["CorrelationId":"DefaultCorrelationId","Source Timestamp":"2019-04-14 23:40:23","Values":  
[{"DisplayName":"disjuntor1","Address":"100002","Value":"1"},  
{"DisplayName":"disjuntor2","Address":"100003","Value":"1"}],  
["CorrelationId":"DefaultCorrelationId","Source Timestamp":"2019-04-14 23:40:24","Values":  
[{"DisplayName":"disjuntor1","Address":"100002","Value":"1"},  
{"DisplayName":"disjuntor2","Address":"100003","Value":"1"}]]]]]]Properties:  
'content-type': 'application/edge-modbus-json'
```

Monitoramento real de um CLP

Tutorial completo



THE
DEVELOPER'S
CONFERENCE

<https://www.hackster.io/waltercoan/azure-iot-edge-reading-data-from-plc-industrial-iot-ef8214>



THE
DEVELOPER'S
CONFERENCE

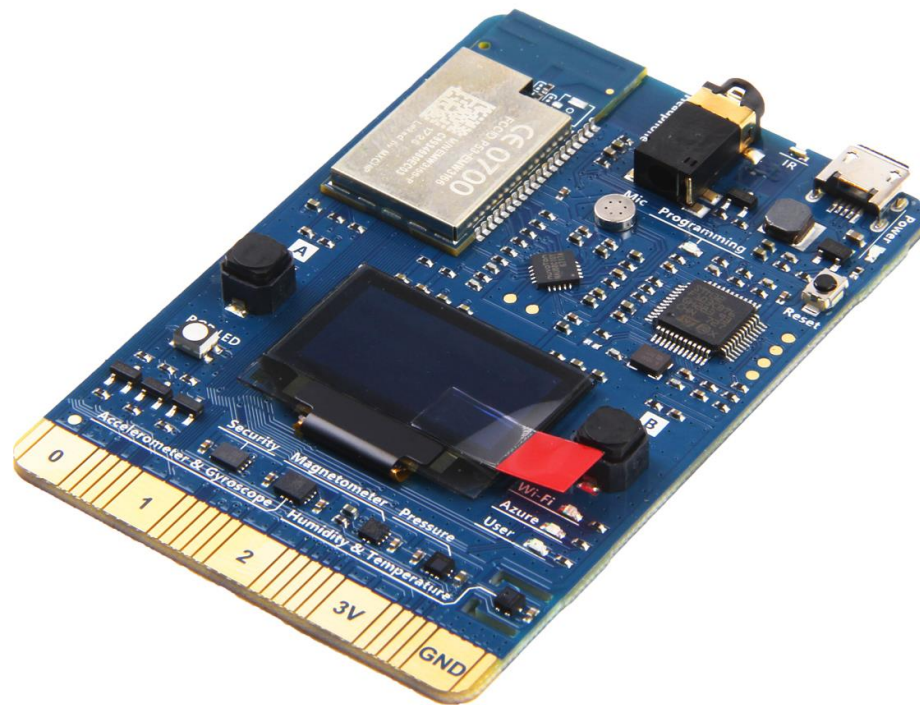
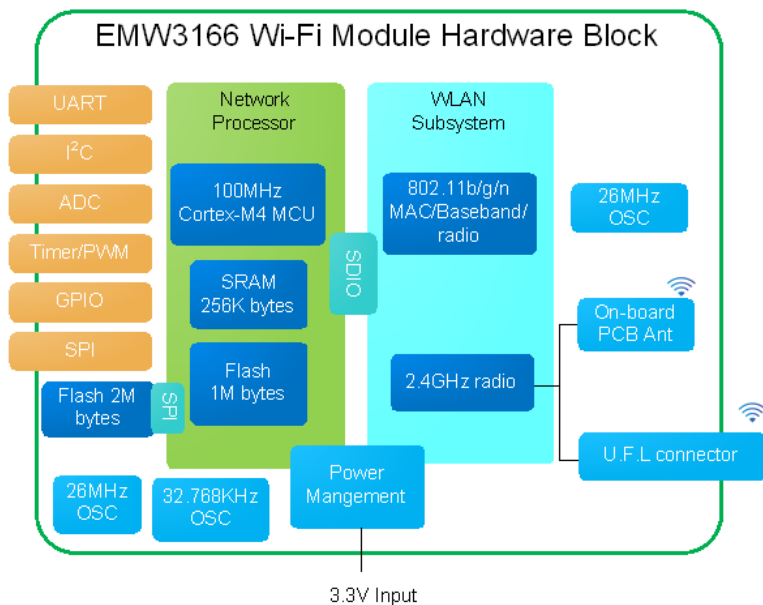
Modelos de Inteligência Artificial em microcontroladores

Azure IoT Starter Kit (AZ3166)



THE
DEVELOPER'S
CONFERENCE

- > MXCHIP
- > ARM Cortex-M4 100Mhz
- > EMW3166 Wifi
- > STSAFE-A100

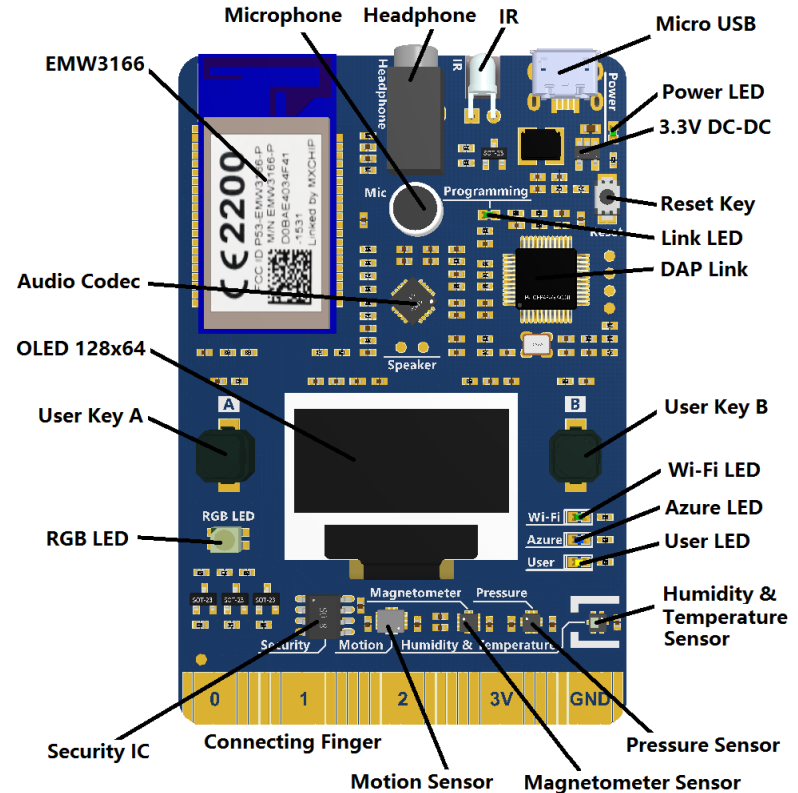


Azure IoT Starter Kit (AZ3166)

<https://microsoft.github.io/azure-iot-developer-kit/>



THE
DEVELOPER'S
CONFERENCE



Azure IoT Starter Kit (AZ3166)

<https://www.seeedstudio.com/AZ3166-IOT-Developer-Kit.html>



THE
DEVELOPER'S
CONFERENCE

AZ3166 IOT Developer Kit - Seeed

<https://www.seeedstudio.com/AZ3166-IOT-Developer-Kit.html>

USD

seeed The IoT Hardware Enabler

Shop Fusion PCB/PCBA Community What are you looking for?

Home / Wireless & IoT / IoT Kits / AZ3166 IOT Developer Kit

AZ3166 IOT Developer Kit

SKU 102990944

★★★★★ 6 Reviews

Smart, wifi, all in one, mxchip, az3166, Microsoft, emw3166, Arduino, wireless

\$39.00

80+ In Stock

10+: \$35.10

1 CN Warehouse

Add to Cart

Contact Support

Azure IoT Starter Kit (AZ3166)



THE
DEVELOPER'S
CONFERENCE

The screenshot shows the Visual Studio Code interface with the Azure IoT Device Workbench extension installed. The extension details page is visible, showing the extension name, version (0.2.6), and a description: "Integrated environment to enable easy development on IoT prototype devices (e.g. MXChip IoT DevKit, teXXm...". The extension is currently disabled, with buttons for "Disable" and "Uninstall".

The terminal window at the bottom shows the following output:

```
2: Pycom Console
Connecting to COM3...
> Failed to connect (Error: Port is not open). Click here to try again.
[]
```

The status bar at the bottom indicates the current file is `device.ino` and the device is `MXCHIP AZ3166` connected to `COM7`.

Azure IoT Starter Kit (AZ3166)



THE
DEVELOPER'S
CONFERENCE

<https://github.com/IoTDevEnvExamples/DevKitKeywordSpotter/blob/master/README.md>

DevKitKeywordSpotter/README

GitHub, Inc. [US] | <https://github.com/IoTDevEnvExamples/DevKitKeywordSpotter/blob/...>

Apps www.unipi.technolo... Gerenciador de fav... Programa do J6 » B... National ICT Austr... Mixim TUTORIAL

321 lines (249 sloc) 15.6 KB

Raw Blame History

Keyword Spotting on IoT DevKit with ELL

In this tutorial, you learn how to do some simple voice recognition locally on your IoT DevKit without using a cloud service. It records your voice, detects what you said from a fixed list of 30 keywords, and shows the result on the DevKit screen.

You can watch the following video to have a deep understanding of what it does.

Running AI on tiny IoT device with ELL

Embedded Learning Library

<https://microsoft.github.io/ELL/>



THE
DEVELOPER'S
CONFERENCE

The Embedded Learning Library (ELL) allows you to design and deploy intelligent machine-learned models onto resource constrained platforms and small single-board computers, like Raspberry Pi, Arduino, and micro:bit. The deployed models run locally, without requiring a network connection and without relying on servers in the cloud. ELL is an early preview of the embedded AI and machine learning technologies developed at Microsoft Research.

We built ELL for makers, technology enthusiasts, students, entrepreneurs, and developers who aspire to build intelligent devices and AI-powered gadgets. Our tools, our code, and all of the other resources available on this website are free for anyone to adapt and use (for details, see licensing below). Just keep in mind that ELL is a work in progress and that we expect it change rapidly, including breaking API changes.

ELL is a software library and an accompanying set of software tools, written in modern C++, with an optional interface in Python. Download ELL from our GitHub repository, either as a zip file, or with the following command:

```
git clone https://github.com/Microsoft/ELL.git
```

While the goal of ELL is to deploy software onto resource constrained platforms and small single-board computers, most of the interaction with ELL occurs on a laptop or desktop computer (Windows, Ubuntu Linux, or macOS). Technically, you can think of ELL as a cross-compiler for embedded intelligence - the compiler itself runs on your laptop or desktop computer and the machine code that it generates runs on your single-board computer.

Embedded Learning Library



THE
DEVELOPER'S
CONFERENCE





THE
DEVELOPER'S
CONFERENCE

Demonstração

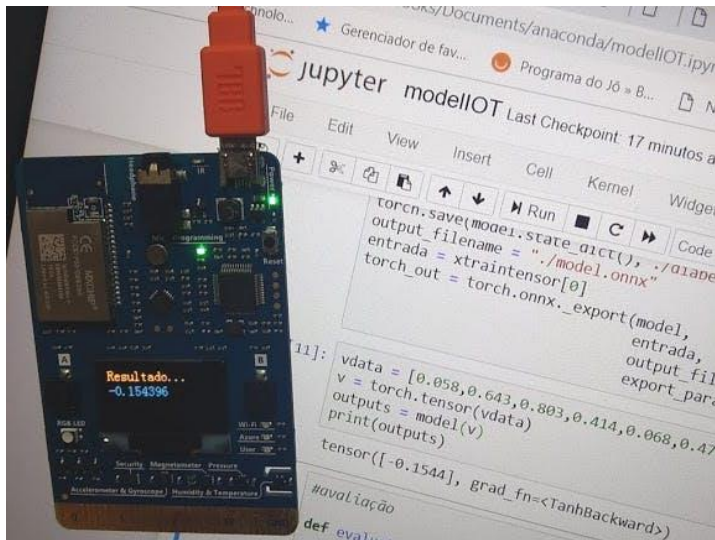
Embedded Learning Library

Tutorial completo



THE
DEVELOPER'S
CONFERENCE

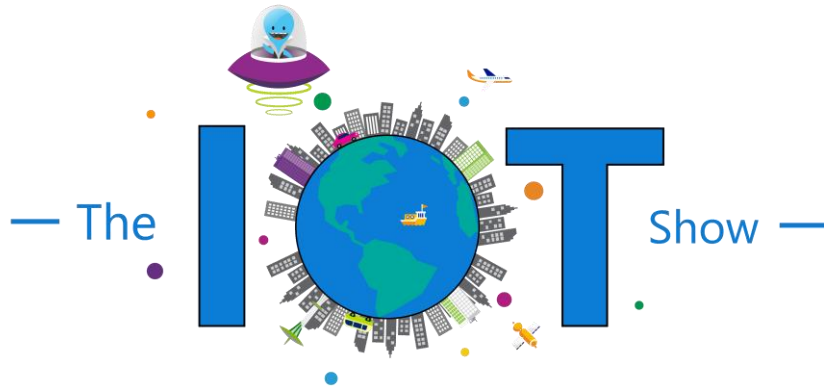
<https://www.hackster.io/waltercoan/machine-learning-model-running-on-azure-iot-starter-kit-f9608b>



Para aprender mais...



THE
DEVELOPER'S
CONFERENCE



aka.ms/IoTShow



aka.ms/IoTSchool

Para aprender mais...



THE
DEVELOPER'S
CONFERENCE

Microsoft

Sign in

Microsoft Professional Program for Internet of Things (IoT)

Learn the skills necessary to start or progress a career working on a team that implements IoT solutions.

8		8 - 60		8
REQUIRED COURSES		HOURS PER COURSE		SKILLS

Enroll Now >

Technologies you will use to gain your skills

<https://academy.microsoft.com/en-us/professional-program/tracks/internet-of-things/>



THE DEVELOPER'S CONFERENCE