

# The Things Network V3 (en hoe komen we daar van V2)

Meetup woensdag 17 februari 2020





# Agenda

Uw gastheren vanavond: **Arnold Kolkman** en Remko Welling

## 1. Mededelingen IoT Apeldoorn

*Deel 1: Algemene informatie.*

2. **V3, wat zijn de plannen en wat komt er op ons af?**
3. The Things Network V3 en V2 architectuur, en wat betekent dit.

*Deel 2: Workshop (Hands-on) Migratie van Applicatie en Nodes.*

4. “Met de hand” van V2-console naar V3-console.
5. **Met `ttnc1` van V2 naar V3**



# Mededelingen

- **13 januari** is de stichtingsakte IoT Apeldoorn e.o. ondertekend
  - Remko voorzitter, Jeroen secretaris, Marcel penningmeester.
  - In afwachting van de KvK inschrijving (Corona 🙄),
  - Daarna: Bankrekening, verzekering, website, mail, overdracht gateways aan de stichting.
- **Nieuwe gateway** op het **Zwitsal** terrein.
- Meetup gepland voor **3 maart** over **Ambasat**.

# V3, wat zijn de plannen en wat komt er op ons af?

Arnold Kolkman, Meetup woensdag 17 februari 2020





Januari 2021:

- 130000+ members
  - 150 countries
  - 17000+ gateways
- Apeldoorn 61 gateways – 31 contributors



## The Thing Stack v3

- Inloggen op V3 met the things ID
  - April 2021: V2 in read only
- September 2021: v2 unavailable
  - Migration tools available
- All gateways stays connected to Packet broker



## The Thing Stack v3

- The Things Industries operates all public clusters
- Opportunity for gateway makers to migrate to basic station (wordt officieel ondersteund in V3)
- <https://eu1.cloud.thethings.network/console>

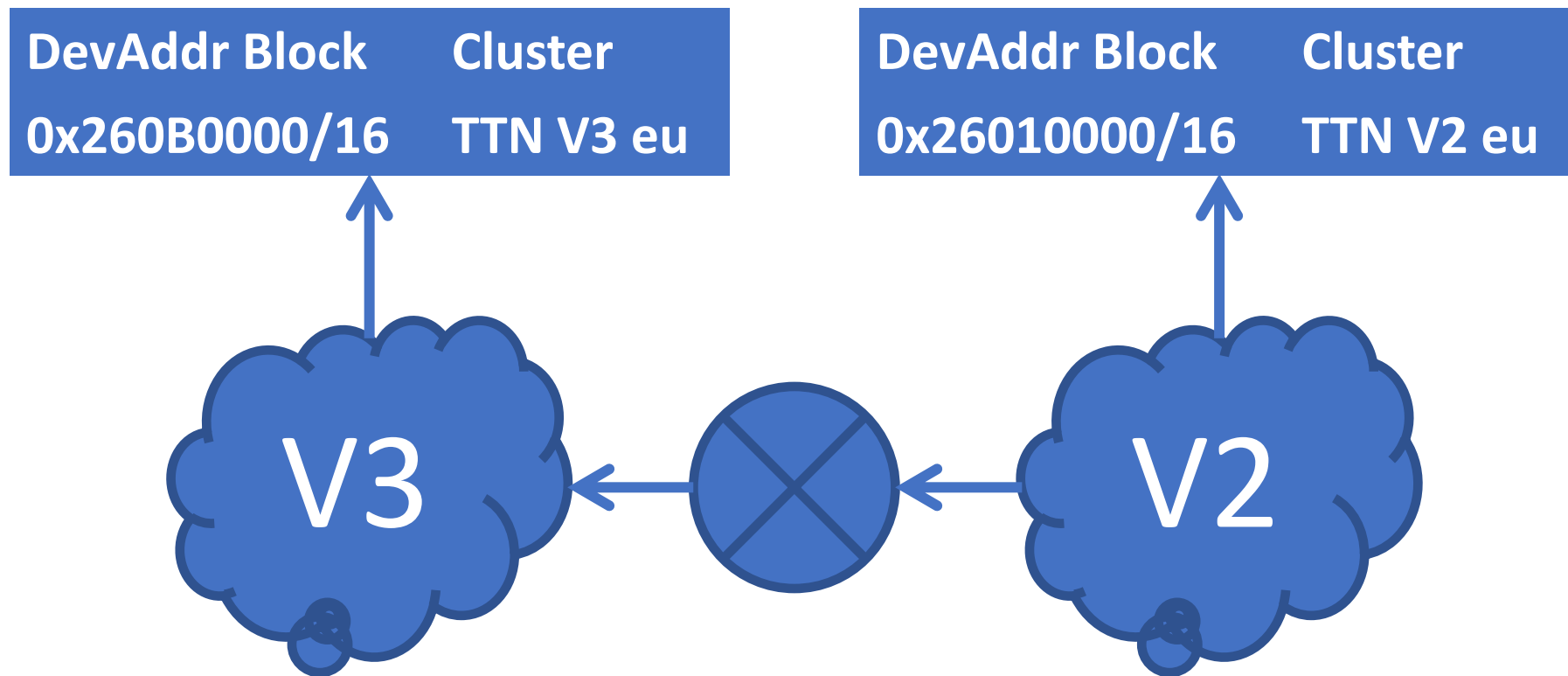
# The Things Network V3- en V2-architectuur, wat betekent dit?

Remko Welling, Meetup woensdag 17 februari 2020

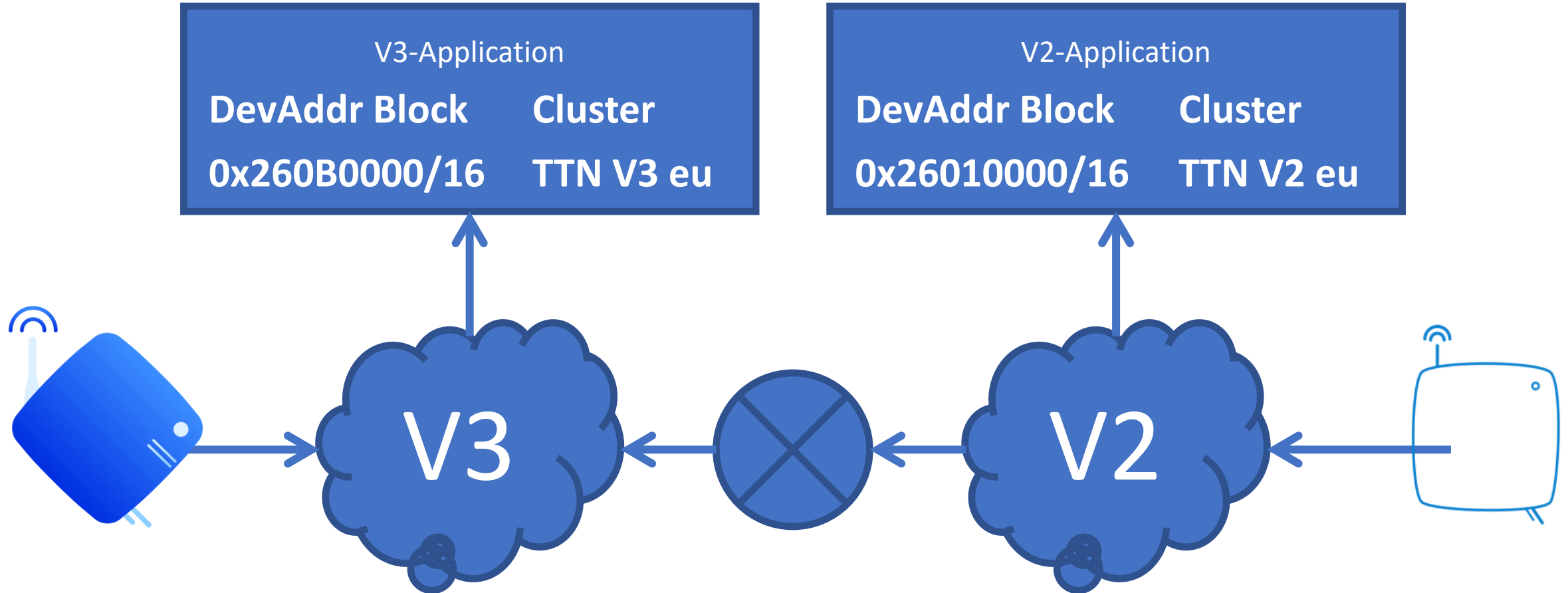




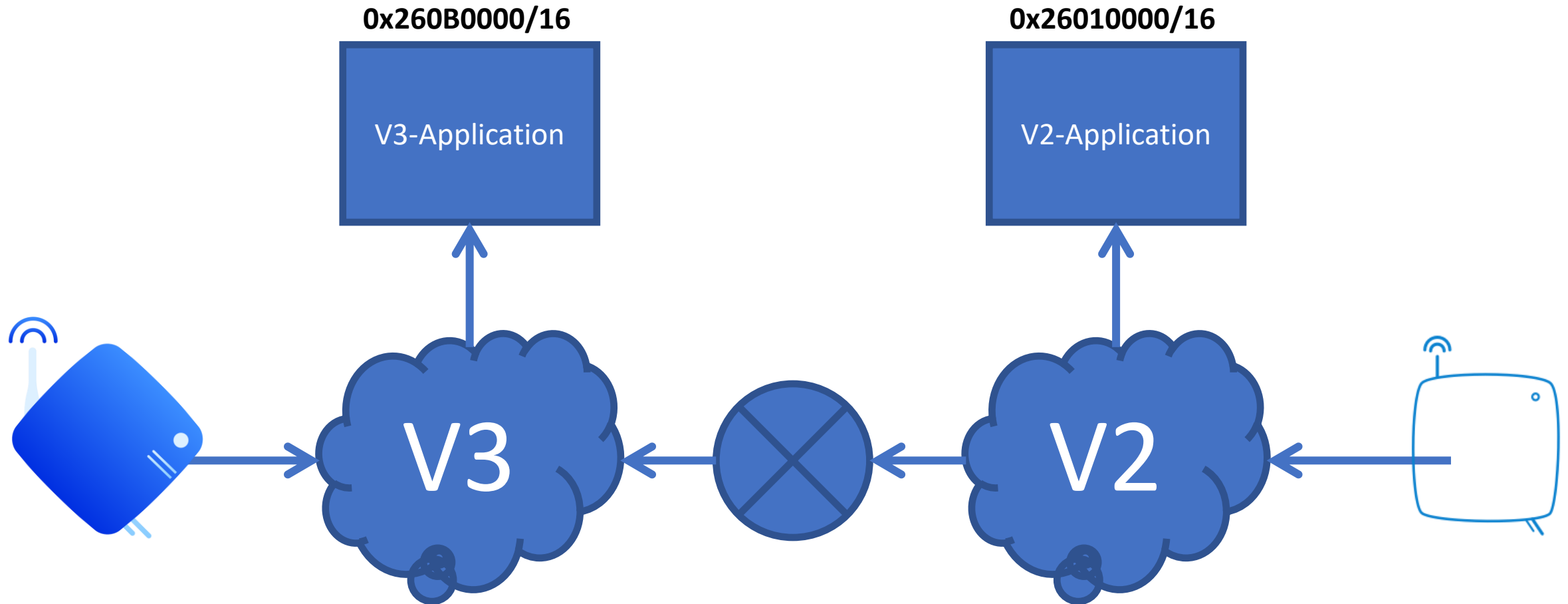
# DevAddrs Routing V2 → V3



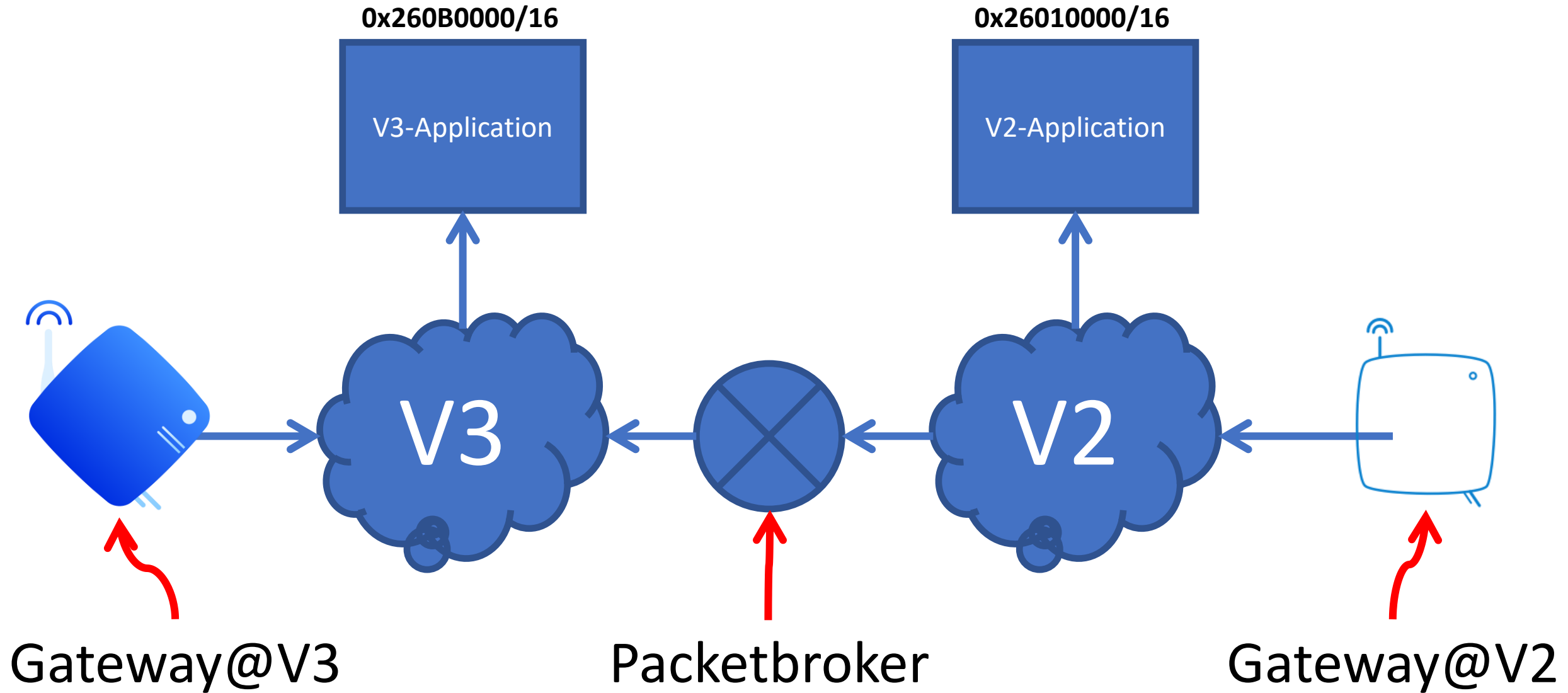
# Intermediate TTN architecture



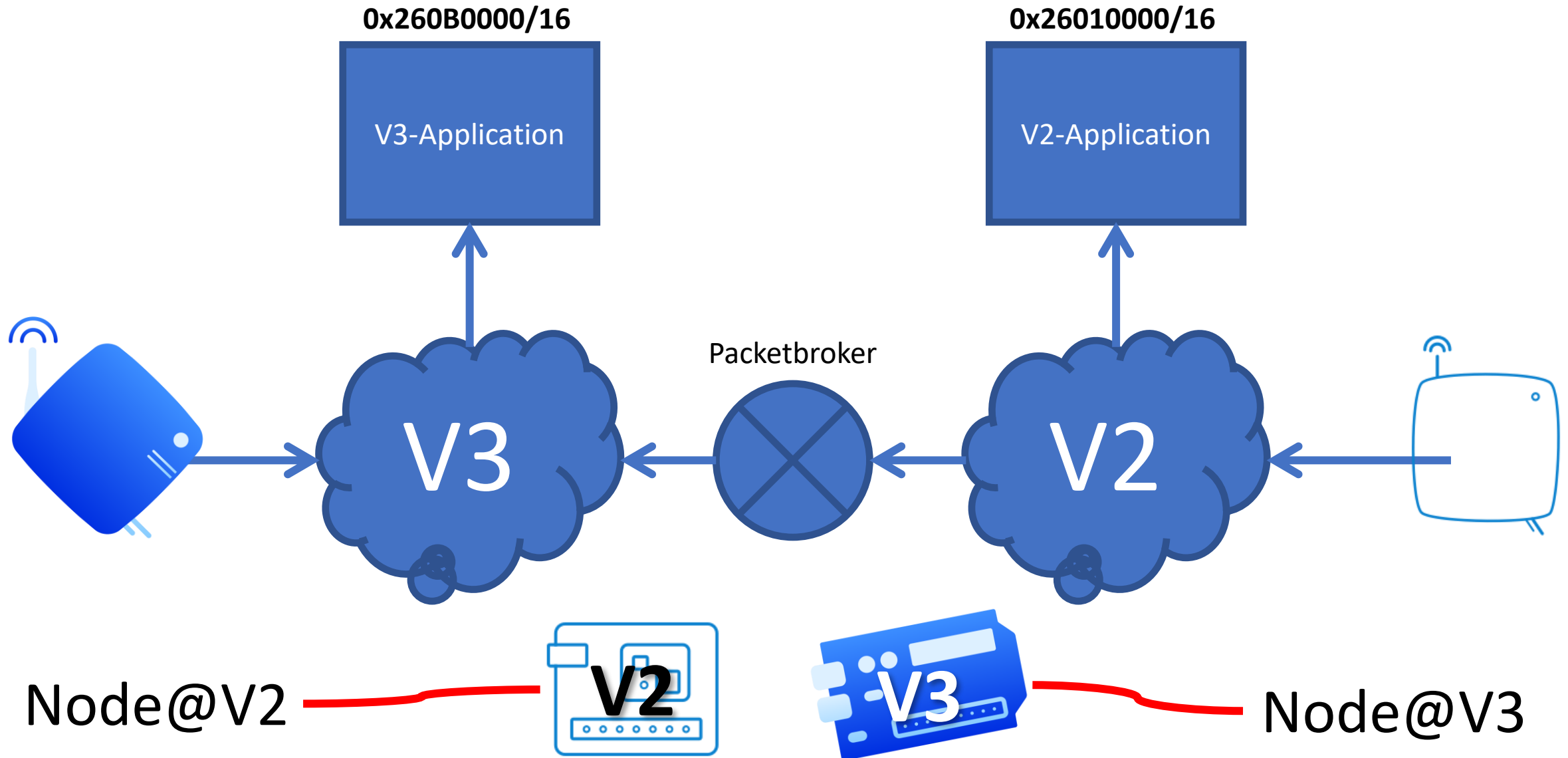
# Intermediate TTN architecture



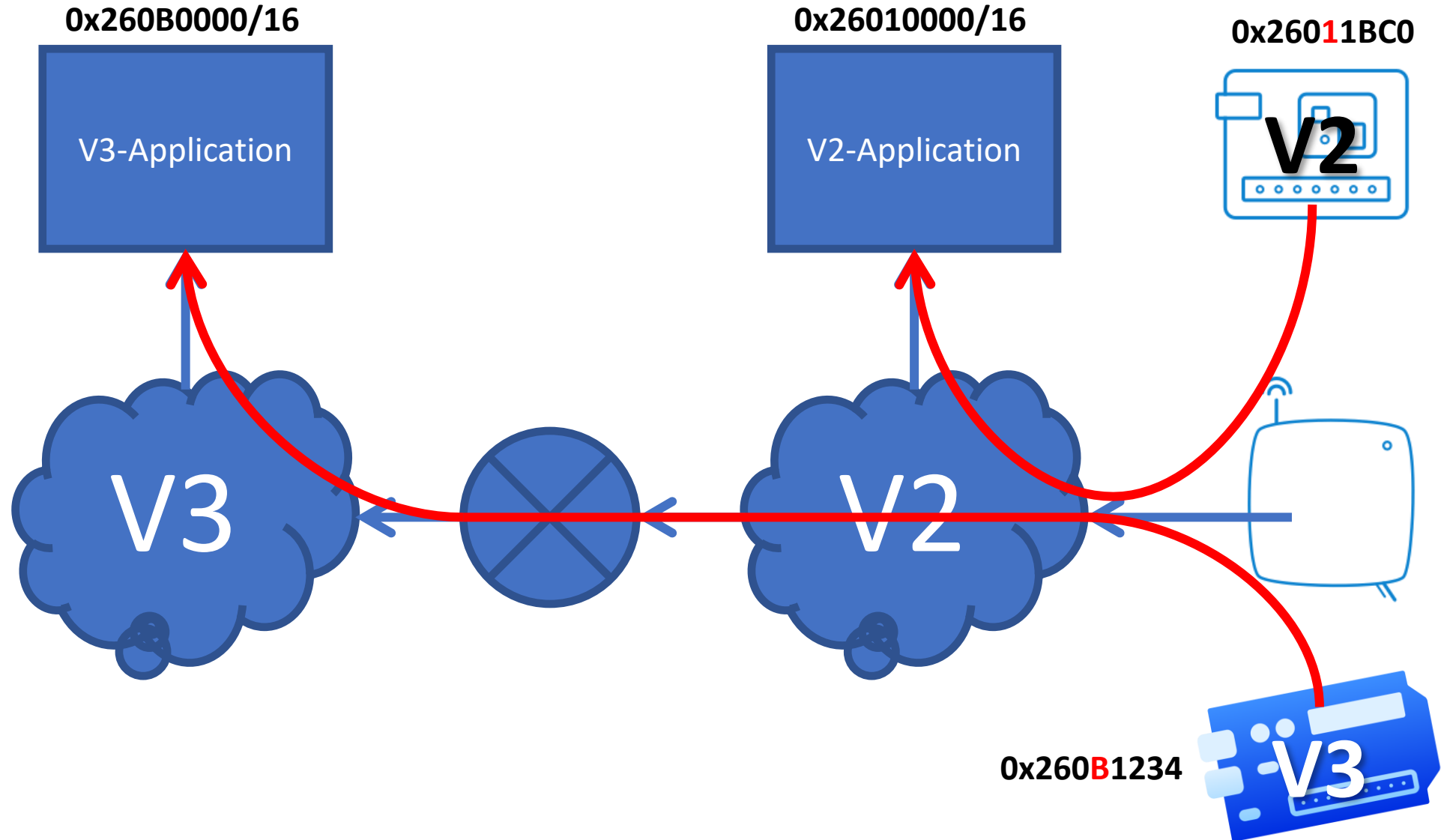
# Intermediate TTN architecture



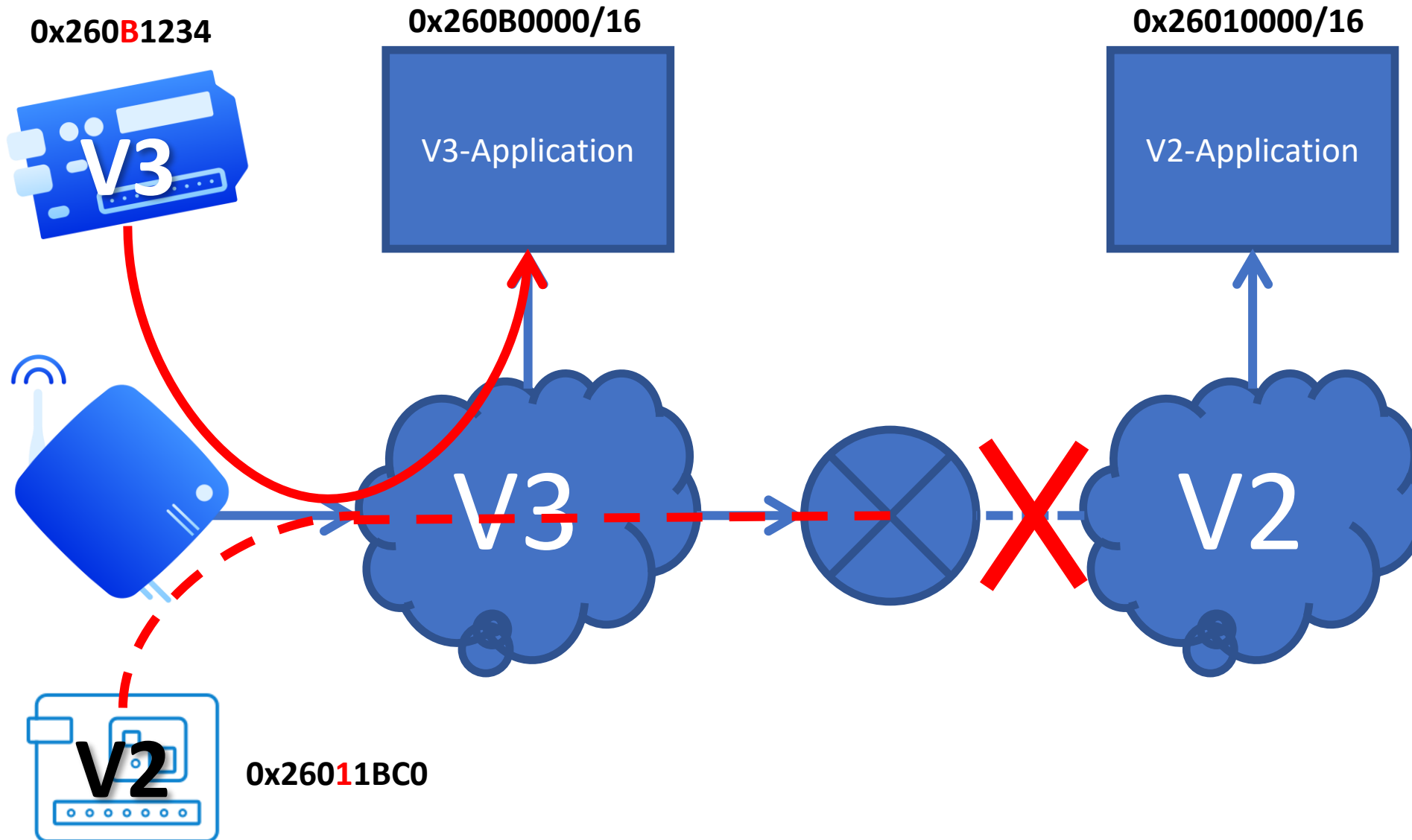
# Intermediate TTN architecture



# V2/V3 devices reach application through V2 gateway



V3 devices can reach application **V2 devices not**



# Conclusie

- V3 gateways sturen geen packets door naar V2 applicaties.
- V2 gateways sturen packets door naar V3 applications.
- Het migreren van gateways naar V3 betekent dat er van deze gateways geen packets meer naar V2 applicaties gaan!
- Migreer gateways alleen naar V3 wanneer alle (community) applicaties over zijn naar V3.
- Gateway migratie IoT Apeldoorn:





## TTN Apeldoorn

de Mheen

Kadaster

Europaweg

Stadhuis

Werkgebouw Zuid

Uddel

Hoenderloo

Radio Kootwijk

Deventer Lebuinuskerk

Zwitsal

V2 V3

✓ ✓

✓ ✓

✓ -

✓ -

✓ -

✓ -

✓ -

✓ -

✓ -

✓ -

- **Alle gateways blijven** (voorlopig) **verbonden aan V2**

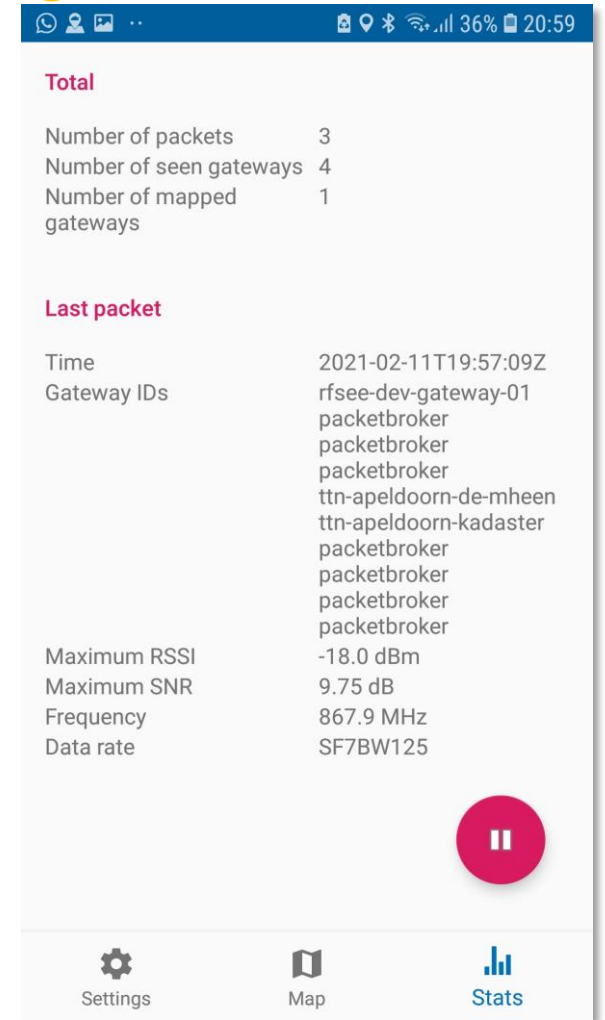
- Enkele gateways zijn “dubbel afgesteund” op V2 en V3

- De Mheen
- Kadaster

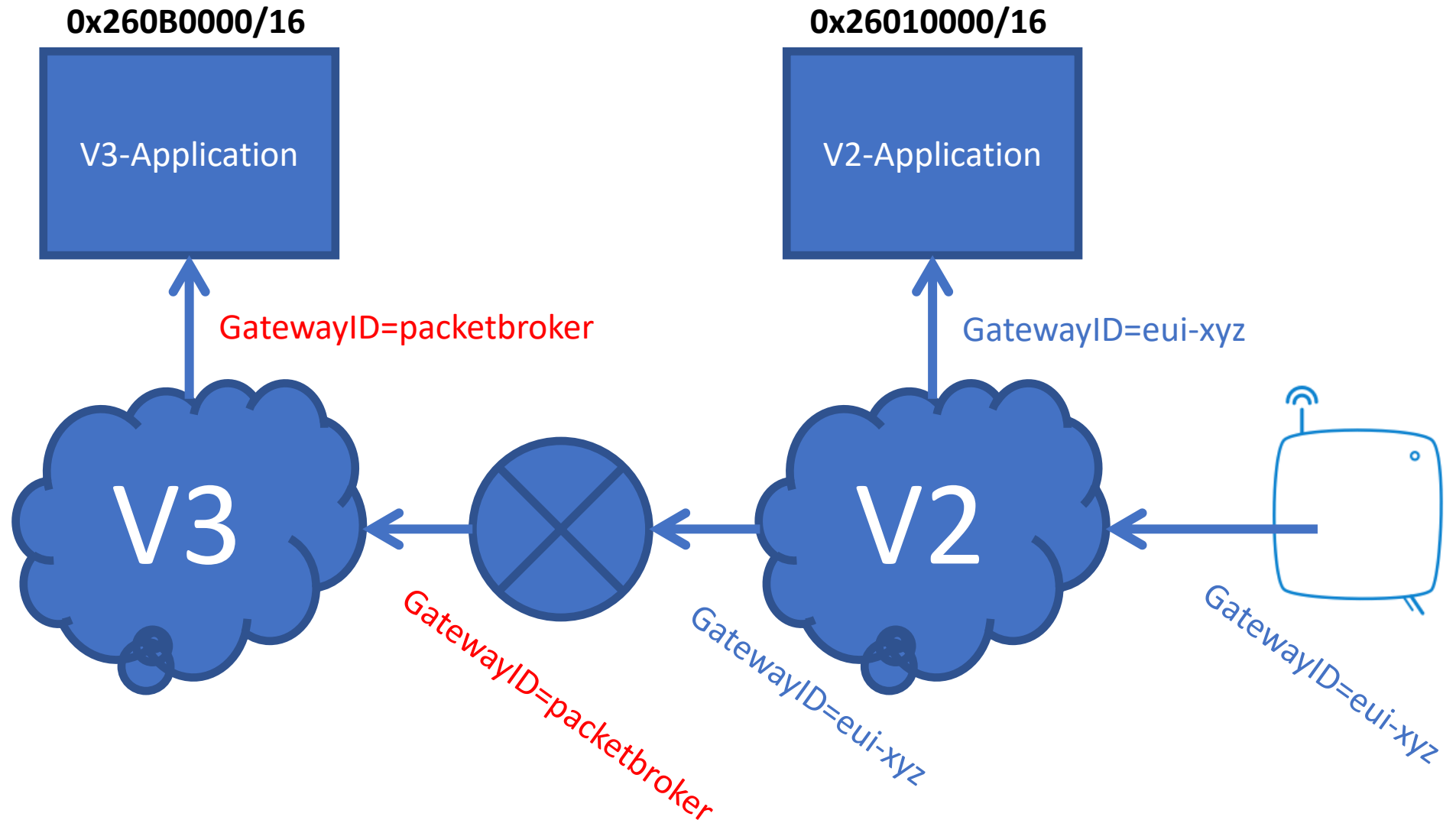
Deze gateways maken gebruik van Semtech UDP-protocol (deprecated)

# Consequenties TTNMapper

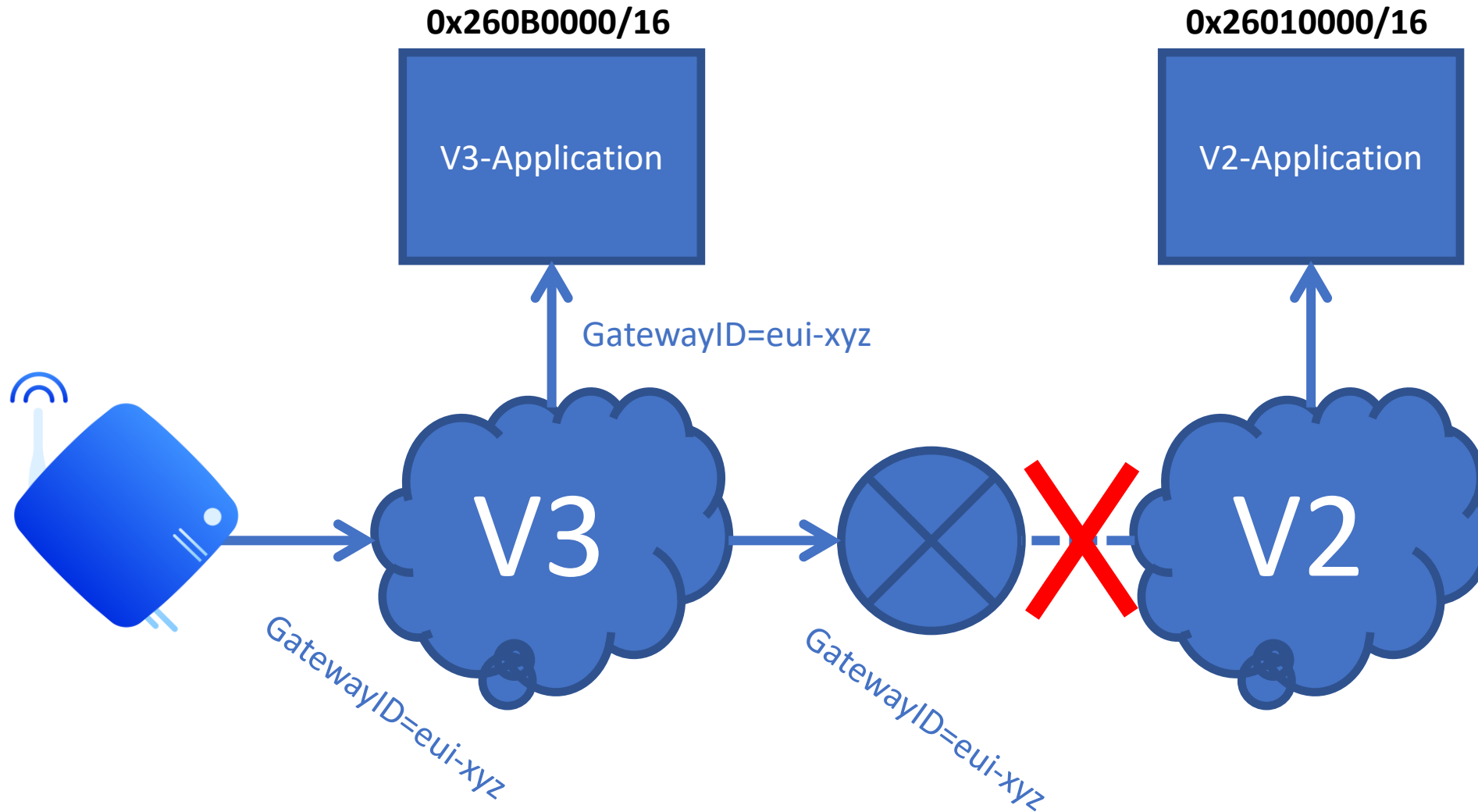
- De nieuwe TTNMapper kan met TTV-V2, TTN-V3, en Chirpstack verbinden
- App en device op V2:  
Door de splitsing van V2 en V3 gateways “verliest” TTNMapper de metadata van de V2 gateways.
- App en device op V3:  
Door de splitsing van V2 en V3 gateways “komt er geen data meer binnen van de V2 gateways.” →  
Het V2-netwerk is “verdwenen”



# Gateway metadata



# Gateway metadata

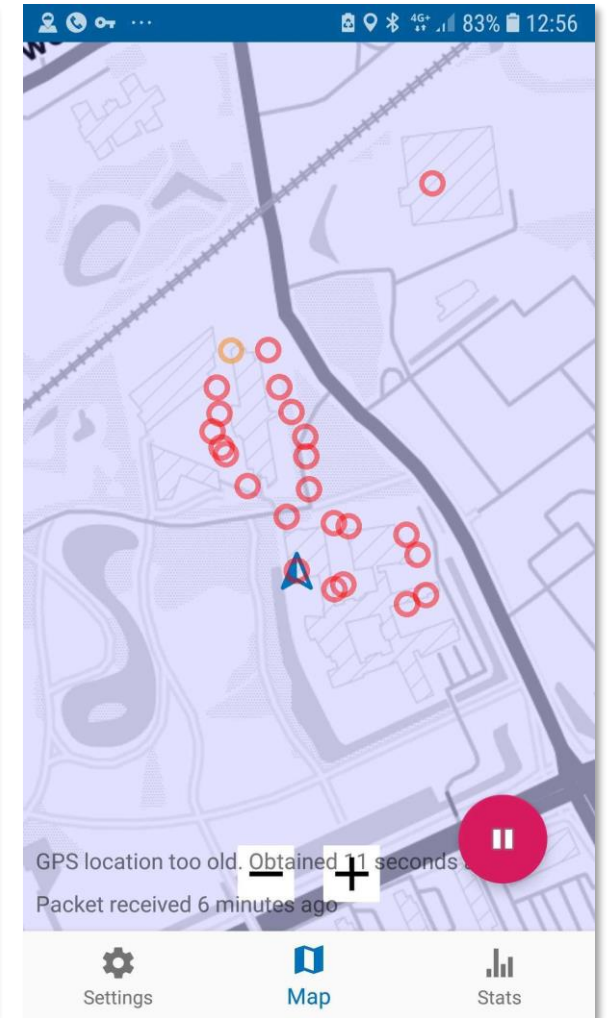
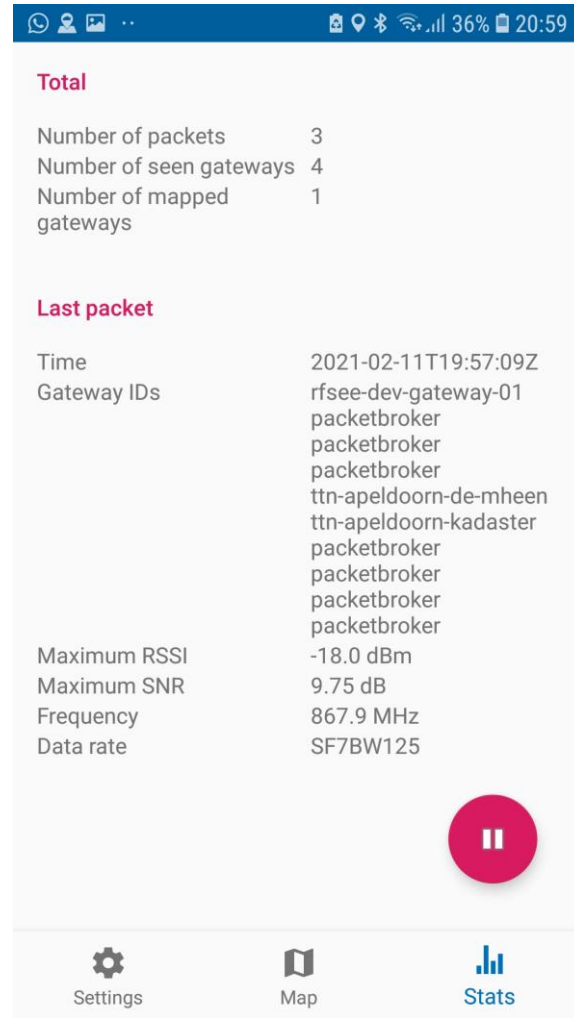
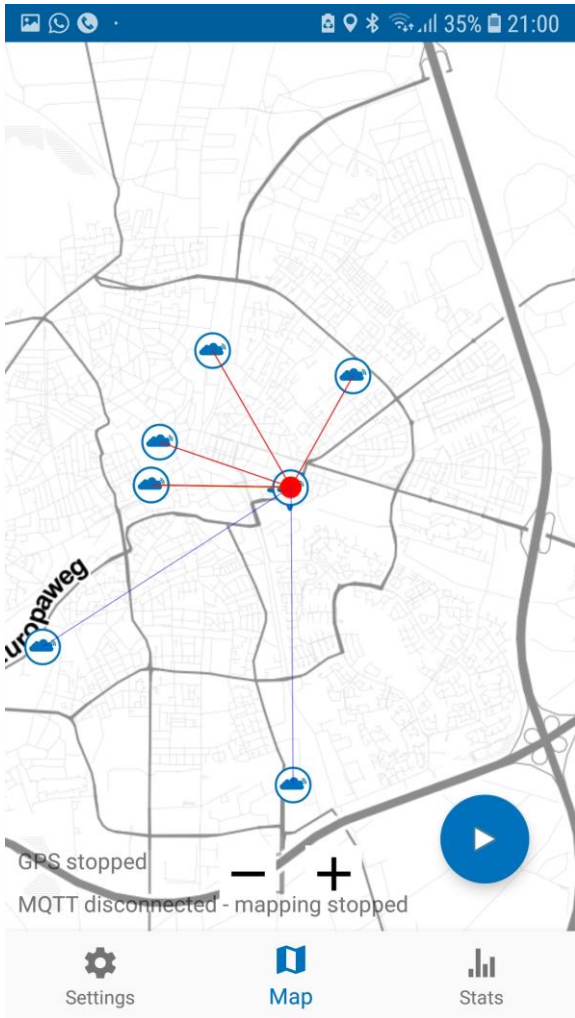




# Applicaties & integraties in V3

- Cayenne van MyDevices is (nog) niet beschikbaar in V3.
- + MQTT integratie, V3 als MQTT client publiceren op willekeurige broker.
- Copy-past tool uit V2 (nog) niet in V3.
- +/- http-integratie heet in V3 “webhooks”
- + Collaborators kunnen als “organisation” worden gemanaged.  
(TTN-Apeldoorn gebruikers kunnen zo gateway traffic kijken)
- Rechten structuur is “onduidelijk”
- + Live data is verrijkt (meer informatie ook MAC)
- Live data is vertroebeld door alle informatie, filters missen.

# TTNMapper



# Migratie workshop: Met console van V2 naar V3

Remko Welling, Meetup woensdag 17 februari 2020



# Oefening/demonstratie 1

**Move OTAA device from V2 to V3:**

- *Moved ABP device will use V2 gateways*



# Oefening/demonstratie 1



## Move OTAA device from V2 to V3:

1. Create new application in V3
2. Create new device in new application
3. Copy credentials from device in V2
  - AppEUI
  - DevEUI
  - AppKey
4. Copy DevEUI in V2 to comment
5. Change DevEUI to random number (*prevent V2 from answering Join request*)
6. Restart end device.

```
LoRaWAN version: MAC V1.0.2
External Join Server: false
Europe 863-870 (SF9 for RX2)
Regional Parameters version:
PHY V1.0.2 REV B
```

# Demo...



The image displays a demonstration of The Things Network (TTN) setup. It includes a physical Arduino Uno board with a LoRa module, a screenshot of the Arduino IDE showing the compilation of a program, and two screenshots of the The Things Network Console web interface.

**Arduino IDE Screenshot:** The code defines a LoRa node for TTN. It includes the `<TheThingsNetwork.h>` library and sets the device address, network key, and application key. The program initializes the LoRa module and the TTN client.

```
1 #include <TheThingsNetwork.h>
2
3 // Set your DevAddr, NwkKey, AppKey and the frequency plan
4
5 // V3 abp-1
6 //const char *devAddr = "24013C81";
7 //const char *nwkKey = "8EA0BDC555062B12172EA2F118B440B";
8 //const char *appKey = "C14F1FB6997B54872E816F33F5400E53";
9
10 // V3 tft
11 const char *devAddr = "2408F3B4";
12 const char *nwkKey = "2495FB53908A085A348B09FB2DC0784";
13 const char *appKey = "801CC12B04E89E13F7D458568C54C713";
14
15 #define loraSerial Serial1
16 #define debugSerial Serial
17
18 // Replace REPLACE_ME with TTN_FP_EU868 or TTN_FP_US915
19 #define freqPlan TTN_FP_EU868
20
21 TheThingsNetwork ttn(loraSerial, debugSerial, freqPlan);
22
23 void setup()
24 {
25   loraSerial.begin(57600);
26   debugSerial.begin(9600);
27 }
```

**The Things Network Console Screenshot (Left):** The console shows a welcome message for 'Remko!' and options to manage applications and gateways.

**The Things Network Console Screenshot (Right):** The console shows a welcome message for 'pe1mew!' and options to go to applications or gateways.

# Oefening/demonstratie 2

## Move ABP device from V2 to V3:

- *Moved ABP device will not use V2 gateways*
- *Make **all** settings **at device creation!**  
V3 MAC will not (yet?) change state at parameter change!*
- *Not following this directive will result in **excessive downlink traffic!***

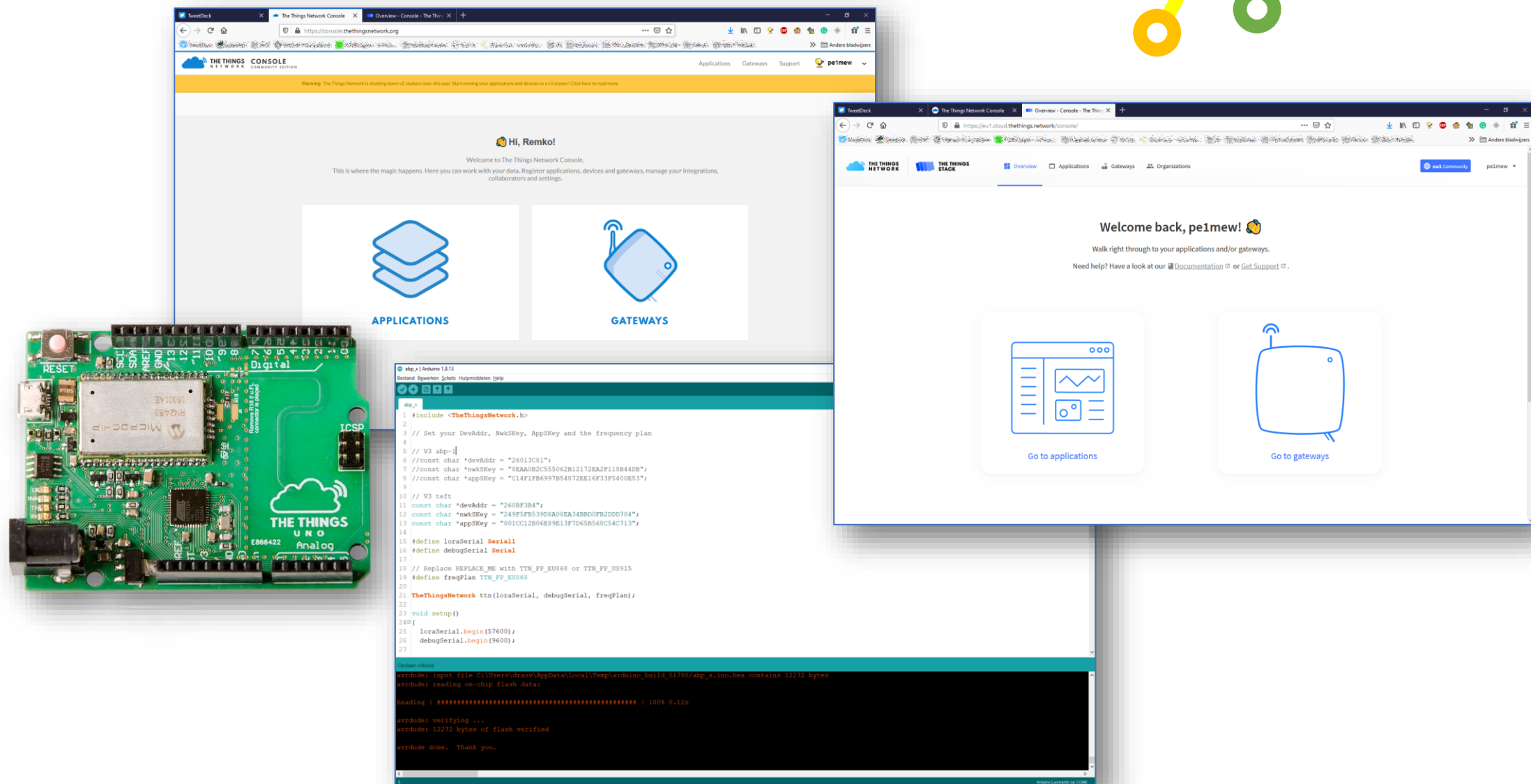
# Oefening/demonstratie 2

## **Move ABP device from V2 to V3:**

1. Create new application in V3
2. Create new device in new application
3. Copy credentials from device in V2
  - Device EUI
  - Network Session Key
  - App Session Key

**LoRaWAN version: MAC V1.0.2  
Europe 863-870 (SF9 for RX2)  
Regional Parameters version:  
PHY V1.0.2 REV B**

# Demo...



The image displays a demo setup for The Things Network. On the left is a green Arduino Uno R3 board with a Microchip PIC16C455 microcontroller and a USB Type-C port. In the center is a screenshot of the The Things Network Console web interface, showing a welcome message for 'Remko!' and navigation options for Applications and Gateways. On the right is another screenshot of the console, showing a welcome message for 'pe1mew!' and navigation options for Applications and Gateways. Below the console screenshots is a terminal window showing the compilation and upload of a program to the Arduino Uno. The program is a simple LoRaWAN node that sends a message to the network.

```
1 // Arduino Uno
2 // The Things Network Console
3 // Set your DevAddr, NwkKey, AppKey and the frequency plan
4
5 // V3 abp-1
6 //const char *devAddr = "24013C81";
7 //const char *nwkKey = "8EA0BDC555062B12172EA2F118B440B";
8 //const char *appKey = "C14F1FB6997B54872E816F33F5400E53";
9
10 // V3 tft
11 const char *devAddr = "2408F3B4";
12 const char *nwkKey = "2495FB53908A085A348B09FB2DC0784";
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15 #define loraSerial Serial1
16 #define debugSerial Serial
17
18 // Replace REPLACE_ME with TTN_FP_EU868 or TTN_FP_US915
19 #define freqPlan TTN_FP_EU868
20
21 TheThingsNetwork ttn(loraSerial, debugSerial, freqPlan);
22
23 void setup()
24 {
25   loraSerial.begin(57600);
26   debugSerial.begin(9600);
27 }
28
29 void loop()
30 {
31   ttn.send("Hello, World!");
32   delay(1000);
33 }
```

avrdude: input file C:\Users\draw\AppData\Local\Temp\arduino\_build\_51780\abp\_x.ino.hex contains 12272 bytes  
avrdude: reading on-chip flash data:  
Reading : ##### 100% 0.12s  
avrdude: verifying ...  
avrdude: 12272 bytes of flash verified  
avrdude done. Thank you.

# Oefening/demonstratie 2



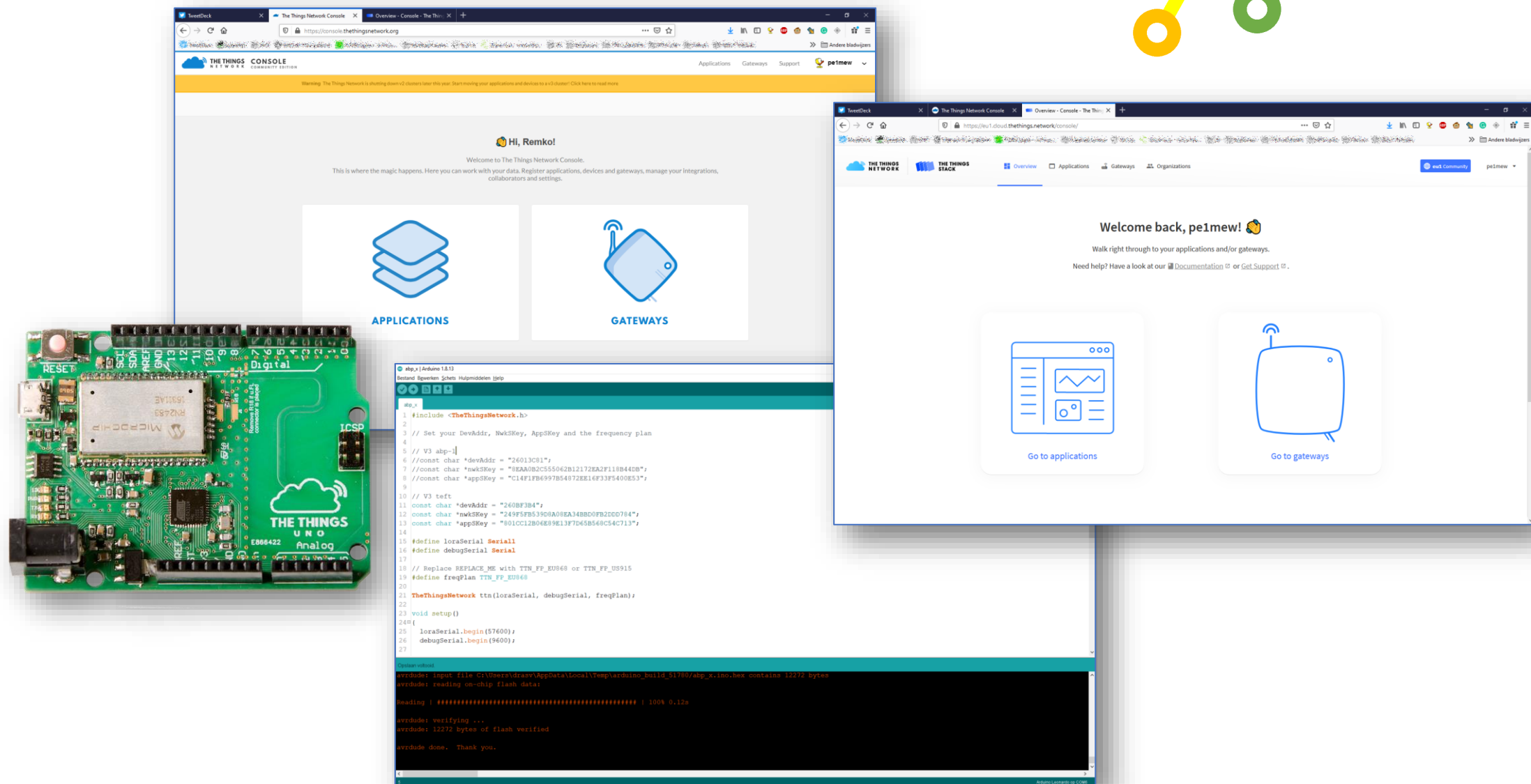
**Move ABP device from V2 to V3:**

***Make all settings at device creation!***

1. Make all settings in Network layer → Advanced settings.

```
RX1 Delay: 1
RX1 Data Rate Offset: 0
Reset frame counters: true
RX2 Data rate Index: 3 (SF9)
RX2 Frequency: 869525000
Factory preset frequencies:
0: 868100000
1: 868300000
2: 868500000
3: 867100000
4: 867300000
5: 867500000
6: 867700000
7: 867900000
```

# Demo...



The image displays a demo of The Things Network (TTN) ecosystem. On the left is a green Arduino Uno R3 board with a Microchip ATmega328P microcontroller and a TTN module. In the center is a screenshot of the The Things Network Console web interface, showing a welcome message for 'Remko!' and navigation links for 'APPLICATIONS' and 'GATEWAYS'. On the right is another screenshot of the console, showing a welcome message for 'pe1mew!' and navigation links for 'Go to applications' and 'Go to gateways'. Below the console screenshots is a terminal window showing the compilation and upload of a program to the Arduino Uno. The program is a simple TTN client that sends a message to the TTN network.

```
1 // Arduino 1.8.1
2 // The Things Network Console
3 // Set your DevAddr, NwkKey, AppKey and the frequency plan
4
5 // V3 abp-1
6 //const char *devAddr = "24013C81";
7 //const char *nwkKey = "8EAB0BDC555062B12172EA2F118B440B";
8 //const char *appKey = "C14F1FB6997B54872E816F33F5400E53";
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avrdude: input file C:\Users\draw\AppData\Local\Temp\arduino\_build\_51780\abp\_x.ino.hex contains 12272 bytes  
avrdude: reading on-chip flash data:  
Reading : ##### 100% 0.12s  
avrdude: verifying ...  
avrdude: 12272 bytes of flash verified  
avrdude done. Thank you.

# Migratie workshop: Met **ttnc1** van V2 naar V3

Arnold Kolkman, Meetup woensdag 17 februari 2020







Maak op C: drive een map temp (C:\temp)

Download TTNCTL:

<https://bit.ly/37gK9GR>

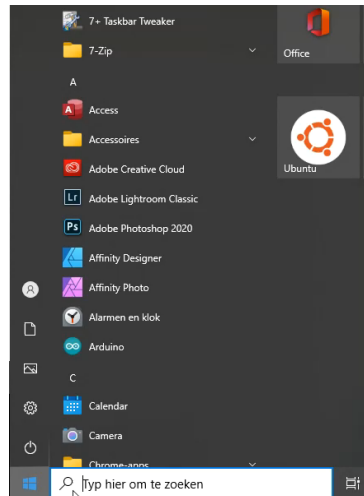
Windows – Select Windows (64bit, zip)

Extract de zip file naar C:\temp



## Open een command prompt in Windows 10:

Klik op start en begin met typen: CMD en selecteer bovenin het zwarte Opdrachtprompt venster.





Navigeer met command prompt naar C:\Temp

1. `cd..` - Enter
2. `cd..` - Enter
3. `cd Temp` - Enter



Vraag autorisatiecode aan via de internet browser voor  
TTNCTL en kopieer deze code naar een tekstfile  
(later nodig):

<https://bit.ly/3qpL8vZ>

#### TTNCTL ACCESS CODE

This is your temporary access code for ttnctl.  
It is valid for 5 minutes.

t07-YeIIWLjOuLA, 3ad8aUVTIO17PuIU

[go home](#)



Vul in het Opdrachtvenster de volgende line in:

`ttctl-windows-amd64.exe user login "autorisatiecode"`

```
C:\Temp>ttctl-windows-amd64.exe user login [redacted]  
INFO Successfully logged in as vaasseniot (info@vaasseniot.nl)  
C:\Temp>
```

# Vul in het Opdrachtvenster de volgende line in:

`ttntctl-windows-amd64.exe applications select`

(selecteer hier de applicatie waarin het device bevint die je wil migreren)

```
C:\Temp>ttntctl-windows-amd64.exe applications select
INFO Found 20 applications:

1
2
3
4
5
6
7
8
9
10
11
12
13  migratemeetup      Migratie meetup
14
15
16
17
18
19
20

Which one do you want to use?
Enter the number (1 - 20) >
```

```
Enter the number (1 - 20) > 13
INFO Found one EUI "A000000000000100", selecting that one.
INFO Updated configuration                               AppEUI=A000000000000100 AppID=migratemeetup

C:\Temp>
```



Indien de applicatie is geselecteerd vul dan het volgende in:

ttnctl-windows-amd64.exe devices list

```
C:\Temp>ttnctl-windows-amd64.exe devices list
INFO Using Application                               AppEUI=A000000000000100 AppID=migratemeetup
INFO Discovering Handler...                         Handler=ttn-handler-eu
INFO Connecting with Handler...                     Handler=eu.thethings.network:1904

DevID  AppEUI                               DevEUI                               DevAddr                               Description
device1 A000000000000100                [REDACTED]                          [REDACTED]                           [REDACTED]

INFO Listed 1 devices                               AppID=migratemeetup
C:\Temp>
```

Indien DevID de juiste node is – sla naam op in kladblok, naam nodig in volgende stap.



## Exporteer device keys en settings naar .json file.

`ttnctl-windows-amd64.exe devices export "device1" --frequency-plan-id EU_863_870 > device1.json`

```
C:\Temp>ttnctl-windows-amd64.exe devices export "device1" --frequency-plan-id EU_863_870 > device1.json
INFO Using Application                               AppEUI=A000000000000100 AppID=migratemeetup
INFO Discovering Handler...                           Handler=ttn-handler-eu
INFO Connecting with Handler...                       Handler=eu.thethings.network:1904
C:\Temp>
```

Er zal nu in C:\temp een file aanwezig zijn met device1.json





Converteer device1 naar ABP, hierdoor vindt join op v2 niet meer plaats.

```
ttntctl-windows-amd64.exe devices convert-to-abp "device1"
```

```
C:\Temp>ttntctl-windows-amd64.exe devices convert-to-abp "device1"  
INFO Using Application           AppEUI=A000000000000100 AppID=migratemeetup  
INFO Discovering Handler...      Handler=ttn-handler-eu  
INFO Connecting with Handler...  Handler=eu.thethings.network:1904  
INFO Remove device AppKey       AppID=migratemeetup DevID=device1 OriginalAppKey=[REDACTED]  
[REDACTED]  
C:\Temp>
```

Hierna mag CMD window worden gesloten.



# Inloggen op V3 console en applicatie aanmaken.

Go to applications → + Add application →

## Add application

Owner \*

vaasseniot

Application ID \*

migratiemeetup

Application name

migratiemeetup

Description

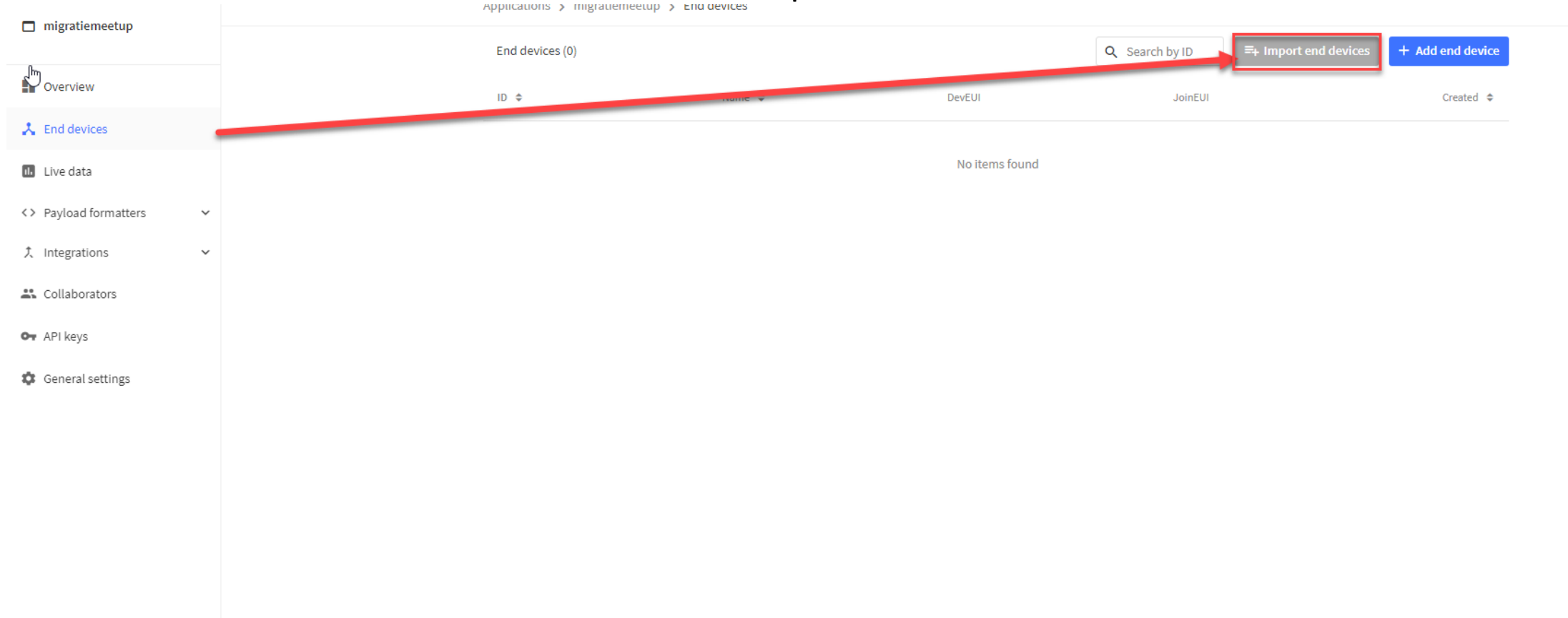
Description for my new application

Optional application description; can also be used to save notes about the application

Create application

## Import End device.

End devices → Import end devices →



The screenshot displays the IoT Apeldoorn web interface. On the left is a sidebar with a navigation menu. The main content area shows the 'End devices' page, which is currently empty. A red arrow highlights the path from the 'End devices' menu item to the 'Import end devices' button.

**Navigation Menu (Left Sidebar):**

- migratiemeetup
- Overview
- End devices**
- Live data
- Payload formatters
- Integrations
- Collaborators
- API keys
- General settings

**Main Content Area:**

Applications > migratiemeetup > End devices

End devices (0)

Search by ID

**Import end devices** + Add end device

ID DevEUI JoinEUI Created

No items found

## Select JSON file.

The The Things Stack JSON → Select a file → C:\Temp\device1.json → Create end devices

Import end devices

File import

Format\*

The Things Stack JSON

Format information:

File containing end devices in The Things Stack JSON

File\*

Select a file...

No file selected

Targeted components

☒ Identity Server ☒ Network Server ☒ Join Server ☒ Application Server

Claiming

☐ Set claim authentication code

Create end devices

selecteer de gemaakte JSON file  
vanuit C:\Temp

100.00% finished??  
Proceed

Creating end devices...

Operation finished •

1 of 1 (100.00% finished)

```
{
  "keys": {
    "f_nwk_s_int key": {
      "key": " "
    },
    "app_s_key": {
      "key": " "
    }
  },
  "lorawan_version": "1.0.2",
  "root_keys": {
    "app_key": {
      "key": " "
    }
  },
  "application_server_address": "eu1.cloud.thethings.network",
  "network_server_address": "eu1.cloud.thethings.network",
  "name": "device1",
  "join_server_address": "eu1.cloud.thethings.network"
}
```

Proceed

# Select the device

device1

 device1

KLIK

A8 40 41 87 E1 82 A0 D5



A0 00 00 00 00 00 01 00



2 minutes ago

# Go to live data

Power cycle your device – OTAA JOIN

Overview **Live data** Messaging Location Payload formatters Claiming General settings

Time Type Data preview Pause Clear

|            |                                            |                                                                                                                                                                                        |
|------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ↑ 16:45:09 | Drop data message                          | Uplink is a duplicate                                                                                                                                                                  |
| ↑ 16:45:09 | <b>Receive data message</b>                | DevAddr: 26 0B 8D D3 FPort: 2 MAC payload: 95 B8 56 F0 84 38 5F 7C F0 BD 40 Bandwidth: 125000 SNR: 7.75 Raw payload: 40 D3 8D 0B 26 00 00 00 02 95 B8 56 F0 84 38 5F 7C F0 BD 40 D7 AA |
| ↑ 16:45:09 | Receive data message                       | DevAddr: 26 0B 8D D3 FPort: 2 MAC payload: 95 B8 56 F0 84 38 5F 7C F0 BD 40 Bandwidth: 125000 SNR: 7.75 Raw payload: 40 D3 8D 0B 26 00 00 00 02 95 B8 56 F0 84 38 5F 7C F0 BD 40 D7 AA |
| ↑ 16:45:06 | Forward join-accept to Application Se...   | DevAddr: 26 0B 8D D3                                                                                                                                                                   |
| ↑ 16:45:06 | Forward join-accept message                | DevAddr: 26 0B 8D D3                                                                                                                                                                   |
| ↑ 16:45:05 | Receive join-accept message                | DevAddr: 26 0B 8D D3                                                                                                                                                                   |
| ↓ 16:45:04 | Successfully scheduled join-accept fo...   | DevAddr: 26 01 2E C2                                                                                                                                                                   |
| ↓ 16:45:04 | Schedule join-accept for transmission...   | DevAddr: 26 01 2E C2 Rx1 Delay: 5                                                                                                                                                      |
| ↑ 16:45:02 | <b>Successfully processed join-request</b> | JoinEUI: Bandwidth: 125000 SNR: 8 Raw payload: 00 00 01 00 00 00 00 00 A0 D5 A0 82 E1 87 41 40 A8 00 F6 68 E3 D0 95                                                                    |
| ↑ 16:45:02 | Drop join-request                          | Uplink is a duplicate                                                                                                                                                                  |
| ↑ 16:45:02 | Receive join-request                       | JoinEUI: Bandwidth: 125000 SNR: 8 Raw payload: 00 00 01 00 00 00 00 00 A0 D5 A0 82 E1 87 41 40 A8 00 F6 68 E3 D0 95                                                                    |
| ↑ 16:45:02 | Join-request to cluster-local Join Se...   | Session key ID:                                                                                                                                                                        |
| ⌂ 16:45:02 | Accept join-request                        | DevAddr: 26 0B 8D D3                                                                                                                                                                   |
| ↑ 16:45:02 | Send join-request to cluster-local Jo...   | Selected MAC version: 1.0.2                                                                                                                                                            |