

A satellite is shown in space, with its solar panels extended. A Raspberry Pi board is visible on the satellite's structure. The background is a view of Earth from space.

GPSTIME

NICO MAAS

PI AND RADIO 2021



WER BIN ICH?

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AGENDA

- Einführung
- balenaCloud / balenaHub
- Installation
- Ende



DISCLAIMER



EINFÜHRUNG







Royal
Observatory
Greenwich

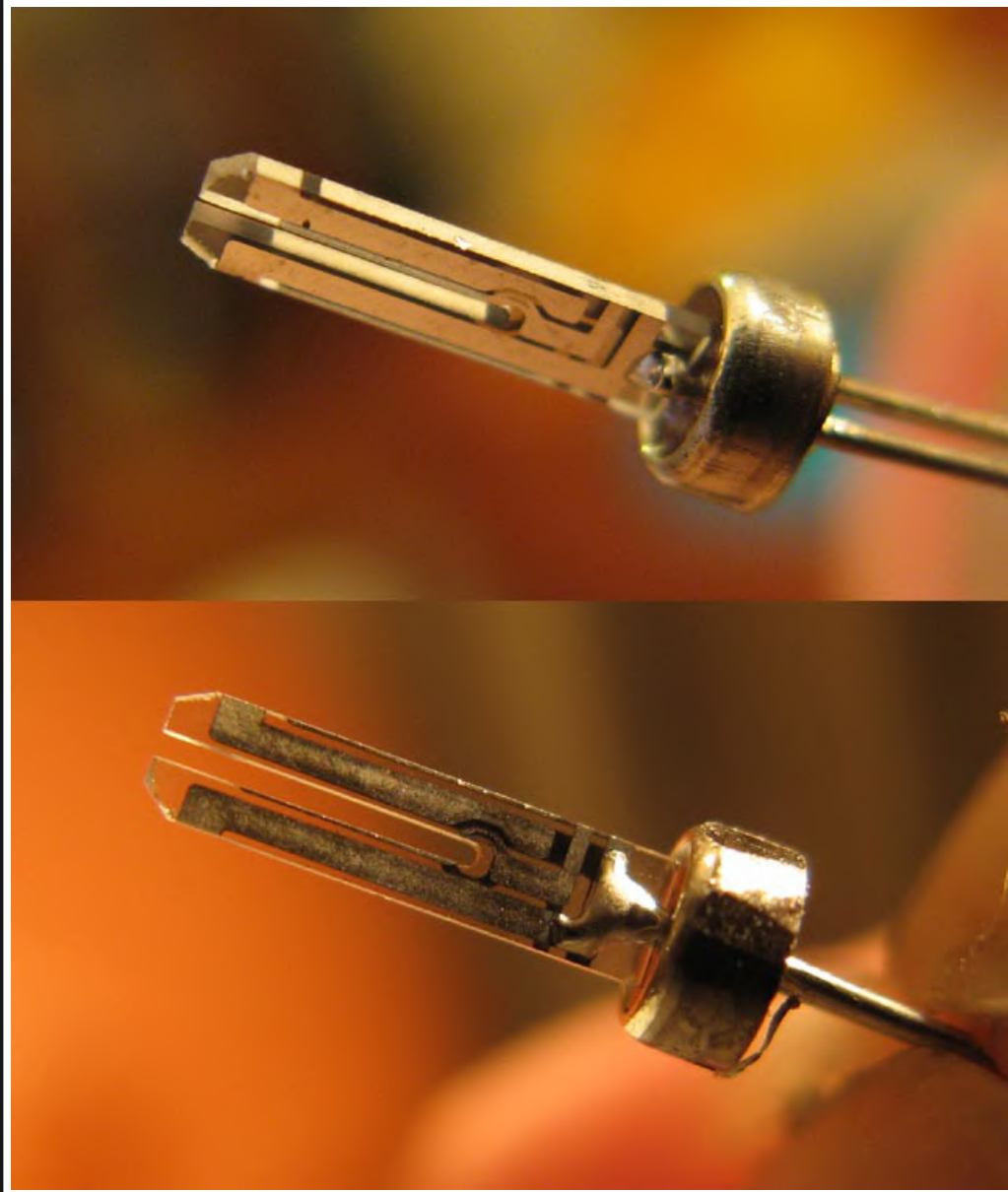


THE OBSERVATORY
SHEPHERD PATENTEE
CALVANIUM-MAGNETIC
CLOCK



ORIGINALLY SURVEY
BRASS BALL









PRÄZISE ZEIT, WOFÜR?

- Automation
- Funksysteme
- Logistik
- Industrie
- Navigation
- Netzwerke / Server
- Space / Aerospace



PRÄZISE ZEIT, WOHER?

- Funkuhren
 - Empfangsbereich / Bedingungen(?)
- NTP
 - ggf nicht präzise genug
 - benötigt Internetanbindung
- GPS / GNSS Systeme
 - “Zeit als Abfallprodukt”
 - günstige Empfänger



GPSTIME

Bau eines eigenen, lokalen, per Ethernet
angebundenen NTP Zeitserver auf Raspberry Pi Basis
mittels GNSS Empfänger



BESTANDTEILE

- Raspberry Pi (2, 3 oder 4)
- RPi Netzteil
- Micro SD Karte (8 GB)
- GNSS Modul (3v3 TTL Level & PPS)
 - Watterott CAM-M8Q-Breakout
 - Adafruit Ultimate GPS Breakout V.3
- Internet (zur Installation)
- Laptop / PC mit SD Kartenleser
- balenaCloud Account (kostenlos)
- balenaEtcher (kostenlos)



BALENACLOUD / BALENAHUB



Build your IoT project with balena.

We provide a full technology stack to help you develop, deploy, and manage projects at any scale.

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Your first 10 devices are always free and full-featured.

[Get started](#)

WAS IST BALENA? (1/2)

- Cloud Provider zum Betrieb von Docker Containern auf Embedded Systemen (wie Raspberry Pi)
- Docker Container vergleichbar mit einer leichtgewichtigen, isolierten, alle Abhängigkeiten beinhaltenden Virtuellen Maschine in standardisierter Form -> ideal um Software auszuliefern



WAS IST BALENA? (2/2)

- balenaCloud um große Flotten von Embedded Systemen zu warten und zu verwalten
- balenaHub als “AppStore” für Raspberry Pis
- gpsTime als “App / Project” in balenaHub

<https://www.balena.io/>



Fleets

Projects

Blocks

[Publish a project](#)

[Add filter](#)

Search entries...

Views



MIDI-Synthesizer

by text/html

Connect your MIDI instruments and start playing

WORKS WITH



uk-train-departure-display

by chrisys's world

A balenaCloud Raspberry Pi app to display replica near real-time UK railway station departure data on SSD1322 screens.

WORKS WITH



kerberos

by Kerberos.io

Video surveillance and video analytics for people and enterprises making this world a safer and smarter place.

WORKS WITH



pneumonia-detection-b...

by Anjlit Das

Real-time Pneumonia Detection by scanning X-Rays using Computer Vision on a Raspberry Pi.

WORKS WITH



helium-data-hotspot

by Marc Pous

Deploys the Helium Data Hotspot that doesn't mine any HNT

WORKS WITH



basicstation-gateway-TTS

by Marc Pous

Deploys the The Things Stack LoRaWAN gateway with Basics Station Packet Forward protocol on SX1301 or SX1302 LoRa concentrators.

WORKS WITH



balena-ads-b

by Ketil

Track the flight traffic over your head with a Raspberry Pi running balena and a cheap RTL-SDR USB dongle.



home-urbit

by gh_odyslam's Organization

Urbit is a new OS and peer-to-peer network that's simple by design, built to last forever, and 100% owned by its users. Urbit is your last computer.



TTS-network-server

by Xose Pérez

Deploys the The Things Stack LoRaWAN Network Server Open Source Edition.




INSTALLATION



BALENACLOUD ANMELDUNG

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 **balenaCloud**

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Your first ten devices are fully-featured and free

Sign up

Already have an account? [Log in](#)

 Sign up with GitHub

 Sign up with Google

or sign up with

Email*

Password*

Send me the balena monthly newsletter

Get it once a month, e-mail is not shared with third parties.

Sign up

By clicking "Sign up" I agree to balena's [Terms of Service](#)

As part of delivering this service, we collect certain account data from you. Please review our [Privacy Policy](#) for more information.

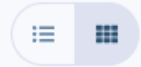




Note! Applications are now Fleets! [Find out more.](#)



Create fleet



You don't have any items yet.
How about adding one?

Need help?



GPSTIME ZU BALENACLOUD HINZUFÜGEN

- <https://hub.balena.io/>
- “Projects”
- “gpsTime”



Fleets

Projects

Blocks

[← Back to Projects](#)

 **gpsTime** by nmaas87

Share this   

Description

Uses attached GPS UART with PPS to provide accurate time via chrony ntp server

Works With



Version v1.0.32 [View code](#) | last updated at: 03 Sep 2021

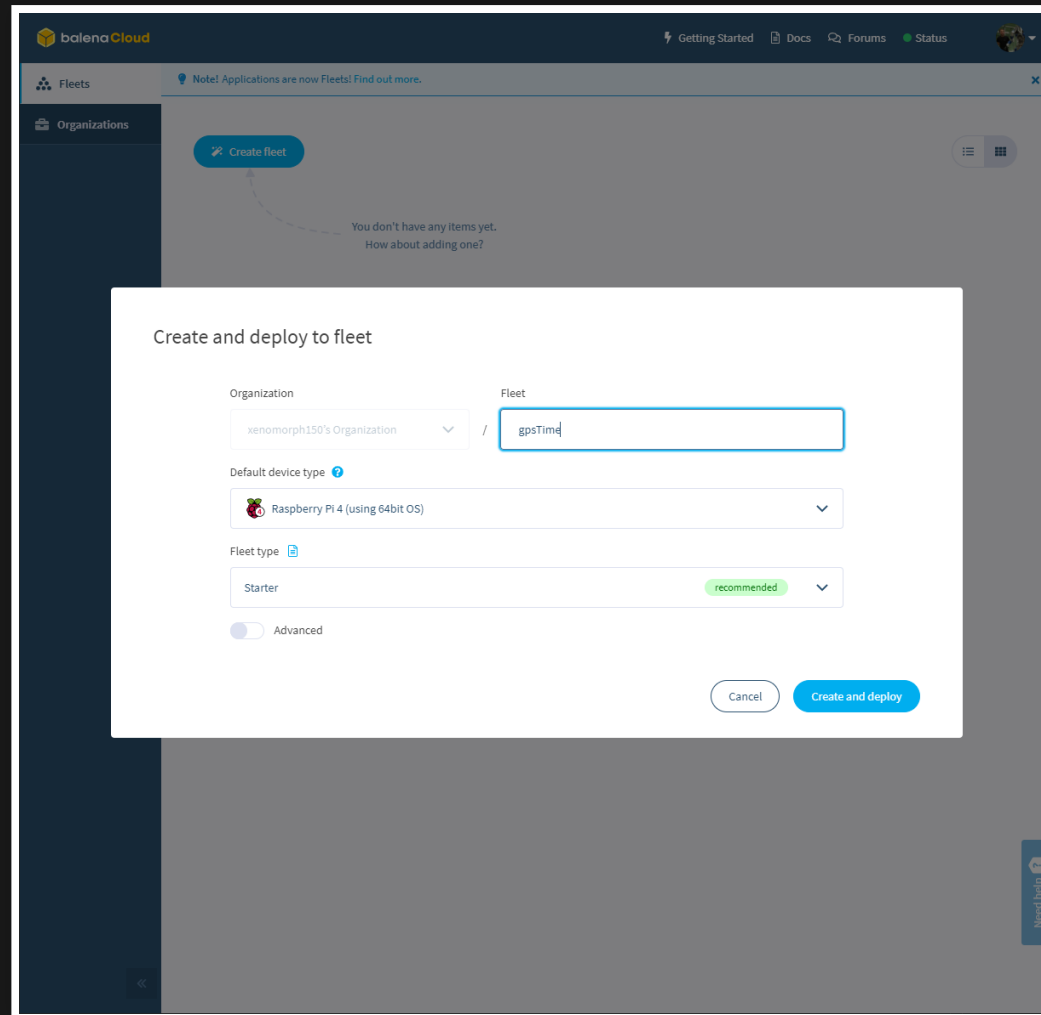
[Fork this fleet](#)

[Report issue](#)

Read correct wiring in the repo README - <https://github.com/nmaas87/gpsTime>

- “Fork this fleet” klicken








- “Default Device Type”: RPi 2, 3 oder 4 auswählen
- “Advanced” klicken



Fleet environment variables

Name	Value	
<input type="text" value="BAUD"/>	<input type="text" value="9600"/>	
<input type="text" value="ALLOW"/>	<input type="text" value="all"/>	
<input type="text" value="OFFSET"/>	<input type="text" value="0.0"/>	

+ Add item

Cancel

Create and deploy

- ggf BAUD RATE ändern (falls nicht 9600 BAUD)
- “Create and deploy” klicken



The screenshot shows the Balena Cloud interface for a project named "gpsTime". The top navigation bar includes the Balena Cloud logo, a lightning bolt icon, and links for "Getting Started", "Docs", "Forums", and "Status". A user profile icon is visible in the top right corner. The left sidebar contains a navigation menu with the following items: "Organizations", "xenomorph150's ...", "Fleets", "gpsTime" (selected), "Summary", "Devices", "Releases", "Variables", "Configuration", "Actions", "Settings", "Members", and "Location". The main content area is divided into three panels. The first panel, titled "gpsTime", features a Raspberry Pi icon with a red circle containing the number "2". Below the icon, it displays "Architecture armv7hf" and "Created Sep 3rd 2021, 8:03 pm". A green "Starter" button is located at the bottom of this panel. The second panel, titled "Devices", shows "0" devices and contains the text "You don't have any devices yet. How about adding one?" with a blue "+ Add device" button. The third panel, titled "Releases", shows "0" releases and contains the text "You don't have any releases yet. How about creating one?" with a blue "Create release" button.


- “Add device” klicken



Architecture

Add new device ✕

Select device type ?

 Raspberry Pi 2 ▼

Select version

v2.48.0+rev1 (recommended) ▼ Show outdated versions

Select edition

Development 💡 Recommended for first time users

Development images should be used when you are developing an application and want to use the fast [local mode](#) workflow. This variant should never be used in production.

Production


Production images are ready for production deployments, but don't offer easy access for local development.

Network Connection

Ethernet only

Wifi + Ethernet

+ Advanced

 **Warning!** The Raspberry Pi 2 is not capable of connecting to WiFi networks without an external adapter.

[Download balenaOS \(~137 MB\)](#) ▼

Instructions

- 1 Use the form on the left to configure and download balenaOS for your new device.
- 2 Write the OS file you downloaded to your SD card. We recommend using [Etcher](#).
- 3 Insert the freshly burnt SD card into the Raspberry Pi 2.
- 4 Connect your Raspberry Pi 2 to the internet, then power it up.
- 5 Your device should appear in your fleet in the dashboard within a few minutes. Have fun!

For more details please refer to our [Getting Started Guide](#).

- “Download balenaOS” klicken



GPSTIME AUF SD KARTE BRENNEN (1/2)

- vom letzten Schritt wird eine ZIP Datei heruntergeladen (balena-cloud-gpsTime-...zip)
- zusätzlich balenaEtcher (<https://www.balena.io/etcher/>) für das Betriebssystem herunterladen, installieren, SD Karte einlegen und die Software starten



GPSTIME AUF SD KARTE BRENNEN (2/2)

- nach erfolgtem Download der ZIP Datei diese mit balenaEtcher auf die SD Karte brennen (besser vorher alle USB Sticks vom PC entfernen und aufpassen dass die SD Karte ausgewählt ist!)
- nach erfolgtem Brennvorgang SD Karte entfernen



GERÄT VORBEREITEN

- SD Karte in RPi einlegen
- GPS Modul mit RPi verbinden
 - GPS 3v3 -> RPi 3v3 power
 - GPS GNS -> RPi Ground
 - GPS TX -> RPi GPIO 15 (RXD)
 - GPS RX -> RPi GPIO 14 (TXD)
 - GPS PPS -> RPi GPIO 18 (PCM_CLK)
- RPi ans Netzwerk anschließen
- RPi mit Strom verbinden



RPI VERBINDET SICH MIT CLOUD ...

The screenshot displays the BalenaCloud dashboard for a project named 'gpsTime'. The interface includes a sidebar with navigation options like Organizations, Fleets, and Devices. The main content area features three summary cards: 'gpsTime' with a Raspberry Pi icon and '2' devices, 'Devices' with a count of 1 and a green progress bar, and 'Releases' with a count of 1 and a 'Create release' button. Below these cards is a table listing the device details.

Name	Status	Device type	Last seen	Created on	UUID	OS version	OS line	OS vari
late-cloud	Online	Raspberry Pi 2	Online (for a few seconds)	Sep 3rd 2021, 8:37 pm	1c11fdc	balenaOS 2.48.0+rev1	Production	



... LÄDT GPSTIME HERUNTER ...

The screenshot displays the 'late-cloud' management interface for a Raspberry Pi 2. The main device status shows it is 'Updating' with a 45% progress bar. Key details include: ONLINE FOR 4 minutes, HOST OS VERSION balenaOS 2.48.0+rev1 (production), SUPERVISOR VERSION 10.8.0, CURRENT RELEASE Factory build, TARGET RELEASE 6e77f97, LOCAL IP ADDRESS, PUBLIC IP ADDRESS, TAGS (0), and PUBLIC DEVICE URL. A 'SERVICES' table at the bottom shows 'gpsTime' is 'Downloading' at 45% progress.

The 'Logs' panel on the right shows the following output:

```
ture_clear"],"enable_uart":"1","avoid_warnings":"1","disable_splash":"1",
"dtparam":{"l2c_arm-on","spi-on","audio-on"},"gpu_mem":"16"}
Applied boot config: {"dtoverlay":{"disable-bt"},"pps-gpio,gpioptn=18,capt
ure_clear"],"enable_uart":"1","avoid_warnings":"1","disable_splash":"1",
"dtparam":{"l2c_arm-on","spi-on","audio-on"},"gpu_mem":"16"}
Applied configuration change {"SUPERVISOR_POLL_INTERVAL":"900000","SUPERV
ISOR_DELTA_VERSION":"3"}
Applying configuration change {"SUPERVISOR_VPN_CONTROL":"true"}
Applied configuration change {"SUPERVISOR_VPN_CONTROL":"true"}
Rebooting
Supervisor starting
Creating network 'default'
Downloading image 'registry2.balena-cloud.com/v2/b3feeec551aa16a2beab71
a243857b8sha256:c489bd06b6e64b1486952f457198f2019dab235b7b396683335fce708
64853e7'
```

The 'Terminal' panel below the logs contains a 'Select a target' dropdown and a 'Start terminal session' button.



... UND WIRD VERFÜGBAR

The screenshot displays the 'late-cloud' interface for a Raspberry Pi 2. The main panel shows the device is 'Online' with a UUID of '1c11fdc'. It lists system details: 'balenaOS 2.48.0+rev1' (production) and 'supervisor version 10.8.0'. The current release is '6e77f97'. Below this, there are fields for 'LOCAL IP ADDRESS' and 'PUBLIC IP ADDRESS', both with copy icons. A 'NOTES' section is also present.

The 'SERVICES' table at the bottom shows:

Service	Status	Release	Actions
gpsTime	Running	6e77f97	▶ ■ ↺ 📄

The 'Logs' panel on the right shows system boot logs for 'gpsTime', including service installation, starting, and started messages. A terminal window below the logs is currently empty, with a 'Start terminal session' button.

- “Local IP Address” abschreiben



NUTZUNG

- Sollte das GPS Modul eine aktuellen Almanach haben sollte der gesamte NTP Server in wenigen Minuten funktionieren
- Erreichbar unter der “Local IP Address” als NTP Server
- Läuft nun auch Offline, ohne Internet
- RPi kann jederzeit stromlos gemacht werden ohne Datenverlust



TEST AUF WINDOWS 10 (KOMMANDOZEILE)

- w32tm /stripchart /computer:IPADRESSE /dataonly
- zeigt Abweichung PC Uhr zum NTP Server an

```
>w32tm /stripchart /computer: /dataonly  
Es ist 03.09.2021 20:52:30.  
20:52:30, -04.2882168s  
20:52:32, -04.2879931s  
20:52:34, -04.2899077s  
20:52:36, -04.2917306s  
20:52:38, -04.2878163s  
20:52:40, -04.2893674s  
20:52:42, -04.2876725s  
20:52:44, -04.2889557s  
20:52:46, -04.2876238s  
20:52:48, -04.2880255s  
20:52:50, -04.2894366s  
20:52:52, -04.2877891s  
20:52:54, -04.2873592s  
20:52:56, -04.2873341s  
20:52:58, -04.2871955s  
20:53:00, -04.2871681s  
20:53:02, -04.2871431s  
20:53:04, -04.2869759s
```



MEHR INFOS / GITHUB REPO

<https://github.com/nmaas87/gpsTime>



FRAGEN?

Danke für Ihre Aufmerksamkeit -
und viel Spaß auf der Pi And Radio 2021 :)!

www.nico-maas.de

