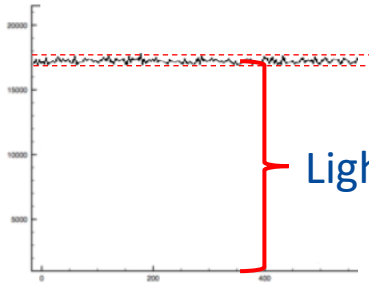
LiFi Optical Communications for the 5G/6G Era

25.05.2022

LiFi uses light to transmit data

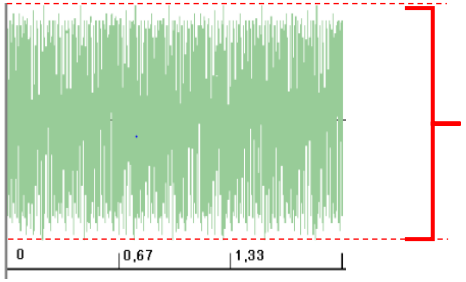
Visible and infrared light is used



Data Signal

Light intensity

Visible Light



Data Signal

Infrared Light

Challenges of radio based data transmission

Congested and crowded areas

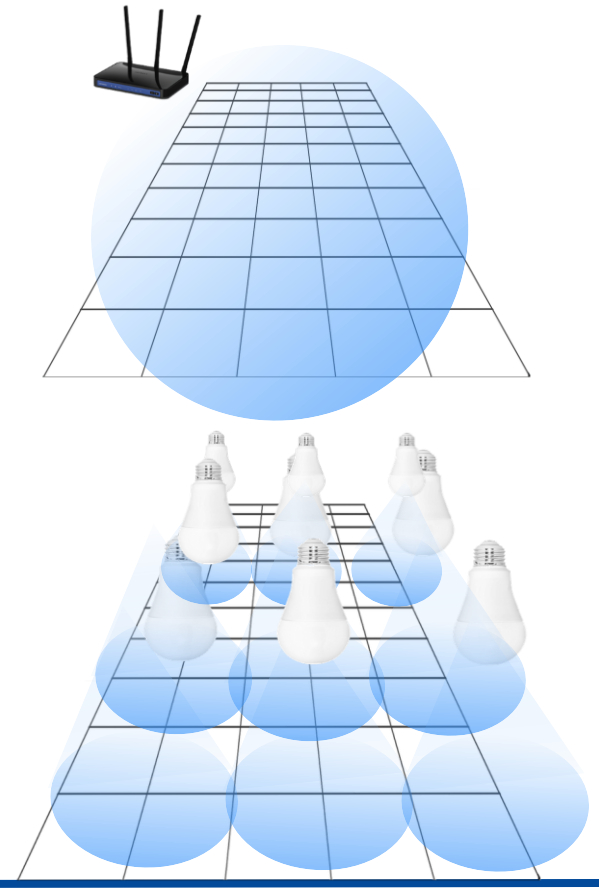
WiFi

- Optimized to cover wide area
- Many devices and parallel networks cause bandwidth decrease

Data Density

LiFi

- Provides “microcells”
- Less devices per cell provide higher bandwidth per device



Challenges of radio based data transmission

RF-disturbed and -sensitive environments

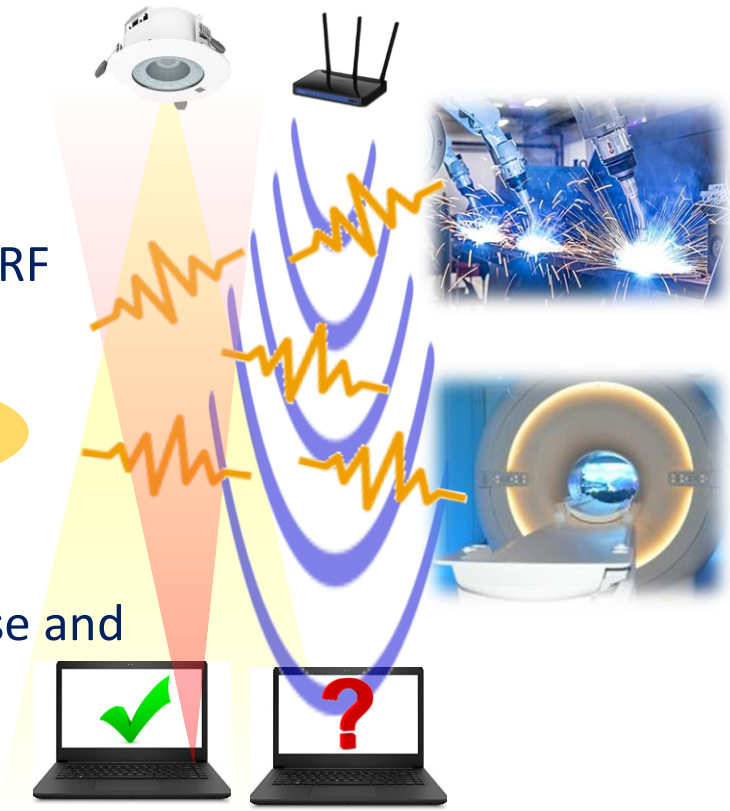
WiFi

- Can be disturbed by external RF sources
- Can be intentionally disabled by induced RF noise

RF - Robustness

LiFi

- Is immune to RF noise and disturbance
- Uses only light for transmission



Challenges of radio based data transmission

security-critical and private environments

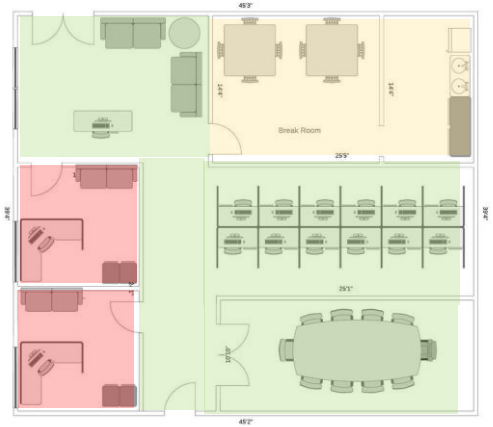
WiFi

- Passes walls
- Accessible to unintended users outside target areas
- Difficult to limit to certain areas

Geo Fencing

LiFi

- Provides local cells
- Signal shielded by walls (and windows)
- Different security levels can be realized in different rooms



Markets and application areas

Data Density

RF - Robustness

Geo Fencing

Towards seamless integration: LiFi/WiFi/5-6G
Example: Virtual Reality Streaming

Atmosphere's drones

- **ATMO1:**
  - Octocopter, privately built
  - Can be commanded and controlled via Iridium and/or 4G (MAVlink)
  - MTOM ~ 6 kg
  - Maximum characteristic dimension = 1310mm
  - Flight time up to 14 min

- **ATMO2:**
  - Octocopter, privately built, based on a modified Tarot TL18T00 frame
  - MTOM ~ 10 kg
  - Maximum characteristic dimension = 1670mm
  - Flight time up to 50 min
  - Carries 360° camera and transmits video in real-time via 4G/5G
  - Can be commanded and controlled via Iridium and/or 5G (MAVlink)

- **ATMO4:**
  - Fixed wing, based on Carolo P360 frame
  - MTOM ~ 25 kg
  - Maximum characteristic dimension = 3.60m
  - Flight time with 20.000mAh batteries up to 60 min
  - Carries 5G modem and WiFi access point to create a backhauled connectivity cell
  - People on ground can connect to the local 5G network
  - Carries also a camera to transmit video from the drone
  - Can be commanded and controlled via Iridium and/or 5G (MAVlink)

Identified areas to fly in Germany

Flight geography (green), contingency volume (yellow), ground risk buffer (red)

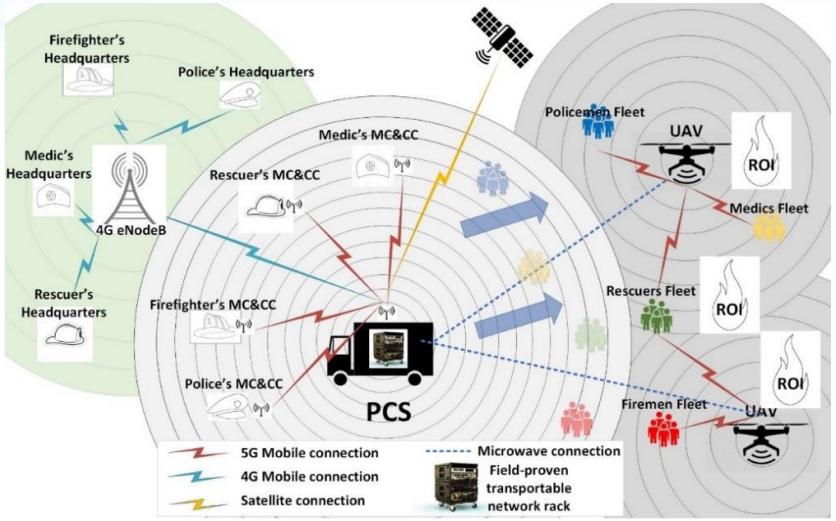
- Land field in the nearby of Meiling:
  - Location: (48.0589777, 11.2238581)
  - VLOS operations
  - Sparsely populated area
  - Automatic flights
  - Controlled airspace (OBERPFAFFENHOFEN – EDMO)
  - Close to urban areas (< 150m)
- Investigating other areas to fly BVLOS

RESPOND-A H2020 - Overview

- **Innovative European** project that searches for cutting-edge technology solutions to evolving threat of climate change and consequences of industrial accidents (fires, accidents, etc.)

- Partners will provide next-generation equipment tools and mission-critical strategies for First Responders

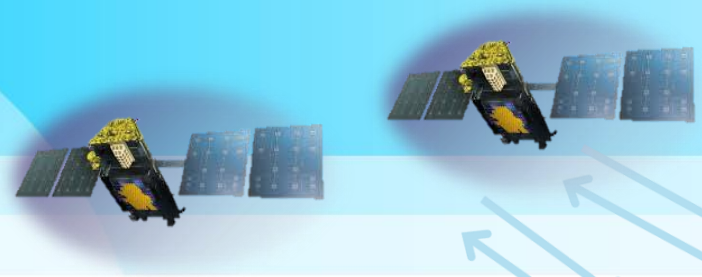
- Atmosphere contributes bringing:
  - UAVs to demos in Cyprus and Spain
  - PLANET (air-to-ground communications)
  - 5G modem integrated with PLANET
  - 5G radio access network



PLANET terminal on-board the UAVs

5G Radio Access Network (Amarisoft Callbox Mini)

Towards 6G NTN



LEO/MEO/GEO satellite capacity:
Iridium, OneWeb, Inmarsat

LEO satellite capacity:
Iridium, Starlink

Command&Control,
Backhaul

ATMO-3

ATM airborne gNB

iridium ✓Certified

MAVLINK ✓ Compliant

ATMO-2

Various sensor payloads:camera, sensors, etc.

ATMO-1

ATM command
and mission
control center

ATM ground 5G-RAN,RRH and
5Gcore

6G NTN

… use cases
- critical communications
- troposphere networking
- (media, MTC)

… reseach pillars/gaps
- 3D mobility management and multi-connectivity
- 3D network management and orchestration
- NTN-based edge computing and caching

… components
- reliable multilink
- mobility management, handover
- slicing (C2 and user traffic)
- MEC, caching, offloading

ATMOSPHERE

Thank you

aeroLiFi GmbH
Atmosphere GmbH

Argelsrieder Feld 22
82234 Wessling

info@aerolifi.com
www.aerolifi.com