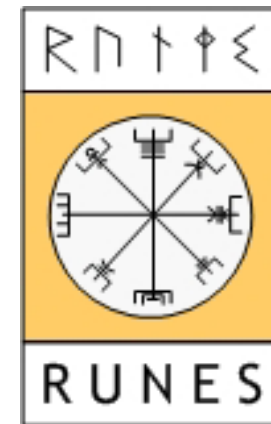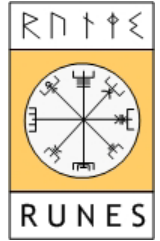# An overview of the RUNES project

Dr. Cecilia Mascolo

Dept. Computer Science

University College London

RUNES Middleware WP leader

A couple of words about me…

- Senior Lecturer and EPSRC Advanced Research Fellow

- Research in
  - Middleware for Mobile and Sensor Computing
  - Delay Tolerant Networking Protocols
  - Protocols for mobile and sensor networking

Introduction

- **RUNES**

  - **R**econfigurable: reorganise and change functionality

  - **U**biquitous: high spatial density (inc. remote/hostile locations)

  - **N**etworked: communicating with each other

  - **E**mbedded **S**ystem: tied hardware & software integration

- EC FP6 IP (call 2, embedded systems)

  - started in Sept. 2004

  - 32-month duration / 1040 person-months

  - €10.5M (€6.5M from EC)

  - 22 partners
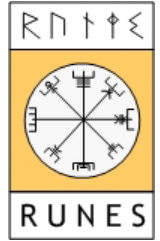
Partners

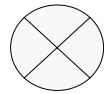*Industrial partners*

Academic partners
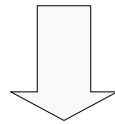
Non-profit research institutes

Patterns in embedded systems

- embedded systems proliferating to non-computing domains

increasing numbers of embedded systems

$\otimes$

Short-range wireless network technologies

new communication technologies

$\Downarrow$

*<u>large scale</u> data capture in <u>various</u> locations*

– Lots of challenges but also lots of new opportunities

RUNES' overview

- To begin realising this vision, we will undertake research and development in a range of **architecturally** interlinked areas:

  - Explore the underlying **radio, hardware** and **network level** technologies and identify issues that impact adaptability and interactions with the middleware layer.

  - Develop cross-platform adaptive component-based **middleware** that operates in the presence of scarce resources and provides application transparency over network hardware resources.

  - Analyse **advanced control** mechanisms to enhance system robustness and performance despite complex dynamic behaviours and major environmental uncertainties.

  - Build extensible **simulation** tools for large-scale systems, and validate those tools against simpler real-world scenarios.

  - Build tools that allow the assessment of **usability** of applications and assess them against a range of possible scenarios.

  - **Validate** the middleware, application transparency, and usability assessment tools with characteristic applications.

Examples of challenges
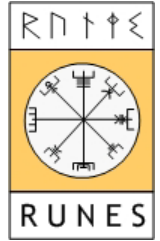
- **Communication paradigms** (synchronous, asynchronous, DTN)

- **Reconfigurable devices** (upload new components, adaptation)

- **Simple set-up** (automatic service discovery)

- **Fault tolerance**

- **Security** (authentication, encryption, DoS)
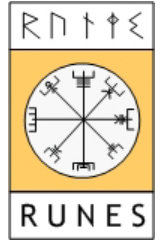
'Road Tunnel Fire' scenario

- Rare and localised

- Restricted access

- Poor information on who/what involved

- Fumes, gases, fire, heat

- Structural integrity

- Traffic management

- Multi-agency, multinational response

Goals

- Re-establish connectivity to determine present conditions

- Interaction with body area networks (e.g. firefighters) and sensors

- Allow authorities and rescue workers to be deployed effectively

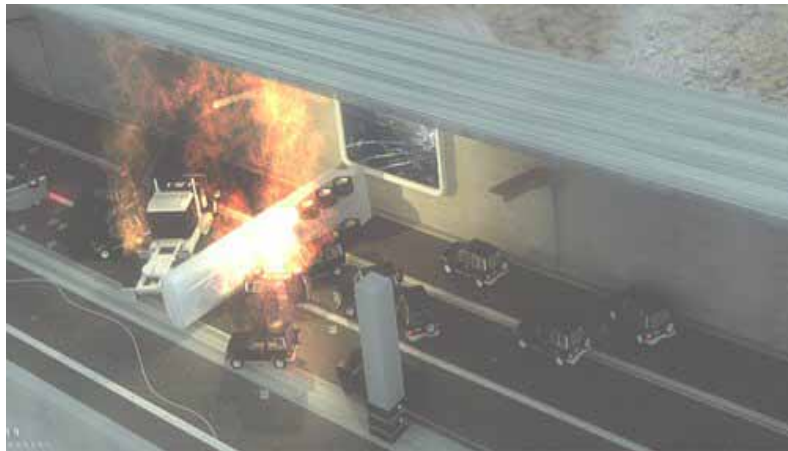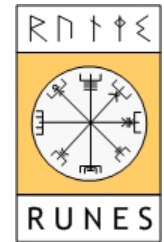- Study data to learn what went wrong

Middleware – the component model

- Components define: interaction, distributed reconfiguration, location, advertising/discovery, coordination

- Build systems from components
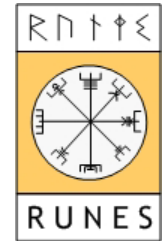
- Implementations of core (C, Contiki and Java)
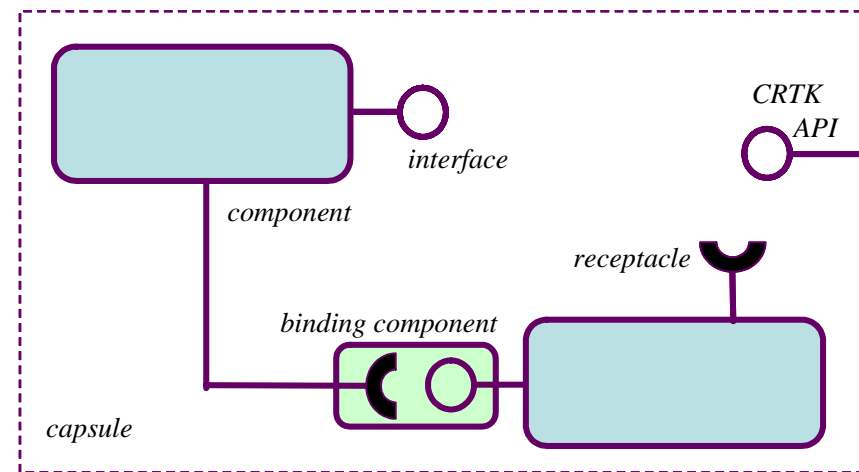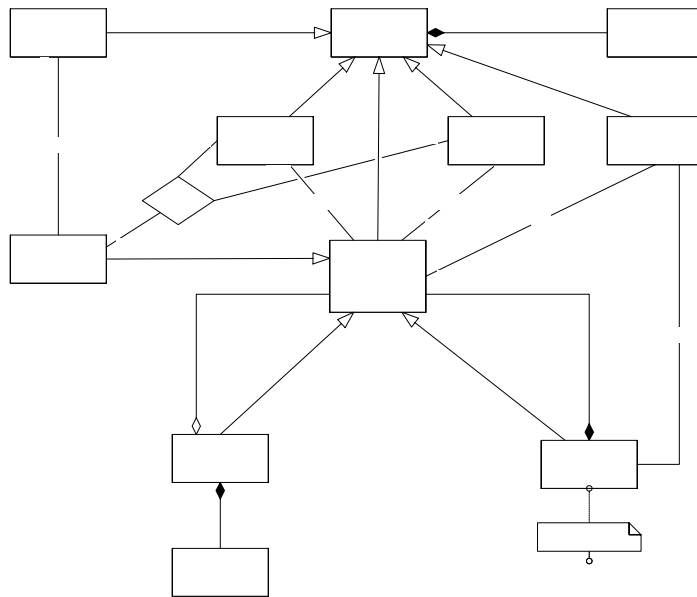
Simulator

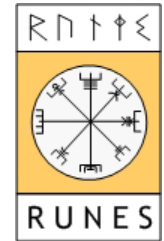- Role in mission preparation, rehearsal and training

Further info

Join the RUNES Interest Group

www.ist-runes.org/interest_group.html

Further info

Public deliverables, papers, events etc.

www.ist-runes.org