

Advanced systems for prevention and early detection of forest fires

ASPiRes

Advanced Systems for Prevention & Early Detection of Forest Fires

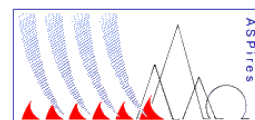
March 21-22, 2019 (Skopje, Republic of N. Macedonia)

Advanced Systems for Prevention & Early Detection of Forest Fires (ASPIres)

Advanced Open IoT Platform for Prevention and Early Detection of Forest Fires

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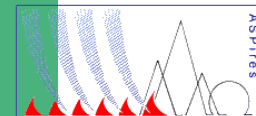
Project financed under the Civil Protection Programme Call 2016:
Agreement No.: ECHO/ SUB/2016/742906/PREV03 by European Commission:
DG for European Civil Protection and Humanitarian Aid Operations (ECHO)



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AGENDA

- Objectives
- Platform Benefits
- Platform Overview
- State of the Art
- Demo



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Objectives



Open and interoperable

Wide range of interfaces, protocols and devices
Existing Crisis Management Systems (National, EU-level)



Continuous monitoring of disaster related data

Retrospective disaster assessment



New methods for fire detection (AI, drones, sensors)



Command devices in surrounding area (i.e. barriers)



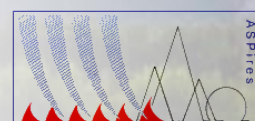
Automatic processing and alert generation



Decision making support



Cost efficient monitoring



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European Commission

Horizon 2020
European Union funding
for Research & Innovation

ASPIres Cloud Platform

Distributed & Open
IoT Platform

Funded by

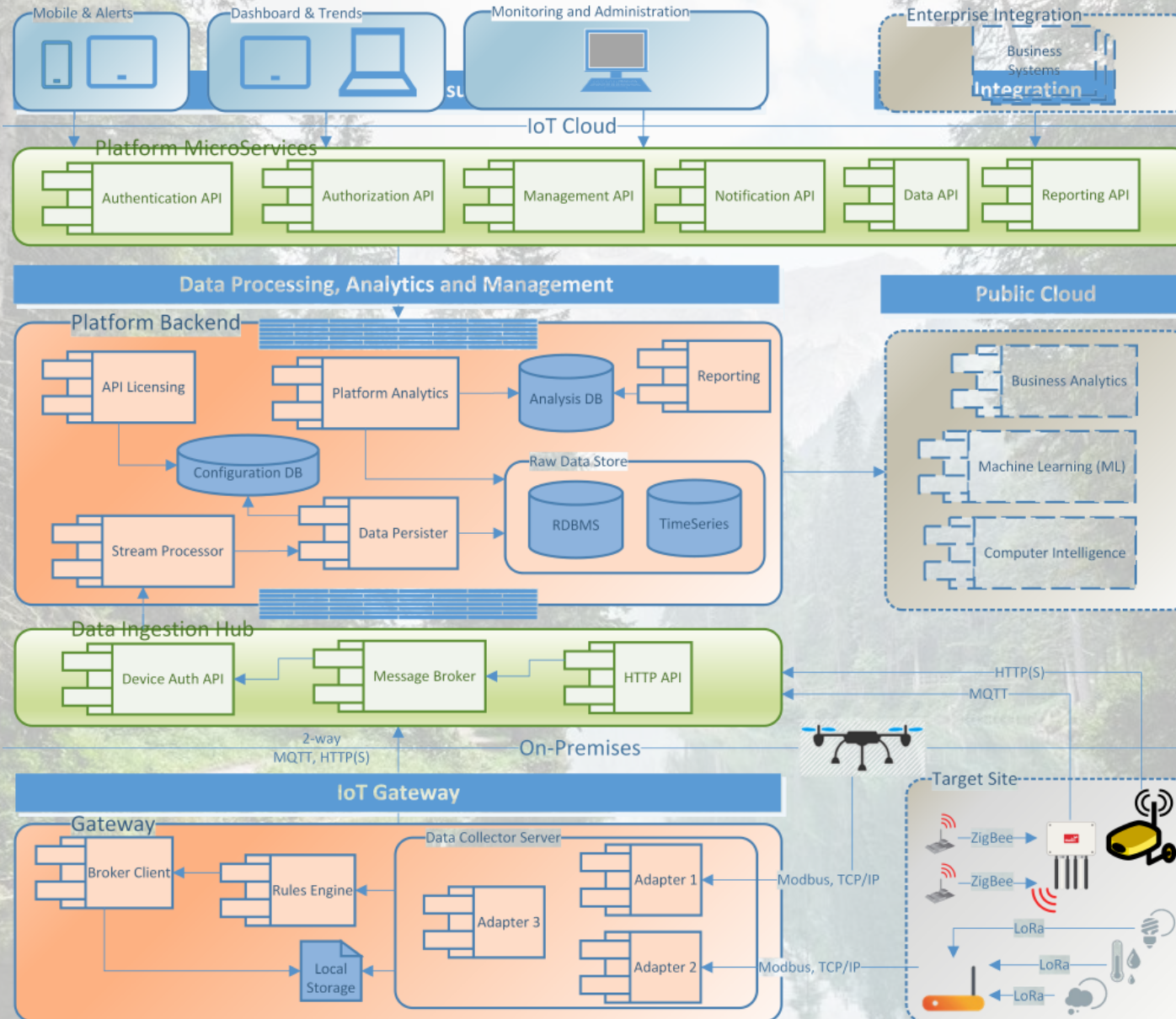
EUROPEAN CIVIL PROTECTION
AND HUMANITARIAN AID
OPERATIONS

ECHO/SUB/742906/PREV03
(ASPIRES)

Hochschule Fulda
University of Applied Sciences

ICB SOFTWARE
INNOVATION

Comjcon®



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



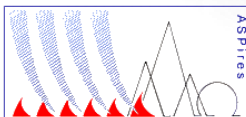
High performance

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.



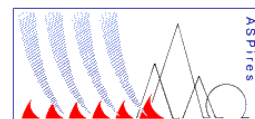
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State of the Art



Drone Support

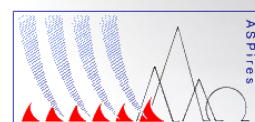
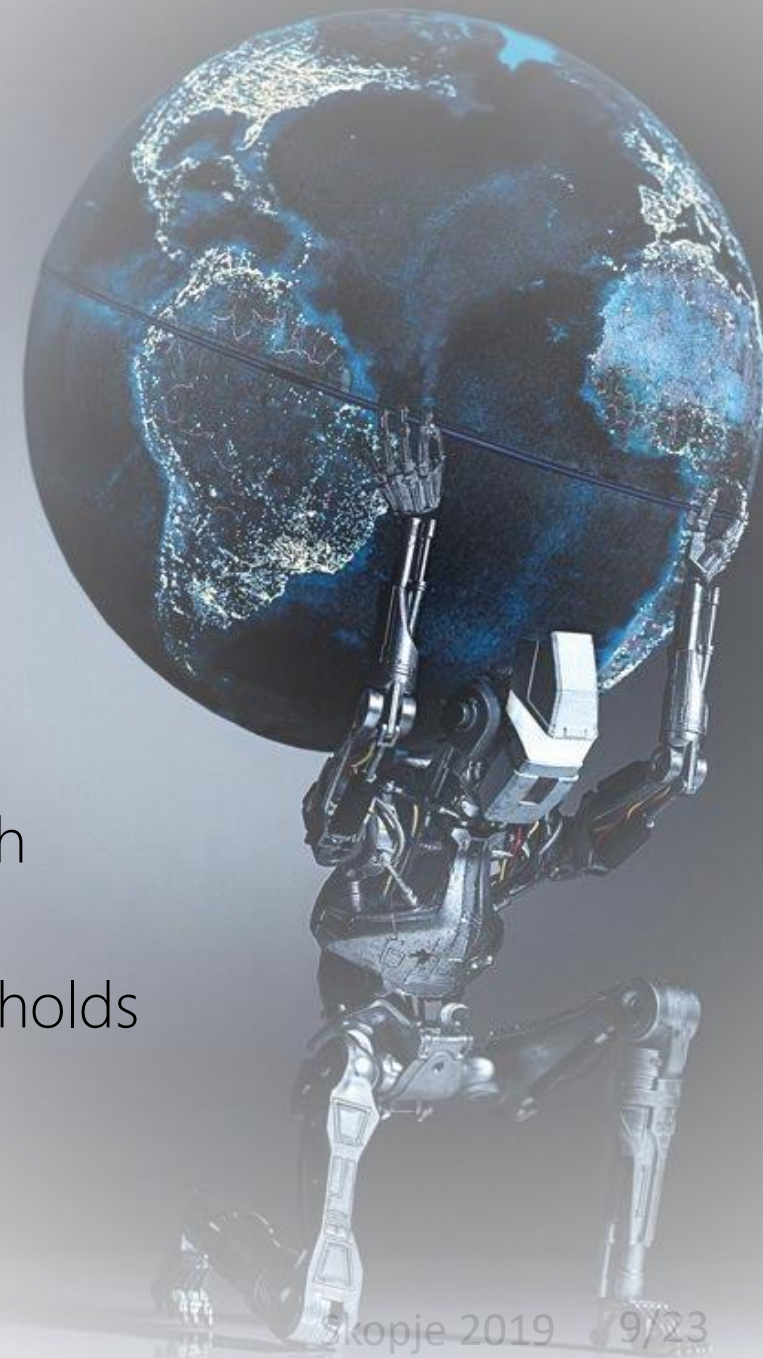
- Complement infrastructure (i.e towers)
- Rapid deployment almost anywhere
- Sensor data collection (fixed, mobile)
- Visual image and thermography
- Near real-time transmission
- Low cost



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Computer Intelligence

- Seas of data are generated by sensors
 - How to gain insight on hidden relations?
 - How to get actionable results?
 - How to make platform provide business value?
- Open issues
 - Cameras are diagnostic and not predictive approach
 - Thermal cameras cannot detect fire behind hills
 - FWI is not able to model hidden relations and thresholds
 - Human operators are required

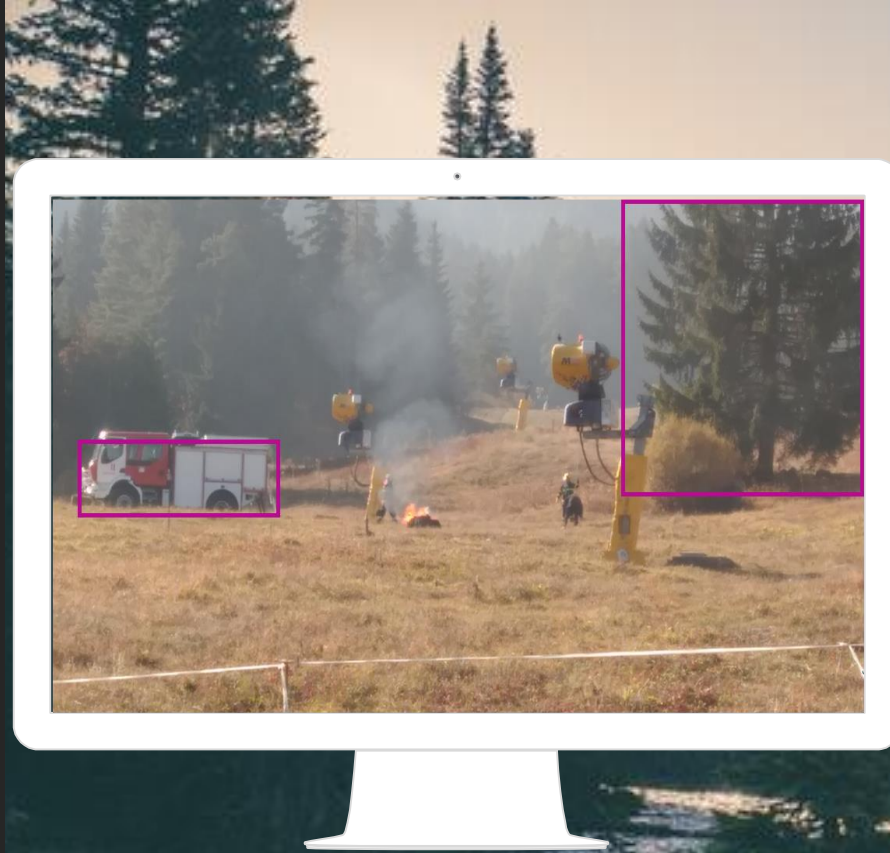


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Computer intelligence and computer vision could be used for **automated alerting**

Works on predefined **description tags**

Less operators could cover larger area



Tags

```
[{"name": "outdoor", "confidence": 0.9998779}, {"name": "grass", "confidence": 0.9998511}, {"name": "tree", "confidence": 0.997886956}, {"name": "horse", "confidence": 0.997886956}, {"name": "battle", "confidence": 0.815849364}, {"name": "fire", "confidence": 0.7221575}, {"name": "wildfire", "confidence": 0.304112881}, {"name": "mountain", "confidence": 0.248454347}]
```

Description

```
{ "tags": [ "outdoor", "grass", "field", "yellow", "track", "train", "standing", "mountain", "smoke", "forest", "covered", "man", "riding", "throwing", "hill", "group", "snow", "air", "fire" ], "captions": [ { "text": "a group of men on a field", "confidence": 0.5467774 } ] }
```

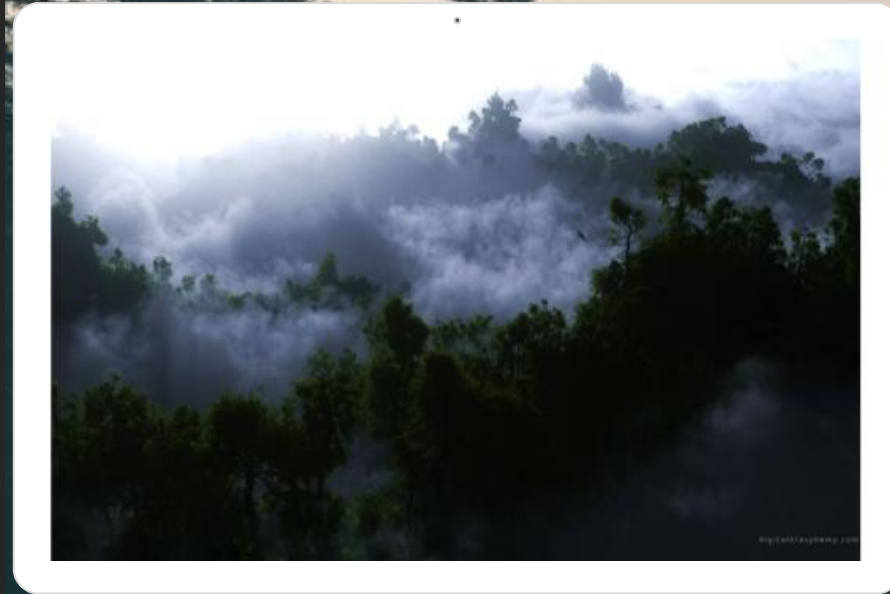
Microsoft
Cognitive
Services Vision



Computer vision can process **low resolution images** (VGA)

Capable to **distinguish clouds** from smoke

Alerts are raised based on **confidence level**



Tags	[{ "name": "outdoor", "confidence": 0.9537012 }, { "name": "clouds", "confidence": 0.734101653 }, { "name": "nature", "confidence": 0.707178831 }, { "name": "smoke", "confidence": 0.5994874 }, { "name": "dark", "confidence": 0.5532302 }, { "name": "cloudy", "confidence": 0.442315549 }, { "name": "spring", "confidence": 0.159802988 }]
Image format	"Jpeg"
Image dimensions	375 x 600
Clip art type	0
Line drawing	0

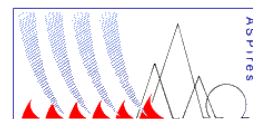
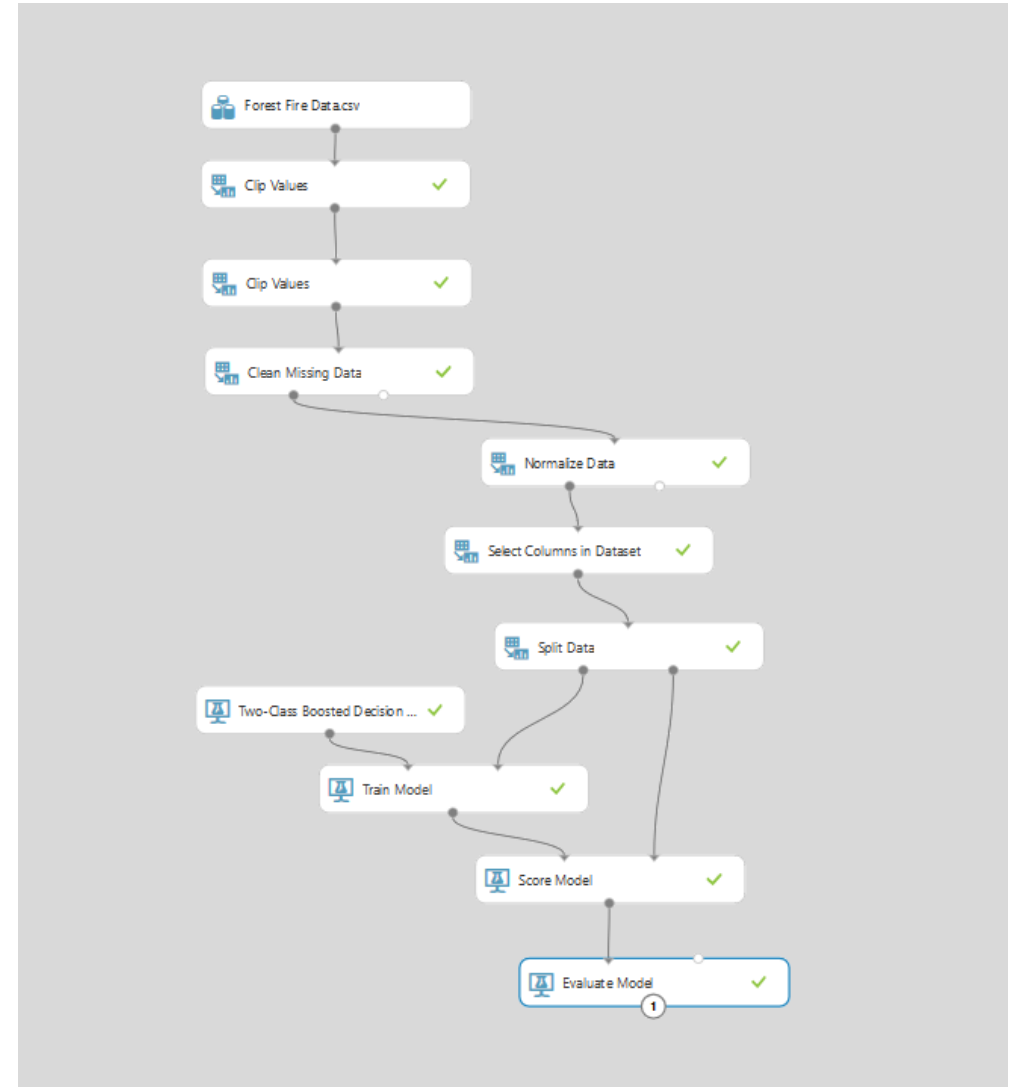
Microsoft
Cognitive
Services Vision



Azure ML

- Predict fire state with certain confidence level
- Predictive features identified by analysis of processes in crisis management systems
- Model consumed as cloud web service

(ML Studio & Azure Model Management Service)



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Platform Openness

✔ Open source technologies

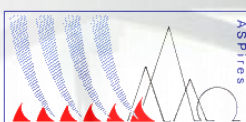
- Azure IoT Edge
- Influx DB
- Mosquitto MQTT
- IdentityServer4

✔ Open protocols

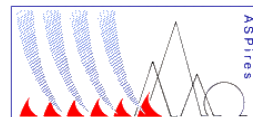
✔ Inbound & Outbound Interfaces

✔ Data & Alerts Services

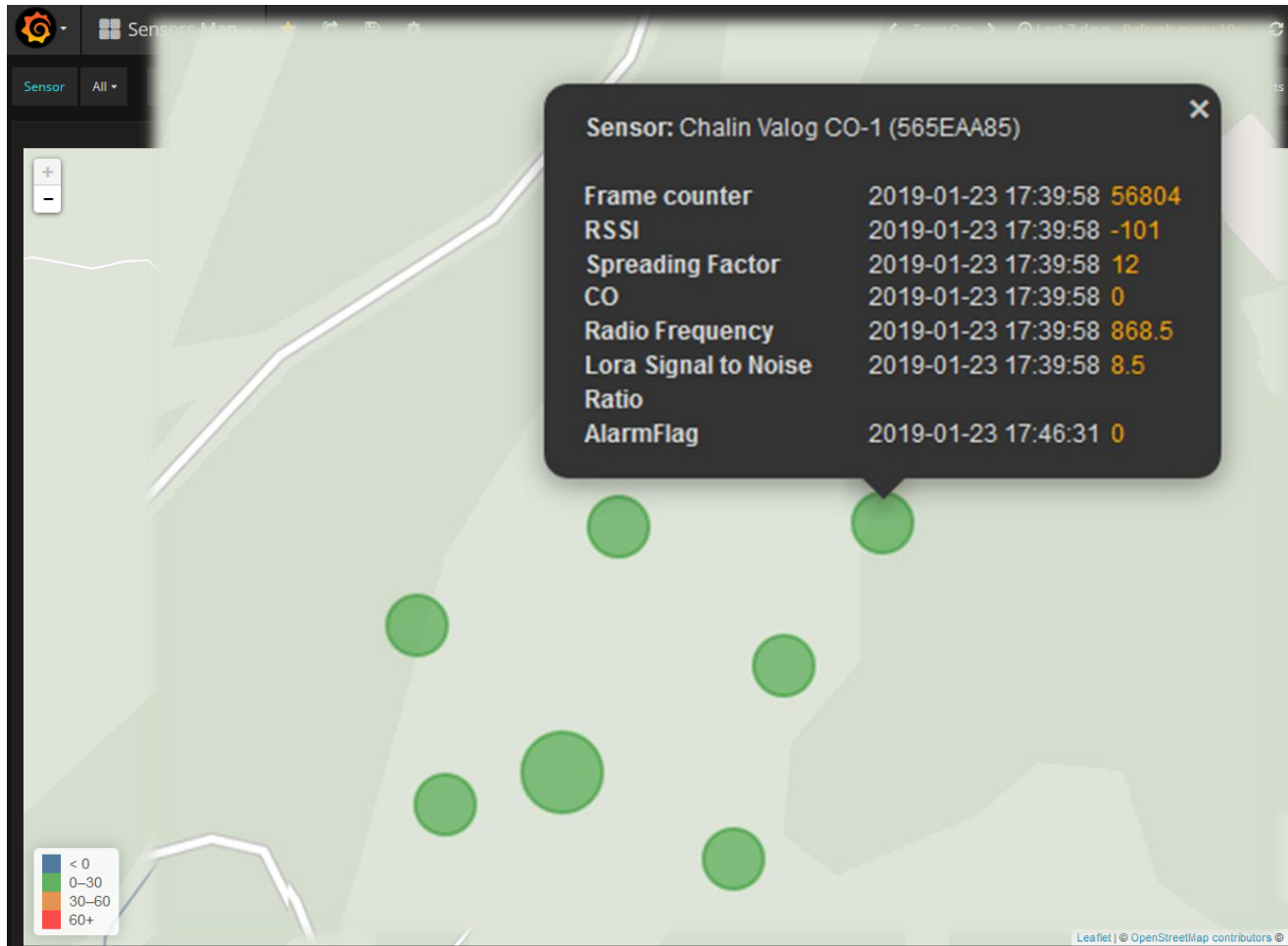
✔ CMS Systems: EFFIS, MKFFIS



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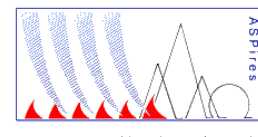


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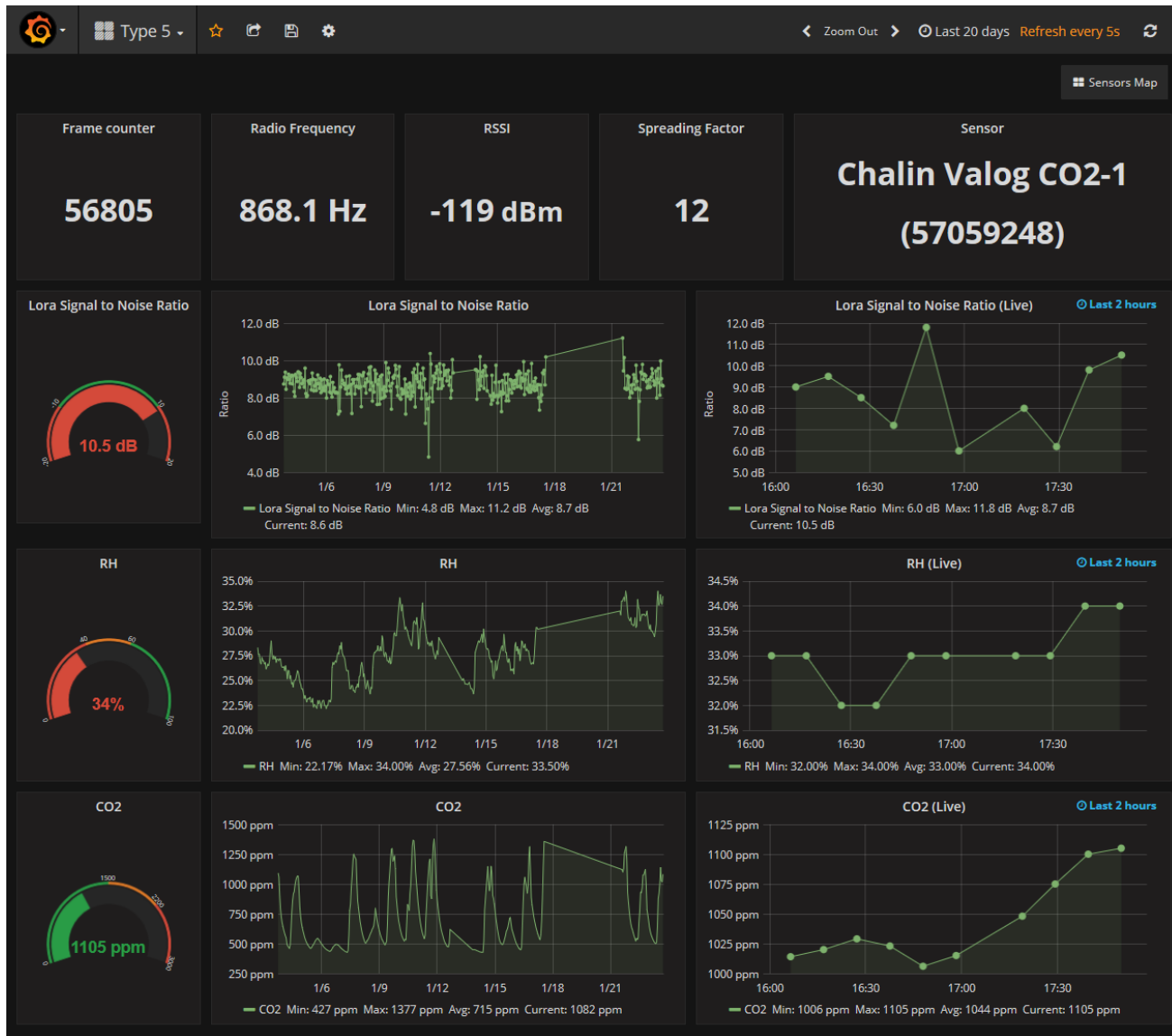


CMS Operator Dashboard

- Sensor location displayed on map
- Mouse over shows last data
- Colour-coded sensor state

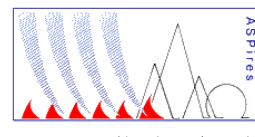


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Sensor Details

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



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Alert Config

Alert Config

Notifications (2) Name Comicon.CO (565EAA85) alert

State history Evaluate every 10s For 0m

Delete

Conditions

WHEN last () OF query (B, 10m, now) IS ABOVE 3

+

Alerts

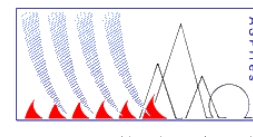
Zoom Out Last 12 hours Refresh every 10s

Sensors Map

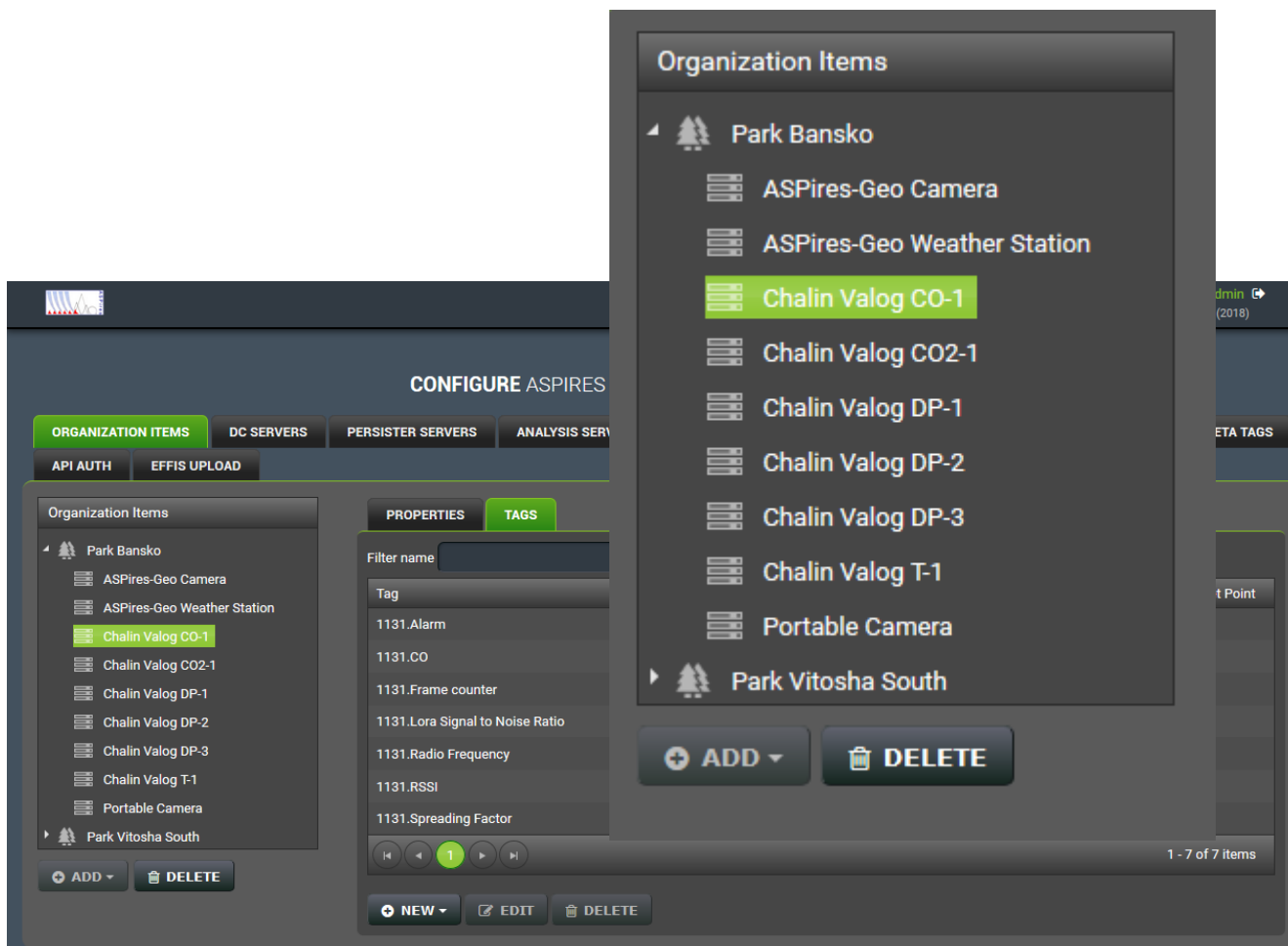
Alert Status	Alert Name	Alert Value	Timestamp
OK	Comicon.CO (565EAA85) alert		Jan 23, 2019 17:46:36
ALERTING	Comicon.CO (565EAA85) alert	CO=4	Jan 23, 2019 17:41:36
OK	ASPIres-GEO Alarm Flag alert		Jan 23, 2019 17:37:37
OK	ASPIres-GEO Temperature alert		Jan 23, 2019 17:37:36
ALERTING	ASPIres-GEO Alarm Flag alert	Alarm=1	Jan 23, 2019 17:36:57
ALERTING	ASPIres-GEO Temperature alert	Temperature=236	Jan 23, 2019 17:36:57
OK	ASPIres-GEO Temperature alert		Jan 23, 2019 12:47:48
OK	ASPIres-GEO Alarm Flag alert		Jan 23, 2019 12:47:47
ALERTING	ASPIres-GEO Temperature alert	Temperature=239	Jan 23, 2019 12:46:48
ALERTING	ASPIres-GEO Alarm Flag alert	Alarm=1	Jan 23, 2019 12:46:47

Alerts

- Define alert rules
- Alert history
- Alert trigger value is available

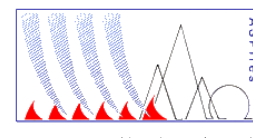


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Administration Portal

- Configure
 - Organisations
 - Gateways
 - Sensors
 - Events, Warnings, Notifications
- EFFIS Import
- RSS Feed



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EDIT EVENT [X]

Name
Fire Danger - CO (High)

+ ADD FUNCTION + ADD TAG ? HELP

Expression
GoOverLimit(GetTagNameByTagType('407', tagid), 3)

Expression Parameters

Name	Type	Value
tagid	Number	0

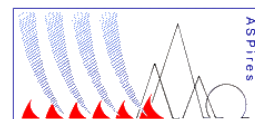
1 - 1 of 1 items

+ NEW [trash] DELETE

[save] SAVE [X] CLOSE

Events

- Rule definitions for situation of interest
 - Value below/above limit
 - Conditions (MIN, MAX, AVG, SPEED)
 - Analyze image (Computer Vision)



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EDIT WARNING ✕

Name
Carbon Monoxide Alarm

Severity
ALARM ▼

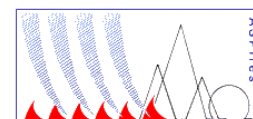
Start Event
FIRE DANGER - CO (HIGH) ▼

End Event
FIRE DANGER - CO (NORMAL) ▼

💾 SAVE ✕ CLOSE

Warnings

- Situation requiring attention
- Triggered by start event
 - i.e. CO level is high
- Stopped by stop event
 - i.e. CO level is normal



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EDIT NOTIFICATION ✕

Name
Fire Detected (Carbon Monoxide)

MESSAGE **FILTERS**

Message Subject
Fire Detected - CO High

+ PLACEHOLDERS

Message Text

```
[{EVENTTIME}] Fire detected at sensor {SENSORNAME}.
{COORDINATES}
```

Events

Name
Fire Danger - CO (High)

1 - 1 of 1 items

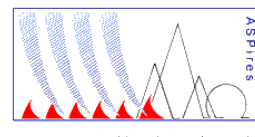
+ ADD **REMOVE**

Addresses

Address	Media Type	Address Type
angelin.nedelchev@icb.bg	Email	Destination
ivelin@icb.bg	Email	Destination

Notifications

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



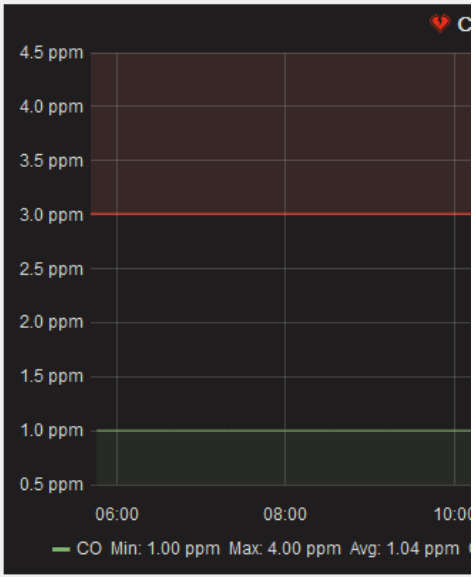
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Sensor: Chalin Valog CO-1 (565EAA85) ✕

Frame counter	2019-01-23 17:39:58	56804
RSSI	2019-01-23 17:39:58	-101
Spreading Factor	2019-01-23 17:39:58	12

[Alerting] Comicon.CO (565EAA85) alert

Metric name
CO



View your Alert rule



Alarm notification

- Sensor turns red
- Audio signal is played
- Email notification is sent
- SMS notification is sent

