

BUILDING LPWAN SOLUTIONS THAT LAST FOR YEARS

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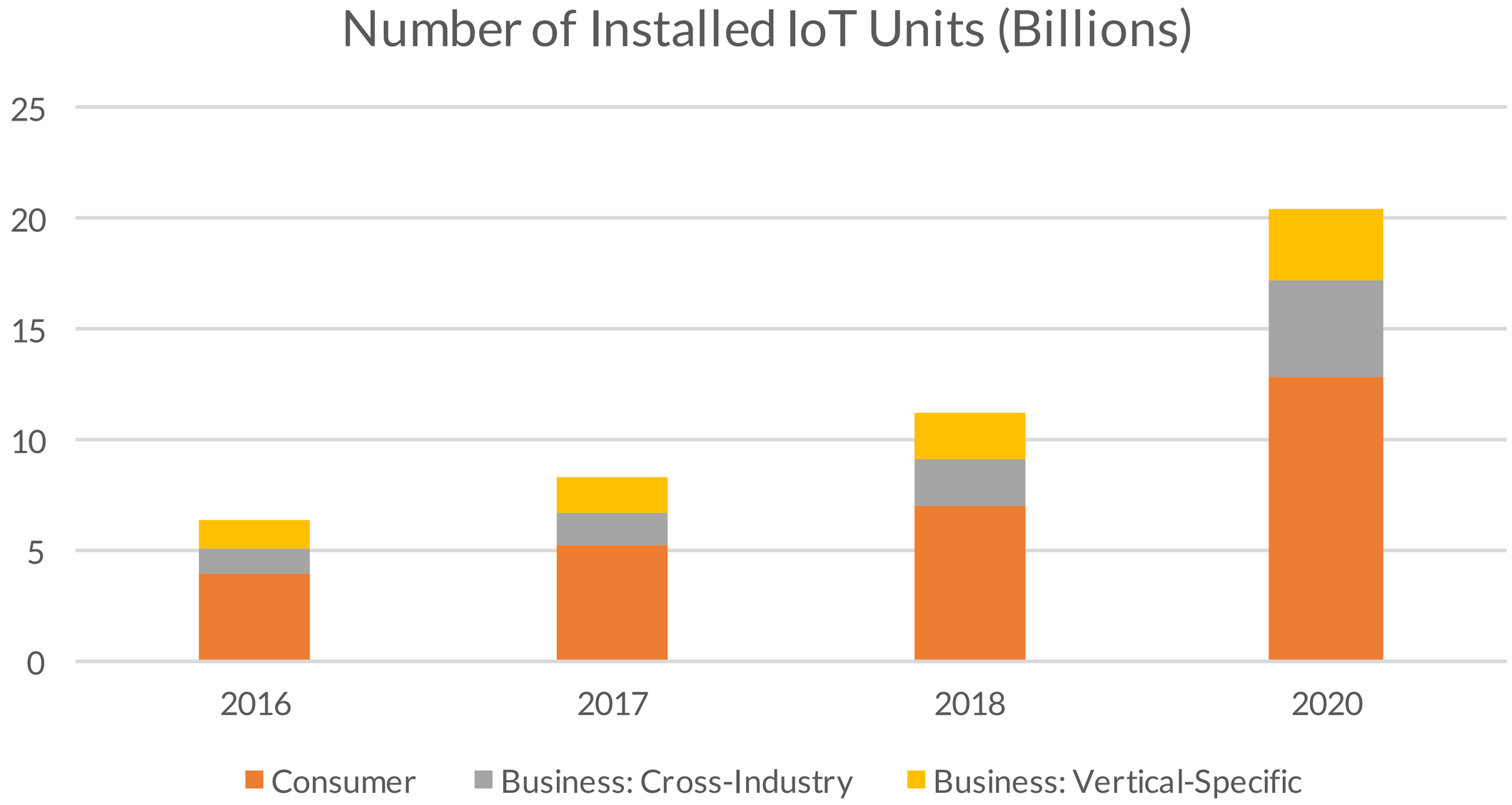
INTERNET OF HUMANS

VS

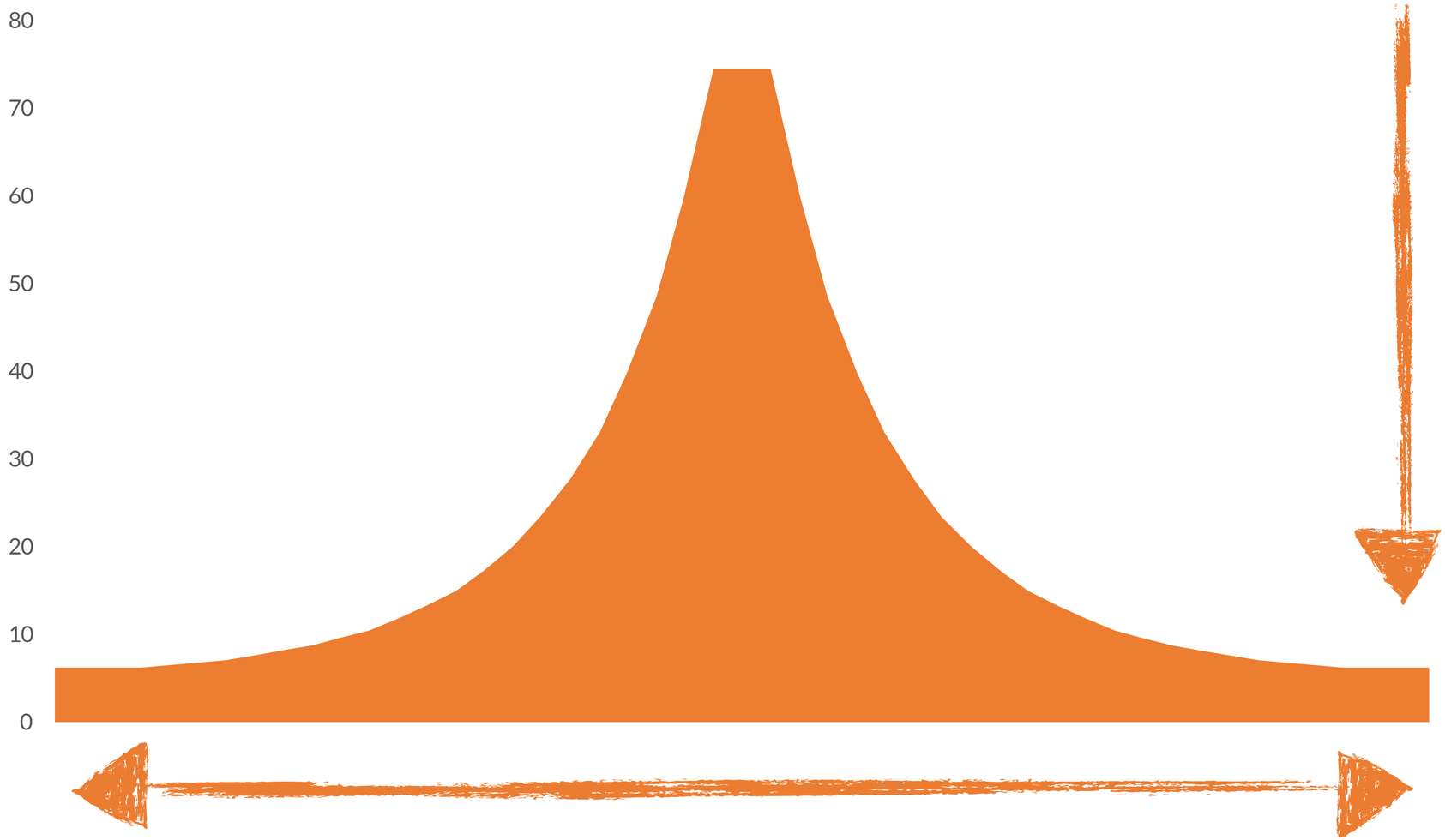
INTERNET OF THINGS

THE THINGS NETWORK

Source: Gartner (January, 2017)



COST AND SCALE

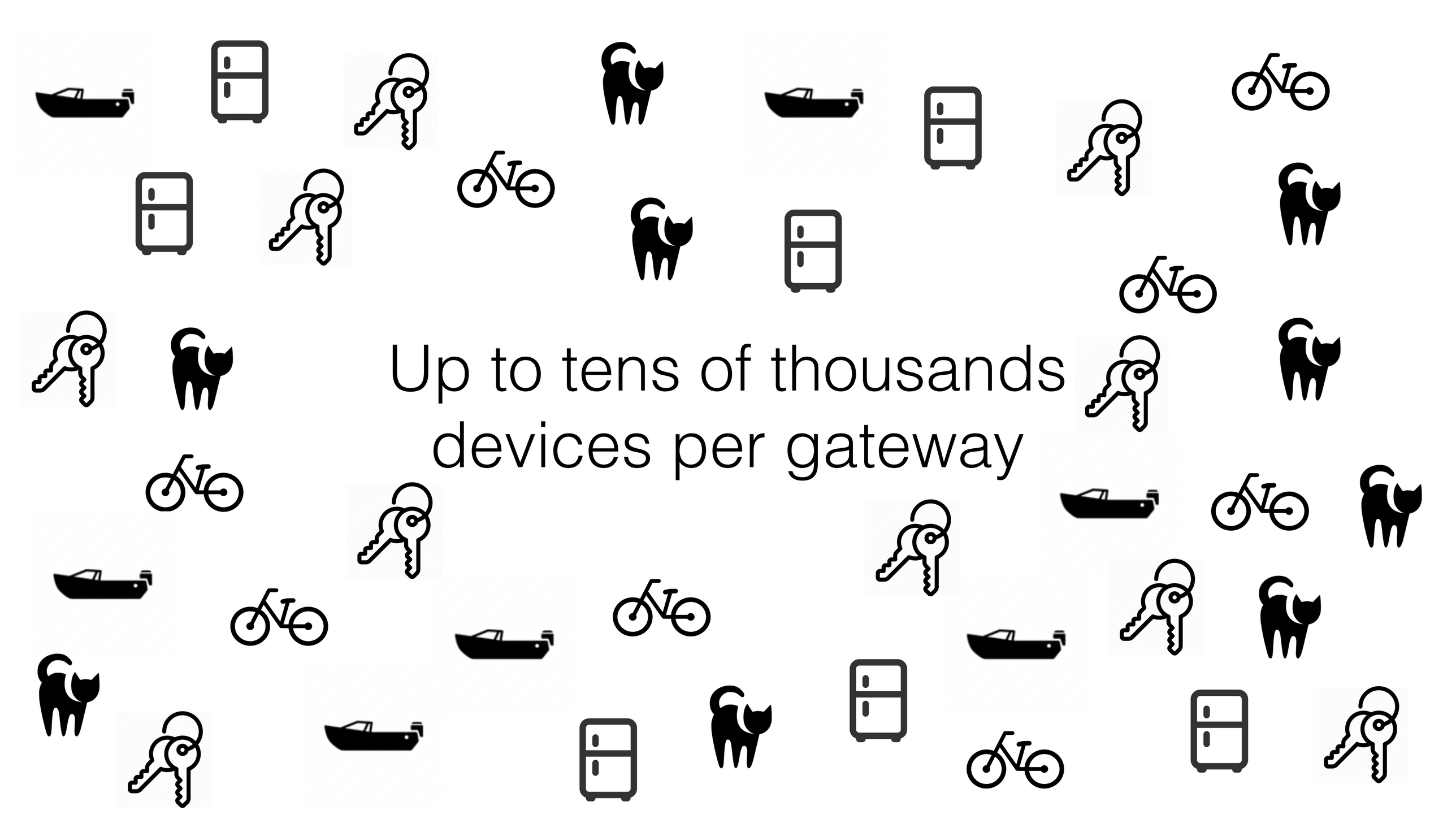


Reduce TCO

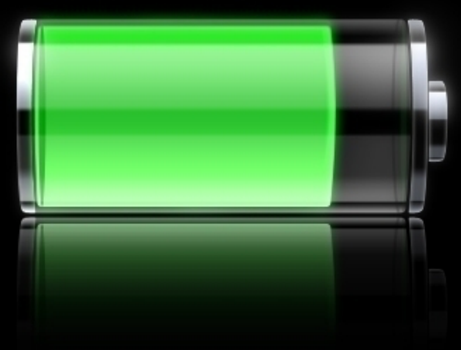
- Design
- Development
- Materials
- Certification
- Distribution
- Commissioning
- Installation
- **Connectivity**
- Maintenance
- Support

THE THINGS NETWORK

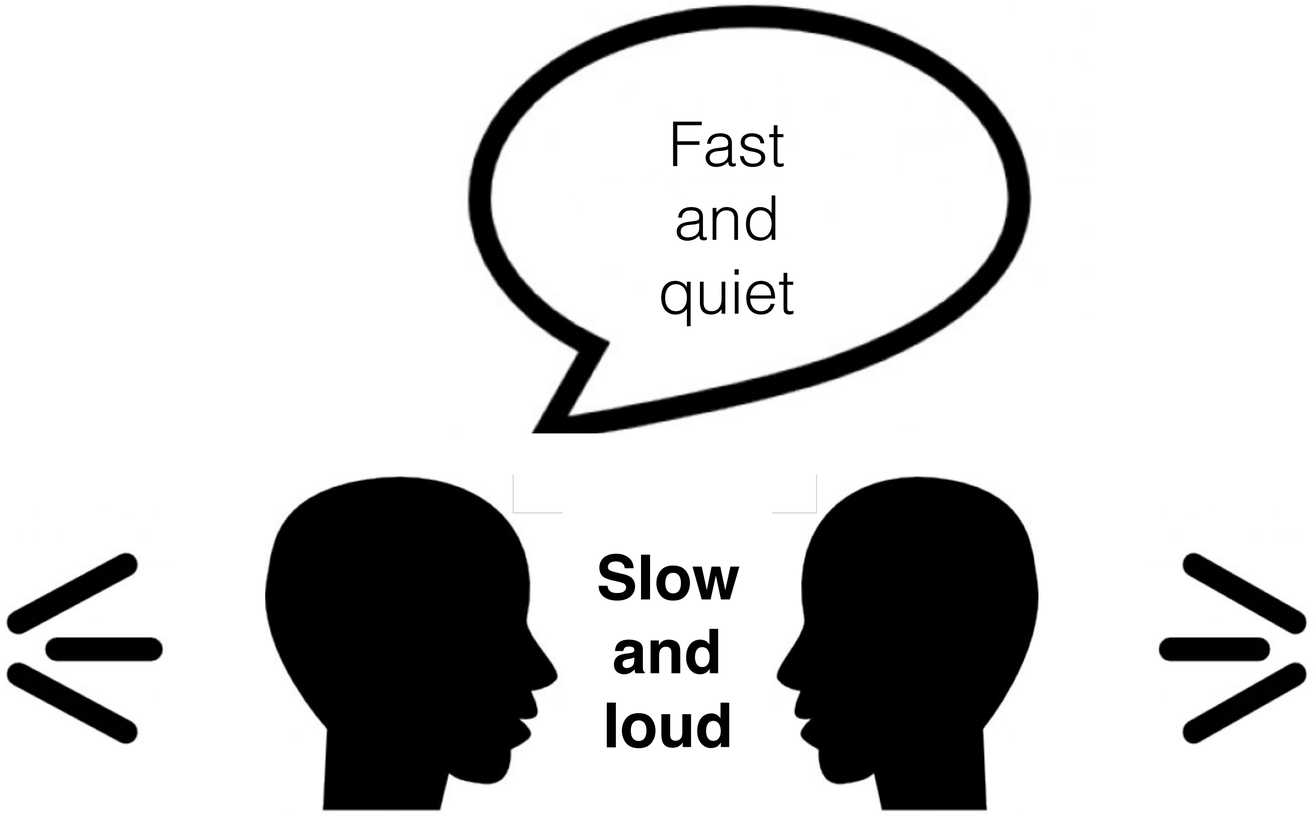

LoRa™


Up to tens of thousands
devices per gateway

Low power and small messages

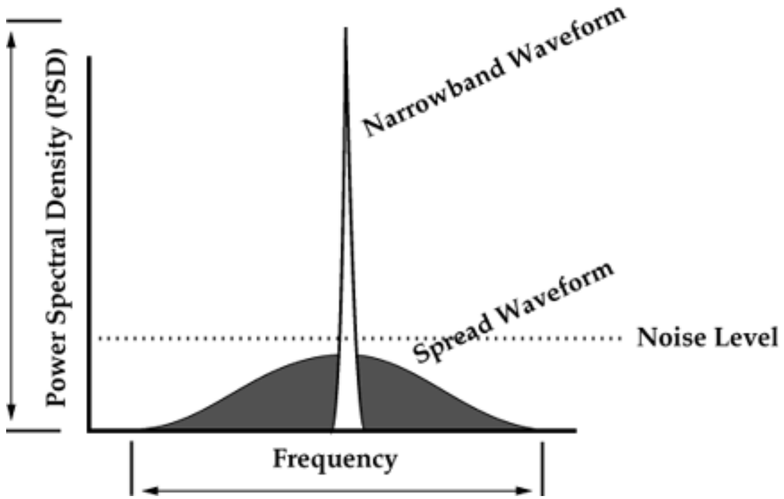


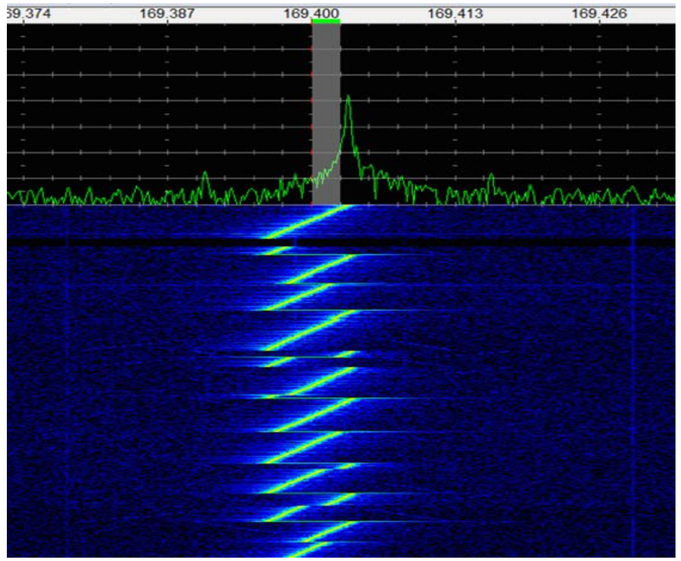
so devices can run on solar panels
for months or years on batteries


Fast
and
quiet
Slow
and
loud

LORA

Spread-spectrum; robust to interference, multipath and fading

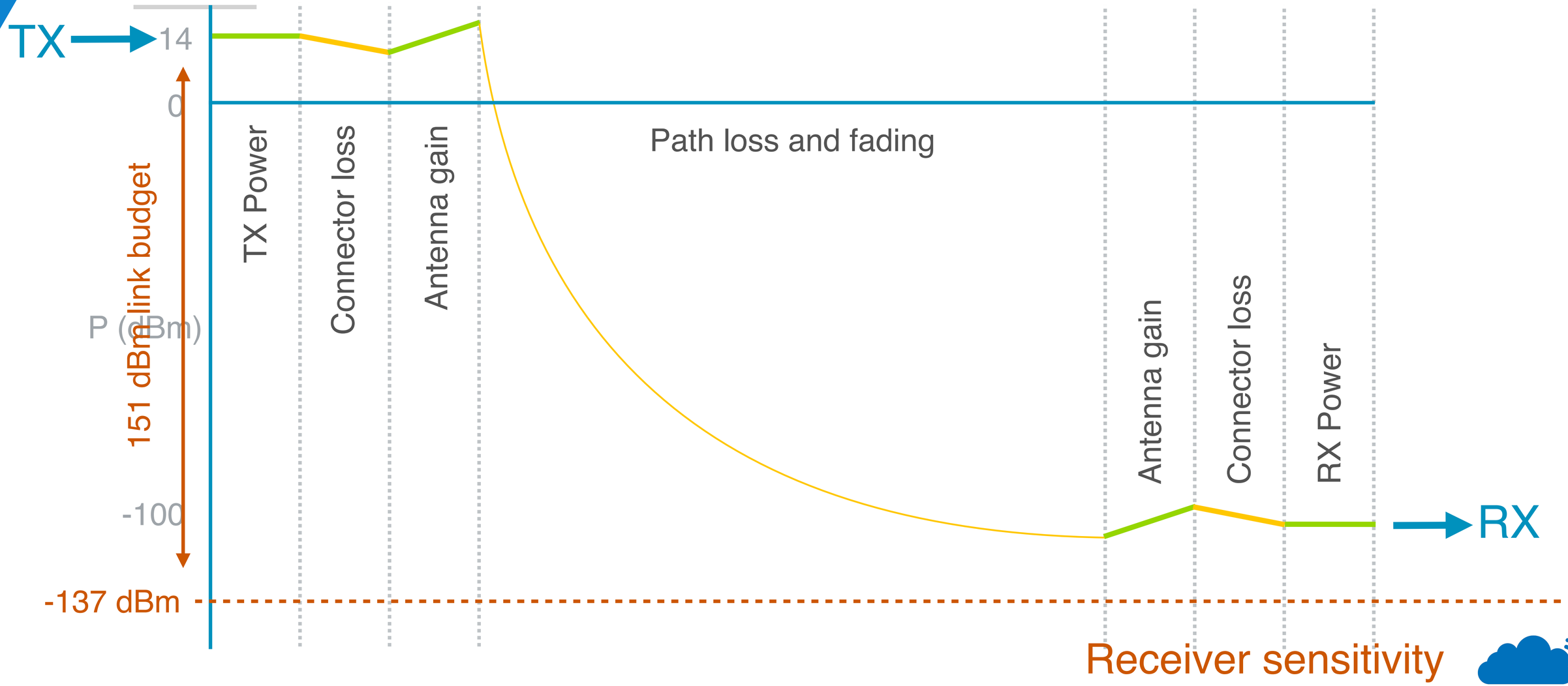




40 BBAA0126 80 D204 2A A50EDB DB2A5FFA

THE THINGS NETWORK

LORA PERFORMANCE



THE THINGS NETWORK

LORA PERFORMANCE

	TX Power	RX Sensitivity	Link budget
Wi-Fi	20.5 dBm	-75 dBm	**95.5 dBm**
Unlicensed LPWAN	14 dBm	-137 dBm	**151 dBm**
Licensed LPWAN	23 dBm	-129 dBm	**152 dBm**

$$FSPL = 20\log_{10}(d) + 20\log_{10}(f) + 20\log_{10}\left(\frac{4\pi}{c}\right) - G_t - G_r$$

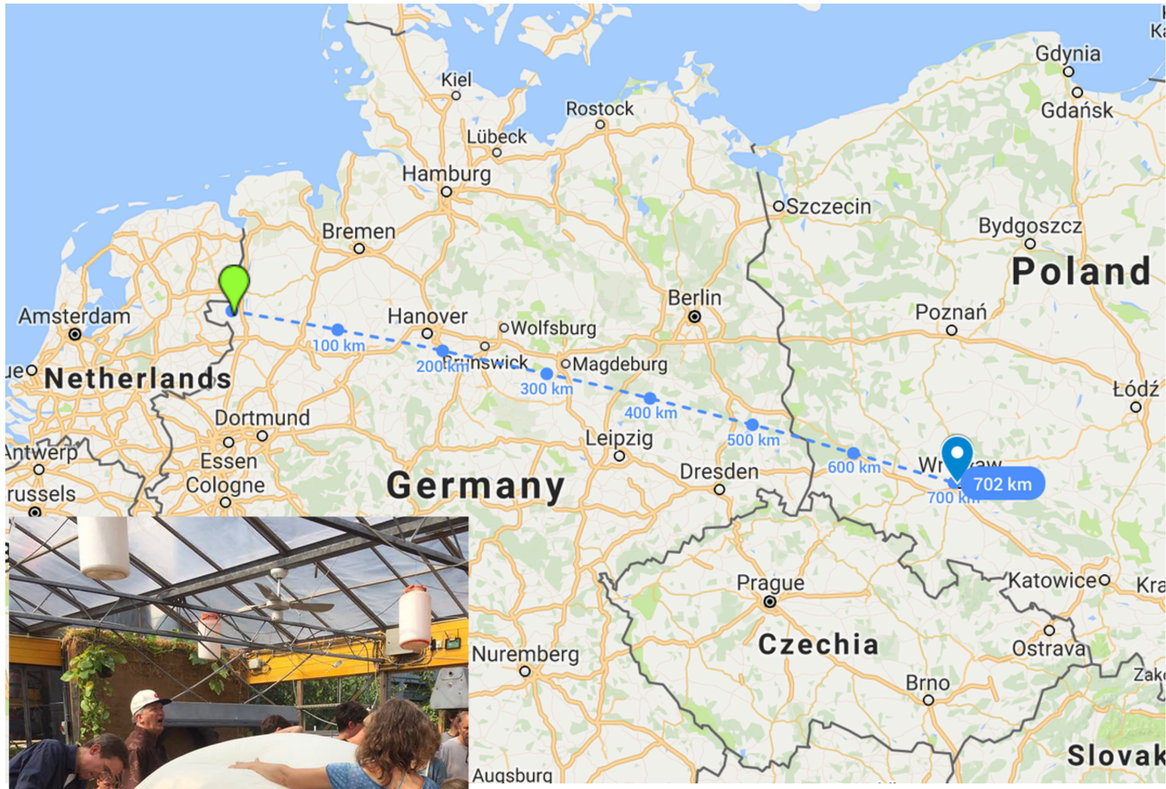
THE THINGS NETWORK

LORA PERFORMANCE

Theoretical maximum in free space is **850 km** (US915 regulations)

Wi-Fi is only **550 meters**

The Things Network Community set the world record: **702 km** using a helium balloon

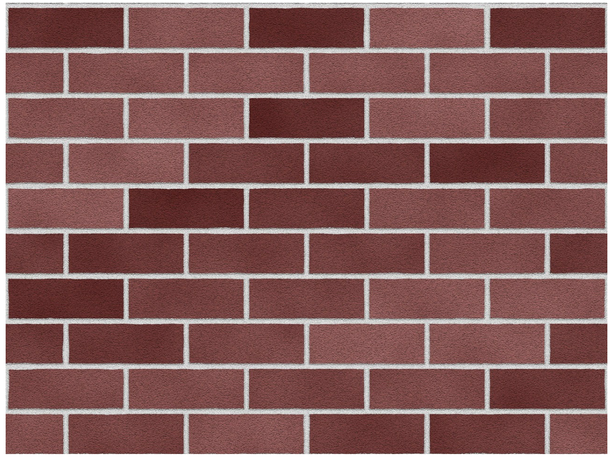




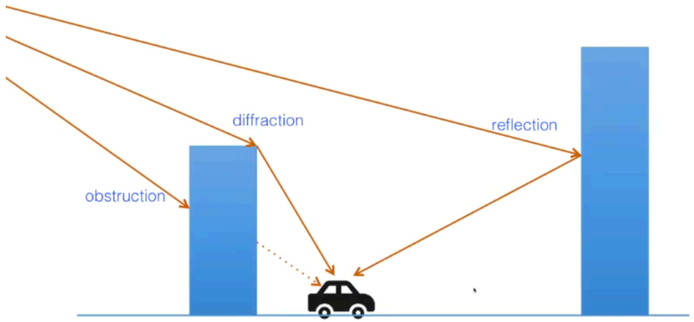


THE THINGS NETWORK

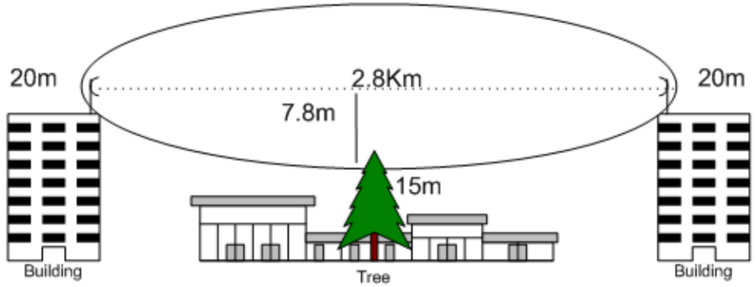
FREE SPACE?



Attenuation



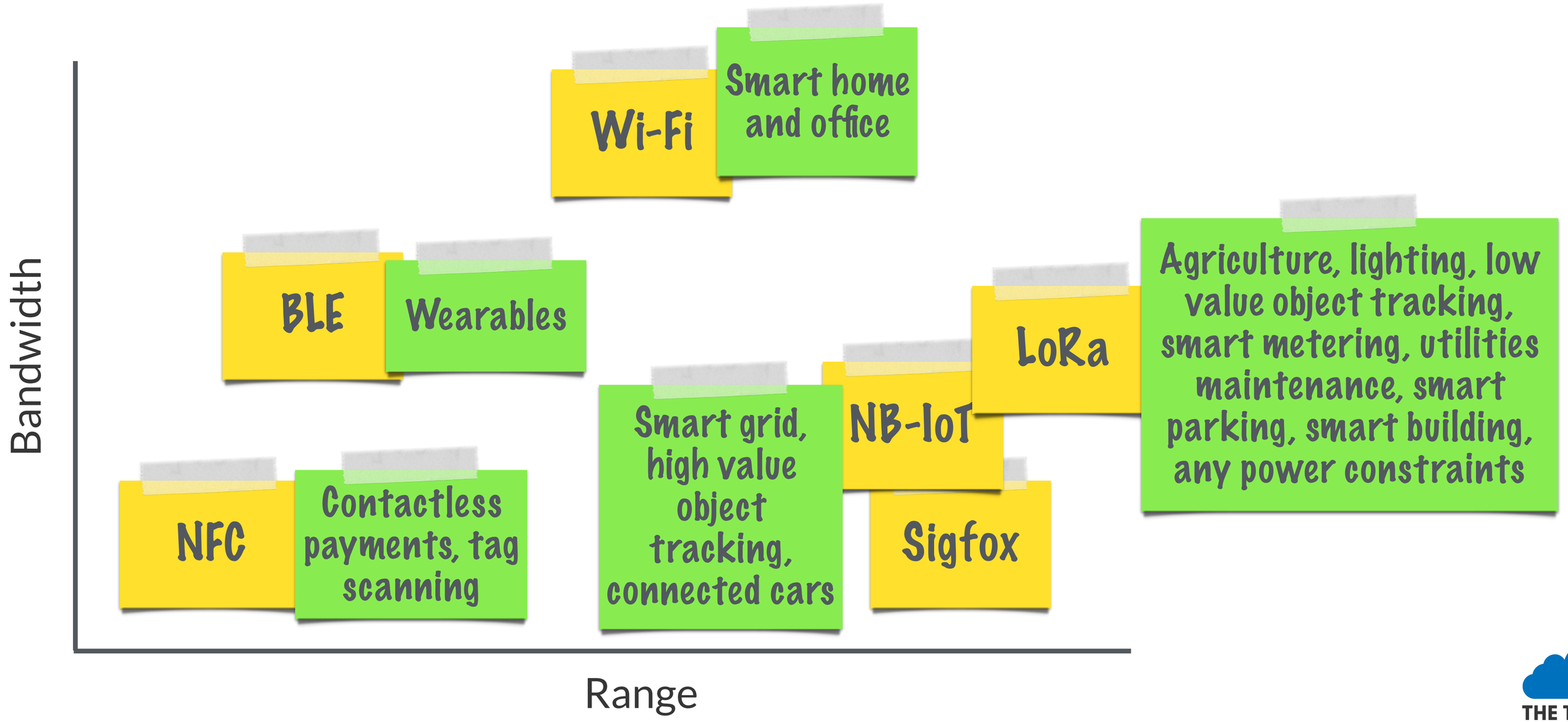
Reflection and diffraction



Fresnel zone

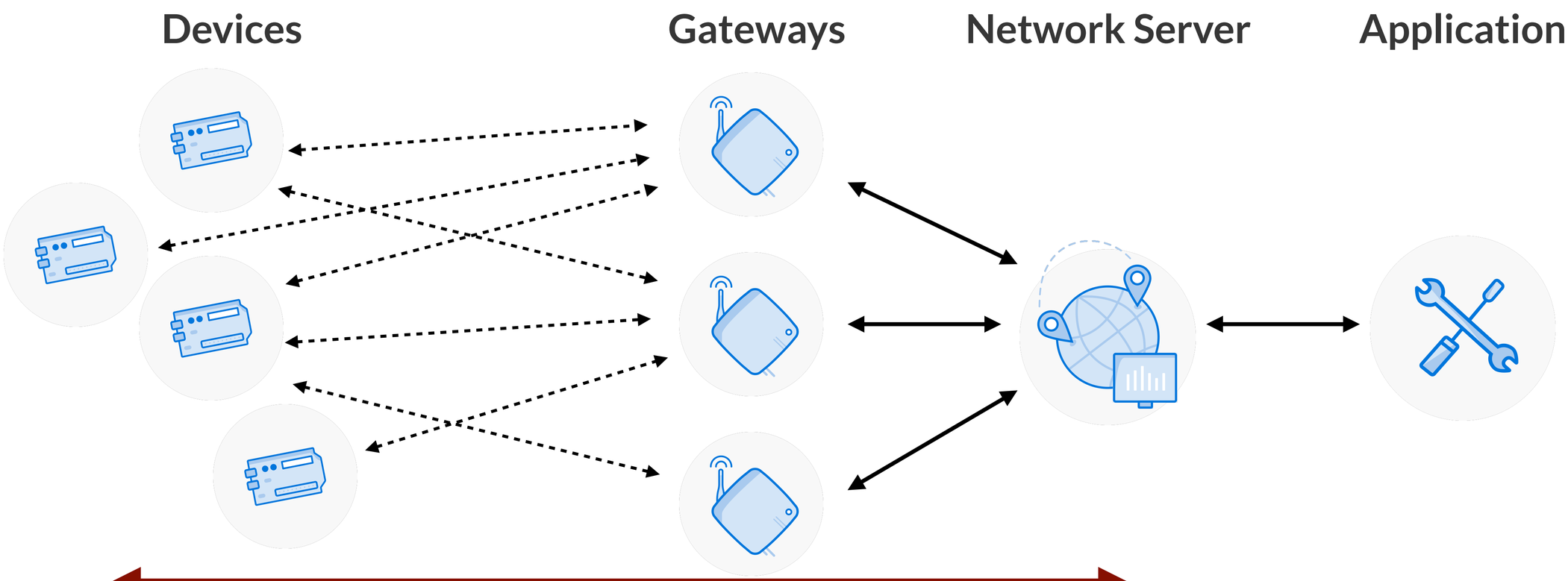
THE THINGS NETWORK

IOT CONNECTIVITY



THE THINGS NETWORK

LORAWAN SESSIONS



Network Session Keys: Message Integrity, MAC commands

Application Session Key: Payload Encryption and Decryption

THE THINGS NETWORK

BACK TO JULY 2015

THE THINGS NETWORK

OUR MISSION
IS TO BUILD
A DECENTRALIZED,
OPEN AND
CROWD SOURCED
IOT DATA NETWORK

OWNED AND OPERATED BY ITS USERS

THE THINGS
NETWORK


Our **mission**
is to build
a **decentralized**
open and
crowd sourced
IoT data network
Owned and operated by it's users


Lipton
Heineken


Port of Amsterdam
BEURS·VAN·BERLAGE
THE SMITHS
rockstart.
We love startups.
waag society
Amsterdam
boven
debalie
TNW
THE NEXT WEB
GLIMWORM
Beacons
trakkies.
Van Gogh Museum
AMSTERDAM-OOST
Deloitte.
peerby
DISRUPTEN
VONRED
Sloten
Diemen
Duivendrecht
Nieuwe Meer
Bosbaanweg
Randwijck
WE SHARE SOLAR
Bijlmermeer
Amsterdam ArenA
KPMG
Nieuwendam
OSDORP
SLOTERVAART
Sloterpark
AMSTERDAM-WEST




vodafone
28%
23:41
donderdag 20 augustus
TTN nu
Uw boot staat onder water!
schuif om te antwoorden



2015
21 AUGUST



2018
21 AUGUST

95
Countries

700
Cities

8 Servers
Which route 6M packets per day

4500 Gateways
Connected to our network

45000 Users
Registerd an account on The Things Network

REDUCING WATER CONSUMPTION



WILDLIFE PROTECTION



GREEN SEA TURTLE TRACKING



SYNCHRONIZING STATION CLOCKS



COLD CHAIN MONITORING



```ino
#include <TheThingsNetwork.h>

const char *appEui = "0000000000000000";
const char *appKey = "00000000000000000000000000000000";

#define loraSerial Serial1
#define debugSerial Serial

TheThingsNetwork ttn(loraSerial, debugSerial, TTN_FP_EU868);

void setup()
{
  loraSerial.begin(57600);
  debugSerial.begin(9600);

  ttn.join(appEui, appKey);
  ttn.showStatus();
}

void loop()
{
  float temp = analogRead(1);
  int16_t temp100 = temp * 100;

  byte payload[2];
  payload[0] = temp100 >> 8;
  payload[1] = temp100 & 0×ff;

  ttn.sendBytes(payload, sizeof(payload));

  delay(10000);
}
```



25,42 °C ⇒ 0×09EE




```
function Decoder(payload) {
  var temp100;
  if (payload[0] & 0×80) {
    temp100 = (0×ffff << 16) | (payload[0] << 8) | payload[1];
  } else {
    temp100 = (payload[0] << 8) | payload[1];
  }
  return {
    temperature: temp100 / 100
  }
}
```

0×09EE ⟹ 25,42 °C

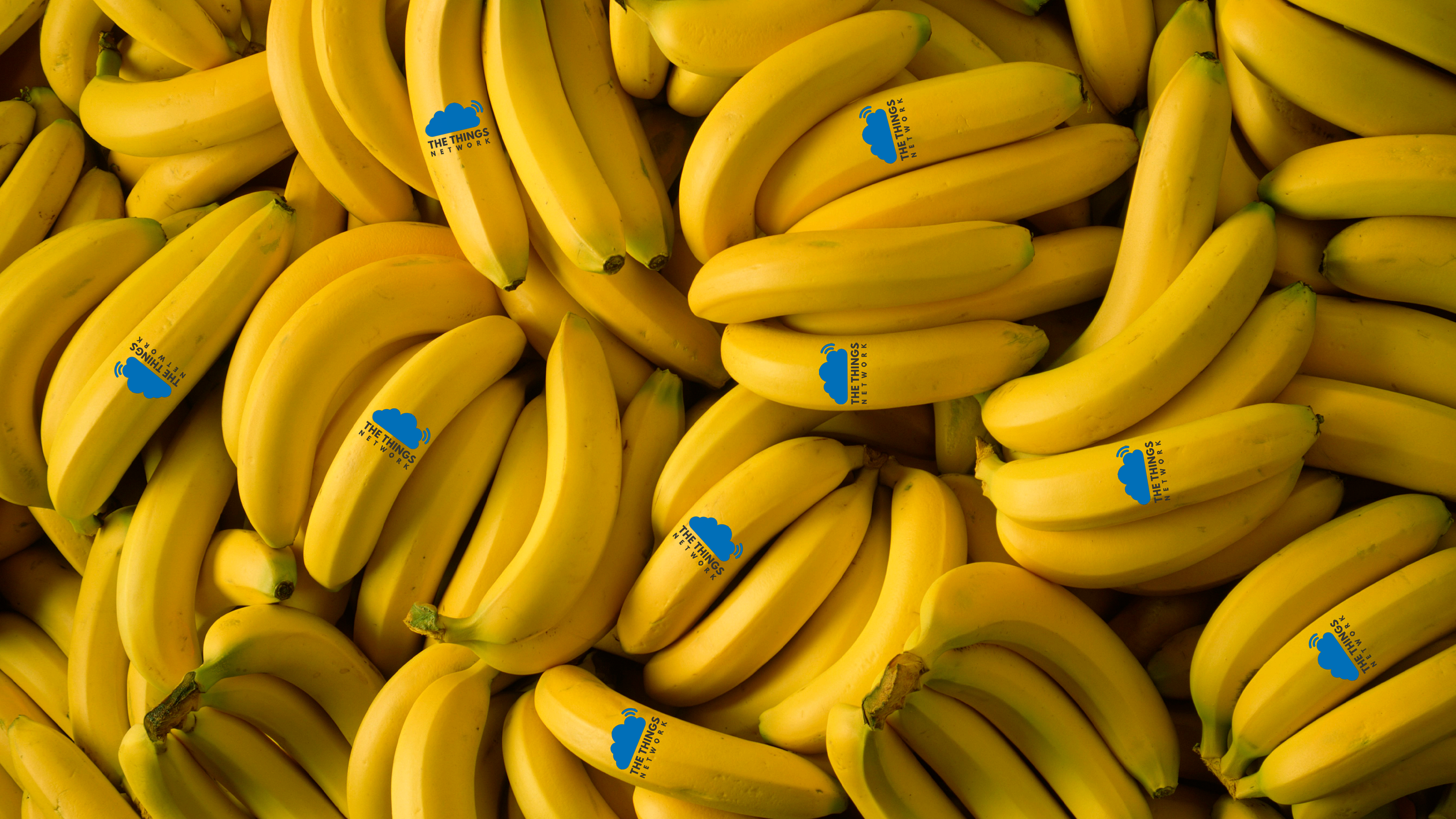


```
var ttn = require("dist")

var appID = "foo"
var accessKey = "ttn-account-v2.eiPq8mEeYRL_PNBZsOpPy-O3ABJXYWulODmQGR5PZzg"

ttn.data(appID, accessKey)
  .then(function (client) {
    client.on("uplink", function (devID, payload) {
      console.log("uplink from ", devID)
      console.log(payload)
    })
  })
  .catch(function (error) {
    console.error("whoops", error)
    process.exit(1)
  })
```

{ “temperature”: 25.42 }


THE THINGS NETWORK


Jaffa
NV Machinefabriek „Jaffa" Utrecht
EYFFES
BANANEN
E. J. STOKKING
DOORN



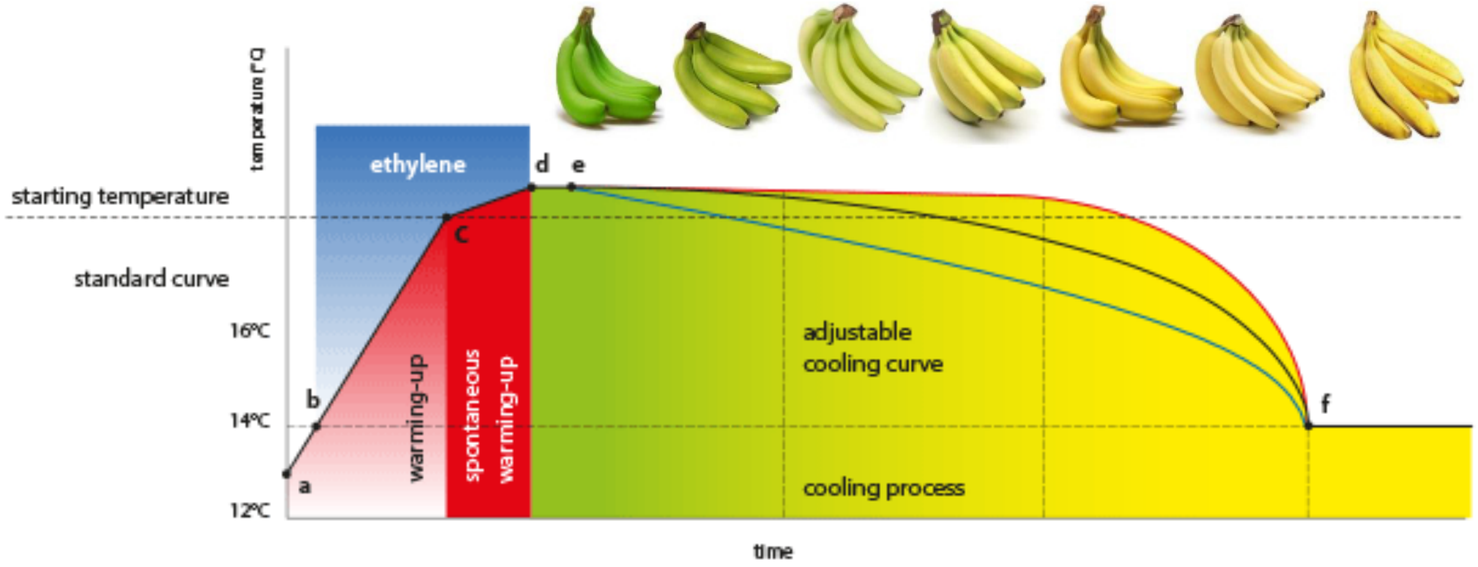

CHIQUITA NEDERLAND
THE THINGS NETWORK
Chiquita

REGULATED CHAIN

3–4 weeks between harvesting and consumption

Very **delicate** product: maturity and shape when harvesting, and bruises and ripening during transportation

Ripening is between 4 days (17,8 °C) to 8 days (14,5 °C) with ethylene gas




CHIQUITA NEDERLAND
THE THINGS NETWORK
Chiquita

CONNECTED CHAIN

Banana Ripening App

The Things Network: public and private

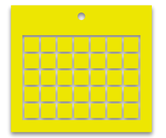
Control temperature, humidity and ethylene gas throughout the chain

LoRaWAN™











Farm	Ship	Transport	Storage	Shop
Private + Public	Private offline or satellite	Private pico + Public	Private	Private

THE THINGS NETWORK

CHOOSE YOUR DEPLOYMENT

Public Networks

- **Operator networks**



- **Collaborative networks**



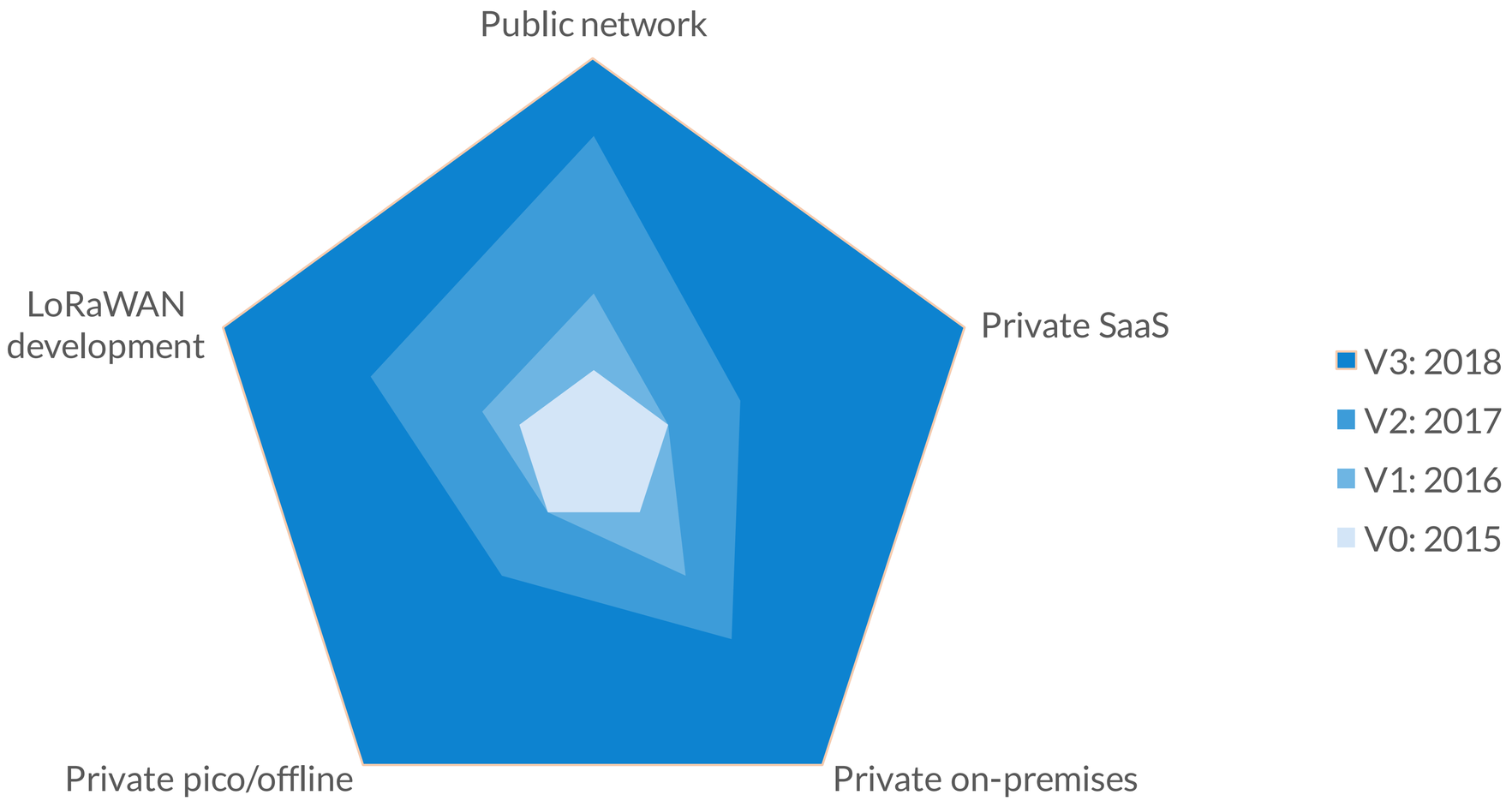
Private Networks

- **Hosted**
  The Things Industries V3 SaaS
- **Private Cloud**: AWS, Azure, GCP, etc
  The Things Industries V3 Private Cloud
- **Images**: Docker, VMware, OpenStack, binaries, etc
  The Things Industries V3 Images
- **Development**
  The Things Network V3 Stack for LoRaWAN

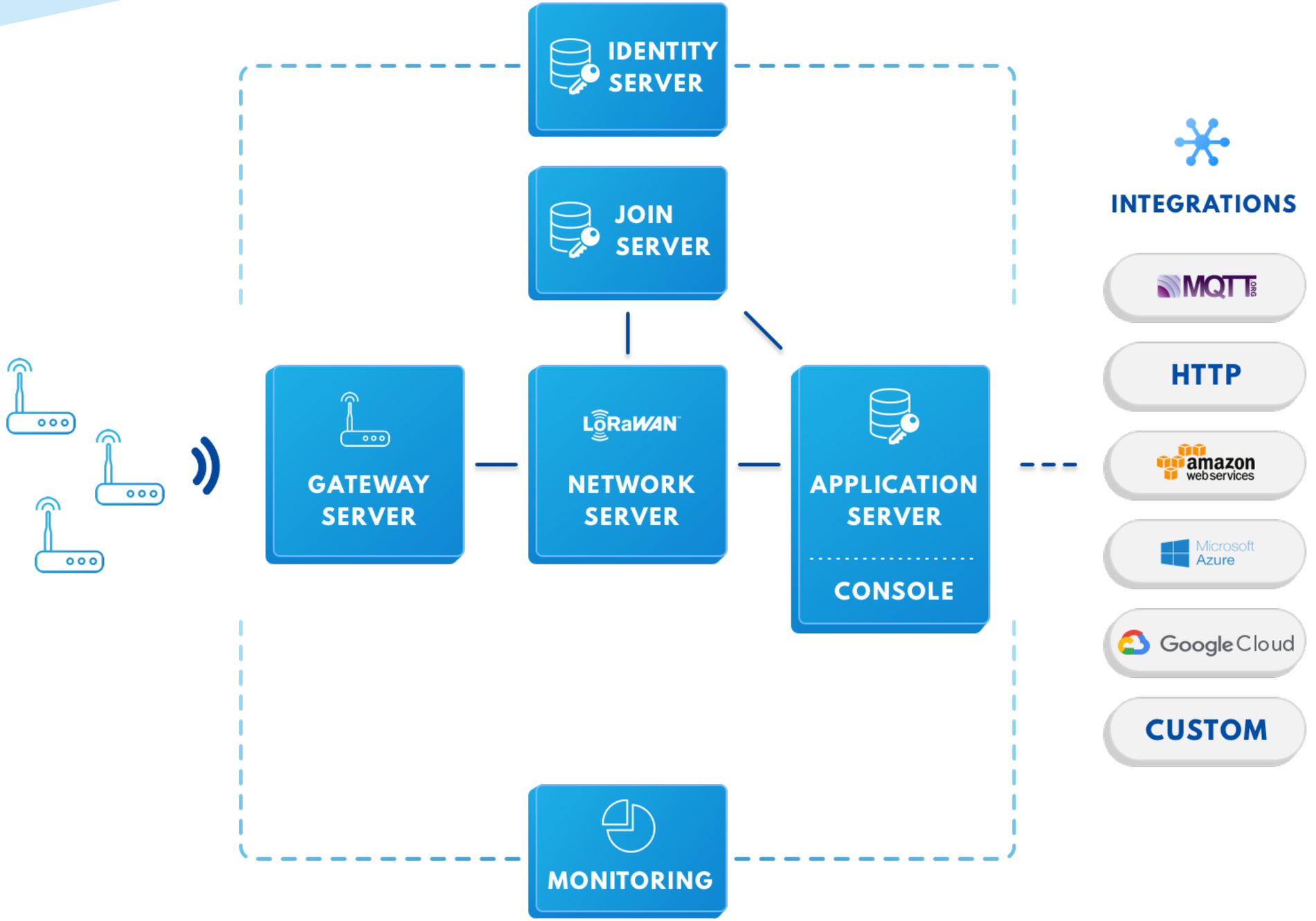




THE THINGS NETWORK STACK V3



THE THINGS NETWORK


IDENTITY SERVER
JOIN SERVER
GATEWAY SERVER
LoRaWAN
NETWORK SERVER
APPLICATION SERVER
CONSOLE
MONITORING
INTEGRATIONS
MQTT
HTTP
amazon web services
Microsoft Azure
Google Cloud
CUSTOM

V3 PUBLIC COMMUNITY NETWORK

The Things Network Foundation

🇪🇺 🇺🇸 🇧🇷 🇸🇬

Open Network Infrastructure Association

🇨🇭

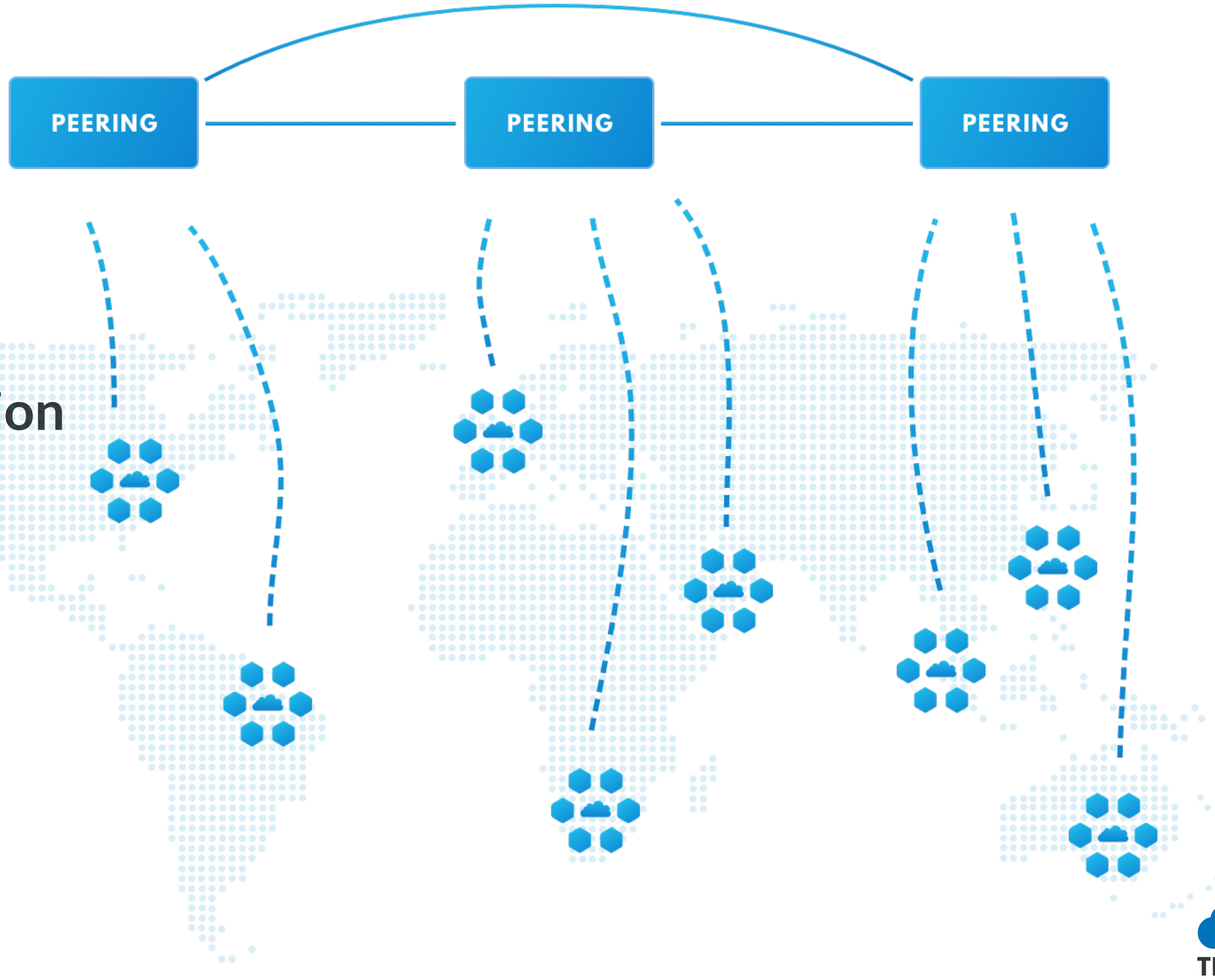
In progress or RFP

Meshed

🇬🇧 🇿🇦 🇯🇵 🇨🇳

🇦🇺

🇷🇺 🇮🇳 🇺🇸 🇪🇺



THE THINGS NETWORK

MANAGER

ABOUT THIS COMMUNITY

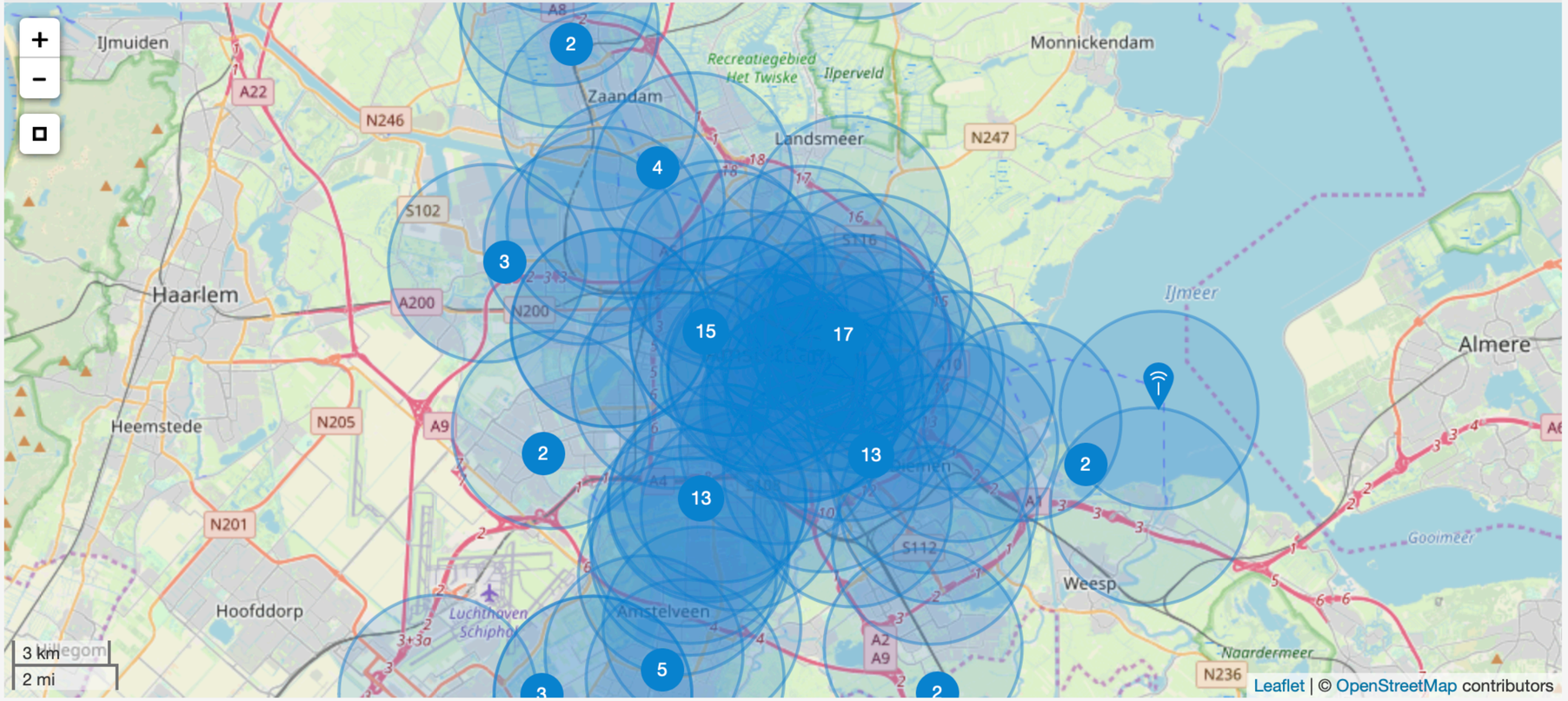
68	145	✓
Gateways	Contributors	Official community

And 142 contributors.

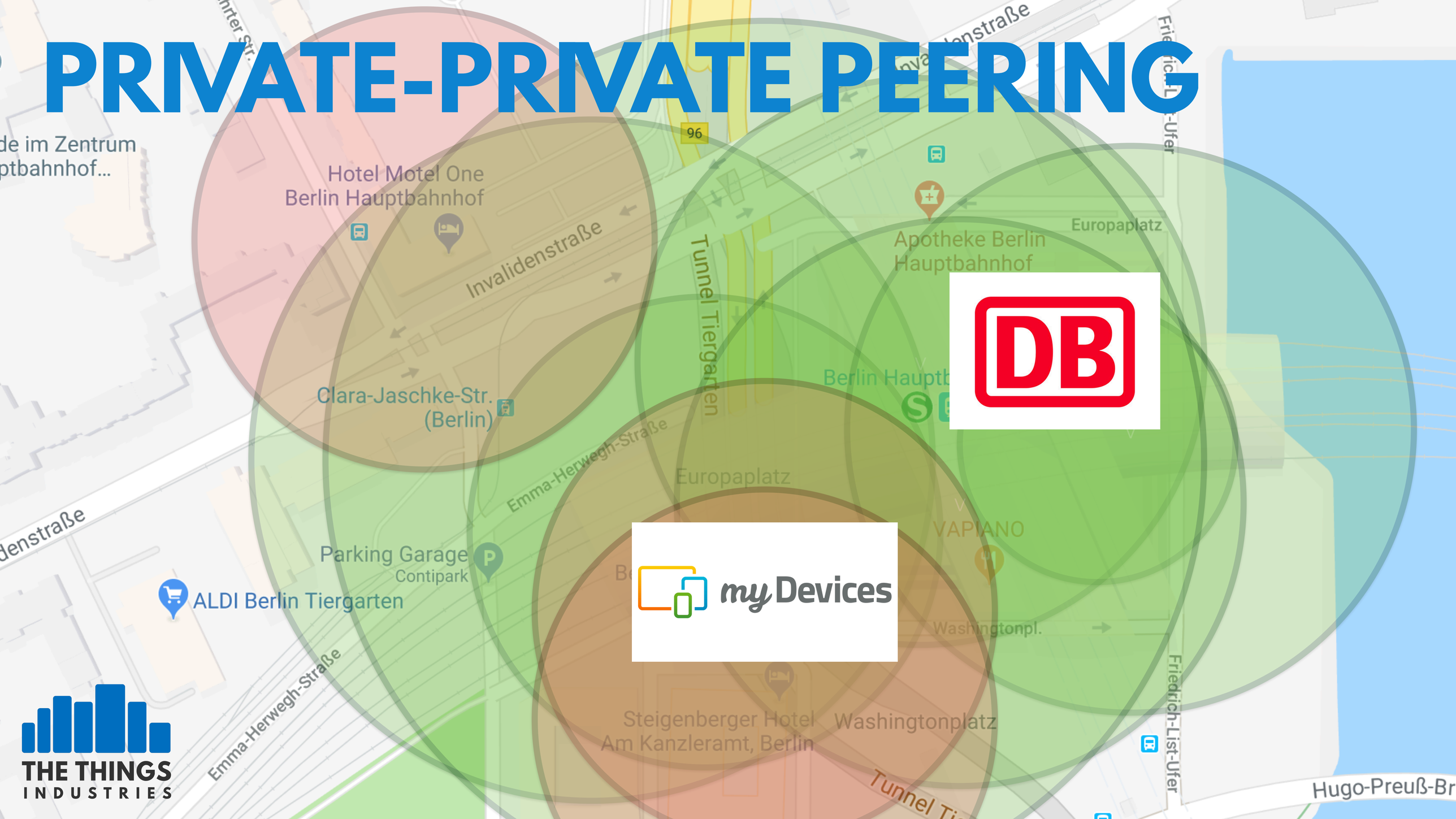
SHOW ALL

GATEWAYS

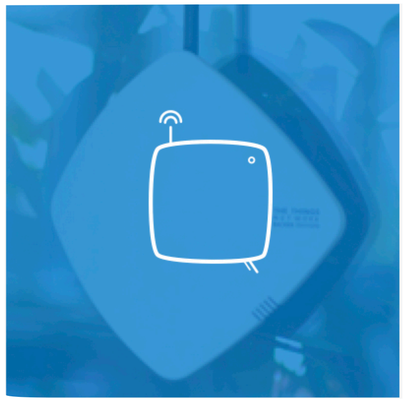
Add a gateway



PRIVATE-PRIVATE PEERING



YOU ARE THE NETWORK









THE THINGS
NETWORK

GET STARTED NOW



THE THINGS NETWORK