

Sustainable Watershed Management Through IoT-Driven AI

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Industrial Facilities in Watersheds

- Fabrication
- Processing
- Washing
- Dilution
- Cooling
- Transportation



Water Treatment Plants



Water Pollution Disasters

- Kokemäki, Finland, 2014
 - 66 tons of nickel
 - 30 hours

UUTISSET > NEWS

News 13.7.2014 7:00 | updated 13.7.2014 11:50

Dead mussels found in Kokemäki river after nearby nickel leak

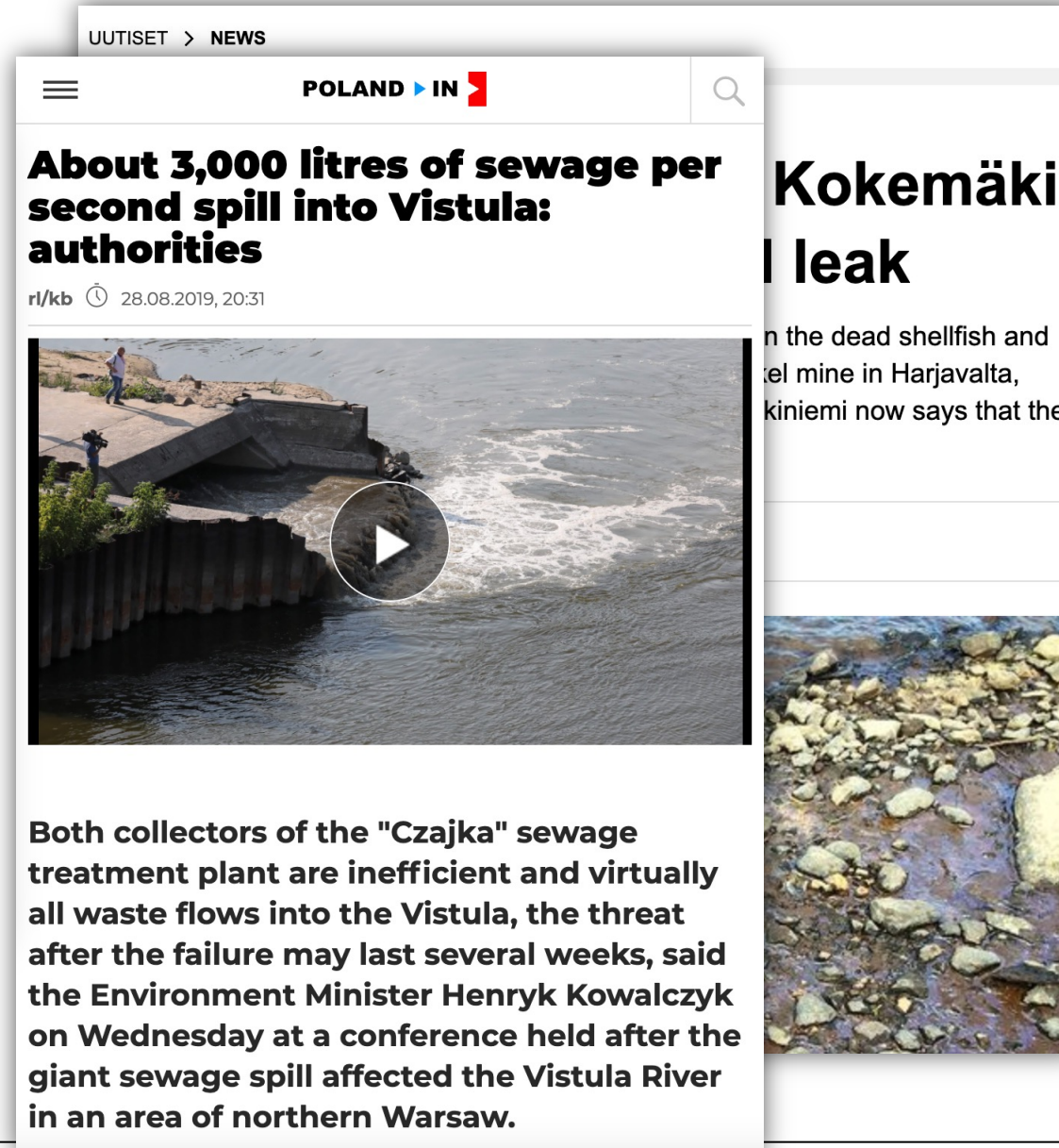
Experts first insisted that no link could be proven between the dead shellfish and last week's release of cooling fluids from the Norilsk Nickel mine in Harjavalta, southwest Finland. Pori environmental director Matti Lankiniemi now says that the link is highly likely.

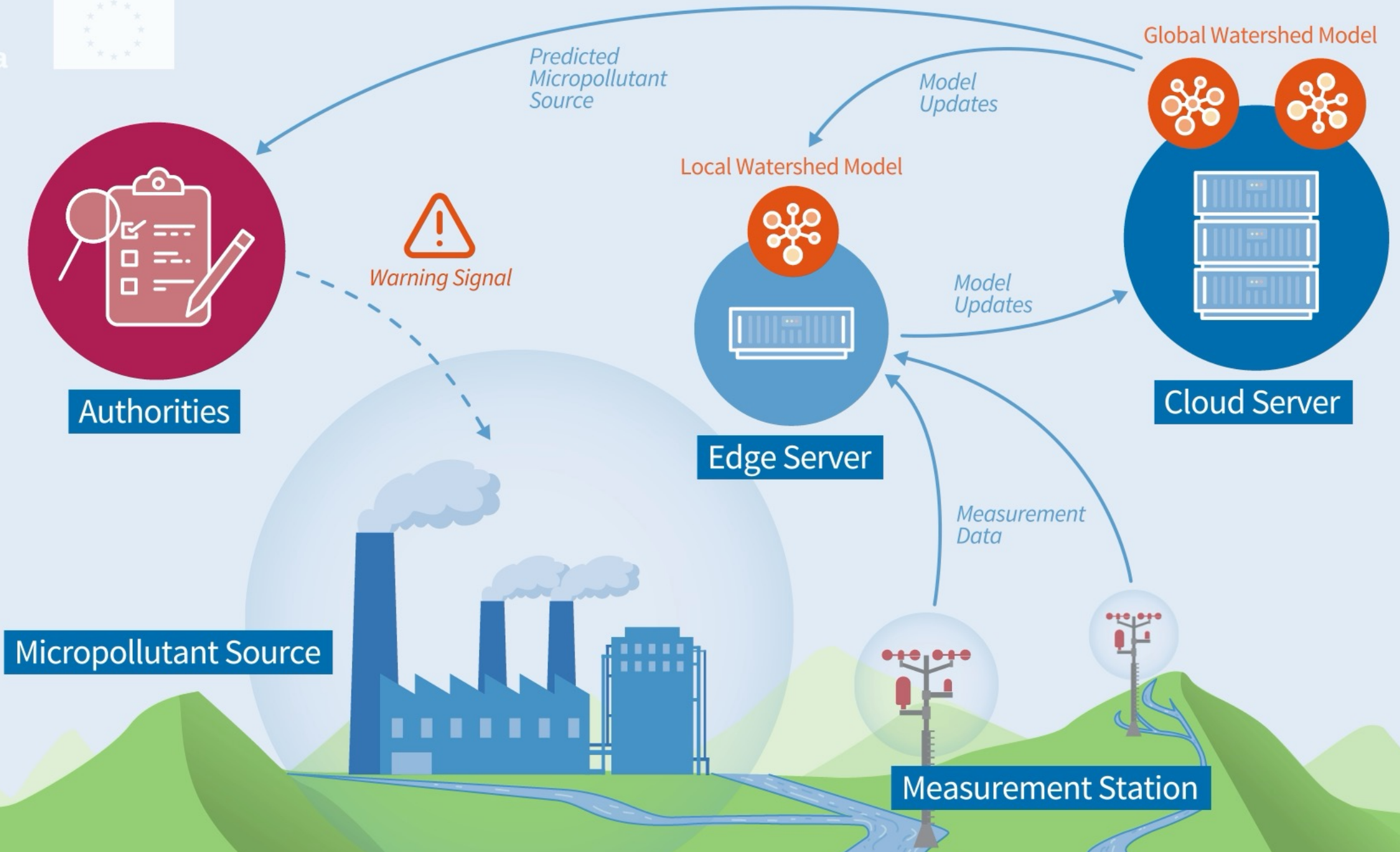
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Water Pollution Disasters

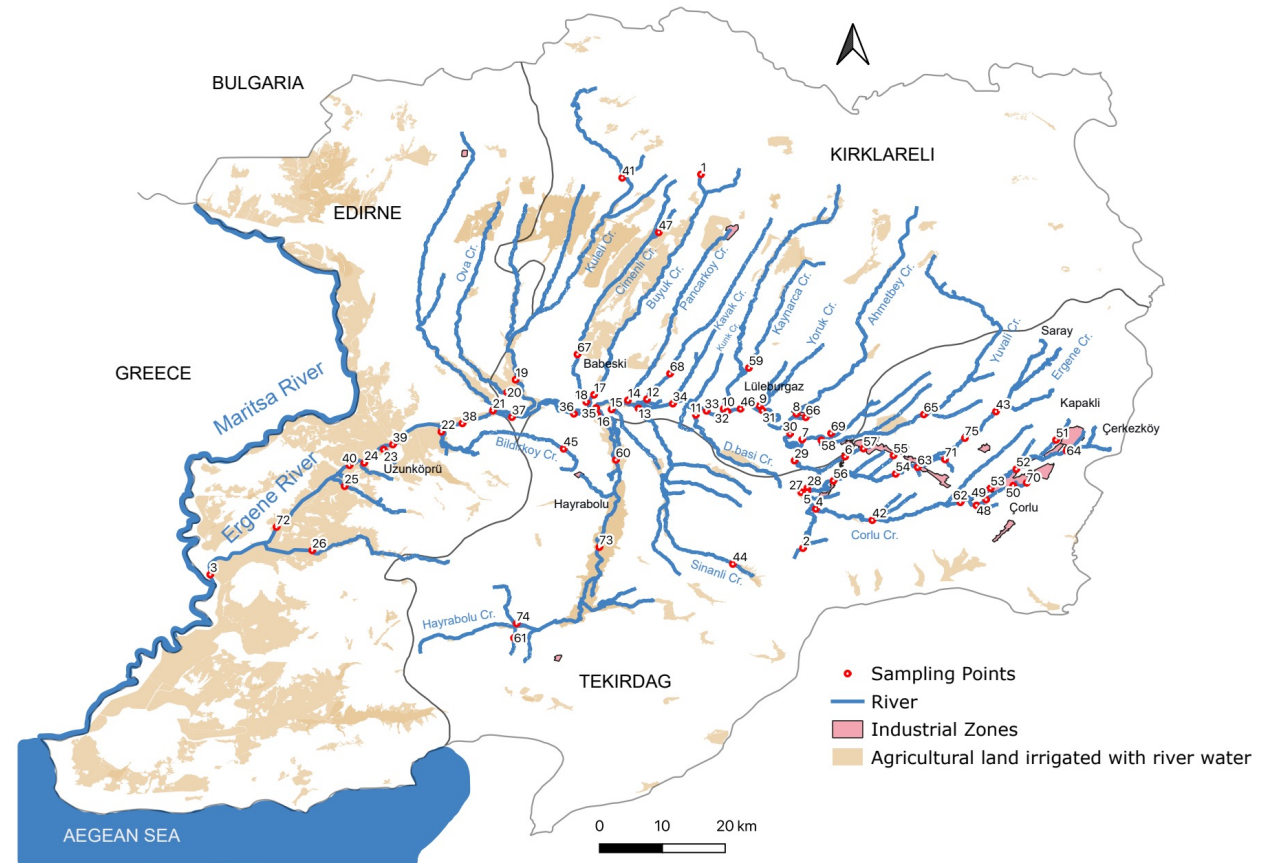
- Vistula, Poland, 2019
 - 300 tons of nitrogen
 - 30 tons of phosphorus
 - Five days





Use Cases

- Use Case 1
 - Ergene River in Northwestern Turkey
- Use Case 2
 - Kokemäki River in Southwestern Finland



SWAIN Project

- Funded EUR 1.2M from March 2021 to March 2024
 - University of Vienna (Coordinator)
 - Vienna University of Technology
 - Università della Svizzera italiana
 - Istanbul Technical University
 - Bogazici University
 - Finish Environmental Institute

<https://swain-project.eu/>
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Der Wissenschaftsfonds.



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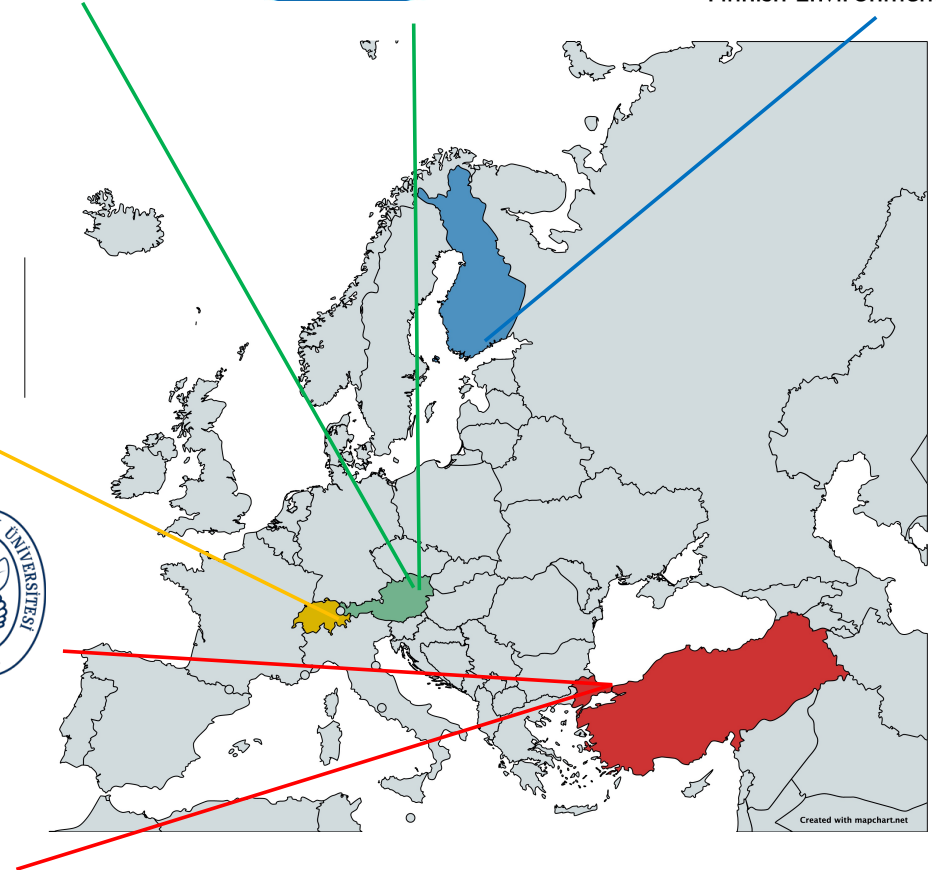
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Finnish Environment Institute



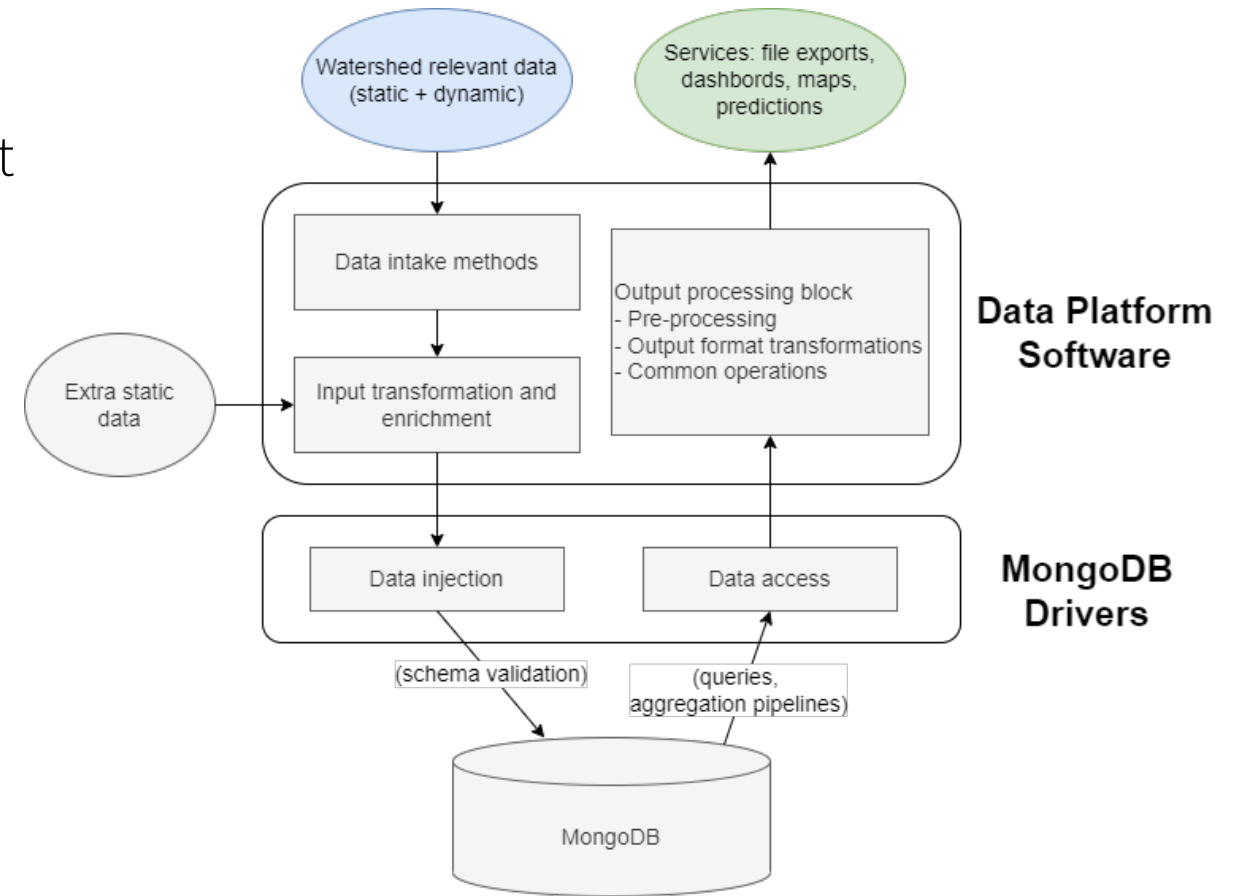
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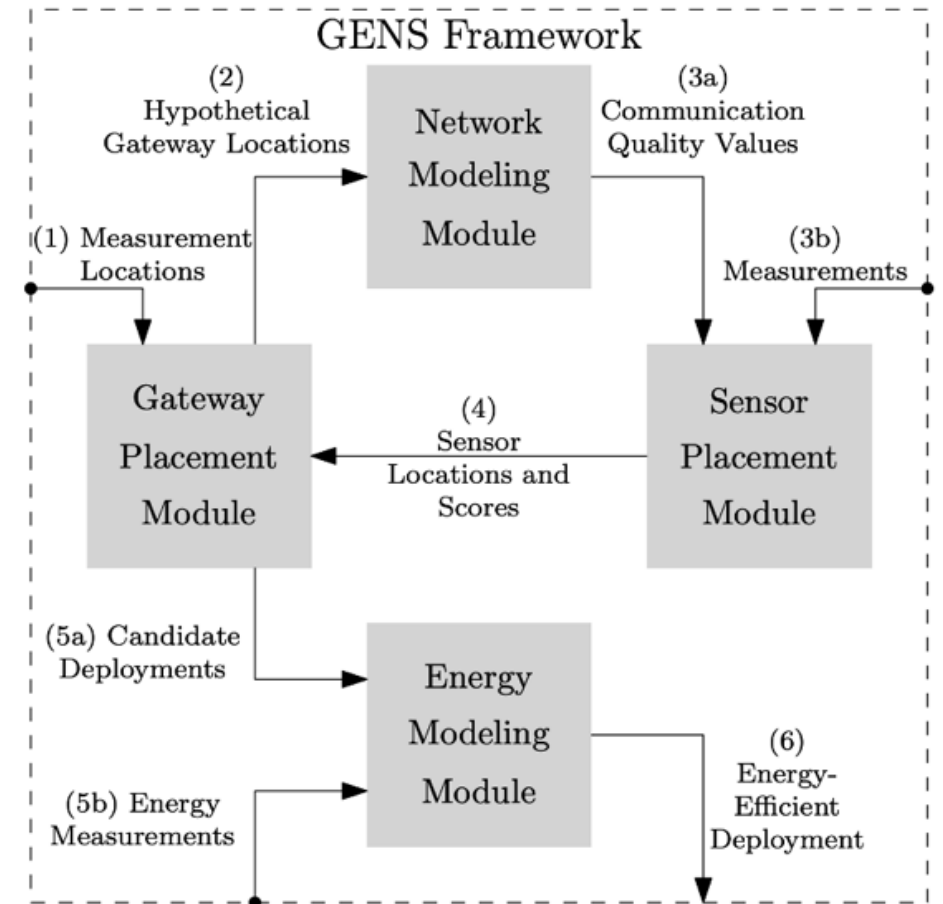
Task Force 1

- Analysis of the factors relating to micropollutant transport and presence in watersheds
- Refinement and update of available data and consolidation of a single geodatabase
- Design and implementation of AI-assisted micropollutant transport model

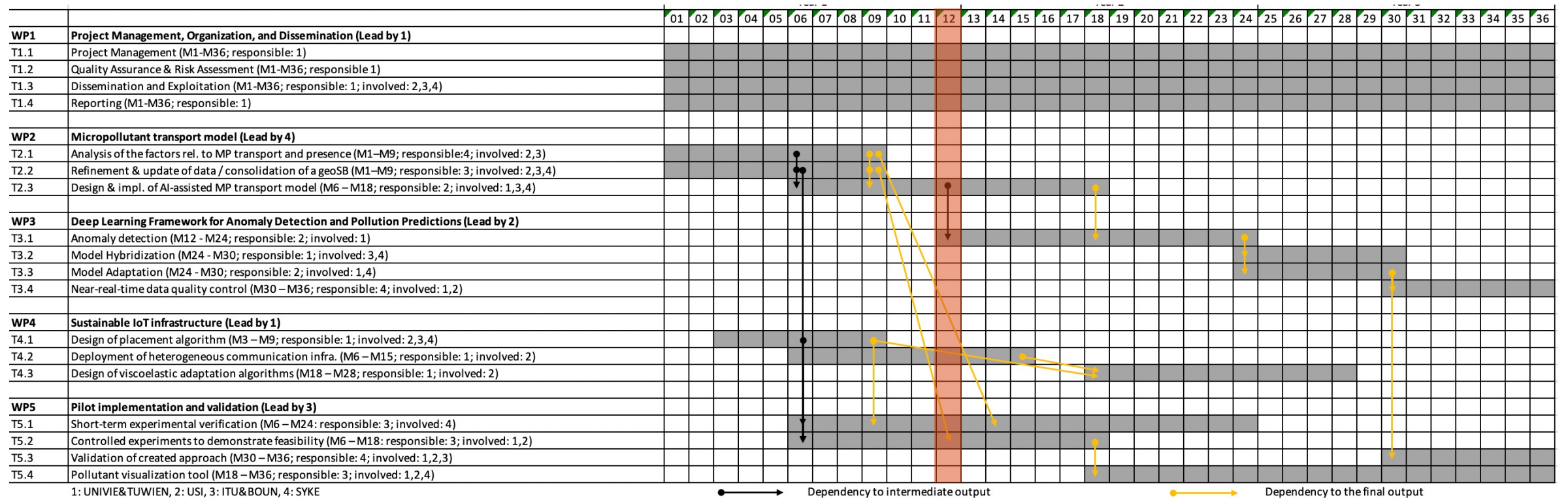


Task Force 2:

- Design of sensor placement algorithm
 - Information quality
 - Communication capability
 - Energy-efficiency
- Deployment of heterogeneous communication infrastructure
- Design of viscoelastic adaptation algorithms



Timeline



Timeline

Meetings				
N°	Date	Location	Attending partners	Purpose
1	01.03.2021 - 03.03.2021	Online	All	Kick-off meeting
2	15.04.2021	Online	All	Regular monthly meeting + Workshop
3	07.05.2021	Online	All	Regular monthly meeting
4	10.06.2021	Online	All	Regular monthly meeting
5	15.09.2021	Online	All	Regular monthly meeting
6	18.10.2021 - 19.10.2021	Vienna, Austria	All (P5 remotely)	Regular monthly meeting + Workshop
7	02.12.2021	Online	All	Regular monthly meeting
8	13.01.2022	Online	All	Regular monthly meeting
9	28.02.2022	Online	All	Regular monthly meeting

Dissemination

- Promotional video
 - Winner of the CHIST-ERA Video Contest 2021
- Video interview with the coordinator
 - University of Vienna magazine
- News article in a national outlet (*Der Standard*)
- Project website and social media accounts
 - Austrian Academy of Sciences – *Colloquium Digitale: Digitalization, People, and Society*
 - ERN – *Environmental Engagements: talks*
 - Leibniz Center for Informatics – *Dagstuhl Seminar*



Scientific Publications

1. Toczé, K., Schmitt, N., Kargén, U., Aral, A., & Brandić, I. (2022). Edge Workload Trace Gathering and Analysis for Benchmarking. In 6th IEEE International Conference on Fog and Edge Computing (ICFEC 2022).
2. Ding, A. Y., Peltonen, E., Meuser, T., Aral, A., Becker, C., Dustdar, S., ... & Wolf, L. (2022). Roadmap for edge AI: a Dagstuhl perspective. Editorial Note, ACM SIGCOMM Computer Communication Review, 52(1), 28-33.
3. Zhou, H., Aral, A., Brandic, I., & Erol-Kantarci, M. (2021). Multi-agent Bayesian Deep Reinforcement Learning for Microgrid Energy Management under Communication Failures. IEEE Internet of Things Journal.
4. *IoT-Enabled Sustainable Environmental Monitoring via LoRaWAN and Signal Reconstruction*
5. *Hydrogeographical and chemical parameters in water quality modelling (WQM)*

Impact

1. The joint optimization and dynamic placement of training and inference tasks across the edge-fog-cloud continuum.
2. Expert knowledge from environmental scientists will be incorporated into the evidence-based models via a novel feedback mechanism.
3. Currently water sample analysis for 250 pollutants takes 20 minutes. By identifying indicator pollutants beforehand and reducing the analysis to 20-50 pollutants, it might be possible to detect micropollutants in 5 minutes.
4. Environmental data from watersheds will be made openly available in much higher granularity than state-of-the-art allowing data fusion.
5. Interdisciplinarity, widening countries, young researchers

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