Towards a Grid aware forest fire evacuation warning system

Dr Nik Bessis[1] and Dr Eleana Asimakopoulou[2]

[1]*University of Bedfordshire, UK*

[2]*Loughborough University, UK*

25th - 29th August 2008: IDRC International Disaster and Risk Conference Davos

Presentation structure

- Background
- Our Thinking
- Supporting Technologies
- Model Architecture
- Implications - Conclusions

- *Questions*

Background

- **Summer of 2007.** Forest fires occurred in Portugal, France, Italy and Greece caused environmental destruction and a number of fatalities:
  - Greece requested assistance 4 times through the Monitoring Information Centre of the European schedule Commission to face forest fires during the months of June, July and August. The total burnt area in 2007 amounts to **268,834 hectares**, of which **180,000 burnt between the 24 and 30 August 2007**.
  - During these events **5,392 people were affected** and **67 of them killed** while the damage has been calculated to **1,750,000 US$**
  - Similar situations were recorded in other European countries

- **What can we do?**

Facts…

- **Need to understand the situation first:**
  - What does it cause forest fires? How can we prevent them?
  - If not, what else can we do?
- **Forest fires occur in many places at the same time:**
  - Fire-fighters need to split up in smaller teams
  - Geological morphology, Atmospheric conditions, etc…
  - Humans do not follow instructions
  - TV channels broadcasting images for a particular area at a given instance
- **Most fatalities occurred because people have been surrounded from the raging fire**
- **People have been found burned on roads or within their cars, as winds were changing directions**

- **So, what can we do?**

The process of an advanced warning system…

- It involves the:
  - **Simulation** of a forest fire in progress,
  - **Assessment** of the hazard it poses, and
  - **Transmission** of a warning broadcasting available evacuation routes – to nearby inhabitants – ahead of any significant danger

- **We are particularly interested with how occupants of an affected area can be reliably kept automatically informed of available evacuation routes when a forest fire is approaching their nearby inhabitant area**

- **Our proposal encompassing a relevant scenario on how to:**
  - Keep nearby occupants automatically informed via special TV (local) channels
  - Cell telephony that broadcast relevant evacuation routes to relevant occupants so as to reduce fatalities

Our thinking…

- Emergency decision managers require up-to-date information
- Current simulation tools require multi-processor speed
- Current cell and digital TV technology is capable of both receiving and transmitting signals from/to dispersed locations
- The technology could be used to broadcast and stream different digital signals encompassing different images (evacuations plans in advance), which could be further **pushed to relevant cluster of groups based on their exact positioning**
- The method will facilitate timely information alleviating concerns with regard to victims receiving a generalized flow of images and news that are best limited to present unrelated evacuation plans

- **How can we achieve it?**

Grid technology I

- **It is a computer-based emerging infrastructure:**
  - Making lots of dispersed computers work as one
  - Linking resource owners together and forms virtual organizations
  - Allowing experts and resource owners to remotely and collaboratively work towards a mutually specified goal
  - Providing access to various distributed data, hardware, instrumentation and specialist applications (which may be proprietary or incompatible in nature) like databases, weather systems, satellites, geographical information systems, area maps, mobile and wireless communications, global positioning systems, simulation, data mining and decision modelling tools
- **Open Source Standards include/ works with:**
  - Web Services standards (UDDI, SOAP, WSDL and XML)
  - Apache, AXIS, Tomcat, OGSA-DAI-WSI, C++, Python and JSP
  - Condor, Globus Toolkit, Oracle, MySQL, DB2, XML, document files, etc…

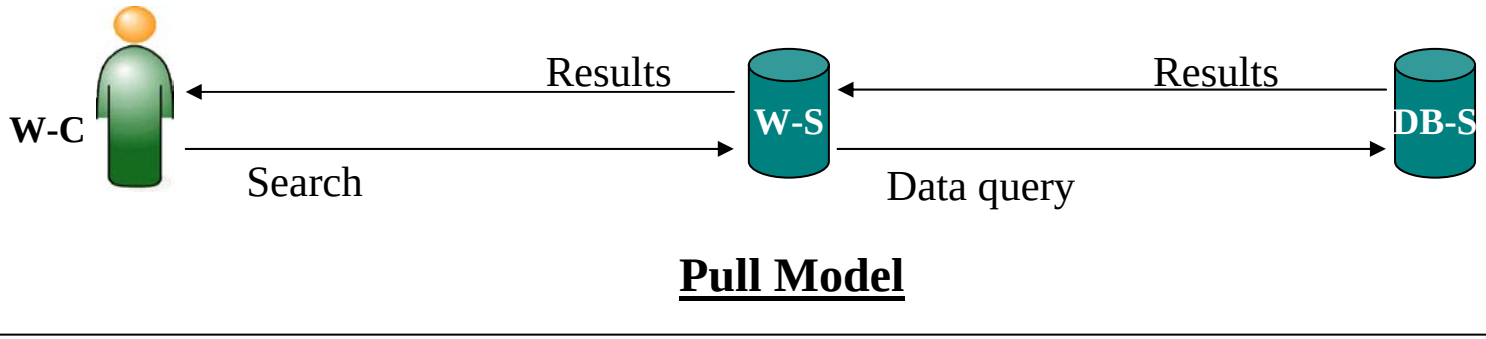
Grid technology II

- It is capable in providing emergency management teams with an infrastructure allowing seamless and flexible collaborative remote access to various resources

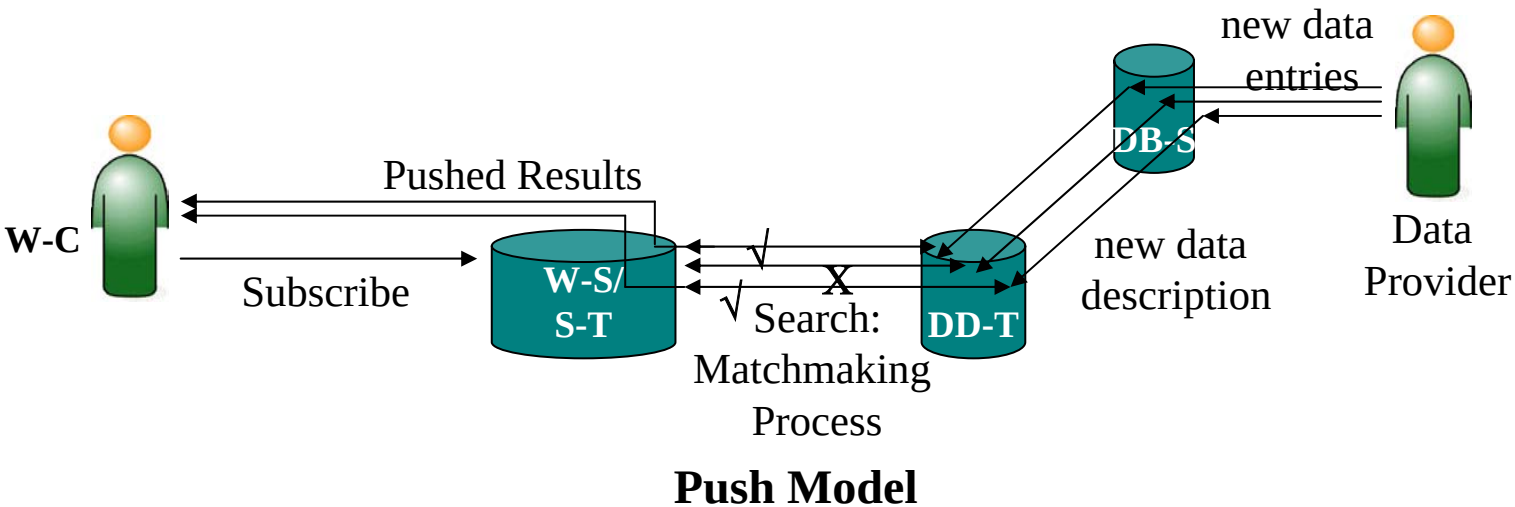
- Emergency management teams are now capable in remotely assessing and managing emergency situations through the utilization of available collaborative tools in a much effective and efficient manner

- **Current developments allow services to automatically 'keep' users 'informed' of latest, relevant, specific changes about data that are registered within the Grid application in which users have access to**

Supporting mechanisms…



Pull Model



Push Model

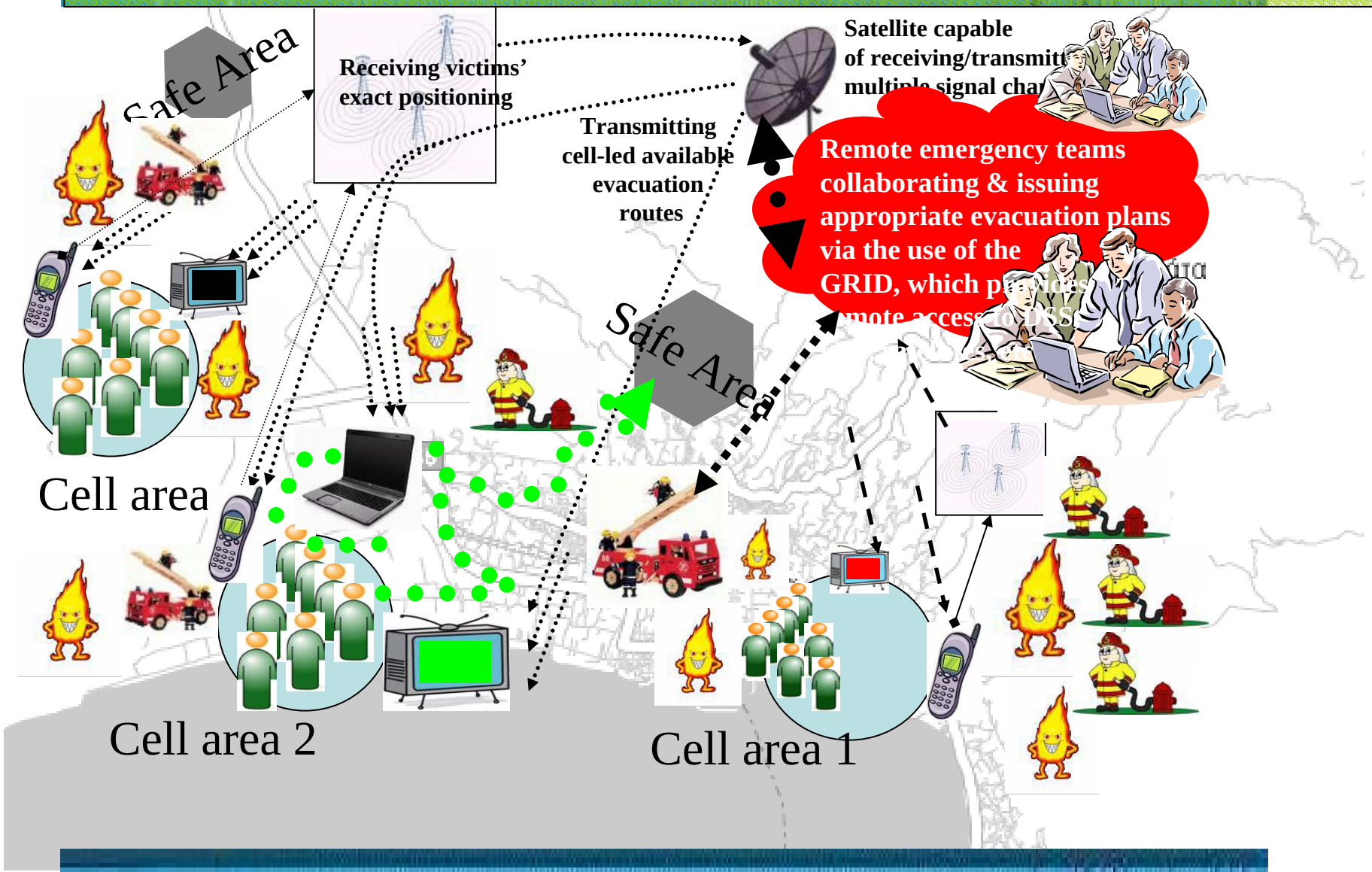
Lets assume:

- That a number of fires have trapped many victims located in a particular region. Current digital and wireless technology that is embedded in cell telephony is capable of reading, identifying and clustering groups of victims based on their exact positioning (cell area 1, cell area 2, etc)

- Sensors could be placed across the fires as a method to continuously read and monitor current fire activity. Data received could be analysed in real-time and feed in to a number of collaborative decision support systems encompassing a simulation tool, which could forecast projected fire path based on parameters like surround material (sensitivity factor), wind speed, temperature, moisture, oxygen levels and other atmospheric readings

- Another simulation tool could take the projected fire path simulation results and combine them with geographical maps towards the identification of possible local evacuation routes. The expectation is that this information would be critical for emergency specialists in order to make informed decisions and timely broadcast and push a number of currently suitable projected evacuation plans that are directly relevant to specific groups of victims based on their identical position across the region

Model Architecture for a Grid-Aware Forest Fire Evacuation System



Implications - Conclusions

- **Our Grid aware forest fire evacuation warning model allows:**
  - Alarming interested parties about an emergency situation
  - Dispersed interested parties (including non-humans) receiving near real-time images and data
  - Utilization of the E112 regulation (exact positioning)
  - Utilization of near real time simulation tools requiring multi-processor speed
  - Dispersed emergency teams making informed decisions timely about a fire-driven emergency situation
  - Dispersed emergency teams issuing evacuation plans about a fire-driven emergency situation
  - Dispersed media reading and broadcasting near real-time images, data and evacuation plans about a forest-fire emergency situation
  - Dispersed occupants reading and receiving personalized evacuation plans via localized TV channels and mobile devices
- Few instances of these services have been already implemented.

Questions…

Towards a Grid aware forest fire evacuation warning system

…we will shortly announce a **Call for Chapters** for a book in the area of **current practices and cutting-edge supporting technologies for disaster management**…

Dr Nik Bessis[1] and Dr Eleana Asimakopoulou[2]

[1] *nik.bessis@beds.ac.uk*

[2] *easimakopoulou@hotmail.com*