



balena Webinar | 14 MAR 2024 | 4 PM UTC

Advanced IoT in Solar Power - A Technical Deep Dive



Daniel Paesa Software Developer at N3uron

Marc Pous Developer Advocate at balena.io

Agenda

- Introductions
- The challenges and pain points of managing a PV plant
- Reference architecture to manage and scale solar installations
- Live Demo
- Q&A



The speakers



Daniel Paesa
Software Developer at
N3uron



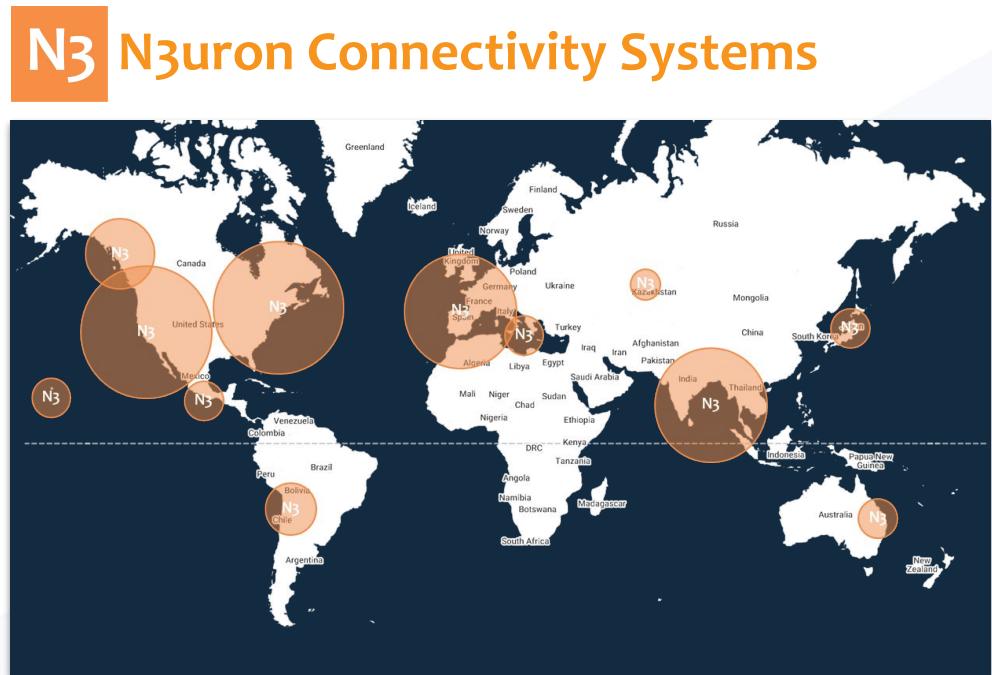
Marc Pous
Developer Advocate at
balena.io



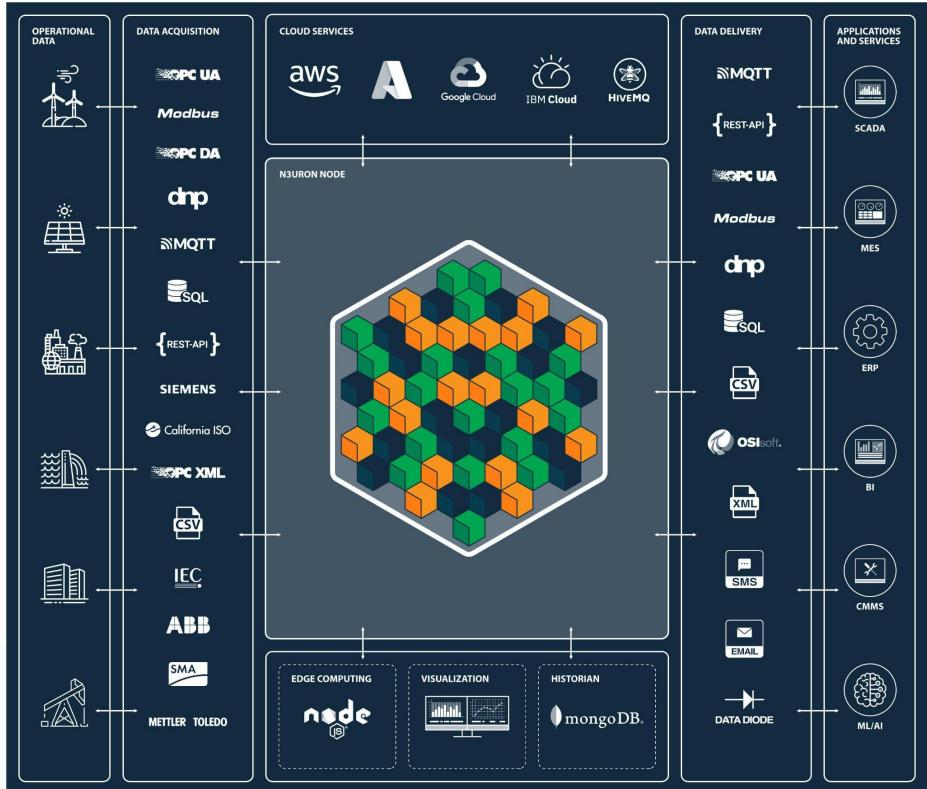
N3uron

What is N3uron?

- Founded in 2018 by System Integrators.
- N3uron the Industrial Edge Platform for IIoT & DataOps.
- Used in 60+ countries.
- 3100+ nodes worldwide.
- 2000+ nodes in power plants and 75+ GW.



N3uron: Industrial IoT Platform



Unmatched Connectivity, Data Modeling & Edge Computing Capabilities:

- Fully Modular.
- Cross-platform.
- Unlimited license.
- Web-based.
- Rapid deployment and development.
- Extremely efficient.
- Scalable and versatile architecture.



N3uron: Industrial IoT Platform



Unmatched Connectivity, Data Modeling & Edge Computing Capabilities:

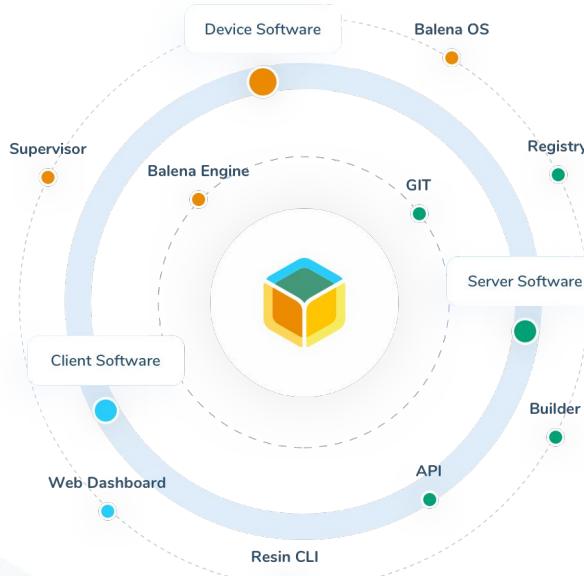
- Fully Modular.
- Cross-platform.
- Unlimited license.
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balena

What is balena?

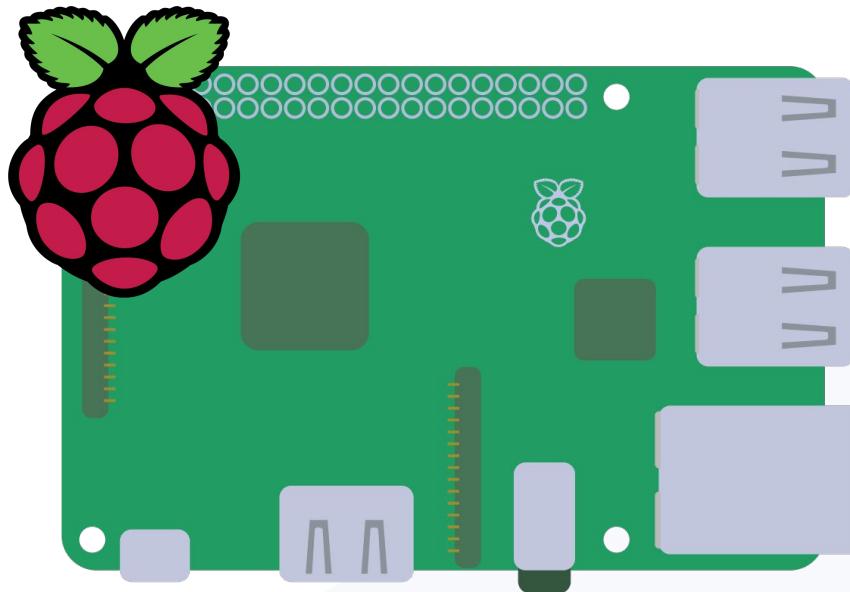


balena provides a **complete set of software tools** to develop and scale Edge applications and IoT devices.

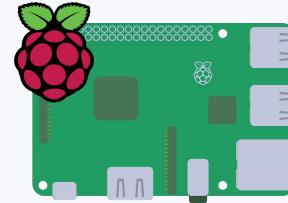
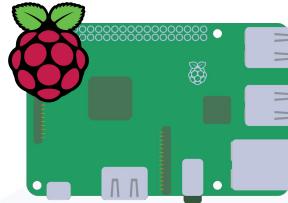
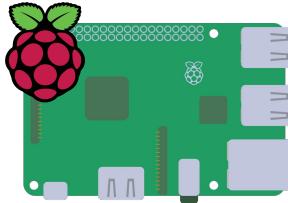
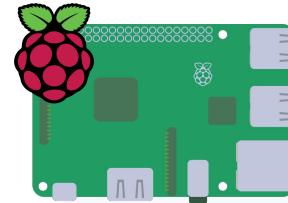
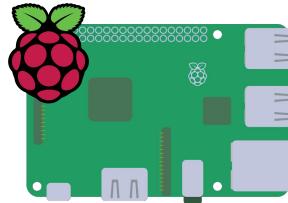
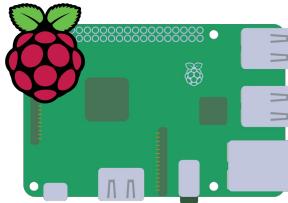
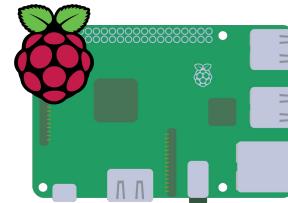
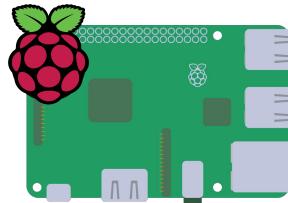
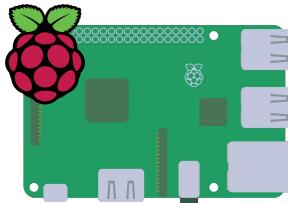
Our secure **infrastructure** enables you to **update** and **Maintain** your fleet, no matter its size, from anywhere in the world.



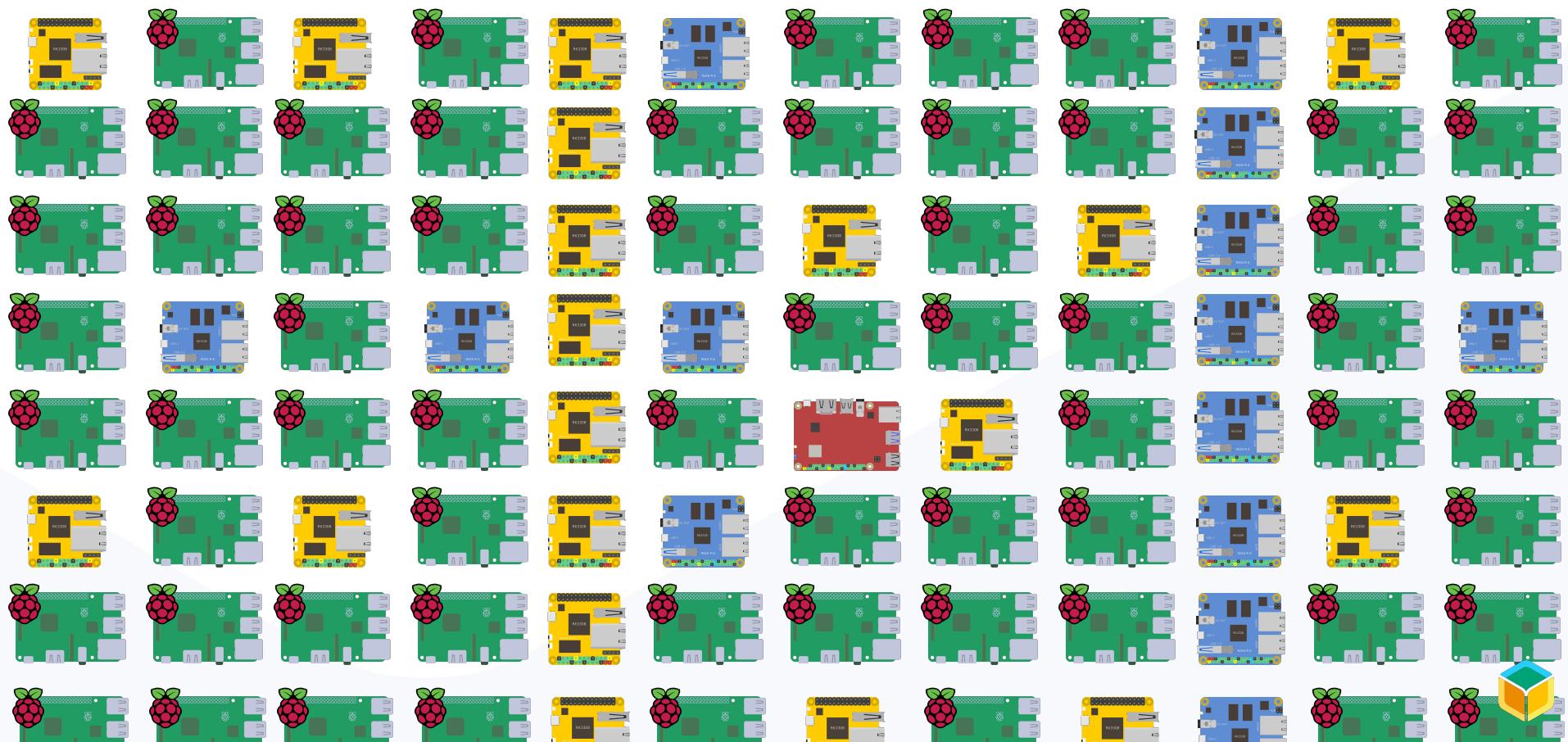
What is balena?



What is balena?



What is balena?



What is balena?



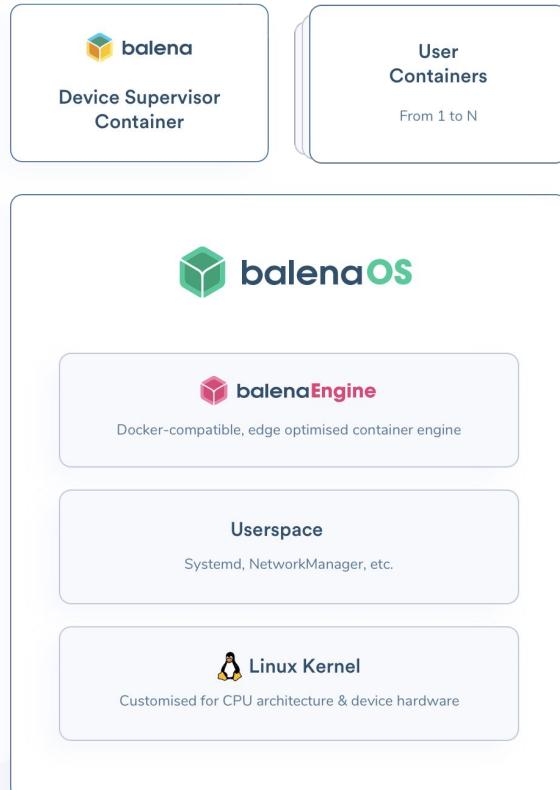
What is balena?

The screenshot shows the balenaCloud IoT dashboard interface. On the left, a sidebar navigation bar includes links for Organizations, N3uron, Fleets, sunn3rgy-eu-spain..., Summary, Devices, Releases, Variables, Configuration, Settings, Provisioning Keys, Members, and Teams. The main content area has three cards: 'sunn3rgy-eu-spain-01' (Device details), 'Devices' (4 online), and 'Releases' (4). Below these is a search bar and a table of devices. The table columns are: Name, Status, Device type, Last seen, Created on, UUID, OS version, OS line, OS variant, and a dropdown menu. The table lists four devices: greenlake-MAD, bluelake-ZGZ, redlake-BCN, and yellowlake-VLL. A 'Need help?' button is located at the bottom right.

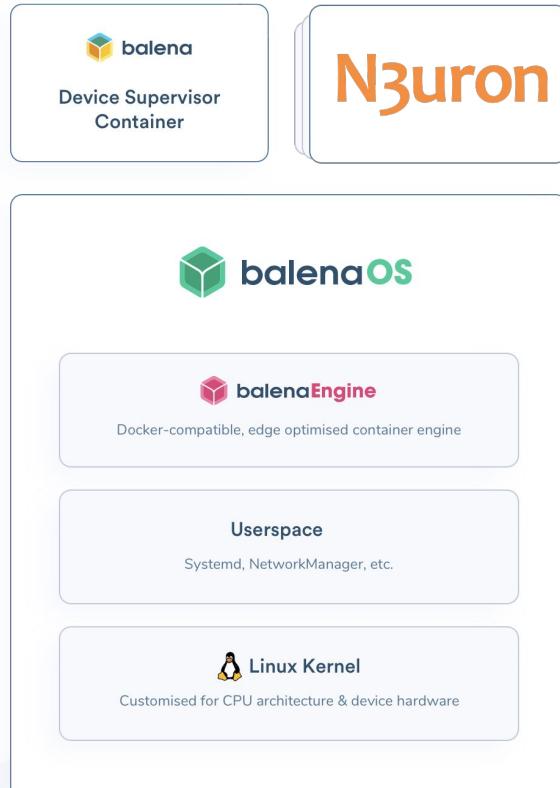
Name	Status	Device type	Last seen	Created on	UUID	OS version	OS line	OS variant	Actions
greenlake-MAD	✓ Online	Raspberry Pi 3 (using 64bit OS)	Online (for 4 minutes)	Mar 3rd 2024, 3:58 PM	4f6937c	balenaOS 5.0.8	Production	15.0.4-	
bluelake-ZGZ	✓ Online	Raspberry Pi 5	Online (for 5 minutes)	Mar 8th 2024, 6:58 PM	d21576b	balenaOS 5.1.37+rev4	Production	16.11.4	
redlake-BCN	✓ Online	Raspberry Pi CM4 IO Board	Online (for about 2 hours)	Feb 6th 2024, 2:01 PM	6d30e68	balenaOS 4.0.16	Development	16.11.0	
yellowlake-VLL	✓ Online	Raspberry Pi CM4 IO Board	Online (for about 14 hours)	Jul 5th 2023, 7:36 PM	f467108	balenaOS 4.0.16	Production	16.11.4	



What is balena?



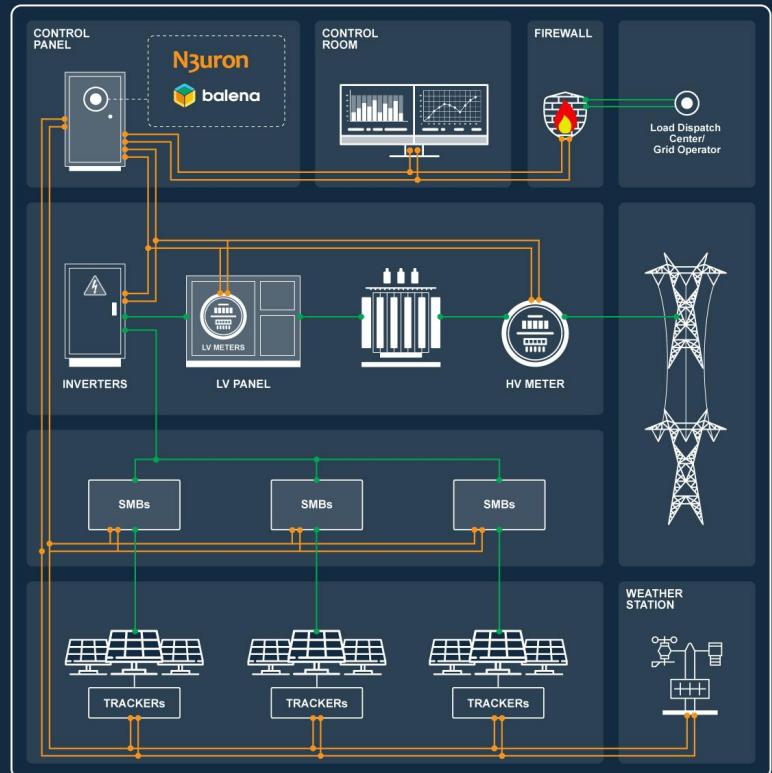
What is balena?



Solar (PV) plants

Challenges and pain points

What is a PV plant?





*“It was essential for us to have a system that provided us with **more comprehensive information**. We required a solution that was **scalable, feature-rich, and reliable.**”*

Dinesh Rathod,

Associate Manager-CoE-Technology at Adani Group

adani

*“Early into my appointment at BayWa r.e. Operation Services, we identified a costly and inefficient SCADA onboarding solution. Redesigning the existing edge integration solution was top priority to **speed up customer integration and reduce costs.**”*

Trent Derr,
OT Engineering Manager at BayWa r.e.



BayWa r.e.

*"The overall infrastructure must **prioritize security**, emphasizing **data integrity and confidentiality** during transmission. Compliance with NERC-CIP standards is essential, ensuring a robust cybersecurity framework capable of defending against cyber threats and responding to security incidents effectively.*

Miguel Angel Hernando,
IT & Monitoring System Manager at Deltatec





*The system must support the current monitoring of over 30 sites and **be scalable to handle additional sites as necessary**. It should facilitate **reliable and efficient remote monitoring of the entire fleet**. The system must provide essential tools for managing and controlling client assets, ensuring **timely response to potential issues or failures**.*

Claudio Pavez,

Site Manager CROCC at NovaSource Power Services

NOVA SOURCE™
POWER SERVICES

What are the requirements to manage a PV solar plant?



- Remote monitoring and management of geographically spread assets.
- Scalability and flexibility.
- Security and data integrity.
- Increase availability and reduce downtime.
- Improve efficiency and maximize profitability and ROI.
- Reduce time and cost for onboarding new plants.
- Guarantee regulatory compliance.
- Meet warranty requirements.



Challenges and pain points of managing a PV plant?



- Scalability and flexibility.
- Lack of interoperability due to a wide variety of data sources (silos) and data formats (proprietary protocols).
- Integrating data from multiple systems across multiple plants.
- Unreliable and bandwidth-limited networks (remote sites).
- Fear of exposing operational systems to cyber-threats.
- Stringent regulations (Security, curtailments, etc.).
- Tight schedules and decreasing budgets.
- Lack of standards for data modeling.
- Lack of skilled human resources and lack of knowledge about current and/or future needs.

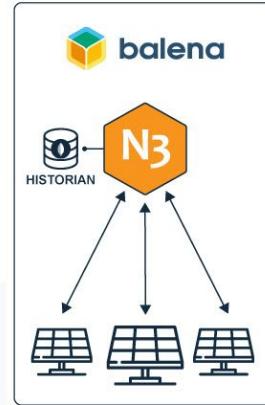
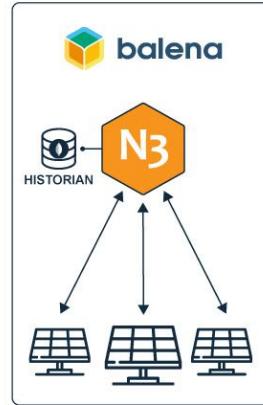
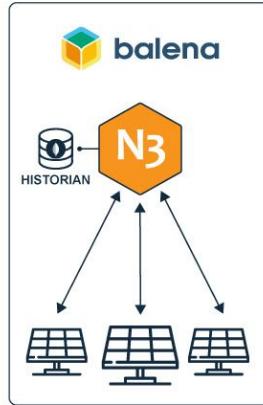
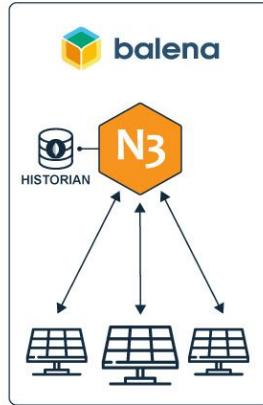


IIoT Reference architecture

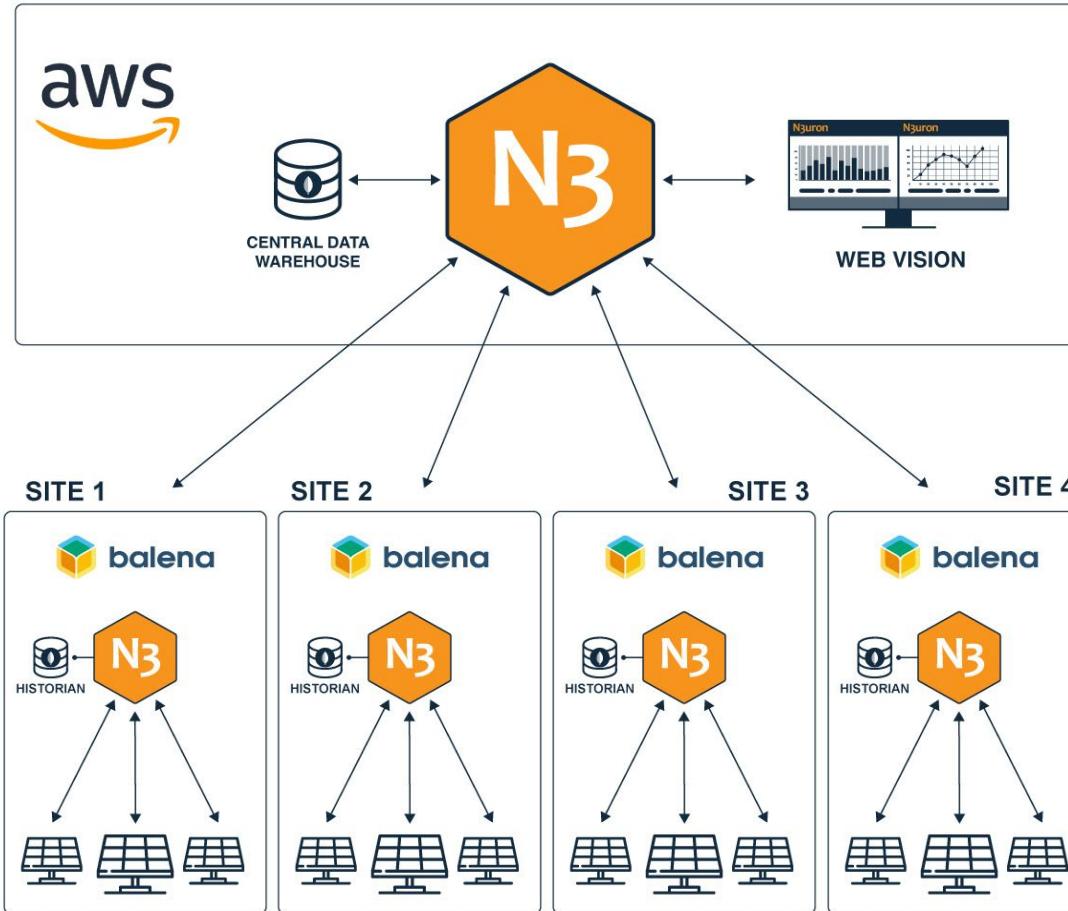
IIoT Reference Architecture



IIoT Reference Architecture



IIoT Reference Architecture

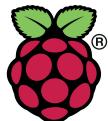


Demo!

Hardware



EdgeBox RPI 200 - Raspberry Pi CM4 with 4GB RAM, 32GB eMMC

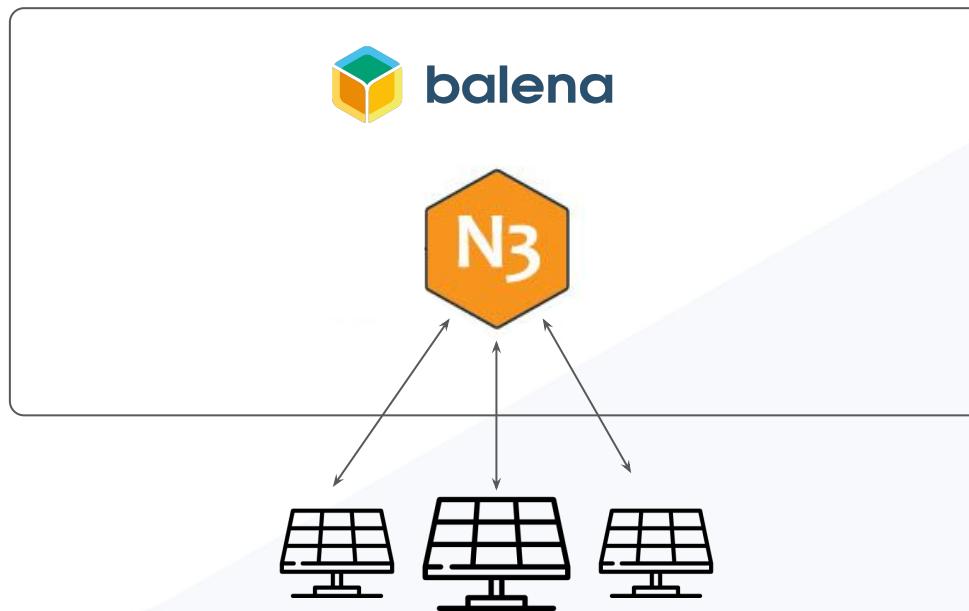


Raspberry Pi

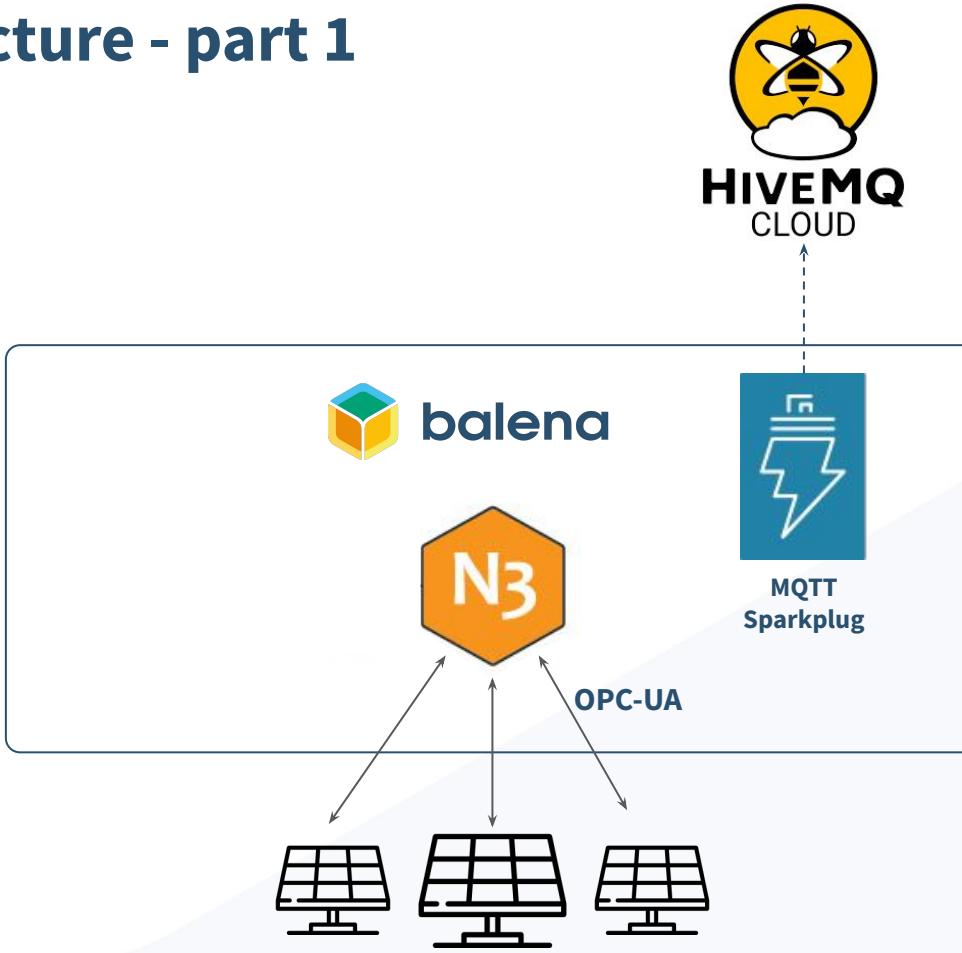
Raspberry Pi 4 and Raspberry Pi 5



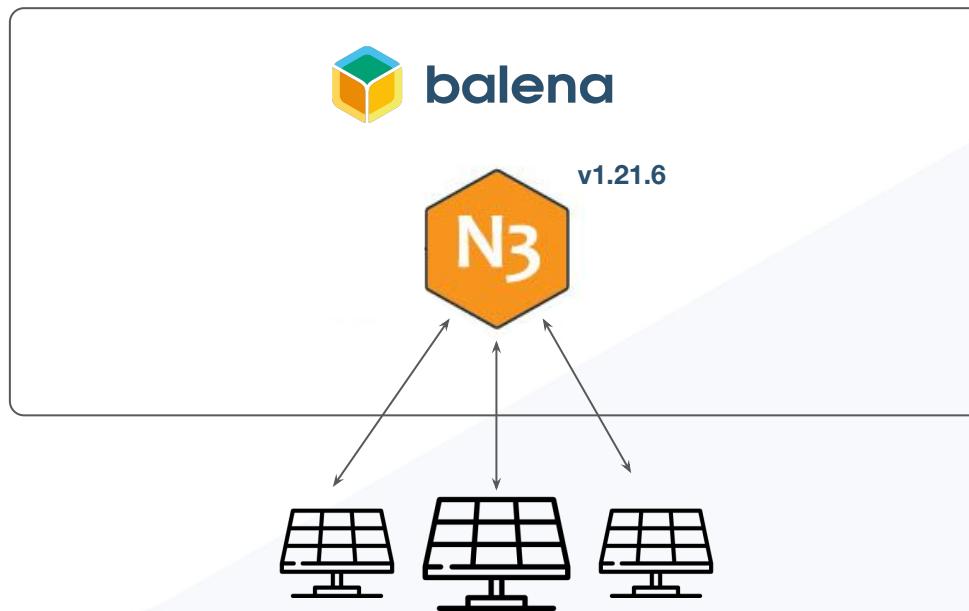
Demo architecture - part 1



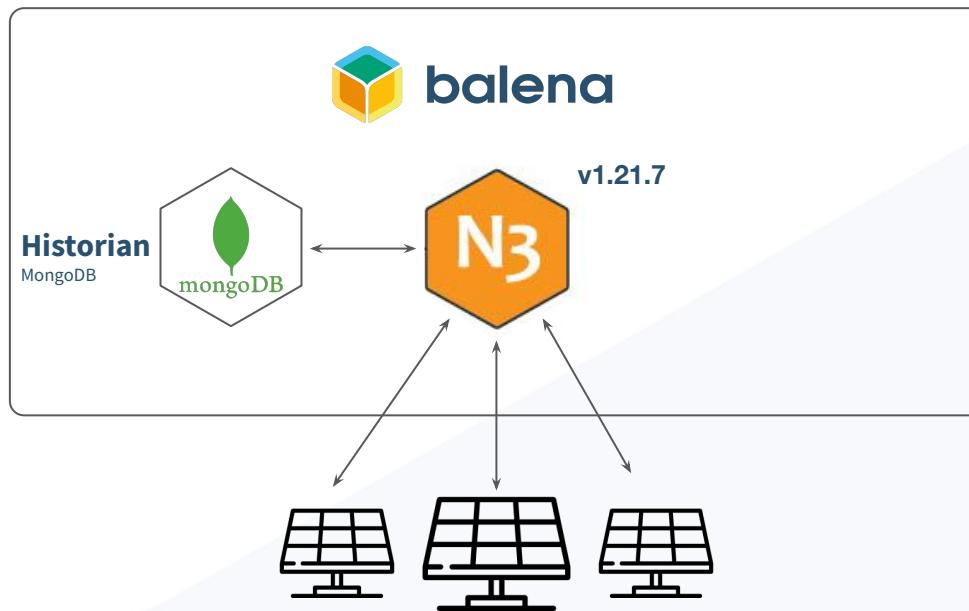
Demo architecture - part 1



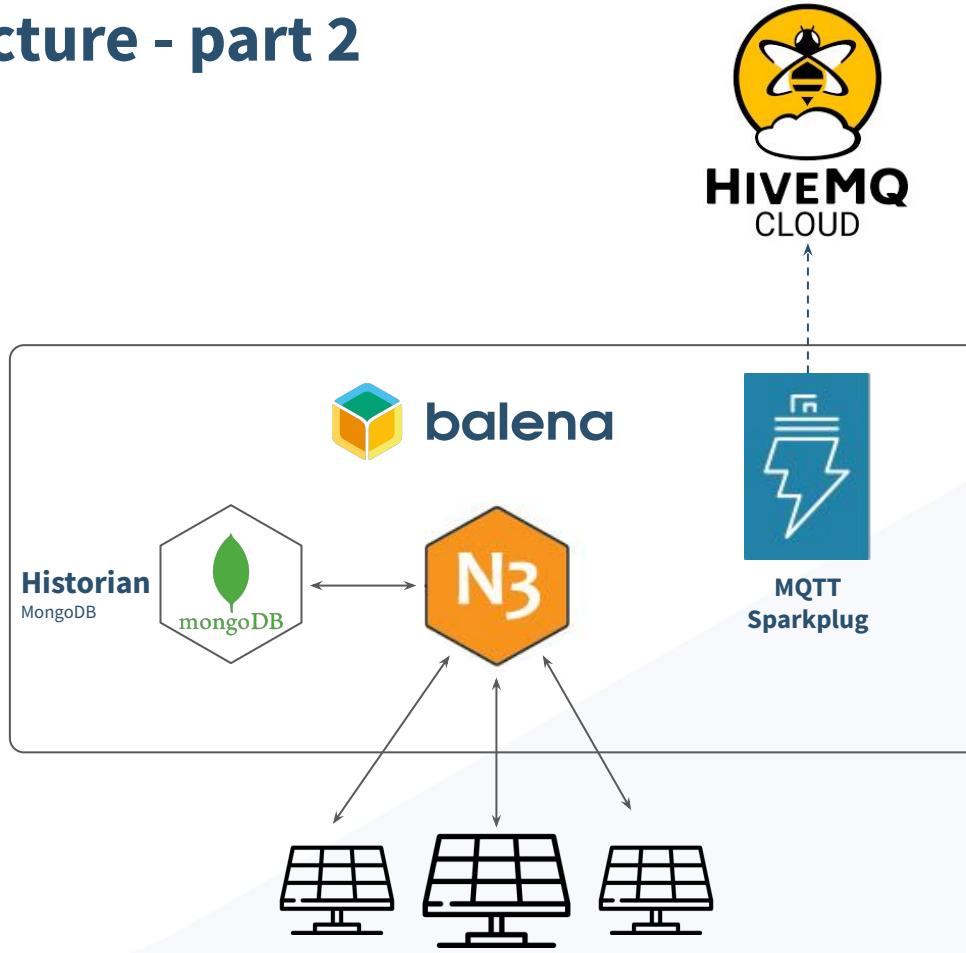
Demo architecture - part 1



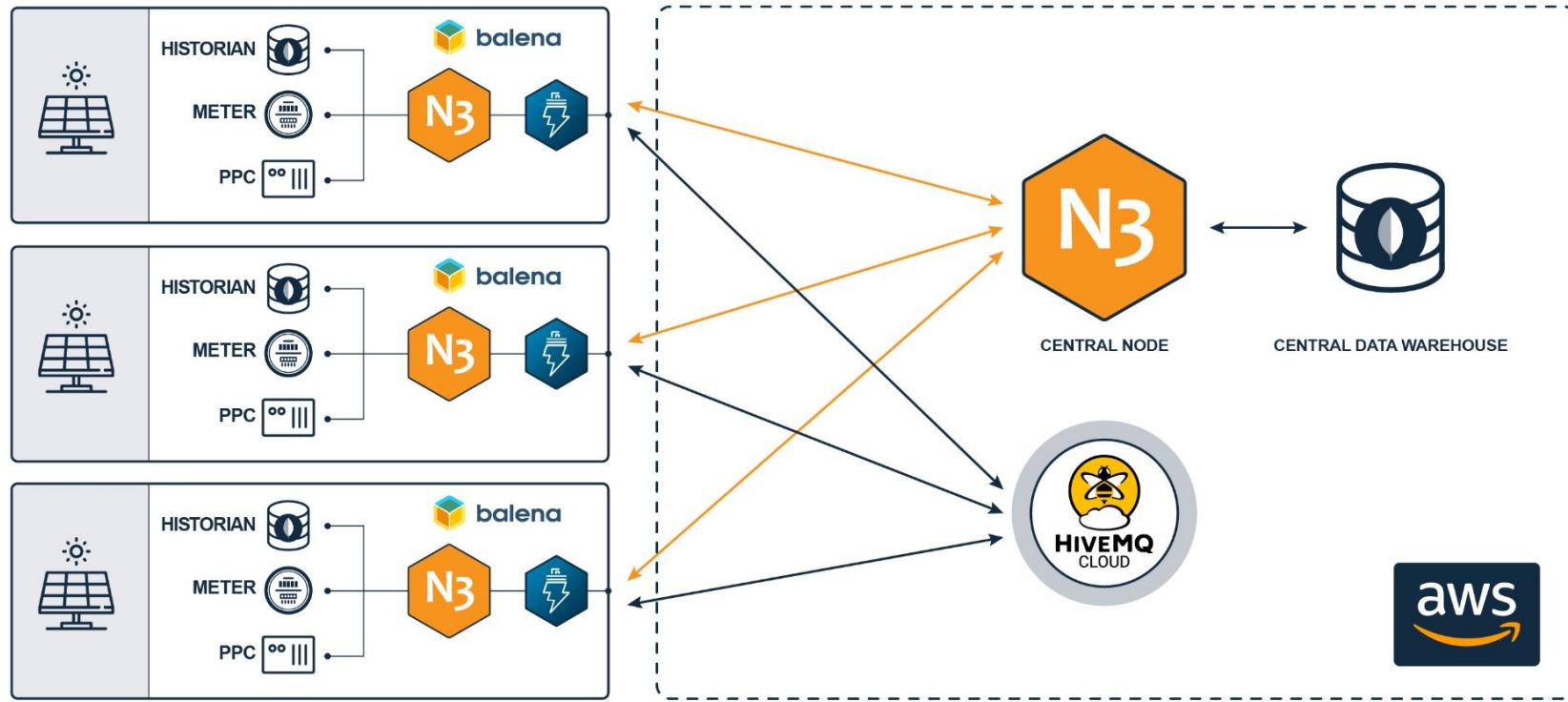
Demo architecture - part 2



Demo architecture - part 2



Demo architecture - part 3



Demo

sunn3rgy-eu-spain-01 | balen... +

dashboard.balena-cloud.com/fleets/2112532

Getting Started Docs Roadmap Forums Status balenaHub Marc Pous

Devices

5

Online Offline

Releases

4

track latest

N3 N3uron Learn more Create release

Summary

sunn3rgy-eu-spain-01

 4

Architecture: aarch64

Slug: n3uron/sunn3rgy-eu-spain-01

Created: Feb 9th 2024, 10:46 AM

Microservices

Add device Modify Search entries...

Name	Status	Device type	Last seen	Created on	UUID	OS version	OS line	OS variant	Supervisor version	Support access	IP address
picture-BCN	✓ Online	Raspberry Pi 5	Online (for less than a minute)	Jan 29th 2024, 4:13 PM	2640761	balenaOS 4.0.16	Development	14.12.2	Off	192.168.1.167	
redlake-BCN	✓ Online	Raspberry Pi CM4 IO Board	Online (for 29 minutes)	Feb 6th 2024, 2:01 PM	6d30e68	balenaOS 4.0.16	Development	16.1.0 - v16.1.4 targeted	Off	192.168.1.152	
yellowlake-VLL	✓ Online	Raspberry Pi CM4 IO Board	Online (for about 9 hours)	Jul 5th 2023, 7:36 PM	f467108	balenaOS 4.0.16	Production	16.1.4	Off	192.168.4.108 fdbd:f9f6b6:0:3db2:b01d:3dfb:f284	
bluelake-ZGZ	✗ Offline	Raspberry Pi 5	about 19 hours ago	Mar 8th 2024, 6:58 PM	d21576b	balenaOS 5.1.37+rev4	Production	16.1.4	Off	192.168.1.135 2a09:d100:7833:e400:5580:5ef5:3b62:a031	
greenlake-MAD	✗ Offline	Raspberry Pi 3 (using 64bit OS)	about 19 hours ago	Mar 3rd 2024, 3:58 PM	4f6937c	balenaOS 5.0.8	Production	15.0.4 - v16.1.4 targeted	Off	192.168.1.134 2a09:d100:7833:e400:52e2:434c:42e3:1a04	



Demo

redlake-BCN | balena dashboard

dashboard.balena-cloud.com/devices/6d30e68fe9decc4aa1e3dd7d461f3a84

Getting Started Docs Roadmap Forums Status

Marc Pous

balenaHub

redlake-BCN

Organizations

N3uron

Fleets

sunn3rgy-eu-spain-01

Devices

redlake-BCN

Summary

Device Variables

Device Configuration

Actions

Settings

Diagnostics

Location

redlake-BCN

FLEET
n3uron/sunn3rgy-eu-spain-01

STATUS
✓ Online

UUID
6d30e68

HOST OS VERSION
balenaOS 4.0.16

TYPE
Raspberry Pi CM4 IO Board

OS VARIANT
development

SUPERVISOR VERSION
16.1.4

CURRENT RELEASE
1.21.6+rev3

SUPPORT ACCESS
Off

LOCAL IP ADDRESS
192.168.1.152

PUBLIC IP ADDRESS
139.47.126.238

MAC ADDRESS
E4:5F:01:99:42:88

TARGET RELEASE
1.21.6+rev3

IS ACTIVE
On

PUBLIC DEVICE URL
Off On

NOTES
Add device notes

Service Status Release

n3uron Running 1.21.6+rev3

CPU

Temperature ~2% ~47C

Memory 457 MB/360 MB Storage 585 MB/6.4 GB

Logs

Search entries...

2024-03-11T16:10:36+01:00 n3uron 15:10:36.016 | INFO | ModuleManager -> Stopping...

2024-03-11T16:10:36+01:00 n3uron 15:10:36.017 | INFO | ModuleManager -> Stopped OK

2024-03-11T16:10:36+01:00 n3uron 15:10:36.023 | INFO | ModuleManager -> Starting...

2024-03-11T16:10:36+01:00 n3uron 15:10:36.024 | INFO | ModuleManager -> Loading config...

2024-03-11T16:10:36+01:00 n3uron 15:10:36.024 | INFO | main -> Loading config file: /opt/n3uron/config/bootstrap/modules.n3c

2024-03-11T16:10:36+01:00 n3uron 15:10:36.026 | INFO | ModuleManager -> Config loaded OK

2024-03-11T16:10:36+01:00 n3uron 15:10:36.027 | INFO | ModuleManager -> Started OK

2024-03-11T16:10:38+01:00 n3uron 15:10:38.389 | INFO | ApSession:WebUI -> Online

2024-03-11T16:59:17+01:00 Supervisor starting

2024-03-11T16:10:38+01:00 n3uron 15:10:38.389 | INFO | ApSession:WebUI -> Online

2024-03-12T13:20:07+01:00 Supervisor starting

2024-03-11T20:00:39+01:00 n3uron 19:00:39.415 | INFO | ApSession:WebUI -> Online

Terminal

Select a target

Start terminal session

Demo

redlake-BCN | balena dashboard

dashboard.balena-cloud.com/devices/6d30e68fe9decc4aa1e3dd7d461f3a84

Getting Started Docs Roadmap Forums Status

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redlake-BCN

FLEET
n3uron/sunnrgy-eu-spain-01

STATUS
✓ Online

UUID
6d30e68

ONLINE FOR
about 3 hours

SUPERVISOR VERSION
16.1.5

CURRENT RELEASE
1.21.7-historian

SUPPORT ACCESS
Off

LOCAL IP ADDRESS
192.168.1.152

PUBLIC IP ADDRESS
139.47.126.238

MAC ADDRESS
E4:5F:01:99:42:88

TARGET RELEASE
1.21.7-historian

IS ACTIVE
On

PUBLIC DEVICE URL
Off On

NOTES
Add device notes

Service Status Release

Service	Status	Release
mongo	Running	1.21.7-historian
n3uron	Running	1.21.7-historian

CPU ~28% Temperature ~50C

Memory 630 MB/360 MB Storage 1.4 GB/6.4 GB

Logs

Search entries...

Time	User	Message
2024-03-12T15:33:52+01:00	n3uron	14:33:52.379 INFO LinkManager -> Config loaded OK
2024-03-12T15:33:52+01:00	n3uron	14:33:52.380 INFO LinkManager -> Starting...
2024-03-12T15:33:52+01:00	n3uron	14:33:52.381 WARN LinkManager -> Inbound connections disabled
2024-03-12T15:33:52+01:00	n3uron	14:33:52.381 INFO LinkManager -> Started OK
2024-03-12T15:33:52+01:00	n3uron	14:33:52.383 INFO ModuleManager -> Stopping...
2024-03-12T15:33:52+01:00	n3uron	14:33:52.384 INFO ModuleManager -> Stopped OK
2024-03-12T15:33:52+01:00	n3uron	14:33:52.385 INFO ModuleManager -> Starting...
2024-03-12T15:33:52+01:00	n3uron	14:33:52.385 INFO ModuleManager -> Loading config...
2024-03-12T15:33:52+01:00	n3uron	14:33:52.386 INFO main -> Loading config file: /opt/n3uron/config/bootstrap/modules.n3c
2024-03-12T15:33:52+01:00	n3uron	14:33:52.389 INFO ModuleManager -> Config loaded OK
2024-03-12T15:33:52+01:00	n3uron	14:33:52.390 INFO ModuleManager -> Started OK
2024-03-12T15:33:53+01:00	n3uron	14:33:53.971 INFO AptSession:WebUI -> Online

Terminal

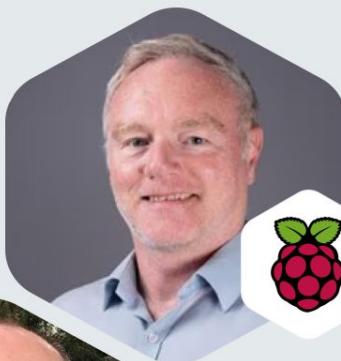
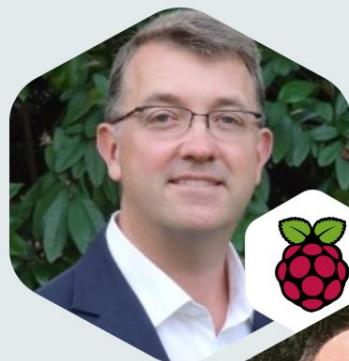
Select a target

Start terminal session



balena Webinar | 24 APR 2024 | 4 PM UTC

Is Raspberry Pi 5 the right choice for your next device fleet?



Simon Burgess Enterprise Business Manager at Raspberry Pi Ltd

James Hughes Principal Software Engineer at Raspberry Pi Ltd

Alan Boris Developer Advocate at balena.io

Questions?



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