ASPires

Advanced systems for prevention & early detection of forest fires

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Advanced Systems for the Prevention and Early Detection of Forest Fires

Stresa WORKSHOP

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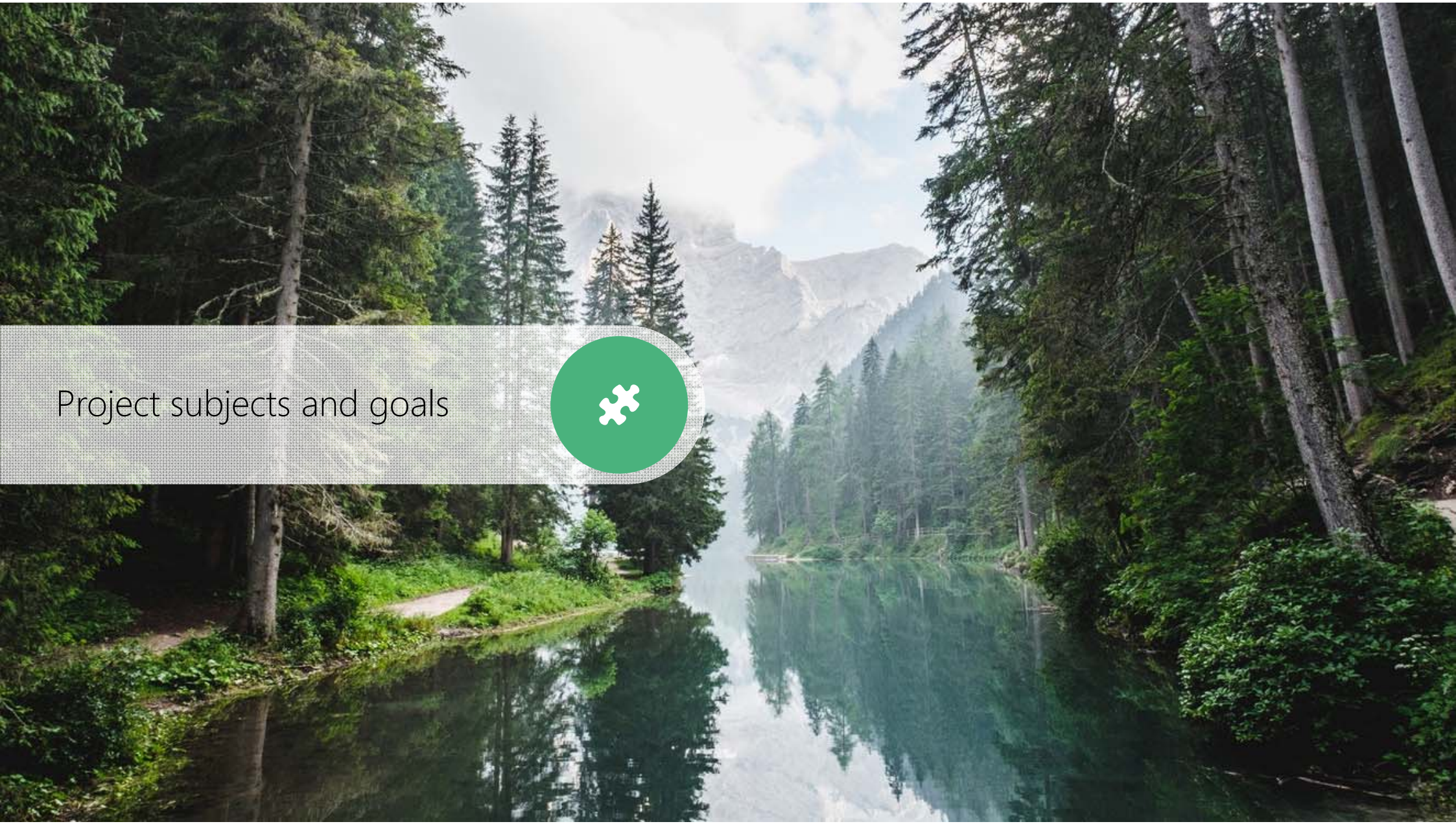
Coordinator: Prof. Dr. Peter Peinl, peter.peinl@informatik.hs-fulda.de

University of Applied Science, Fulda, Germany

Project financed in the EU civil protection framework, 2016 call
Contract no : ECHO/ SUB/2016/742906/PREV03
European Commission DG ECHO

Overview

- Project subjects and goals
- General project information
- ASPires system overview
- European added value
- Summary and conclusions


Project subjects and goals

Prevention & Early Detection of Forest Fires

Forest fires

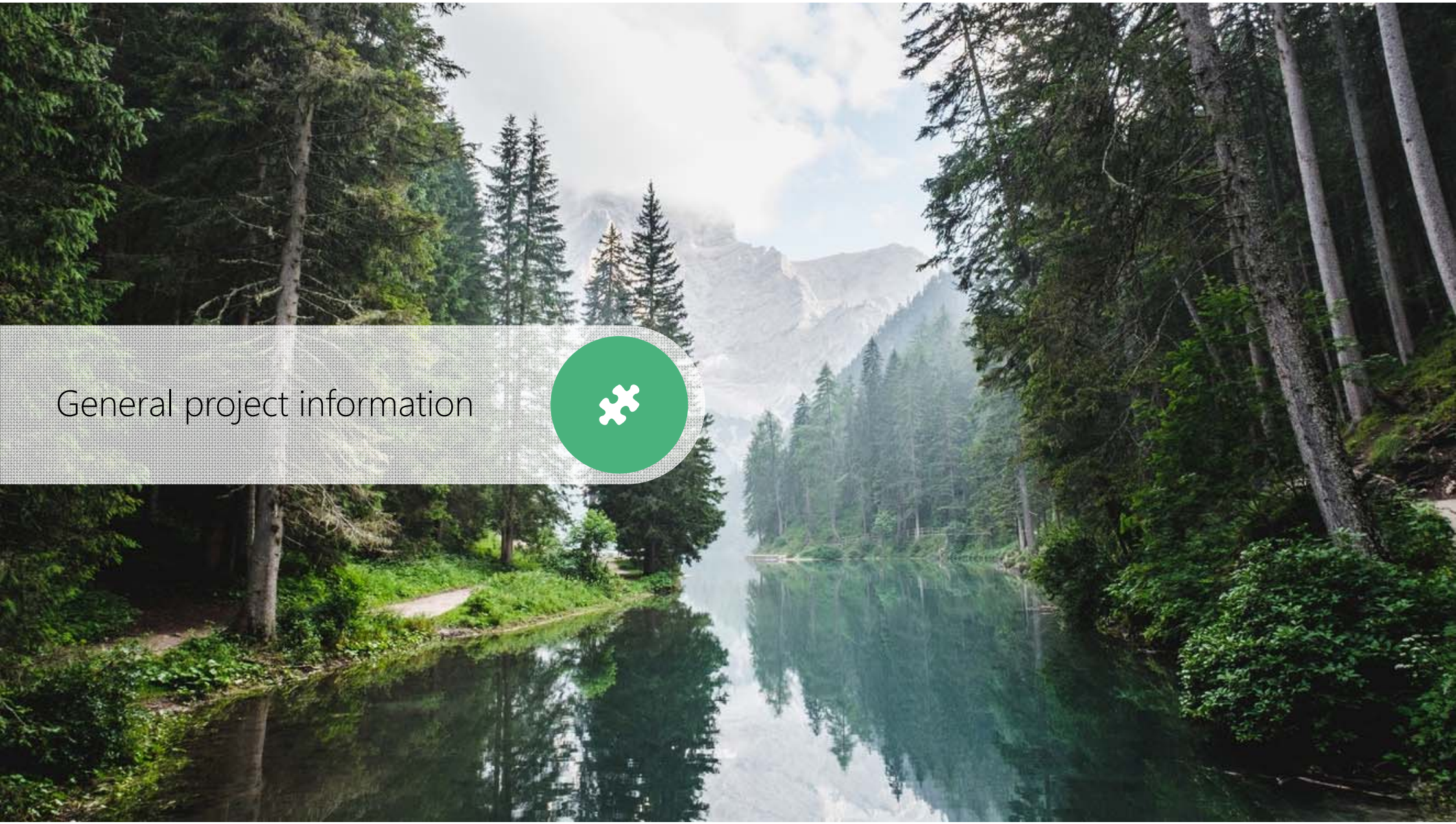
- endanger human life
- cause enormous economical and ecological damage
- reduce biodiversity

Detection time and prevention

- are key factors to reduce damage and cost

Overall project goal

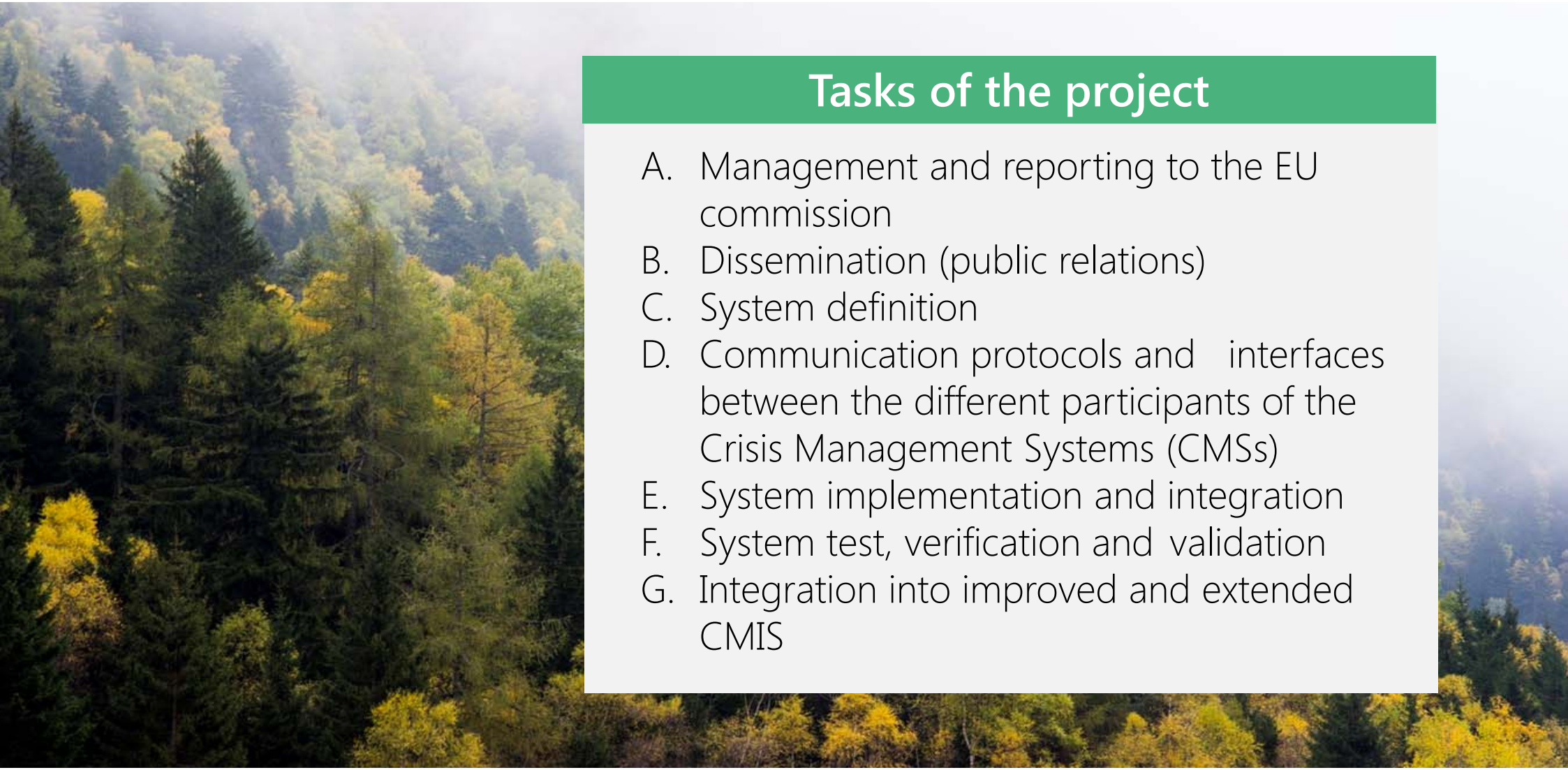
- Support all European Crisis Management Information Systems (CMIS) in the
  - design and implementation of diverse methodologies for the early warning and detection of forest fires,
  - and the organisation, conduct and tactics to fight catastrophies
- Assess, test und deploy novel concepts and information technologies for:
  - sensors, cameras, drones
  - mobile communication technologies, Cloud, IoT (Internet of Things)


General project information

PROJECT TIMING AND GENERAL PROJECT INFORMATION

Duaration: 2 years
Begin: 01.05.2017
End: 31.05.2019

Home page: www.aspires.eu
Facebook
ResearchGate
LinkedIn



Tasks of the project

A. Management and reporting to the EU commission
B. Dissemination (public relations)
C. System definition
D. Communication protocols and interfaces between the different participants of the Crisis Management Systems (CMSs)
E. System implementation and integration
F. System test, verification and validation
G. Integration into improved and extended CMIS

Partners

Military Academy Skopje (NMK)

Comicon Ltd (BG)

InterConsult Bulgaria Ltd (BG)

Cluster NCITES (BG)

Fulda University
of Applied Science (DE)

Military Academy Skopje (NMK)

- Is the ONLY military institution in the Republic of North Macedonia with university education AND research.
- Its fundamental mission is to conduct research AS WELL AS to teach, train and qualify
- personnel for duties and tasks in
  - the Ministry of Defence
  - the army of the Republic of North Macedonia
  - the Crisis Management System
  - the Civil Protection System.

InterConsult Bulgaria Ltd (BG)

ICB SOFTWARE & CONSULTING

ICB SOFTWARE INNOVATION

Competencies:

Software development

With Microsoft's technology stack

Industrial Internet of Things

More than 130 man-years of experience

Simulation and Virtual Reality

From headset apps to hydraulic simulators

Microsoft Partner 2013 Award

Bulgarian Outsourcing Excellence Awards

Deloitte. Technology Fast50

IT Europa European IT Excellence Awards

Technology partners:

Microsoft Partner
Gold Application Development
Silver Application Development
Silver Data Analytics
Silver Datacenter

software AG

OSIsoft. partner

Comicon Ltd (BG)

- Comicon is a SME in areas of R&D- and engineering in Sofia und provides products and services for industry-automation.
- Comicon is a R&D company

  and provides hardware and software for industrial networks, wireless communication, controller, interfaces, converters, …

  works in research and development of prototypes (hardware and firmware) and offers the integration of systems of different producers an.

Cluster NCITES (BG)

- National Cluster for Intelligent Transport and Energy Systems (NCITES) was founded in 2014 in Sofia. http://www.cluster-ites.org/
- Voluntary association of 20 companies and institutes from the industry- and Inter-industry sector for production in the Danube region and the Black Sea basin.
- Goals

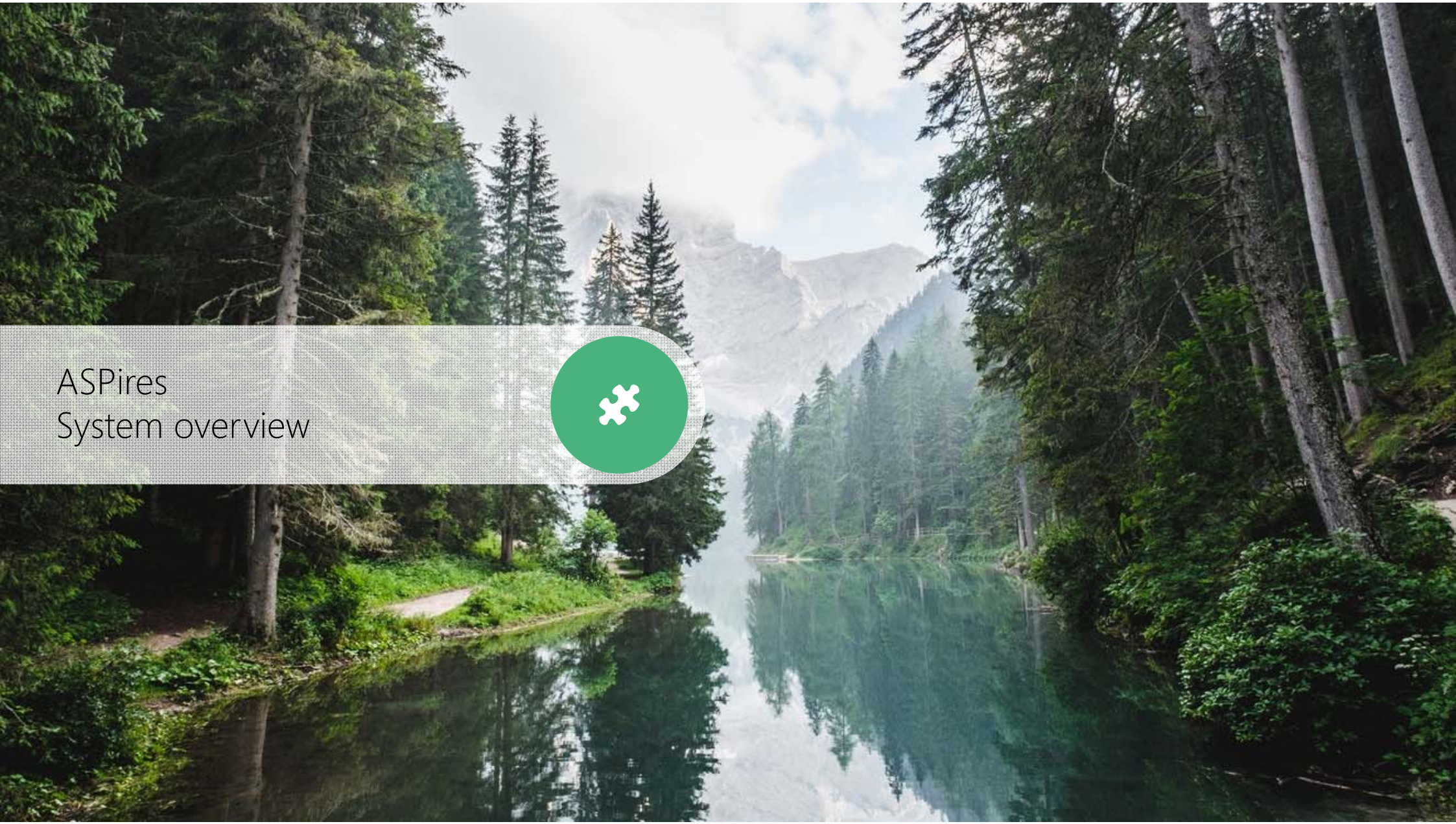
  Development of scientific and practical projects
  Intelligent management and control systems for telecommunications, energy, environment and business

Hochschule Fulda (D)

- First University of Applied Sciences in EUA to award doctoral degrees in focus research areas
- Participation and und coordination of numerous European projects
- Students/professors/faculties >9000/170/8
- Activities in ASPires are

  Coordination, dissemination (public relations) project management, finances,…

  Scientific and technical contributions



ASPires
System overview

Technical challenges

Sensor technologies and gateways

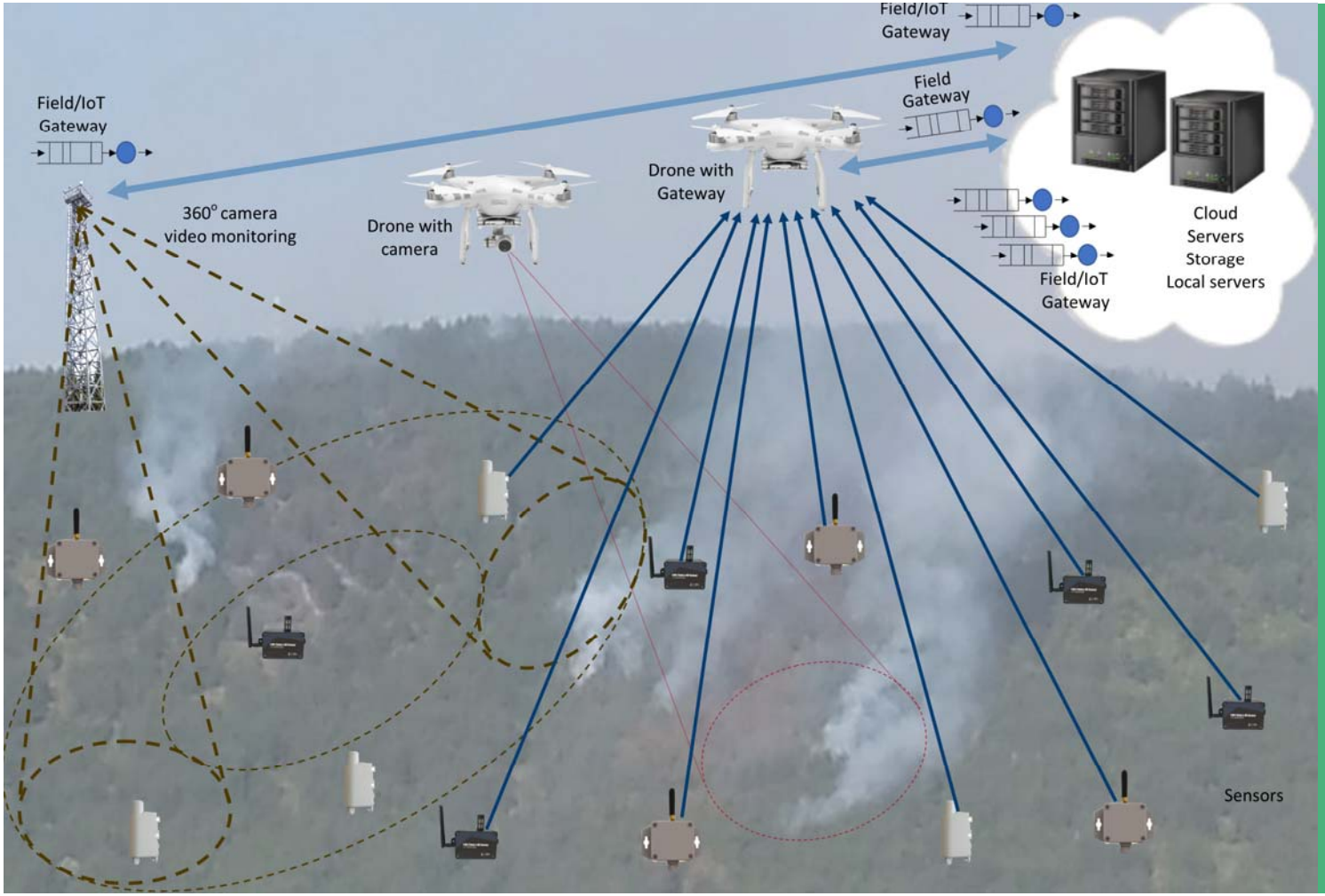
- Assessment and integration
- Sensor technologies
  - images (cameras)
  - chemical and physical parameters
- Gateways

Interoperability and standards

- Information integration
  - Data models
  - Data flows
  - Data acquisition and long-term storage
- Communications protocols

End-user support

- Web applications
- Mobile applications
- Web services



ASPires components and technical equipment

Research for wireless sensor networks (WSN)

- Alternatives for data collection in the project - wireless sensors and cameras.
- Research for wireless sensor networks (WSN), development of a prototype of gateway for WSN, simulation of WSN
- Why LoRa®?
  - This is a new LP WAN advanced technology, It is able to cover big distances – theoretically up to 15 km, it is powered by batteries or energy harvesters.
- Measure environmental parameters of a place like humidity, temperature, CO, CO_2, fine particle matters
- Send the measured data to a gateway.

Two kinds of LoRaWAN™ sensors were used in the project: a radio module with an integrated sensor and a set of radio module + external transducer.

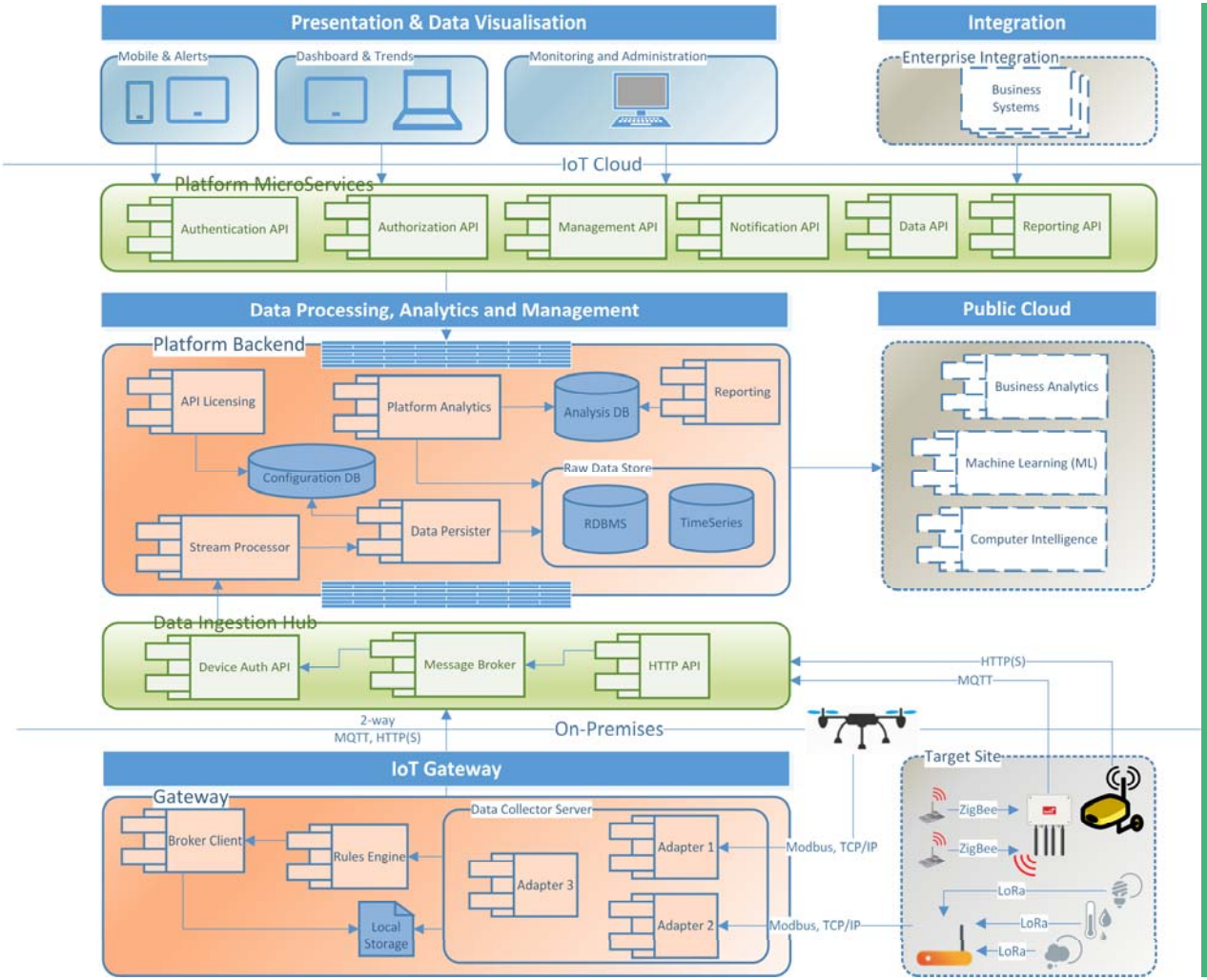
Particle Matters

Beyond the planned in the project, a suitable particle matter transducer and smart particle matter transducer were developed.

Drone with a mobile gateway

A drone, flying with a mobile gateway on board, is of a great significance for forest fire prevention and detection:

- If there is no fixed sensor network gateway, if it is damaged or if communication obstacle is present, the mobile gateway collects data.
- In case there is lack of cellular communications coverage (3G, 4G..)
- In case there is no line of sight for a fixed thermal camera
- The combination of a wireless sensor network and a drone with a gateway on board allows fast data collection from an area of importance and decreases the delay in forest fire detection.

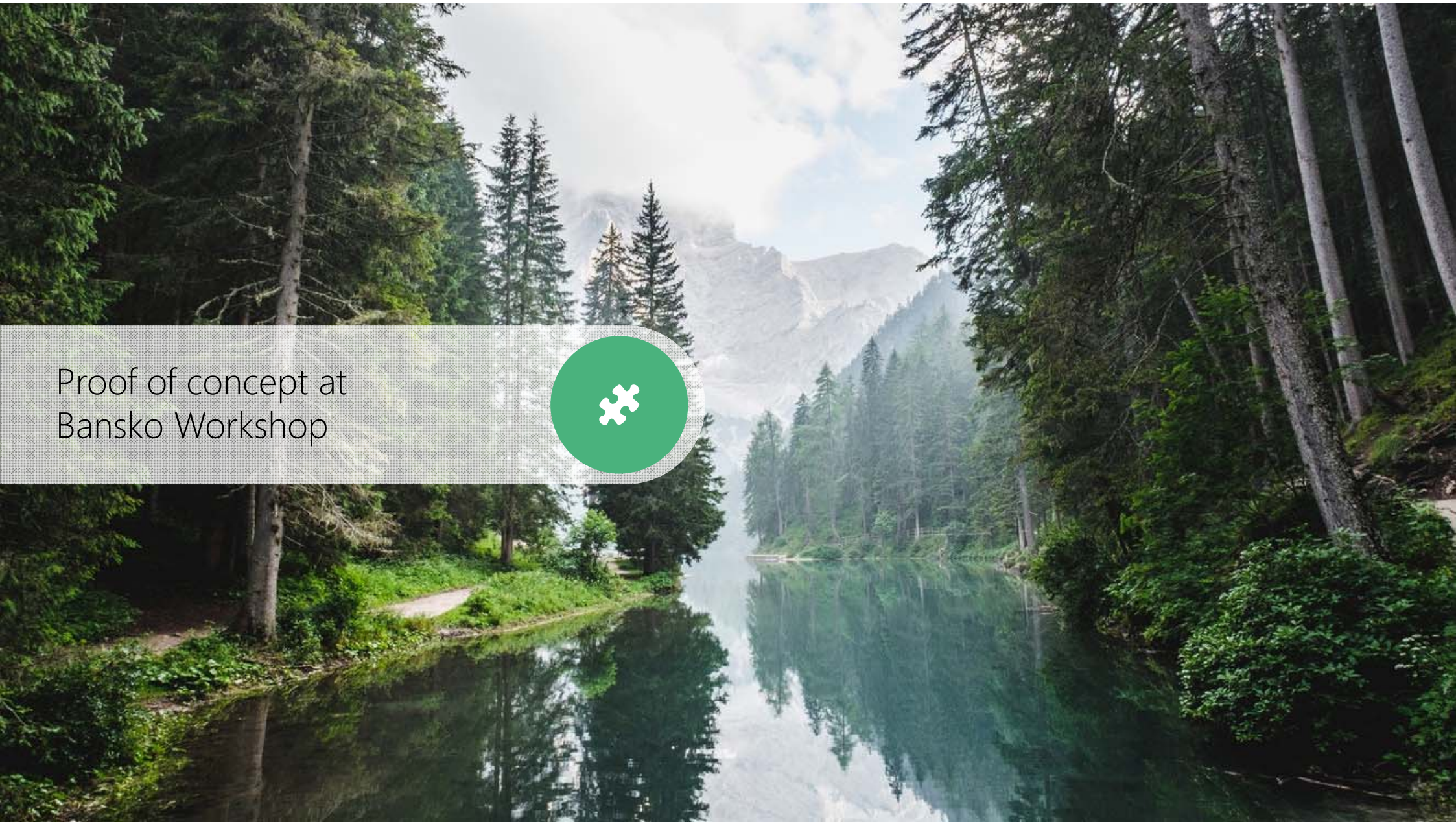


ASPires cloud software System architecture

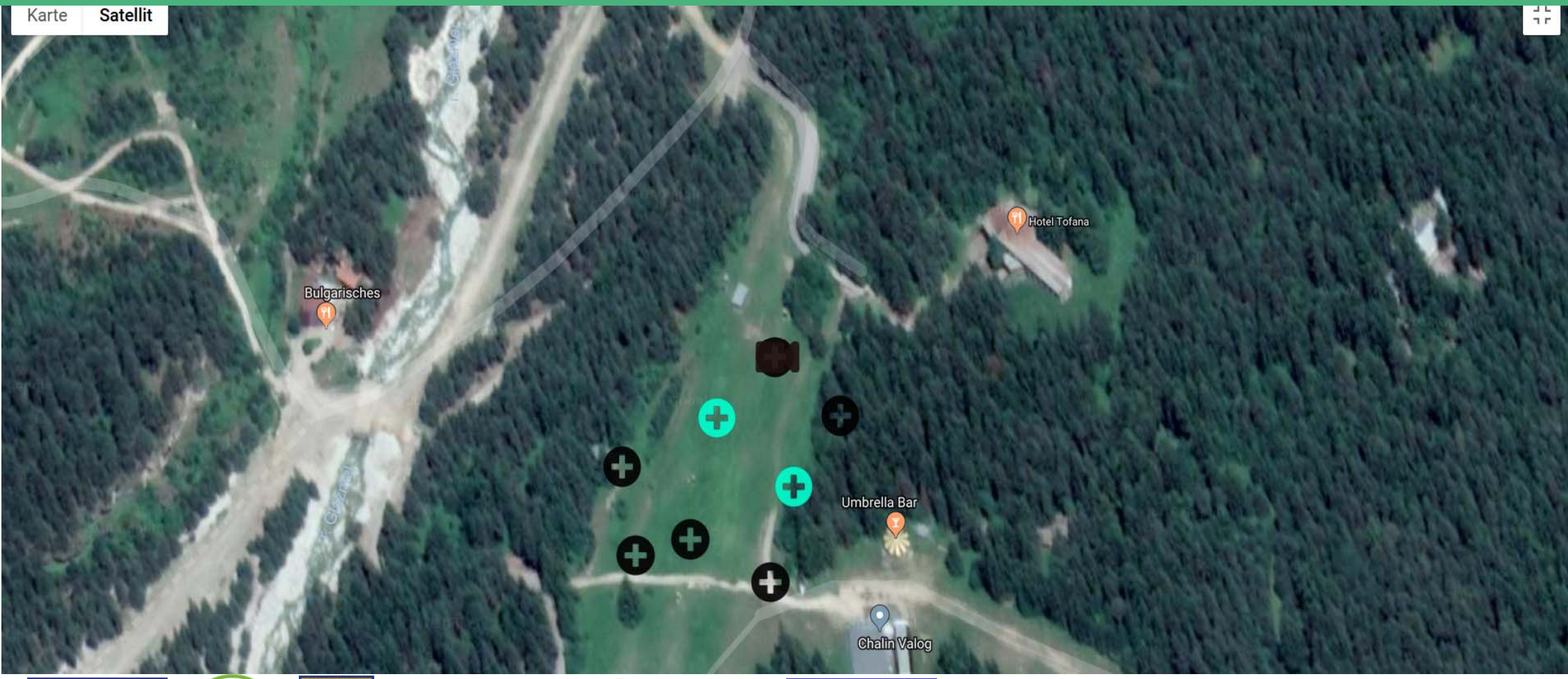
Platform benefits

- Open source and free license components
- Deployment on-premises and public cloud
- Adaptable – multiple abstraction points
- Cutting edge technologies
  - AI, Machine Learning, Time Series data, Drones support
- High performance
  - 30’000+ connections, 7’000 req/second, 10M sensor parameters
- Built with security in mind

The cloud platform aims to **combine the best approaches** to achieve **10% better fire assessment and prevention.**


Proof of concept at
Bansko Workshop

ASPires National Park Pirin - satellite view



National Park Pirin fire drill - controlled fire

Experiments with LoRa® wireless sensors at National Park Pirin

LEGEND

1- DP-1 SENSOR (PM MEASUREMENT)	5- CO-1 SENSOR (CO MEASUREMENT)
2- DP-2 SENSOR (PM MEASUREMENT)	6- CO2-1 SENSOR (CO2 + RH MEASUREMENT)
3- DP-3 SENSOR (PM MEASUREMENT)	7- T-1 SENSOR (T + RH MEASUREMENT)

National Park Pirin - fire automatically detected by sensors and by thermal cameras software simulatenelously

ASPires-Geo

Stationary system for the detection of forest fires

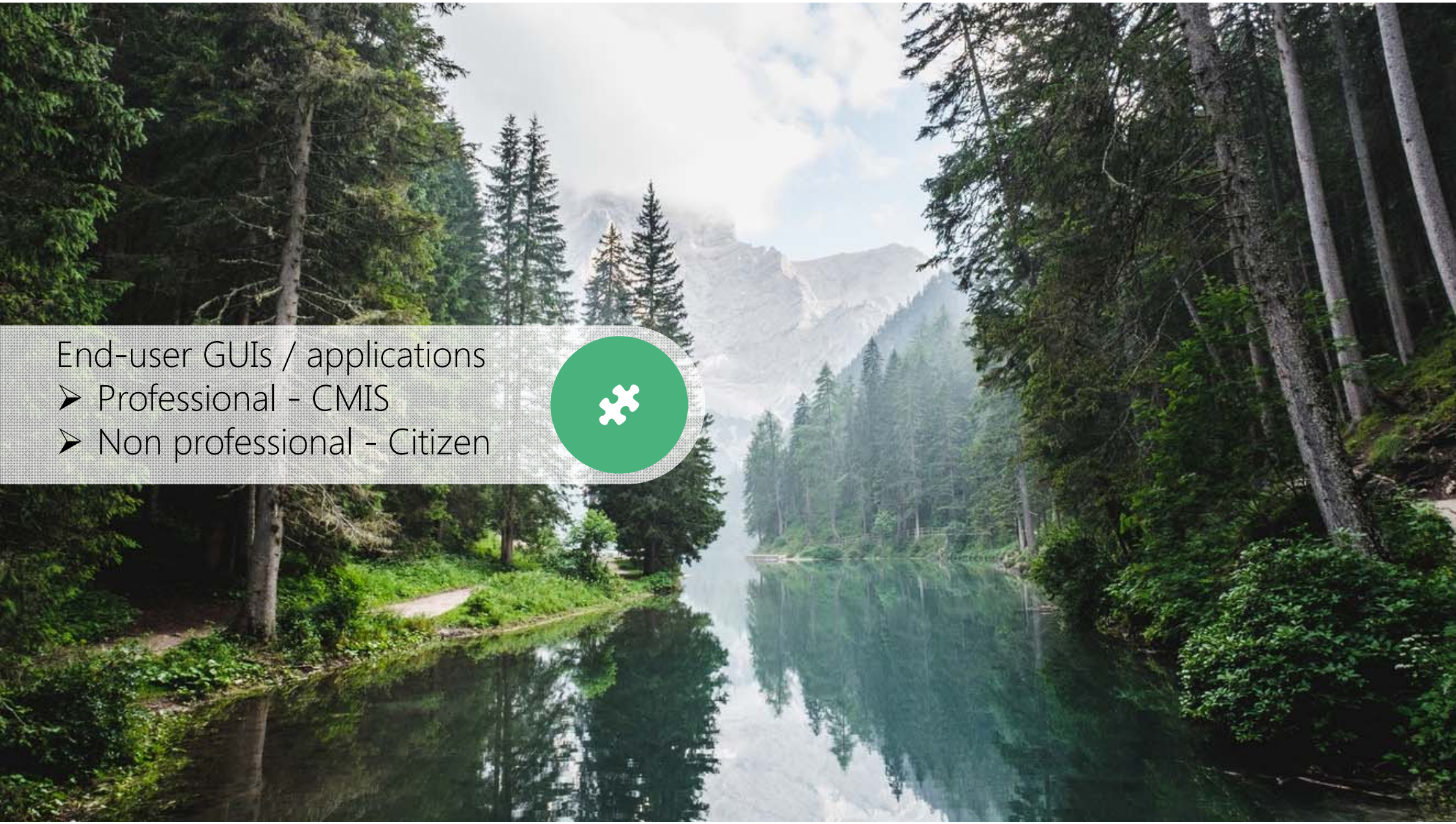
- ASPires-GEO is based on available hardware and software components on the market.
- The main components are HD CCD/CMOS and Thermographic cameras, Pan/Tilt device, Laser pointer, Meteorology station, Intelligent software for fire detection.

- ASPires-GEO is located on stationary towers in forest areas and used for early detection of forest fires.

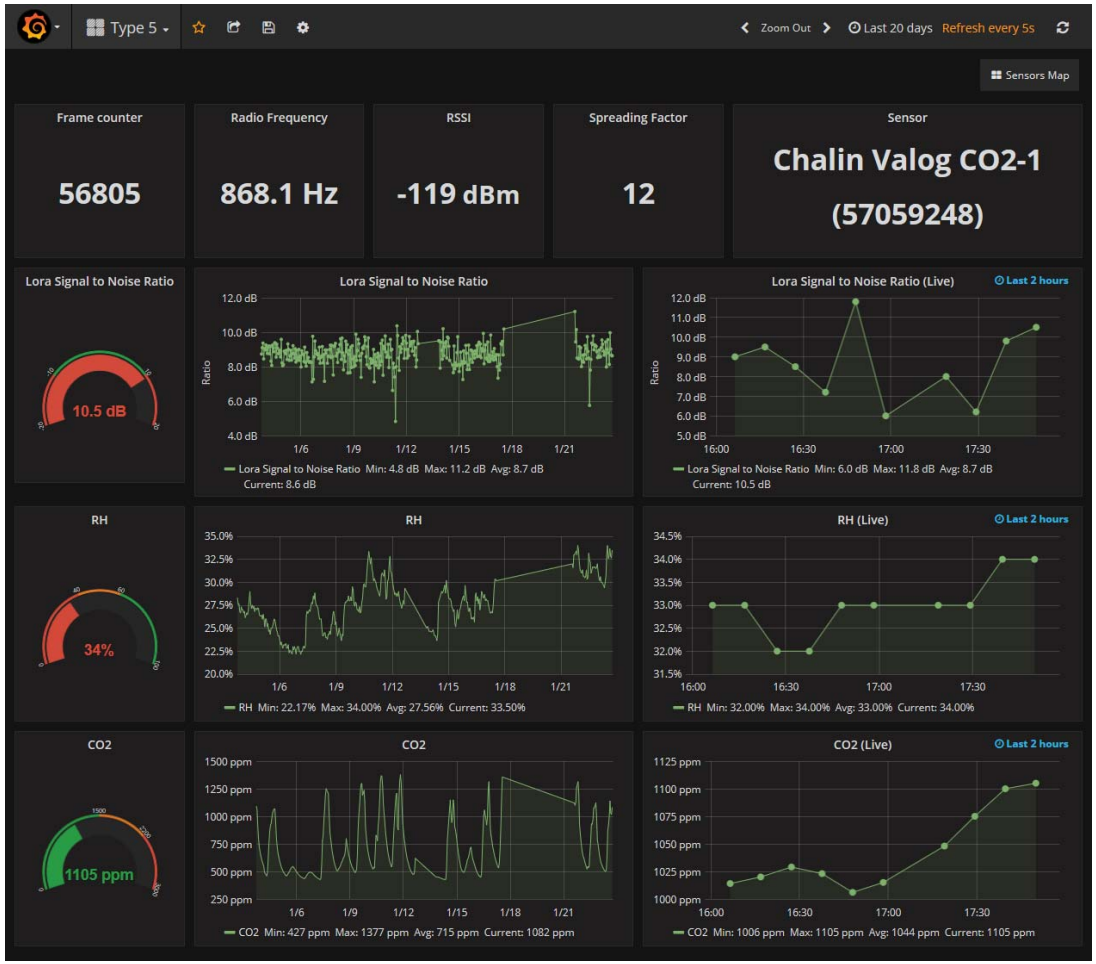
- The experiments shown that ASPires-GEO recognize a fire within a few seconds and sends an alarm to ASPires Platform.

- ASPires Platform automatically sent SMS to chosen mobile phone numbers.

https://www.aspires.eu/web/guest/aspires-geo-implementation


End-user GUIs / applications
➢ Professional - CMIS
➢ Non professional - Citizen

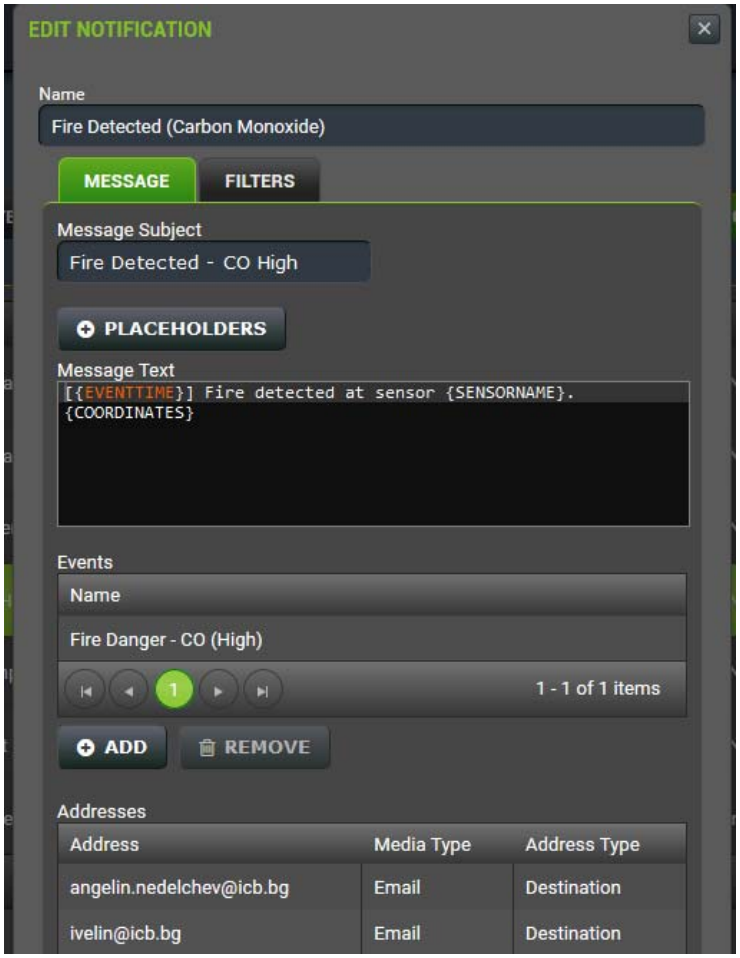
Professional end-user



Sensor Details

- Clicking on a sensor navigates to details page for the sensor type
- Details show
  - Live data (2h)
  - Historical data (2w)
  - Meta data

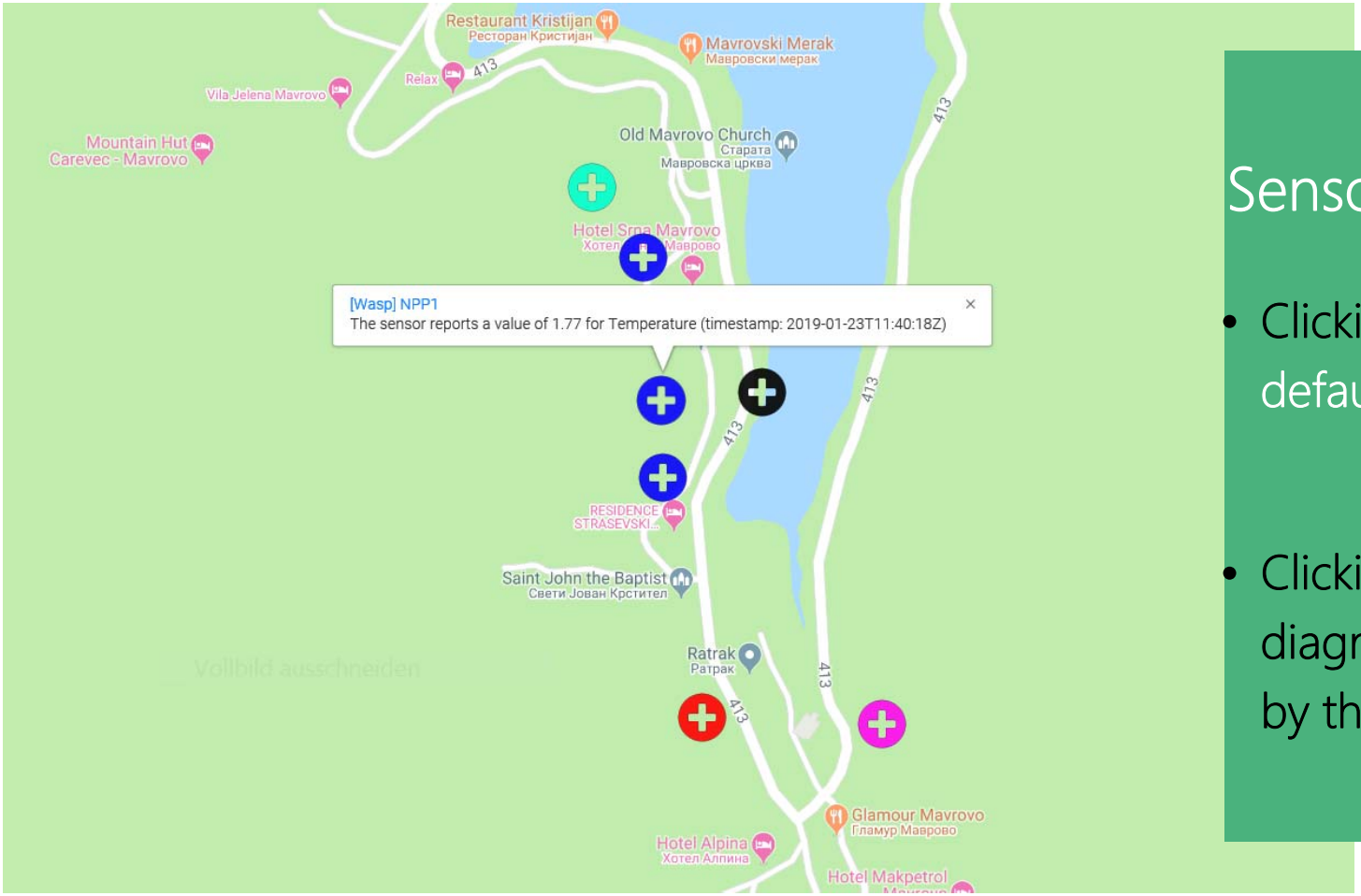
Professional end-user



Notifications

- Triggered by events
- Messages sent over
  - SMS
  - Email

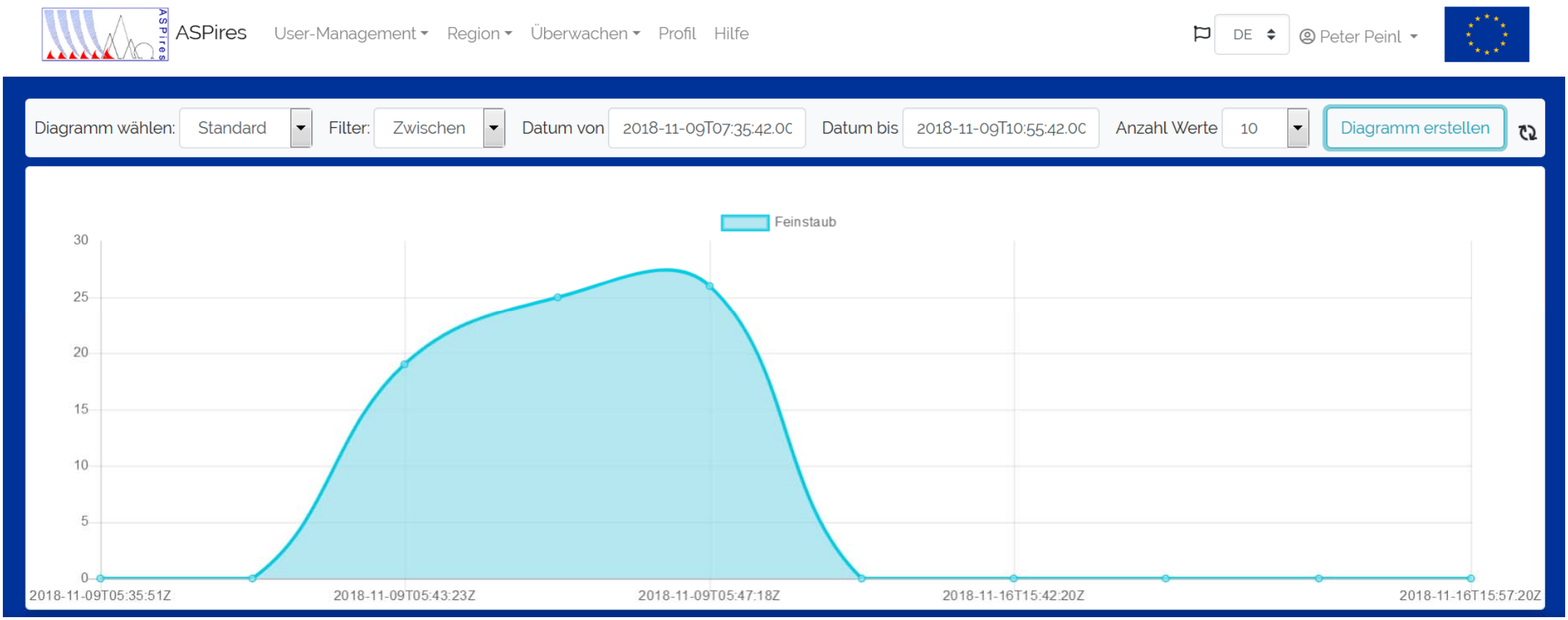
Non professional end-user

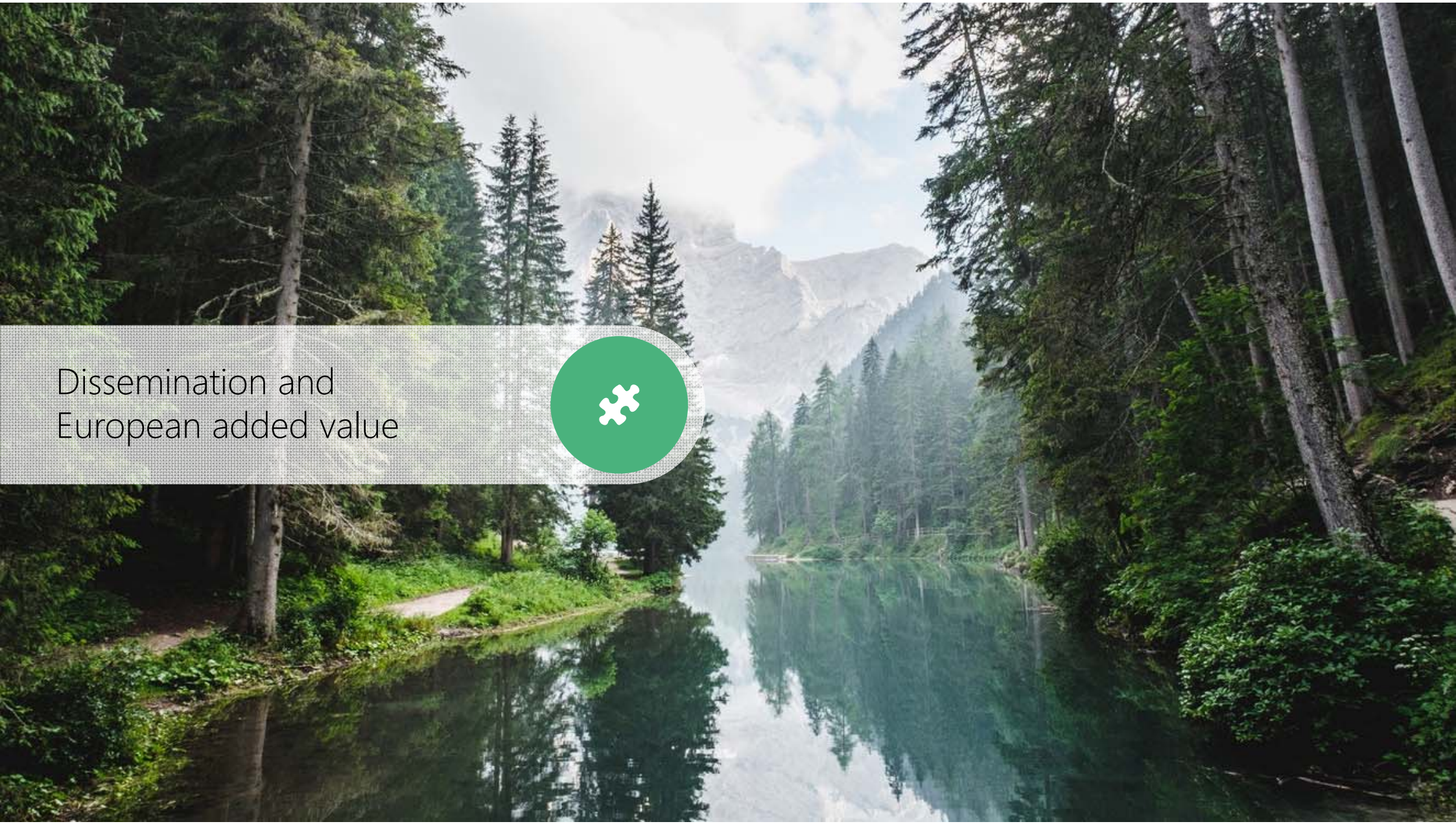


Sensor Data

- Clicking on a sensor pin displays default parameter of the sensor
- Clicking on a sensor name displays diagrams of all parameters captured by the sensor

Non professional end-user





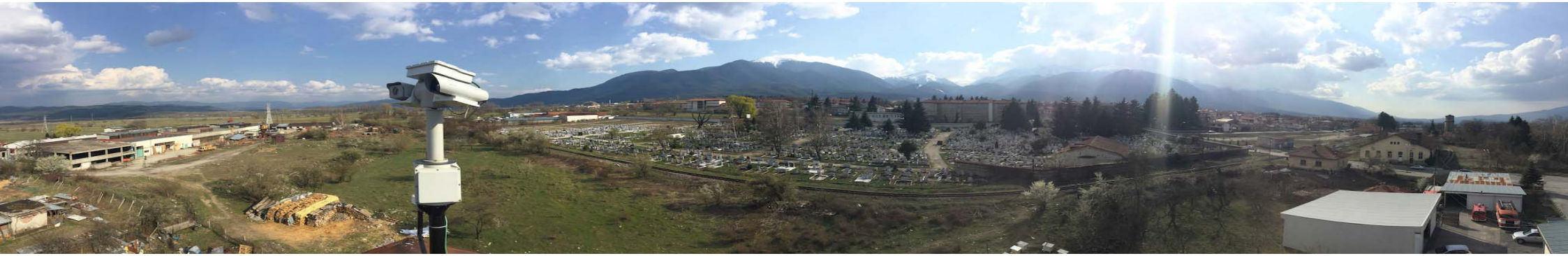
Dissemination and European added value

Dissemination activities

- 5 ASPires Workshops in 3 countries : Berovo, Skopje (NMK), Bansko (BG), Fulda (D)

  Presentations of concepts and results to and information exchange with stakeholders from competent national authorities (ministries, national parks, fire fighting and rescue organisations)
- Exhibition stands at several relevant trade fairs and exhibitions
- Scientific papers at scientific and technical conferences
- Newspaper articles, radio interviews, reports and interviews on television
- Several public project deliverables and ASPires project catalogue (https://www.aspires.eu/documents/20182/318545/ASPires_CATALOGUE_DINA4_210x297mm_1812_v17_final.pdf/2ad1bbc7-fed6-47c5-a9df-4f1007ca941d)
- ASPires project Website (www.aspires.eu) and presence in social networks
- Training (material and courses) for personnel of national parks with ASPires equipment
- Durable installation of ASPires equipment in national parks (NMK) and Municipality of Bansko (BG)

Equipment for National Park Pirin



- Beginning of April 2019
- Assistance of the fire brigade in Bulgaria and Municipality of Bansko (BG)
- Sensors with fixed gateway installed to measure particle matters and race alarms
- ASPires-GEO module installed at a height of 25 meters
- ASPires-GEO scans 125 positions at 360 degrees of horizontal motion and 180 degrees of vertical movement.
- Last 50 measurements, the last 50 critical situations and real data from the weather station could be seen at https://www.aspires.eu/web/guest/aspires-geo-implementation.
- The data is stored in a central database.

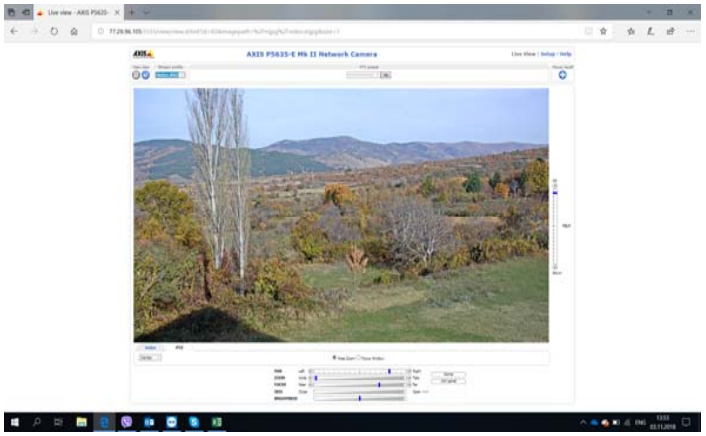
Equipment for National Park Mavrovo

1. Temperature, Humidity and Pressure
2. Carbon Dioxide (Sensor ProbeCO2) Gas Sensor [Calibrated]
3. Carbon Monoxide (CO) Gas sensor probe for high concentrations (calibrated)

Equipment for National Park Pelister

- One camera - AXIS P5635-E Mk II PTZ
- Three controllers - Waspmote Plug & Sense! SE-PRO 868

  with temperature, humidity, pressure, CO, CO_2 Sensors
- Controllers are placed near village Capari in places with high danger of forest fire



- Several tests were made, and the functionality of the system was proven

European added-value

- The use of time series for cloud solution, thermal and HD cameras for the forest surveillance, drones with gateways, LoRa and xBee sensors in combination to the cameras make the ASPires platform design contemporary and unique worldwide
- Stationary and mobile gateways for the LoRa sensors are designed for mapping the measured data in real-time and near-real-time
- Found mobile solution to collect data from sensors in the areas of difficult proximity

European added-value

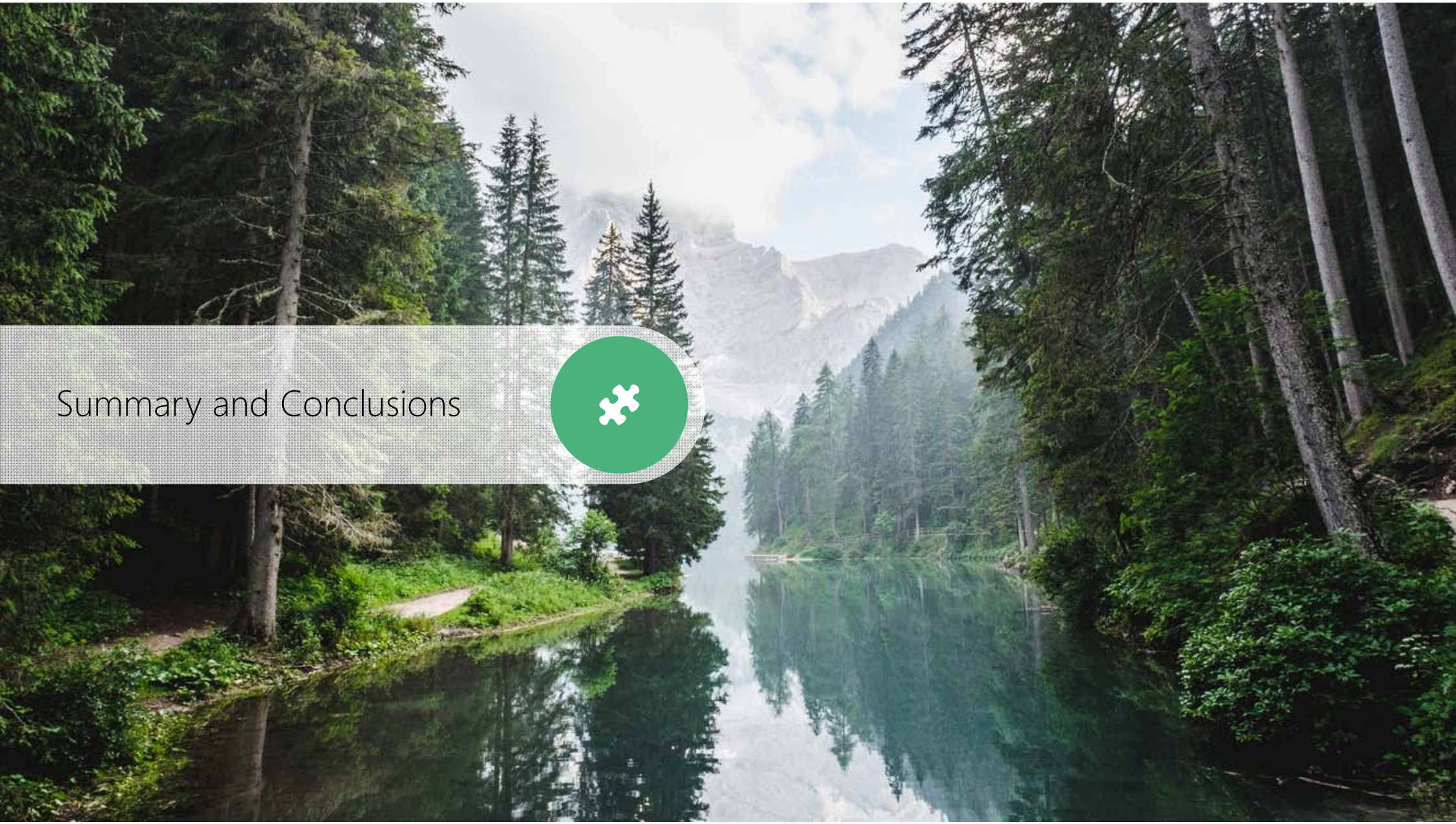
- We created a global solution for IoT platform which
  - is synergetic, open, integratable and interoperable
  - uses services based on machine learning, data analytics, big data technology

Create marketable valuable solution based on standards

- ready for the digital single market
- and preparations for further procurement procedures

- Ready for
  - pilot implementation, scaling and
  - forest and disaster management services definition

- Decrease the time for forest fire detection


Summary and Conclusions

Summary and Conclusions

- Prevention and early detection of forest fires

  Integrates sensor networks and mobile technologies (drones) to capture and gather data of existing CMIS.

- Mobile technologies (drones) and their advantages

  Cover larger areas and difficult terrain.
  Allow to detect more forest fires in an earlier phase.
  In particular in sensitive protected areas (rare species of trees, etc.).

- Implementation in selected test areas

  Cooperating with civil protection authorities and National parks in North Macedonia and Bulgaria.

- System will be open to all European states

- System allows for earlier detection of fires


Mille Grazie!
Ви благодарам!
Благодаря!
Thank you!
Merci!
Danke schön!
ASPires