LoRaWAN and city infrastructure

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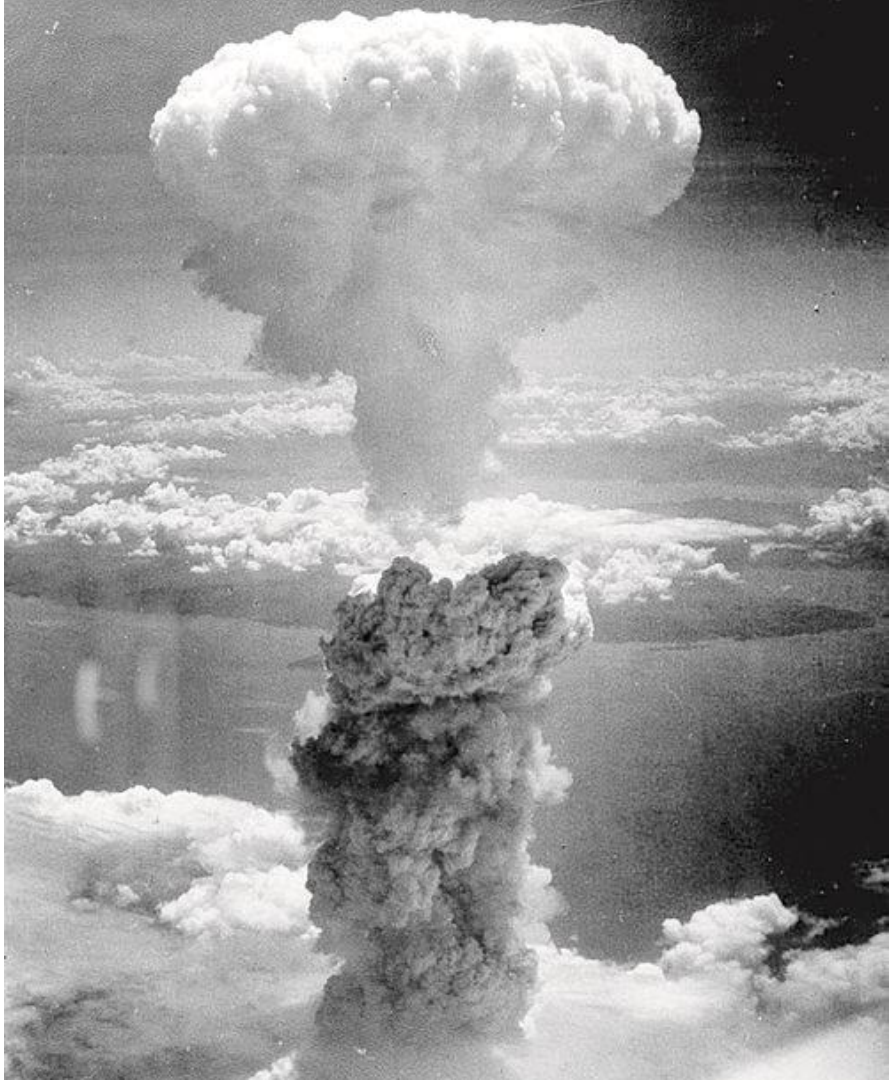
The IoT

- Billions of devices, large areas of interest, low power
- The IoT Mushroom Cloud
- The “I” and the “T”



The "Things"

Autonomy

Reliability

Use-case

Cost

The “Internet”

Infrastructure
was not built for that

Protocols
were not built for that

Do you really need it?

Network Infrastructure

- Built for population coverage
- Public infrastructure sits in low density areas

Water facilities | Garbage treatment | Natural resources

Agriculture | Wildlife

Low Power Wide Area Networks

- NOT "internet"
- Broadcast systems
- Proprietary technologies
- Open or Proprietary communication protocols

Just pick up one and give it a go.

LoRaWAN

LPWAN as a new radio alternative

- Redesign your “things”!
- Rewrite your App Software
- Rethink your Use Cases

LoRaWAN

LPWANs are not the tool to give long range capabilities to existing products

LPWAN as Infrastructure

LPWANs are Infrastructure technologies and should be treated as such.

- Design ahead
- Long term support schemes
- Future proof deployment
- Avoid tailored deployment
- Keep an eye on the technology

Social aspects | Policies | Management | Infrastructure | Services

LPWANs as the new kid on the block

- non-LPWAN technologies have dealt with smaller scale deployments and are designed as "connectivity solutions"
  - State the problem
  - Design the solution
  - Pick the correct connectivity solution
    - ...or go hybrid
- LPWANs deal with the same connectivity issue but from the point of infrastructure
  - LPWAN technologies are not there to replace existing ones. Use With Care!

LPWAN as Infrastructure

Go back to the 1800s and built a train track for anyone who needs to transport goods.

PERFECT, YOU JUST KILLED THE TRAIN!

The LoRa Modulation

In theory communication can reach hundreds of kilometers

In practice ... it actually does!

In production

Rural areas ~20km | Low density urban areas ~10Km | High density urban areas ~2Km

Ok, what's the catch?

ISM regulations

Spray and pray

Low Data Rates

The LoRa Alliance

Semtech's approach to come up with an industry standard

Focus on the need for a protocol that will unlock the ability to deploy LoRa as infrastructure based on the success of previous open standards

- LoRaWAN Specs 1.1 is publicly available!
- Official software stack on Semtech's GitHub!

ARM IBM kpn cisco

Actility orange Google

THE THINGS
NETWORK

THE THINGS NETWORK

- A free global IoT Network based on LoRaWan - Infrastructure for IoT
- A decentralized open and crowd sourced IoT data network owned and operated by its users

- TTN Manifesto

"**We believe that this power should not be restricted to a few people, companies or nations. Instead this should be distributed over as many people as possible without the possibility to be taken away by anyone.**"

- TTN is a contributor member of the LoRa Alliance

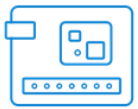
137
countries

6977
gateways

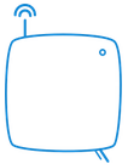
67541
members

Building Blocks

Devices

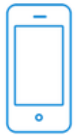


Gateways

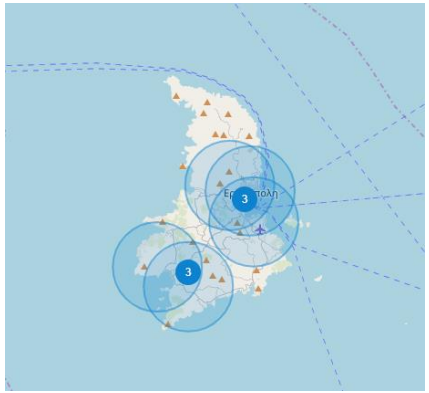


Network

Applications



The Things Network Syros



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Gateways

20

Contributors

08/16

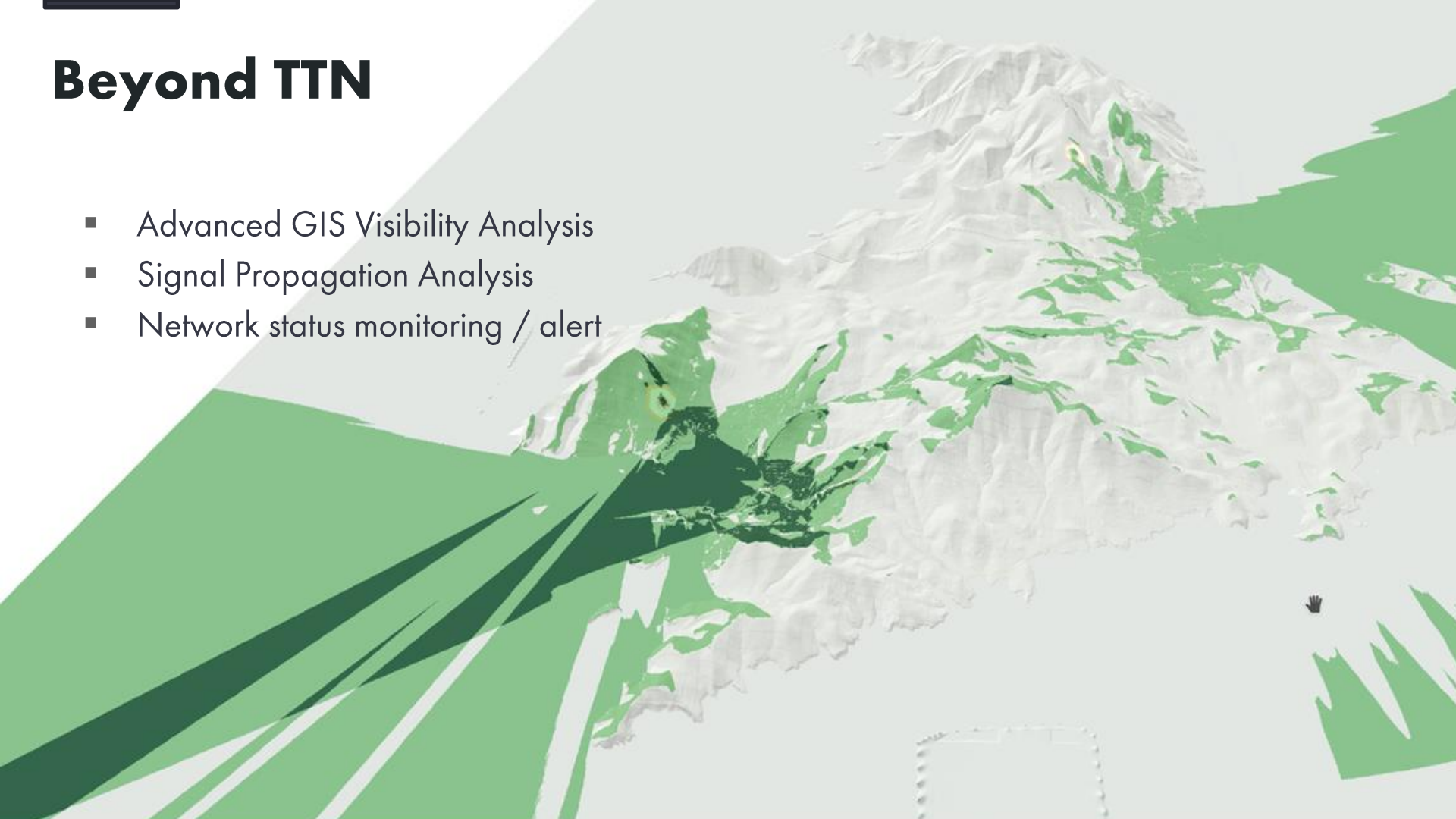
Founded

The beginning

- Back to spring 2016
- The 1st gateway for personal development
- Engage the academic community and friends / early adopters
- 4 gateways on August 2016
- Coverage tests with extraordinary results
  - 50km radius
  - Tinos, Mykonos, Paros, Antiparos, Serifos, Kythnos
- TTN Syros Official Community
- Improve DIY Gateways with more robust implementations
- Set up monitoring mechanism for the infrastructure

Beyond TTN

- Advanced GIS Visibility Analysis
- Signal Propagation Analysis
- Network status monitoring / alert

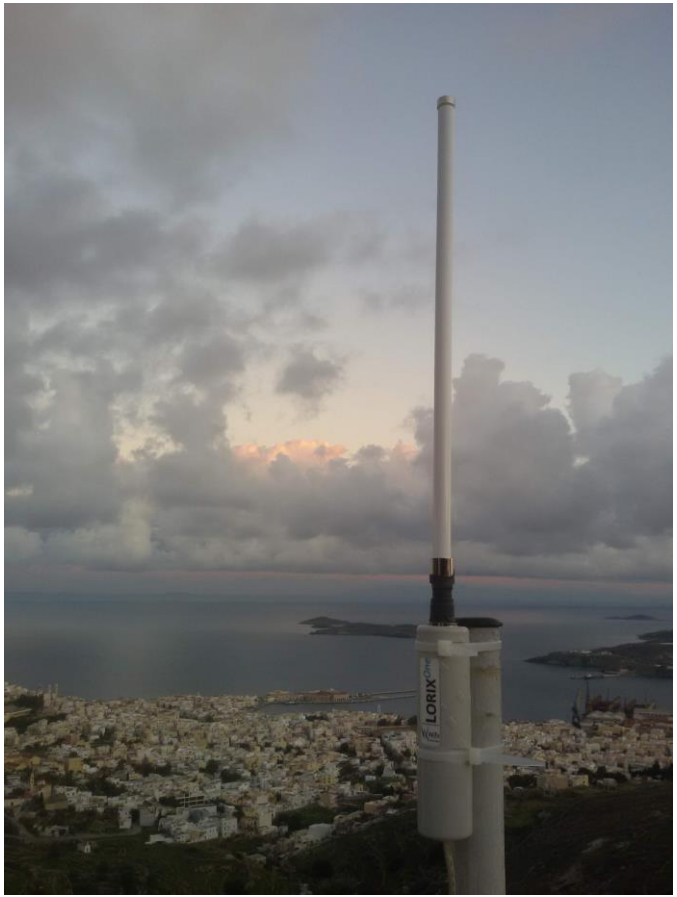


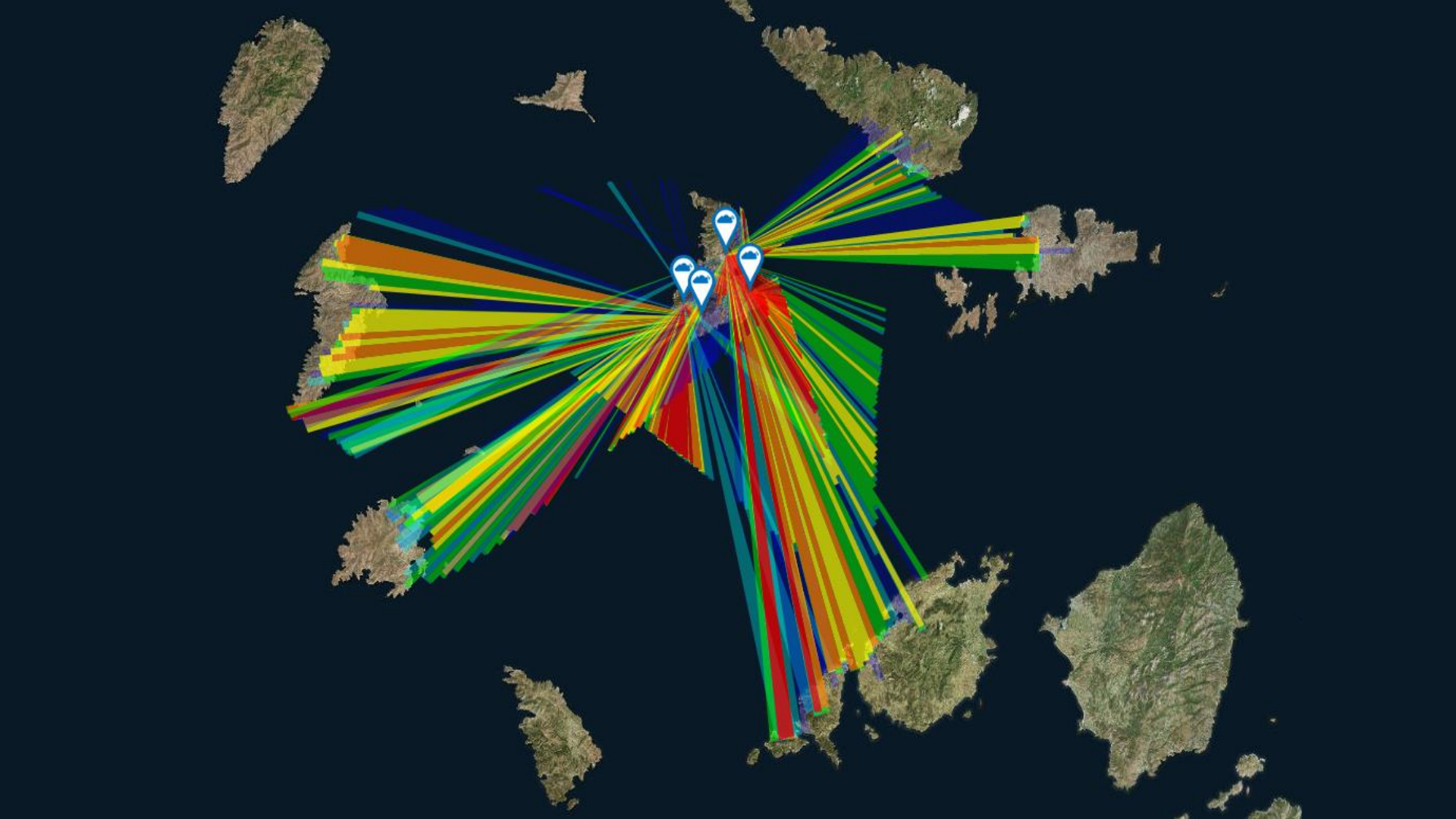
What we do

Island hopping
Penetration trials
Indoor Coverage
Mobile trials
Extreme weather conditions

The hardware | Devices & Gateways

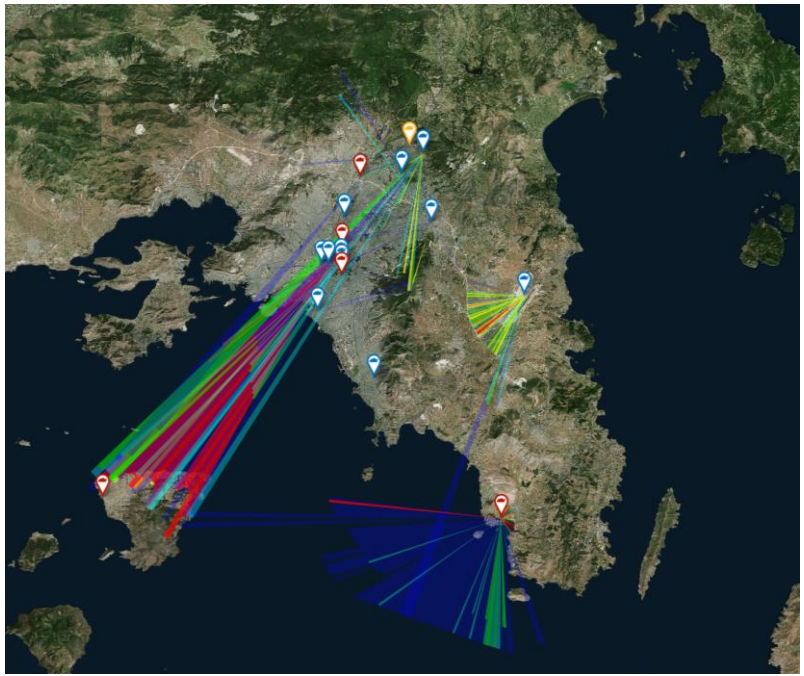
Building the infrastructure

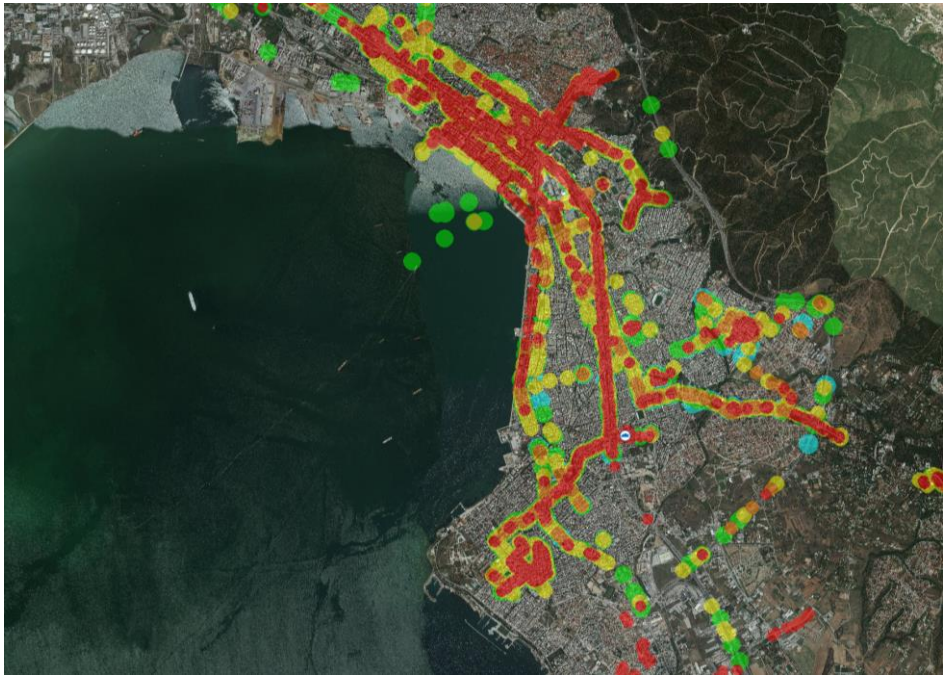




A closer look

Beyond islands





Building the human network

- Communication with local enterprises
- GPS trackers to hikers and hunters
- Geofencing trials for kayaks
- 3D print cases for devices
- Brainstorming and small private projects (agriculture, water management)
- Collaboration with public organisations is difficult without a legal entity
- An interesting community funded project

Syros AirMon | the motivation

- Find a matter that will drive the community
  - Health and wellbeing
- Public Funding
  - More than 20 people and local businesses microfunded
- Publicly available visualization and data
- Engage Local non-techies
  - 15+ volunteers
  - 6 hosts of gateways and sensors
  - 200 facebook users following the data

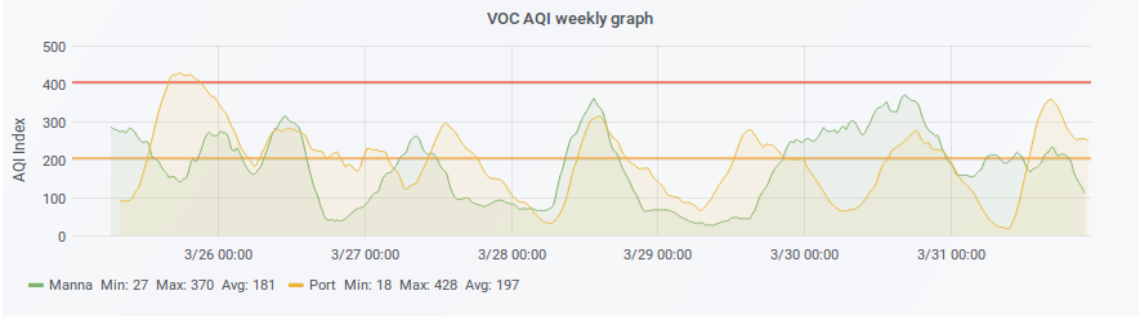
Syros AirMon | the tools

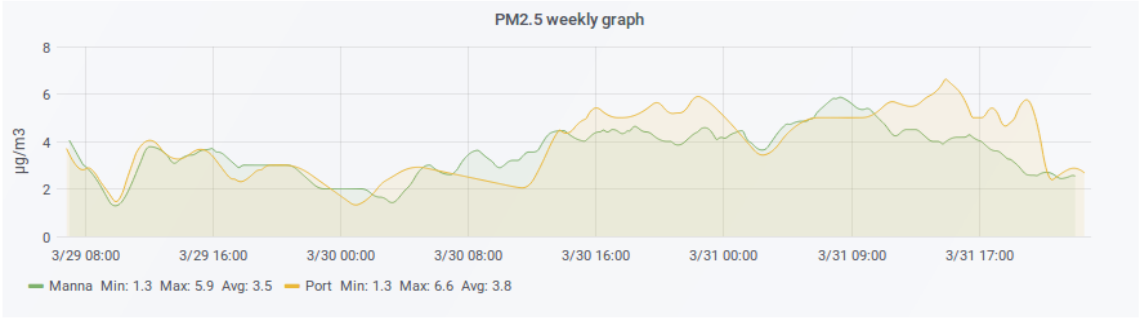
- 4 devices for environmental monitoring
  - Temperature, Pressure, Humidity
  - CO2, PMs, VOCs etc
- Backed by a Worldwide Air Monitoring Project
- Supporting Backend
  - Databases
  - Monitoring tools

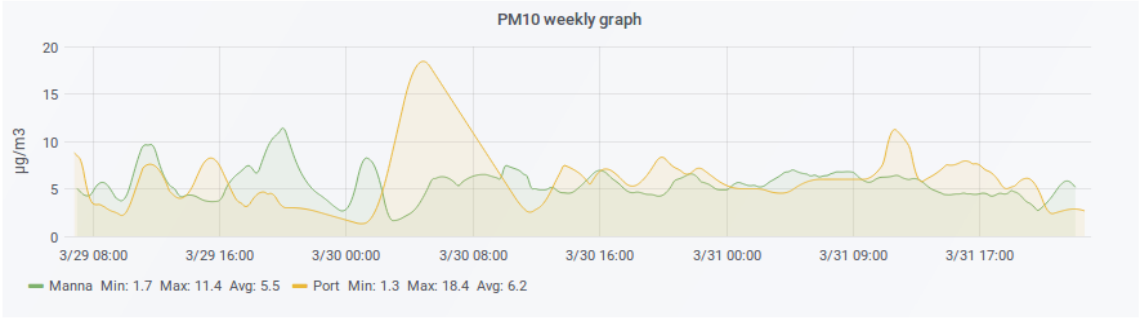
Syros AirMon | the vision

- Extend the coverage with 10-20 outdoor devices
- Engage local authorities
  - Deploy to schools and public buildings
- Educational workshop for the development of mobile devices
  - OpenLab
  - University of the Aegean
- 2 Dissertation theses
  - University of the Aegean
  - University of Thessaly
- Data management plan
  - Make use of the data
  - Data beyond graphs

25-31/3/2019 Weekly measurements







Knowledge Sharing & Collaboration

"Making Sense of the Data: Air Quality Index (AQI) "
https://bit.ly/2UvjsZH

"Particulate Matter (PM) Concentrations: Making Sense of the Data"
https://bit.ly/2CYxNEa

Challenges & Vision

- Grow the network, not the application
  - Full city coverage
  - Deploy more gateways
  - Expand to nearby cities
- Reliable Network Operation
- Grow the community
  - Engage the educational community
  - More community based projects
- Sustainability plan
- Greek cities as LPWAN testbed

Thank you!