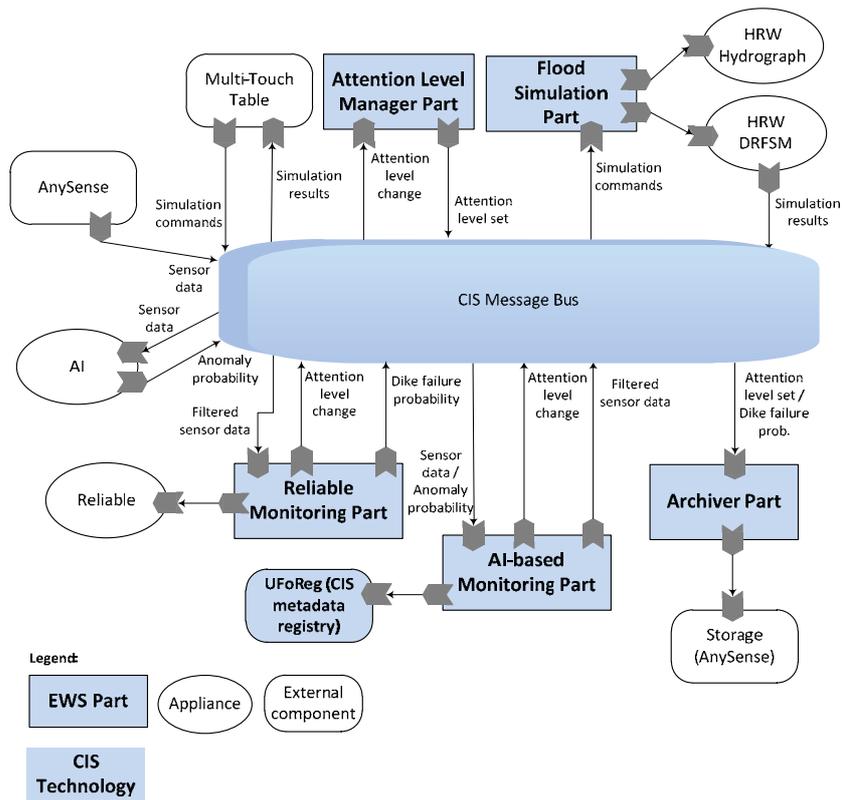# UrbanFlood

Orchestrating the information flow in a Common Information Space

Work Package 5 – D5.3
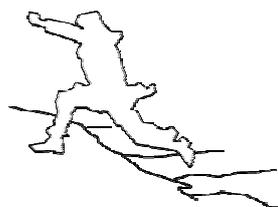
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DOCUMENT INFORMATION

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29-11-2010	0.1	Bartosz Balis	CYFRONET		First version
29-11-2010	1.0	Bartosz Balis, Marian Bubak, Tomasz Bartynski	CYFRONET	Rob Meijer	Various changes.

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DISCLAIMER

1   Introduction

Deliverable 5.3 is not a report but a prototype. This document only describes the functionalities and possible acces to demonstrations. D5.3 is a prototype of the Common Information Space (CIS), a software framework facilitating creation and operation of Early Warning Systems. This document describes the implementation of the Dike Monitoring EWS (DM-EWS), the first Early Warning System integrated with the CIS technology. As of writing of this document, the operational DM-EWS has been demonstrated at a number of events, including the Joint UrbanFlood & SSG4Env Workshop 'Monitoring and Flood Safety', on November 10-11, 2010, Amsterdam.

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 that UrbanFlood is developing. It is a project under the EU 7th framework Programme which started in December 2009 and will run for 3 years. Partners of UrbanFlood include 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   The Common Information Space

The CIS provides services and building blocks to create operational Early Warning Systems. In the current prototype of the CIS, the following services are implemented:

- **The Integration Platform (PlatIn)**: core technologies used to integrate and run EWSs. PlatIn includes application containers, service bus technology (OpenESB), workflow orchestration engine (OpenESB BPEL), integration patterns engine (Apache Camel), and message bus technology (ActiveMQ JMS)

- **The metadata registry (UFoReg)**: general-purpose metadata store which currently contains metadata about sensor data, EWSs, and status of cloud resources. The metadata stored in the UFoReg can be browsed through the following web page:

  http://149.156.9.57/uforeg/

Three types of entities can be involved in a EWS:

- **Appliances**: any piece of software exposed as a service[1] and wrapped into a virtual machine image. Typically an appliance contains domain-specific legacy application, such as a dike failure prediction or an inundation simulation.

- **External components**: providers or consumers of data which are not wrapped as appliances. Typical examples include GUIs, sensor data sources and databases.

- **EWS Parts**: essential pieces of software developed in the CIS core technology which realize high-level business logic of an EWS. Parts organize data and control flow between appliances and external components (and possibly also other Parts), and perform additional processing essential for the EWS (such as message filtering, data transformation, generation of alerts, etc.).

The detailed system specification and design for the CIS have been presented in the previous deliverables D5.1 and D5.2.

1.3   Dike Monitoring Early Warning System

The Dike Monitoring Early Warning System (DM-EWS) monitors selected sections of dikes through sensor networks and detects anomalous dike conditions. If the latter occur, alerts are generated and further inundation simulations may be performed for prediction and damage assessment in the event of a dike failure.

Various software components involved in the DM-EWS have been organized into an operational Early Warning System using the CIS technology as shown in Fig. 1. These components are summarized in Table 1.

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[1] "Service" means that the software's functionality is exposed via one of technologies supported by the CIS which currently include SOAP and REST Web Services, JMS message queue and FTP.
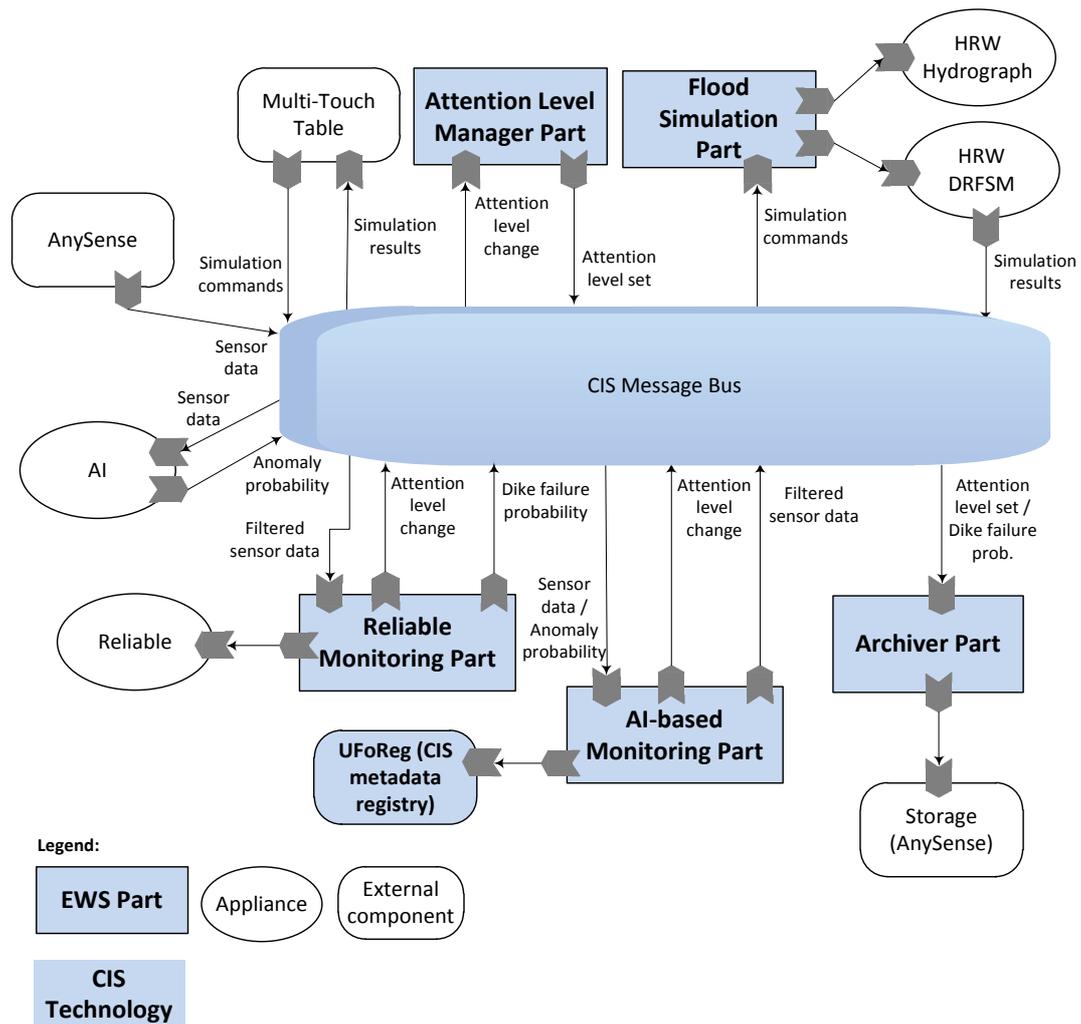
Figure 1: Implementation of the Dike Monitoring Early Warning System in the Common Information Space. The information flow through CIS is orchestrated by (1) EWS Parts and (2) CIS message bus. EWS parts are independent pieces of software developed using the CIS technology which implement high-level business logic of the EWS. Parts communicate through the message bus by publishing and consuming messages. UFoReg metadata registry can be invoked by any part to retrieve metadata regarding the EWS. External components which produce or consume information may also be connected to the bus.

Table 1: Data and application components integrated in the Dike Monitoring Early Warning System.

Component name	Function	Type	Provider(s)
AnySense	Sensor data source / archive data repository	External data source	TNO
Multi-Touch Table	Visualization, user-driven steering	External GUI, client and data consumer	UvA, TNO

AI	Machine-learning based detection of anomalies in sensor signals	Appliance	Siemens
HRW Reliable	Computation of dike failure probability	Appliance	HR Wallingford
HRW Hydrograph / HRW DRFSM	Inundation simulation	Appliances	HR Wallingford
AI-based Monitoring Part	Integration of the AI appliance, generation of alert messages, filtering of sensor data	EWS Part	Cyfronet
Reliable Monitoring Part	Invocation of the HRW Reliable appliance, generation of alert messages.	EWS Part	Cyfronet
Flood Simulation Part	Service for performing simulation tasks specified by simulation command messages. Invokes the HRW Hydrograph and DRFSM appliances and performs necessary data transformations.	EWS Part	Cyfronet
Alert Level Manager Part	Consumes alert messages published by other parts, calculates a new alert level, and publishes the corresponding message to the message bus.	EWS Part	Cyfronet
Archiver Part	Consumes various messages published to the message bus, and passes relevant pieces of information over to the AnySense for archiving.	EWS Part	Cyfronet

1.4 Using DM-EWS

The operation of the DM-EWS is determined by the behavior of the EWS parts described in the previous section. These parts are loosely coupled, i.e. do not directly depend on each other and communicate through the message bus. The DM-EWS works automatically as long as the parts are started, and the appliances as well as the external components are available. The data produced by the EWS is visualized on the Multi-Touch Table which also performs some control operations (such as starting a simulation on demand).

A part can be started in one of three ways:

- Automatically, along with the CIS.

- Using the UFoReg EWS management interface (access restricted):

  http://149.156.9.57/uforeg/ewslist

- Using the provided URL.

Out of five parts in the DM-EWS, three of them are started automatically (AI-based Monitoring, Alert Level Manager and Archiver). The latter two can be started and stopped on demand using provided Web Service endpoints:

- Reliable Monitoring: http://149.156.9.58:9080/StartDMEWS

- Flood Simulation: http://149.156.9.58:9080/StartFloodSim

In addition, the flood simulation part works as a service, i.e. once started it waits for simulation commands. The commands can be sent to a JMS topic *simulation_request*. The address and security details (username / password) for the JMS service are explained on the following web page (available only for UrbanFlood consortium members):

http://188.40.109.248/UrbanFloodWiki/index.php/CIS_JMS

The results of the simulation are published to a JMS topic *simulation_results*.

All EWS parts of the DM-EWS are available in the SVN repository (only for UrbanFlood consortium members):

https://gforge.cyfronet.pl/svn/urbanflood/trunk/