CREXDATA

Critical Action Planning over Extreme-Scale Data

PROJECT OVERVIEW

HORIZON-CL4-2022-DATA-01-01 started: 01/01/2023

Investigator NAME

Investigator ORGANIZATION

This project has received funding from the European Union's Horizon Europe programme under grant agreement number 101092749.

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Grant agreement ID: 101092749

DOI

10.3030/101092749

Start date
1 January 2023

End date
31 December 2025

Funded under

Digital, Industry and Space

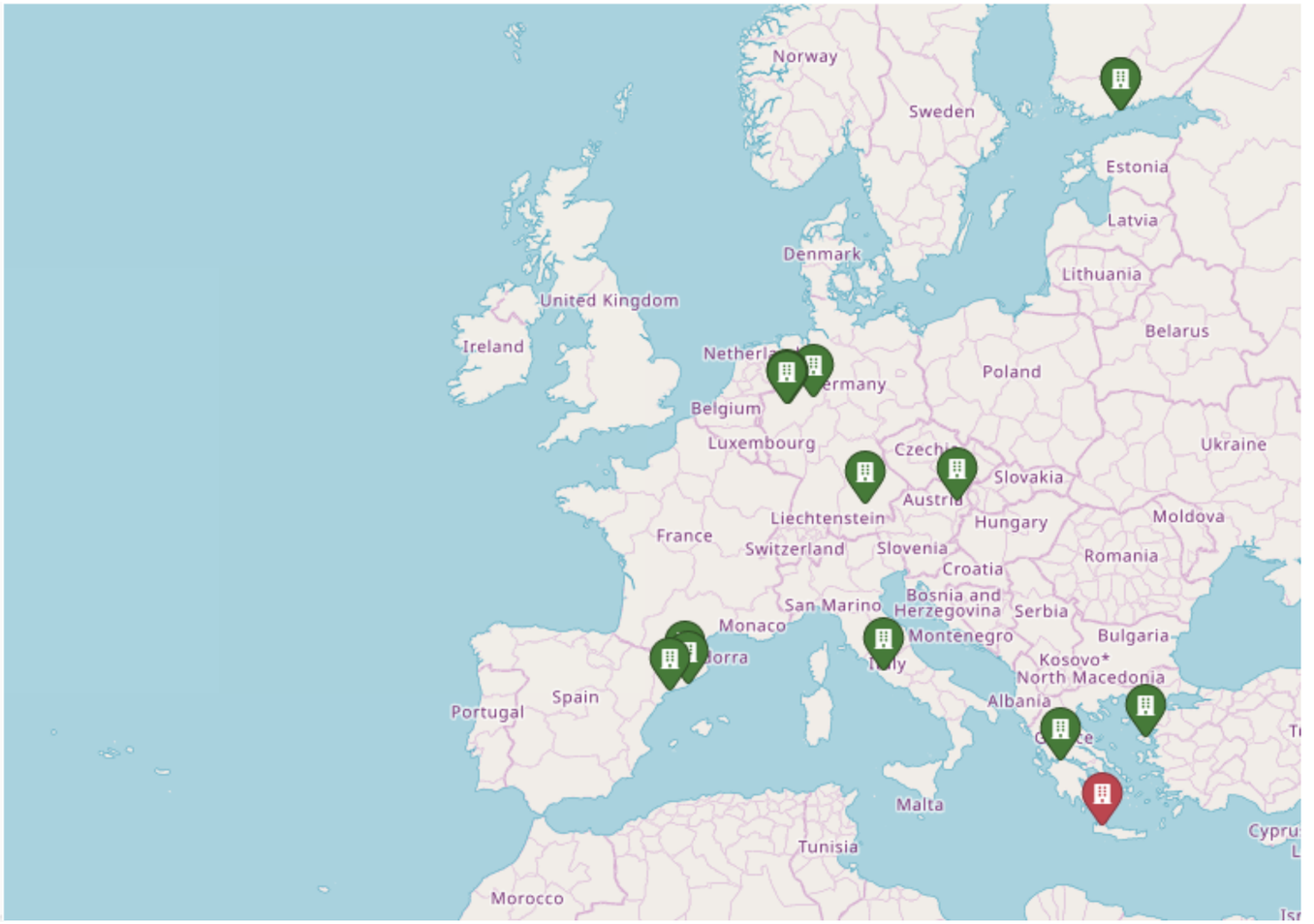
Total cost
€ 8 698 105

EU contribution
€ 8 698 104,75

Coordinated by

POLYTECHNEIO KRITIS

Greece



MISSION

THE VISION

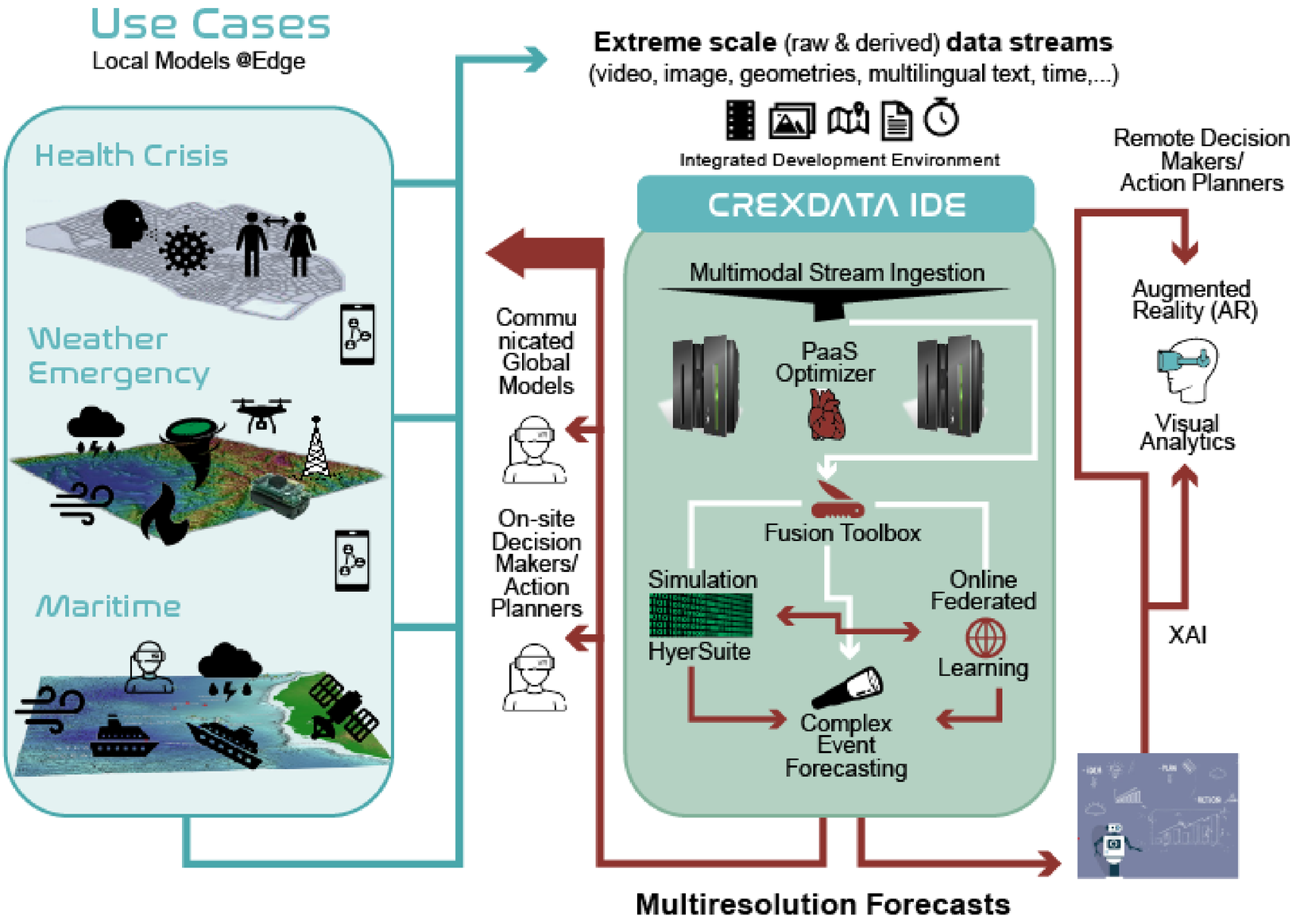
The vision of CREXDATA is to develop a generic platform for real-time critical situation management including flexible action planning and agile decision making over data of extreme scale and complexity.

Emergency management and critical action planning call for timely and accurate decision making in several, diverse applications with the goal to optimize economic, societal, or environmental impacts. Weather and health emergencies and maritime applications collect live streams of extreme scale data that reach high speeds and volumes and possess highly volatile statistical properties, incorporating uncertainties and diverse modalities through a multitude of sources.

CREXDATA will develop a generic platform for real-time critical situation management including flexible action planning and agile decision making over streaming data of extreme scale and complexity. **The project will develop the algorithmic apparatus, software architectures and tools for federated predictive analytics and forecasting under uncertainty**. The envisioned framework boosts proactive decision making providing highly accurate and transparent short- and long-term forecasts, explainable via advanced visual analytics and accurate, real-time, augmented reality facilities.

To achieve its vision, CREXDATA will develop a next generation Prediction-as-a-Service (PaaS) system where action planners will easily register their multimodal data stream sources and compute resource federations and graphically design predictive analytics workflows.

OVERVIEW


Use Cases
Local Models @Edge
Health Crisis
Weather Emergency
Maritime
Extreme scale (raw & derived) data streams
(video, image, geometries, multilingual text, time,...)
Integrated Development Environment
CREXDATA IDE
Multimodal Stream Ingestion
PaaS Optimizer
Fusion Toolbox
Simulation
HyerSuite
Online Federated Learning
Complex Event Forecasting
Communicated Global Models
On-site Decision Makers/ Action Planners
Remote Decision Makers/ Action Planners
Augmented Reality (AR)
Visual Analytics
XAI
Multiresolution Forecasts

OBJECTIVES

OBJECTIVES

EXTREME-SCALE DATA INGESTION/GENERATION, FUSION AND EXPLOITATION

REAL-TIME PREDICTIVE KNOWLEDGE AND FORECAST

REDUCED PERCEIVED COMPLEXITY

Critical Action Planning:
Alert action planners about imminent events ahead of time

Assist people operating on-site

Reduce the complexity of setting up analytics workflows via (code-free) graphical user interfaces

Display accurate and trustworthy long-term forecasts

Visual explanatory representations supporting XAI.

Addition Challenges
Large variety of data, as well as multilingual social data need to be fused

Online Federated Learning required: Communication only when needed

Computing resources (cloud, edge/fog devices) need to be optimized

Develop truthful simulation models that can deal with scarce events

USE CASES

USE CASES

Weather emergencies use case (led by Paderborn University)

- Forest fire
- Flooding

The purpose of this use case is to improve situational awareness significantly so that informed decisions are taken by civil protection considering ranked future worlds with explicit uncertainties avoiding disaster impacts. Use case validation is performed in reproducible test bed scenarios and in 4 field trials.

•Pilots at Dortmund (Germany) and Innsbruck (Austria)
•Many involved partners at all levels of command

USE CASES

Health crisis use case (led by Barcelona Supercomputing Center)

- Forecasting and effective interventions in the modelling of epidemics and drug treatment optimization in COVID-19 infection
- 2 scenarios:
  - Epidemics Scenario: Using epidemiological models, build a digital twin for COVID-19 transmission
  - Drug Treatment Scenario: Use multiscale mechanistic models to build a digital twin of a drug assay in COVID-19 patients to identify the best treatment for each patient & condition

The purpose of this use case is to integrate epidemiological and multi-scale simulations models with large-scale machine learning, to help develop a generalizable and flexible analytical platform for supporting decision-making processes, such as designing strategies for health crisis responses, as well as treatment optimization

USE CASES

- **Maritime use case (led by the University of the Aegean)**
  - Vessel digital twins
  - Routing under adverse weather or under emergency conditions

The purpose of this use case is to develop the first solution, combining hardware and software development, that will be able to use data coming from a vessel's VDR, which will be fused with global views of data creating reliable digital twins of vessels. It will develop the first weather and emergency routing and route forecasting solutions that will be performed for all vessels of a fleet simultaneously (instead of on-demand requests per vessels) and that will rely on big data and AI technologies. The use case will be validated in a sea trial experiment, where real small vessels will be used simulating hazardous situations (e.g., proximity events, groundings).

CORE APPLICATIONS

- Graphical Workflow Design
- Multimodal Data Ingestion and Fusion
- Simulation Models & Suites
- Complex Event Forecasting
- Prediction-as-a-Service Optimization
- Transparency & Explainability
- Augmented Reality
- Online Federated Learning
- Visual Analytics under Uncertainty
- Real-time Social Media & Multilinguality

LATEST TECHNICAL UPDATES BY M18

Use Cases

- T2.1: Weather Emergencies Use Case
  - Facilitating end-user requirements.
  - Developing slide deck to explain WP3-WP5 technologies.
  - Pilots in Dortmund and Austria in progress.
- T2.2: Health Crisis Use Case
  - Selection of epidemiological compartmental model (MMCA).
  - Design of HPC workflow for model calibration.
  - Dataset selection and metric definition for calibration and testing.

Technical Work Packages

- T5.3: Visual Analytics for Decision Making
  - Experimenting with CER data and transforming outputs for relational representations.
  - Construction of trajectories and complex event marking in progress.
- T5.4: Augmented Reality at the Field
  - Initial testing of User Interfaces for AR visualization for forest fires.
- T5.5: Uncertainty Visualization in AR
  - State-of-the-art review on immersive analytics and uncertainty visualization in AR.
  - Welcome new full-time researcher Alexis!

PARTNERS

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Consiglio Nazionale delle Ricerche

DEMOKRITOS
NATIONAL CENTRE FOR SCIENTIFIC RESEARCH

DRZ
DEUTSCHES RETTUNGSROBOTIK ZENTRUM

DCNAustria
Disaster Competence Network Austria

City of Dortmund
Fire Department

empresite

Fraunhofer

HEINZ NIXDORF INSTITUT
UNIVERSITÄT PADERBORN

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MarineTraffic

Ministry of the Interior
Finland

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OF CRETE

RAPIDMINER

UNIVERSITAT
ROVIRA i VIRGILI

UNIVERSITY OF THE
AEGEAN

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THANK YOU!

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www.crexdata.eu