Flood Monitoring System-of-System

Overall Description

Carlos Diego N. Damasceno
Milena Guessi

SCC5944 Software Architecture

Prof: Elisa Nakagawa @ USP-ICMC

April - 2016

Summary

1. Context and Problem
2. Product Perspective
3. Product Functions
4. User Classes and Characteristics
5. Design and Implementation Constraints
6. Assumptions and Dependencies

Context and Problem

flood *noun* **(WATER)**

a large amount of water covering an area that is usually dry

[1] Flooding near Key West, Florida, United States from Hurricane Wilma's storm surge in October 2005.

[2] Flooding in a street of Natal, Rio Grande do Norte, Brazil in April 2013.

[3] Flooding in São Carlos - SP

References: [1,2] https://en.wikipedia.org/wiki/Flood (Accessed: April 4th, 2016)
[3] http://g1.globo.com/sp/sao-carlos-regiao/noticia/2015/11/chuva-causa-alagamento-em-diversos-pontos-de-sao-carlos-sp-veja-fotos.html (Accessed: April 4th, 2016)

Context and Problem

Flash floods are one of the most devastating natural hazards [1,2]

Fast-moving *and generally* ***violent***

High ***threat to life*** *and severe* ***damage to property and infrastructure***

Floods affected many mo *ard*

Hazard type	Deaths (thousands)	% of total	Affected (millions)	% of total
Drought/famine	276	44%	734	29%
Floods	94	15%	1,401	56%
Windstorms	61	10%	313	13%
Earthquakes	75	12%	35	1%
All 'natural' hazards	531	85%	2,496	100%
Technological hazards	93	15%	1	0%
Total (10 years)	624	100%	2,497	100%

Disaster impacts by hazard type, 1993–2002[3]

[1] Sene, Kevin, **Flash Floods: Forecasting and Warning**, Springer Netherlands, 2013, http://dx.doi.org/10.1007/978-94-007-5164-4_1.
[2] Burrell E Montz, Eve Gruntfest, **Flash flood mitigation: recommendations for research and applications**, Environmental Hazards, Vol. 4, Issue 1, March 2002, Pages 15-22, ISSN 1464-2867, http://dx.doi.org/10.1016/S1464-2867(02)00011-6.
[3] DFID, **Disaster risk reduction: a development concern: a scoping study on links between disaster risk reduction, poverty and development**. Department for International Development, London/Overseas Development Group, Norwich, 2004

Context and Problem

Flood Warning System [1]

Provide **people** and **organisations** with more **time to prepare for flooding**

Reduce the **risk to life** and the **damage caused**

Hydrometry → The science of moni

"The development of flood w *ith river monitoring-based services"*

Flood sign [2]

[1] Sene, Kevin, Flash Floods: Forecasting and Warning, Springer Netherlands, 2013, http://dx.doi.org/10.1007/978-94-007-5164-4_1
[2] http://www.spaldingvoice.co.uk/105000-to-tell-us-how-to-flee-floods/

Context and Problem

Hydrometry in early days → *Human observers + Manual recording* [1]

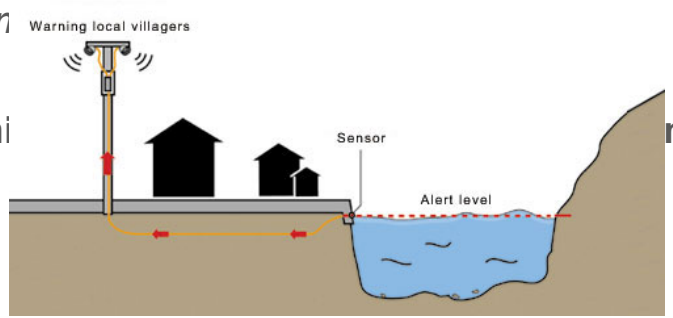
Relays via **telephone**, **radio** or **telegraph**

Graduated painted metal ‘staff gauges’

Hydrometry nowadays → *Telem*

The science of **electroni** **mation** about distant objects

Example of staff gauge [1]



Schematic layout of Flood warning system [4]

[1] USGS, Definition of "Streamgage", 2014, http://water.usgs.gov/nsip/definition9.html
[2] Sene, Kevin, Flash Floods: Forecasting and Warning, Springer Netherlands, 2013, http://dx.doi.org/10.1007/978-94-007-5164-4_1.
[3] Telemetry definition: http://dictionary.cambridge.org/dictionary/english/telemetry
[4] http://www.dsd.gov.hk/EN/Flood_Prevention/Keeping_the_Drainage_System_in_Good_Shape/Flood_Warning_Systems/index.html

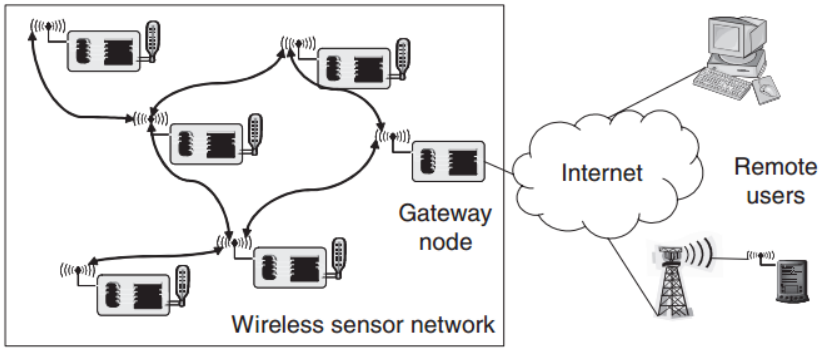
Product Perspective

Flood Monitoring System of System (FMSoS)

Support disaster management-related tasks → ***River monitoring***

Communication interface to a wireless sensor network (**WSN**) for **monitoring river levels**

Gateway node + S



A WSN with gateway node, enabling access to remote clients via the Internet

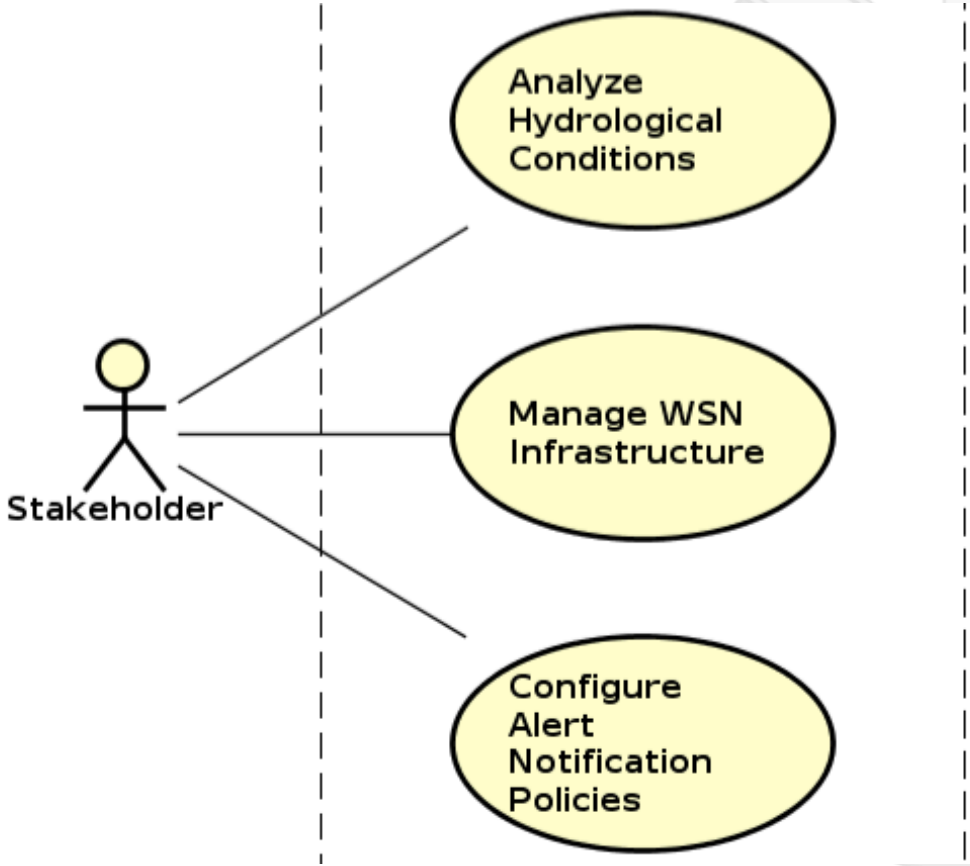
[1] Holger Karl and Andreas Willig. Protocols and Architectures for Wireless Sensor Networks. John Wiley & Sons. 2005.

Product Functions

Analyze Hydrological Conditions

Manage WSN Infrastructure

Configure Alert Notification Policies



User Classes and Characteristics

Hydrologists - domain stakeholders

Developers - technical stakeholders

Public authorities (Policy managers) - domain stakeholders

Operators - technical stakeholders

Managers - technical and/or domain stakeholders

Design and Implementation Constraints

Layer Architectural Style

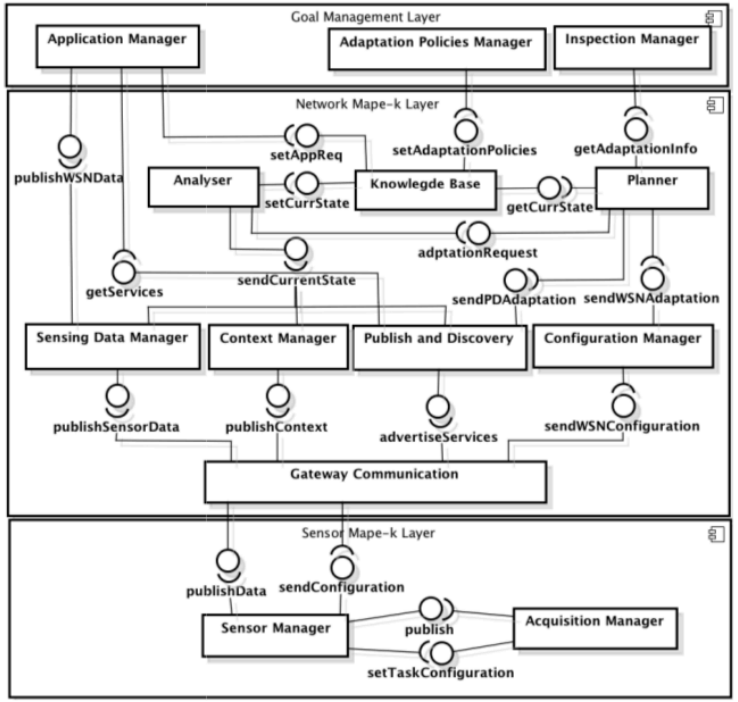
Goal → FMSoS

Network → Gateway

Sensor → Sensor node

Service-Oriented Architectural Style

OGC Standards



Reference Architecture for Self-Adaptive Management in WSN

Portocarrero et al., Reference Architecture for Self-Adaptive Management in Wireless Sensor Networks., 2014, http://link.springer.com/chapter/10.1007%2F978-3-319-11298-5_12

Assumptions and Dependencies

Geographic distribution of constituents of FMSoS

Operational independence of Sensor Nodes and Gateway

Managerial independence of Sensor Nodes and Gateway

Evolutionary development of the FMSoS