# UrbanFlood

## Monitoring, rich browsers and cloud service technologies for an online EWS hosting platform

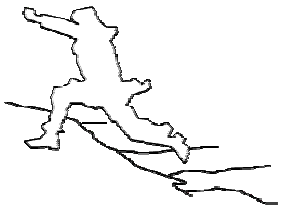
### Work Package 6 – D6.4

**version 1.0, 29 Nov. 2010**

**November 2010**

SEVENTH FRAMEWORK PROGRAMME

# URBAN FLOOD

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## DISCLAIMER

# TABLE OF CONTENT

## SUMMARY

This document describes technologies which form the base for the UrbanFlood online hosting platform. These technologies are virtualization and cloud computing. Rapid progress of those kinds of technologies made the development of EWS hosting platform possible.

## Acronyms and Abbreviations

| | |
|---|---|
| C&D | Communication and Dissemination |
| CYF, CY | Cyfronet AGH, Cracow, Poland – UrbanFlood partner |
| Defra | Department for Environment, Food and Rural Affairs, UK |
| DoW | Description of Work, annex to the UrbanFlood Grant Agreement |
| EC | European Community |
| EWS | Early Warning System |
| FLOODsite | EU funded project: Integrated Flood Risk Analysis and Management Methodologies. 6th Framework Programme |
| FRM | Flood Risk Management |
| HRW | HR Wallingford |
| ICT | Information and Communication Technology |
| IJkdijk | IJkdijk Foundation, dike testing site in Groningen, the Netherlands |
| IWS | International Online Early Warning Workshop |
| LiveDijk | Test location for sensor technologies at Eemshaven, Groningen, the Netherlands |
| M&E | Monitoring and Evaluation |
| NEMO | Science museum in Amsterdam, the Netherlands |
| PU | Public (report) |
| RE | Restricted (report) |
| RTD | Research (in DoW) |
| SIE | Siemens, Germany. OOO Siemens in Russia is an UrbanFlood project partner |
| SME | Small and Medium sized Enterprise |
| STOWA, STO | Dutch acronym for the Foundation for Applied Water Research, Utrecht, The Netherlands – UrbanFlood Partner |
| TNO | TNO Dutch organisation for Applied Research, The Netherlands – UrbanFlood lead partner |
| UK | United Kingdom |
| UvA | University of Amsterdam |
| WP | Work Package (there are 7 work packages in UrbanFlood) |
| OS | Operating System |
| VM | Virtual Machine |

# 1 Introduction

## 1.1 UrbanFlood

UrbanFlood is a project investigating the use of sensors within flood embankments to support an online early warning system, real time emergency management and routine asset management. It is a project under the EU 7th framework Programme which started in December 2009 and will run for 3 years. Partners of UrbanFlood are TNO Information and Communication Technology, the University of Amsterdam and STOWA (Dutch acronym for the Foundation for Applied Water Research) from the Netherlands; HR Wallingford in the UK, ACC Cyfronet AGH in Poland and OOO Siemens in Russia

## 1.2 Introduction

Figure 1 describes the context and goals of UrbanFlood. At the end of the first year, in this report, we summarize the state of major technological innovations of UrbanFlood and how they relate.


**Figure 1 A summary of the (goals of) the UrbanFlood project.**

Although UrbanFlood test the technologies in the context of flood prevention in Urban area's, its technology is much more general and can be applied in many other contexts that are equally complex. Complexity is characterized, amongst others by, a large number of data

sources (e.g. sensors), internet data, data and collaboration software computational models from many organisations and a dynamic physical environment. Hence, whether its data from the environment, from a man-made infrastructure like a dike, road or off-shore windmill farm, the UrbanFlood technology can be applied as a basis for a distributed, internet based information technology for monitoring, visualisation, decision making and control.

# 2 State of UrbanFlood technology

UrbanFlood innovates in the following area's: monitoring of sensor data, visualisation of information, distributed computing and – when everything is put together – that of large scale distributed observation systems (that are able to mitigate the effects of climate change). These innovations mean, in the context of the application context of UrbanFlood – flooding - that UrbanFlood delivers a monitoring technology that is able to monitor tens to hundred thousands of kilometres of dikes, forecasting failures, increasing safety and minimizing the costs of strengthening dikes (which are in the order of 500€ - 1000€ per meter).

The Urbanflood technology is summarized in Figure 2:

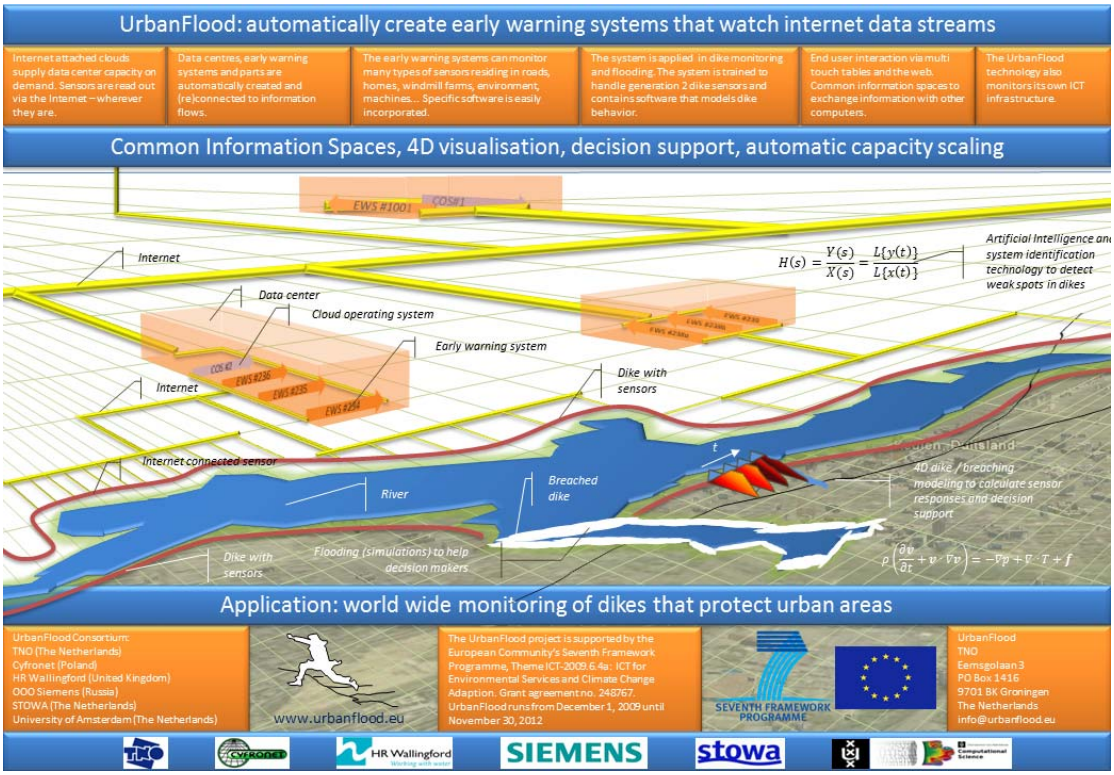


**Figure 2 Summary of the UrbanFlood project, emphasizing areas of innovations and the application in the domain of flood prevention control.**

In December 2010 most of the technologies where built, integrated and shown to the public in the workshop UrbanFlood has organized (November 2010). The following table summarizes the technological progress in certain domains and the major developments that are going on.

| Innovation area | Realized | Major developments 2011 |
|---|---|---|
| **Monitoring** | Monitoring of sensor data from dikes, transmission via | AI that detects alarming physical conditions on basis |

| | | |
|---|---|---|
| | the internet, storage and sensor failure detection | of sensor data |
| **Rich browsers (dedicated on-line visualization technologies)** | Visualisation of sensor, inundation and environmental data and EWS properties on multitouch tables and web pages. | Interactive, automated generation of breaching, inundation simulations. Inspection, manipulation and comparison of sensor and environmental data (meteo, ships, buildings…).<br><br>Creation of visualisation technology suitable for public places |
| **Cloud service technologies (management of distributed computational resources via the internet)** | Instantiation and operation of multiple EWS's on a collection of virtualisation servers in several data centres. User interface for adaption of physical resources and workflow management. Performance and robustness monitoring of EWSs, EWS components and virtualisation servers. | Automated EWS generation and automated resource adaptation |
| **Online EWS hosting platform** | Anomaly detection. User interface for resource and application configuration and workflow management. Visualisation of dike conditions and generation of decision support information. 3D (time dependent behaviour of two dimensional slices of stressed dikes) simulations. | Automated workflow management. 4D (three dimensional, time dependent) computation of sensor data on basis of simulations of (stressed) dikes. Anomaly detection on basis of linear response technology/neural networks. |

As UrbanFlood develops its technology in iterations, minor improvements on all parts of the technologies are also undertaken. In conclusion, in the first year of UrbanFlood the basic realisation of all innovations and developments have been realized.

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# 3 References and bibliography

[1] TNO (2009a). UrbanFlood proposal Annex I – “Description of Work”