



## UbiquiTalk

*An Infrastructure for  
Ubiquitous Computing*

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Ecole des Mines de Douai

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*Context:*

## Ubiquitous Computing

- Ever smaller computers (nanotechnologies)



624 MHz  
128 Mo RAM  
7,7 x 13,5 x 1,5 cm  
200 g  
...



55 MHz  
8 Mo RAM  
3,5 x 1,9 x 1,9 cm  
18 g  
...

- "computers" everywhere and often invisible
  - Cars (~20 micro), washing machines, fridges, clothes, ...
- Network connections (wireless) everywhere
  - GPRS, UMTS, Wifi, WiMax...

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*Context:*

## Ubiquitous Computing

- Many devices per person (phone, PDA, ...)
  - Access services (software + data) from different devices
  - Use many devices possibly simultaneously
    - Connection, "Synchronization" = Data replication, ...
- Mobility of both users and devices
  - Only some devices move with their owners
    - Often Small => with little resources (memory, battery...)
  - Remote access to services (software + data)
    - Exchanging data, collaborative work, ...
  - Varying environment
    - Network type and quality, peripherals, ...

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*Consequences:*

## Building Software even more complex

- Multiple varying parameters to take care of
  - Unpredictable Hardware resources/capabilities
  - Unpredictable network characteristics
  - Space/Time environment changes
- Negative impact on software projects
  - Production delays (time to market)
  - Higher production costs
  - Need of experts (scarce and expensive)
  - Decreasing reliability of produced software



## Goals of UbiquiTalk

- Help developers build distributed software
  - Framework for development
  - Middleware for automatic deployment
- Minimize the administration tasks
  - Zero networking configuration




## Few Assumptions made by UbiquiTalk

- Unanticipated Remote Interactions
  - Open/dynamic set of devices
    - Devices may join and leave the network dynamically
  - Open/dynamic set of software used remotely
    - Softwares may be added and suppressed at run-time
- Any Network Setting
  - Ad hoc, private LAN, Internet, ...
  - Wifi, Bluetooth, Ethernet, ...
- Heterogeneous hosts
  - Different software/hardware resources (e.g. display, printer)
  - Different amount of resources (e.g. RAM, energy)



## Outline

- Motivation
- Overview 
- User Interface
- Applications
- Conclusion



## An Infrastructure for Ubiquitous Comp.

- Infrastructure =
  - Middleware for distribution
  - Framework
    - Domain objects
    - User Interface
- Ubiquitous Computing
  - Unanticipated remote interactions
  - Heterogeneous hosts

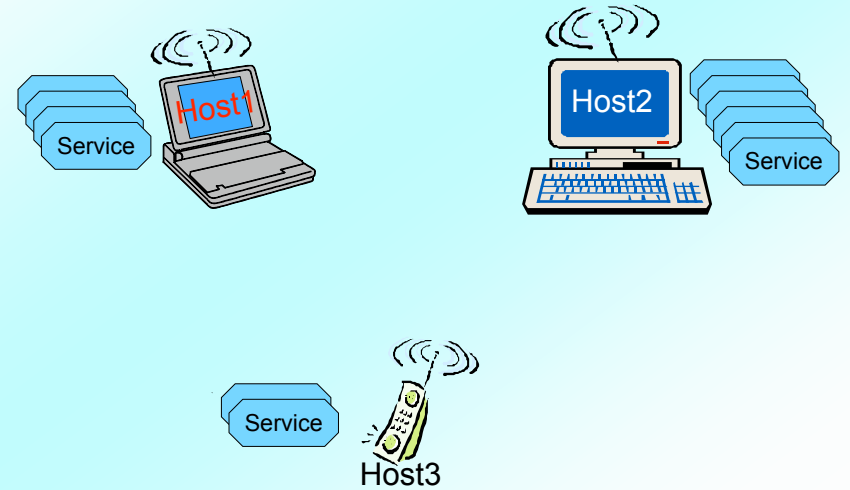


# Two Basic Concepts

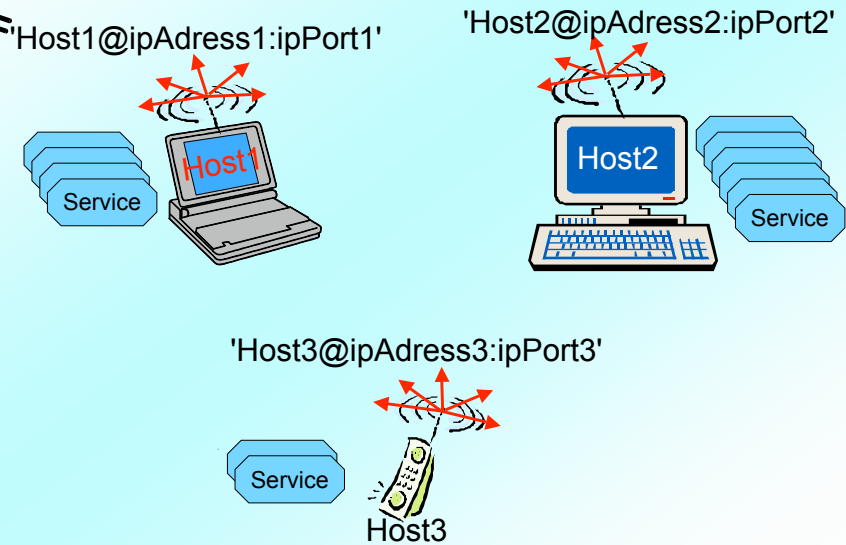
- Host: Any device with computation capabilities and a network interface
- Service: Any object in a host that can be accessed remotely
  - Application service: An application object
  - Middleware service: A middleware object that supports host activities (i.e. other services)
    - Host Discovery, Services registry, ...



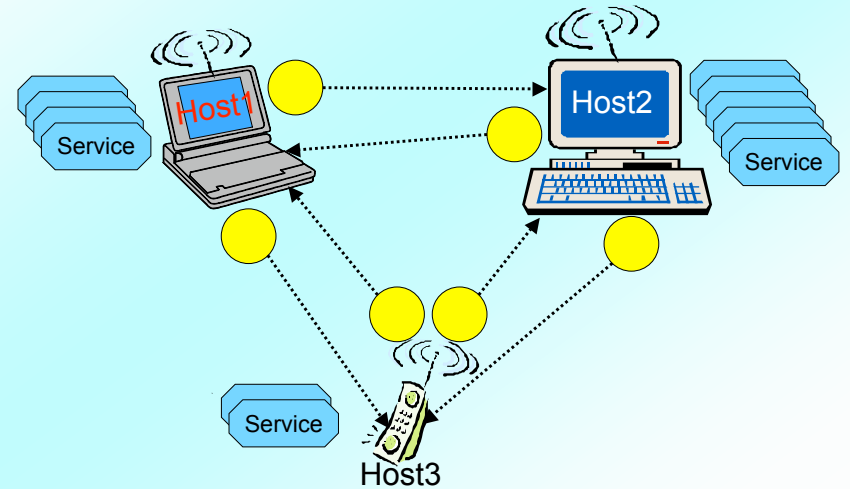
# Big picture Heterogeneous devices in a network



# Big picture Presence Notification Loop

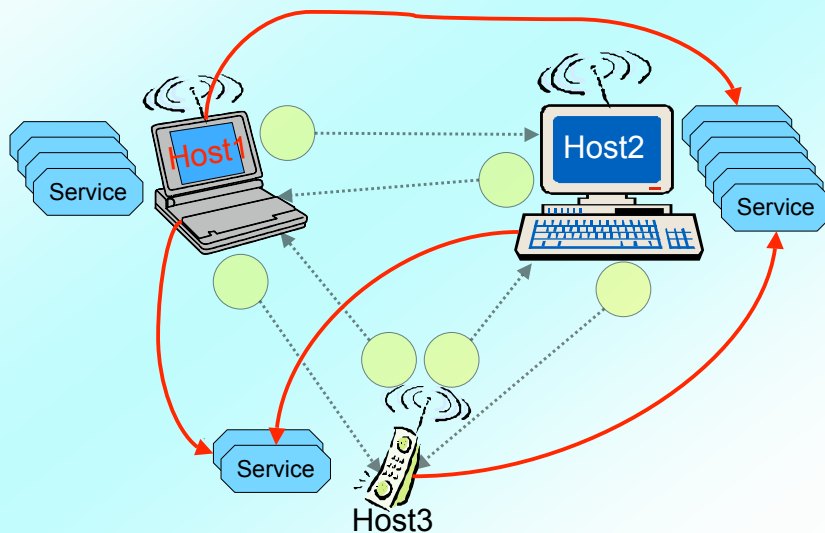


# Big picture Detection => Proxies on peers



## Big picture

### Interaction => Remote messages



## Features

### Middleware

- Remote communication
- Automatic host discovery
- Services registry
- On-demand deployment at run-time

### Framework

- Services Functionalities
- Services GUI
- Services Administration=Configuration + Usage constraints
  - Each service may have its own specific properties
  - Limited number of simultaneous users of a service
  - Access rights (login/password)

## Middleware Features

### Remote communication

- Any IP network: Wifi, Ethernet, ...
- Any Infrastructure/topology: Ad Hoc, LAN, Internet

### Automatic discovery

- Detect connections/disconnections
- Without any prior knowledge on remote hosts

### Services registry

- White pages (by name) - Yellow pages (by description)

### On-demand deployment at run-time (to do)

- Automatic download and deploy services client parts
  - e.g. client GUI

## Framework Features


### Service definition

- Application entry points or middleware extensions
- Reactive or Proactive
- 3 parts
  - Provider part
  - Client part (to deploy on-demand) : usually GUI
  - Administration part

### GUI

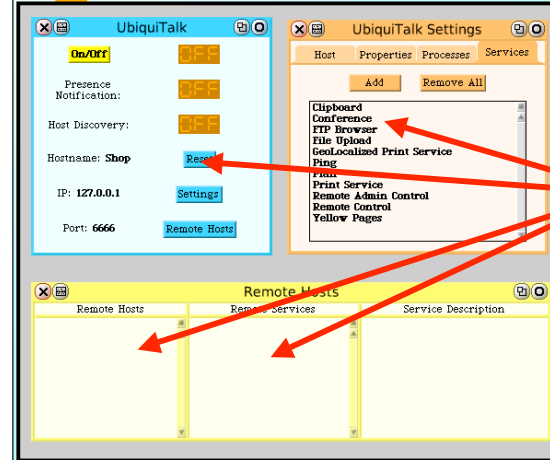
- Targeting various display sizes
  - Desktop/Laptop, PDA, Phones (to do)
- Admin : Service setup, activation, passwords, ...

# Outline

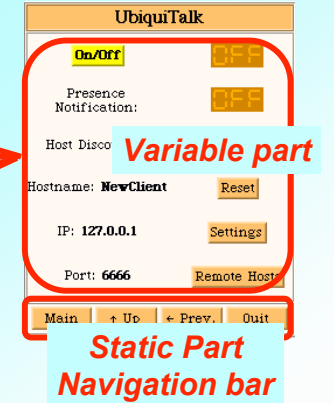
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# Two GUI depending on the target

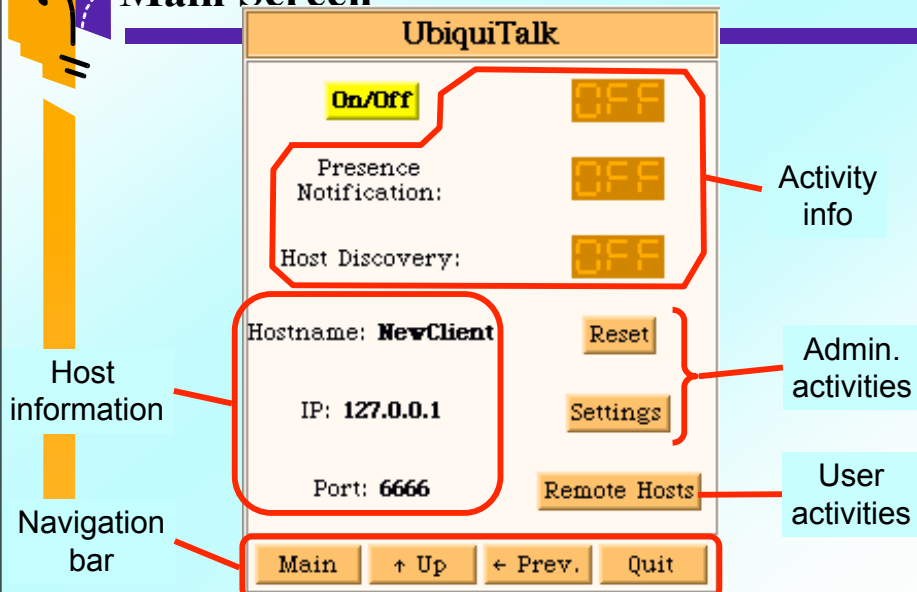
For Desktops/Laptops



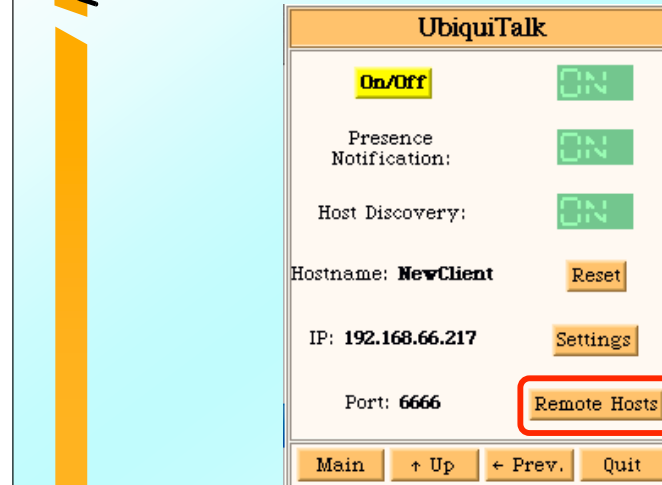
For PDAs



# PDA's UI Main Screen

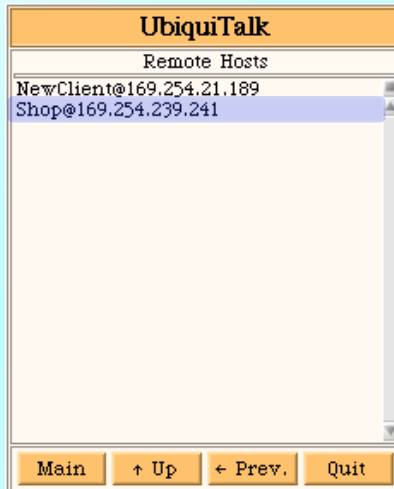


# PDA's UI From Host discovery to service use



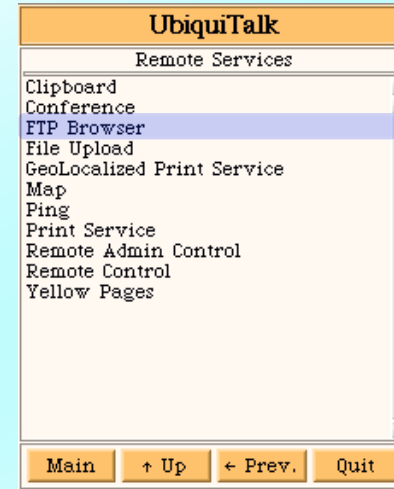
## PDA's UI

### From Host discovery to service use



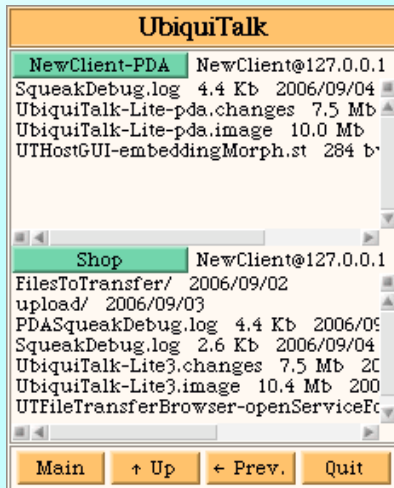
## PDA's UI

### From Host discovery to service use




## PDA's UI

### From Host discovery to service use



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## Some Services implemented so far

- Cross-Platform Copy/Past
- FTP
- Chat Conference
- Printing
- Geo-Localized Printing
- Remote Administration
- Remote Control

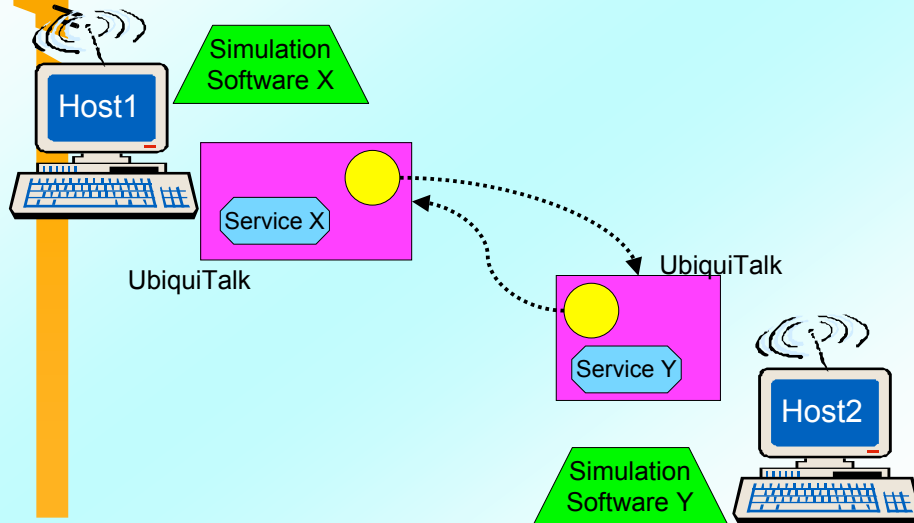


## Scientific Computing The Problem

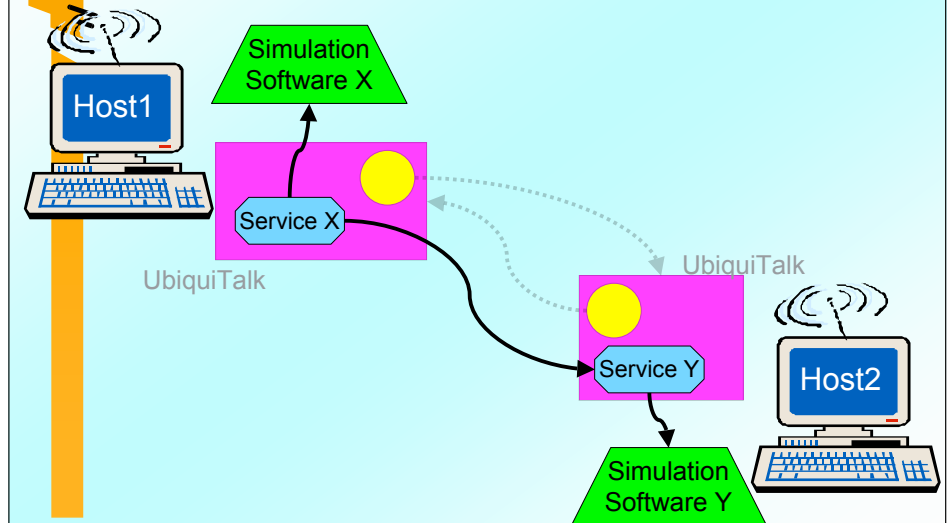
- Ongoing project
  - Large scale application with multiple users
    - Chemistry Consortium (companies and academia)
  - Open set of simulation softwares
    - Developed since 15 years
    - Standalone simulation softwares
      - No interaction planned
    - Each partner has a different subset of softwares
- Goals
  - Do cross-simulation
  - Drive simulations remotely



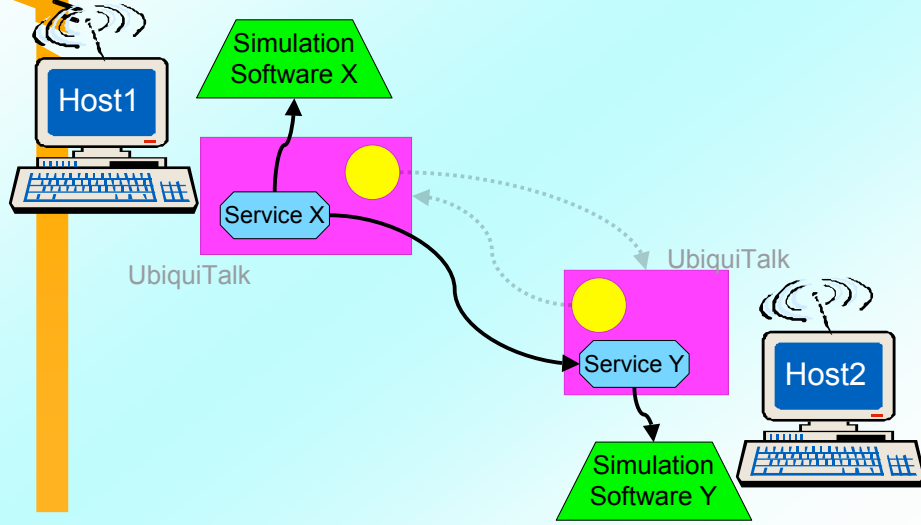
## Scientific Computing The UbiqiTalk-based solution



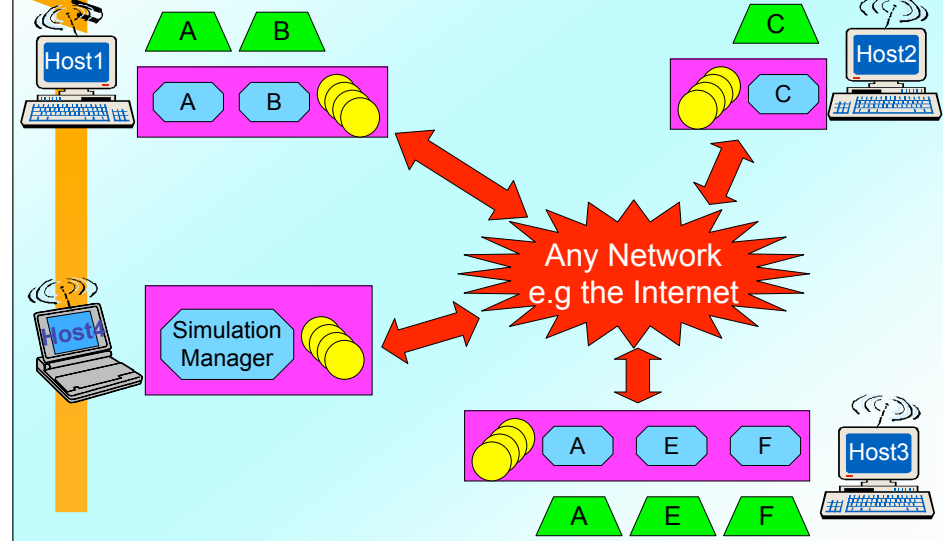
## Scientific Computing The UbiqiTalk-based solution



# Scientific Computing The UbiqiTalk-based solution



# Scientific Computing The UbiqiTalk-based solution



# Robotic Rescue

- An arbitrary fleet of robots that cooperate in a hostile environment
- Cheap robots
  - High resource constrains



### Partners


- o IRD/Géodes, Bondy & Hanoï
- o CNRS/MICA, Hanoï
- o AUF/IFI/MSI, Hanoï
- o INRIA/LORIA/MAIA, Nancy
- o ITC, Phnom Penh
- o CNRS/INRIA/LRI/TAO, Orsay
- o CNRS/GREYC/MAD, Caen
- o ARMINES/CSL, Douai

# Seeking for Partners

- Current partners are mainly non-Smalltalkers
- Any Smalltalkers are welcome ☺
  - Companies
  - Academia
- Various partnership possibilities
  - Specific "private" project
  - European funded project
  - ...



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## Summary

- Middleware for P2P unanticipated interaction
- Support for:
  - Automatic Host Discovery
  - Service definition and administration
  - UI
  - Hethorginity
  - Different Uis
  - Managing service hardware requirements
- Goal : Go from research to real world software



## Future work

- Support for automatic deployment
  - Deal with heterogeneity
  - I.e. Detect target properties and provide the right implementation of used services
    - What if the implementation is not available?
    - Simply forget it? Provide an incomplete but runnable service?
- Refactoring
  - Fully Uniform architecture
  - => Everything is a service
  - => Fully open architecture : every part will be replaceable
    - E.g. replace discovery protocols

*Questions? Comments?*

<http://csl.ensm-douai.fr/UbiquiTalk>