

## Application domains summary

“RUNES” means “Reconfigurable Ubiquitous Networked Embedded Systems”. It is a middleware that supports various components over heterogeneous networks. It was designed to solve the combination and analysis issue of complex system with multiples sensors.

RUNES middleware can be used in many applications domains that require analysis of multiple sensors.

### Healthcare (ex: cardiac monitoring)

- Cost of healthcare increase.
- ⇒ Need to make healthcare solutions more efficient
- ⇒ Maybe provide healthcare services and monitoring solution closer to the patient
- ⇒ Need to run well everywhere the patient is, regardless of the network environment

Example: integrated cardiac monitoring

- One of the most important causes of mortality
- A lot of symptoms and things to monitor: fatigue, decreased exercise tolerance, unexplained cough, decreased food intake, delirium, abdominal symptoms...)
- Patient must be mobile and active
- ⇒ Need of real-time monitoring
- ⇒ In home system as a package of sensors:
  - RFID tags to locate the patient in the house
  - Sounds sensors to monitor patient's breath
  - Weight sensors in bathroom floor
  - Blood pressure
  - Pulse
- ⇒ In home interface system for the patient to communicate with nurses and doctor
- All these sensors communicate with the local clinic
  - Need of secured connection
- With this, cardiac specialist give:
  - Better treatment regime adjusted
  - More appropriate activities specified

### Emergency services (ex: tunnel fire)

- Save life in various natural and man-made disasters is important
- ⇒ Need to have more coordinated emergency services
  - More accurate map of the disaster
  - Officials instantly alerted
- ⇒ Maybe need of disaster prediction system

Example: tunnel fire

- Important issue that costs 210 M€ per year in Europe countries only.
- ⇒ Need to have a better analysis of the disaster despite of having old road tunnel installations:
  - RFID on ALL cargos that give information on contents, quantity and hazard
  - Block all cargos that are too dangerous for a given road tunnel installation
  - Information on air quality, humidity, temperature
  - For people who have personal healthcare monitoring solution (see precedent part), transmit data to the analysis system
  - Cameras
  - Robot to establish conditions
- ⇒ Better control of evacuation system and air control
- ⇒ Head up displays provided for fire-fighter equipped with a body area network
- ⇒ Problem to coordinate various communication systems. RUNES must answer to this issue.

### Factory automation (ex: wine production)

- Today industries search to produce more and more at lower and lower costs.
- Need of flexibility to compete in the global market because of the need of product customization
- ⇒ Reduce waste
- ⇒ Reduce time of operations
- ⇒ Improve volumes
- ⇒ Need to monitor manufacturing facilities to control process and improve manufacturing performance

#### Example: wine production

- Global market of 150 billion €
- Quality of the wine is important and is dependant of the distribution
- Actually, tracking and monitoring systems exist but with no seamless link between them : information are lost between production and distribution
- ⇒ Need to unify the system and monitor all the chain
  - Light, moisture and heat measurement for agriculture
  - Grape acquisition
  - Barrel management
  - Laboratory controls
  - Temperature, humidity, pH, CO2 measurement for bottles or tanks in distribution vehicles
- ⇒ Provide better quality of wine
- ⇒ Can equipped distribution vehicles to manage cooperative distribution chain with multiples transportation ways.
  
- ⇒ Actually, "Eurojet Wine" only monitors production but no distribution.

## Retail settings (ex: stocks management)

- Today's industry one important facet is logistic management. Stocks management, distribution are great stakes
- ⇒ Need to reduce cost about stocks, manage product shipment with fluidity
  - Inventory tags
  - Price checking
  - Sensor on shelves

## Automotive safety and security (ex: accident with cars)

- Modern vehicles have already a lot of embedded electronic.
- Increase of software in cars
- Also need to reuse or factorize code with Middleware (RUNES!)
- Need to increase safety
- ⇒ Need of sensors to prevent or help in accident:
  - For Assisting drive
    - Magnetic sensors to detect cars and monitor traffic to schedule traffic lights with more accuracy
    - Network communication between cars about safety conditions and accident
    - ABS sensors
    - Wheel pressure
    - Engine various sensors

Actually, "ConnectedDrive" is developed by BMW. Information about safety conditions of street are transmitted to others vehicles.

Cars manufacturers (Audi, BMW, DaimlerCrysler, Fiat, Renault, Volkswagen...) have founded a consortium CAR 2 CAR to establish a Wi-Fi communications between cars about safety.

## In-home safety and security (ex: old people...)

- Important market
- Enhance safety for regular users, old people...
- Enhance security against thieves
- ⇒ Need to add sensors at home

Example: old people safety and security

- Important as we live older
- ⇒ Opening sensors for doors, windows, fridges...
- ⇒ Carbon monoxide /gas detector
- ⇒ Movement detector to monitor old people activities to detect problems

Example: security against thieves

- ⇒ Cameras or mobile phones that survey on demand

Example: home help

- ⇒ RUNES provides ways to communicate with various systems over wireless network. In the future we can imagine that RUNES help to transfer data over the home network like maps to an in-car sensor network.

Actually, a well advanced project is CSTB "GERHome". GERHome provides also real physical sensors, in addition to the middleware.

- ⇒ RUNES is a middleware that help to connect multiples sensors over heterogeneous network. With RUNES, developers can have a unique development framework that provides easy ways to reuse existing components for various projects from in-home monitoring to complex wine production and distribution chain.

## References:

- [http://www.ist-runes.org/potential\\_apps.html](http://www.ist-runes.org/potential_apps.html)
- <http://www.ist-runes.org/scenario.html>
- [http://www.ist-runes.org/docs/deliverables/D2\\_01.pdf](http://www.ist-runes.org/docs/deliverables/D2_01.pdf)
- <http://gerhome.cstb.fr/>

Olivier Barafani