École Nationale Supérieure
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ENST Bretagne


# Dynamic Data Replication and Consistency in Mobile Environments

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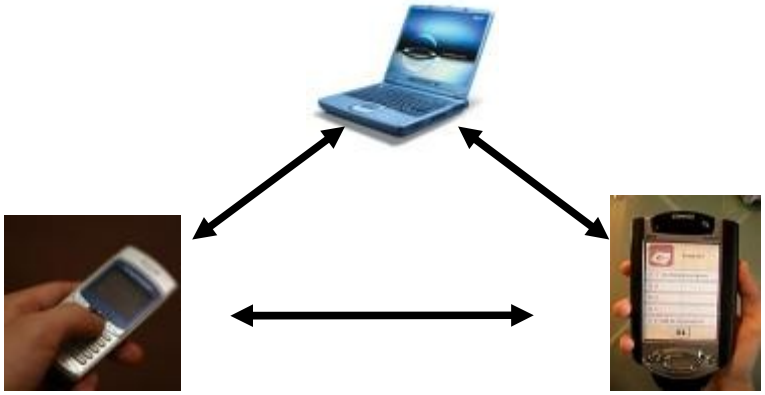
get

# Overview

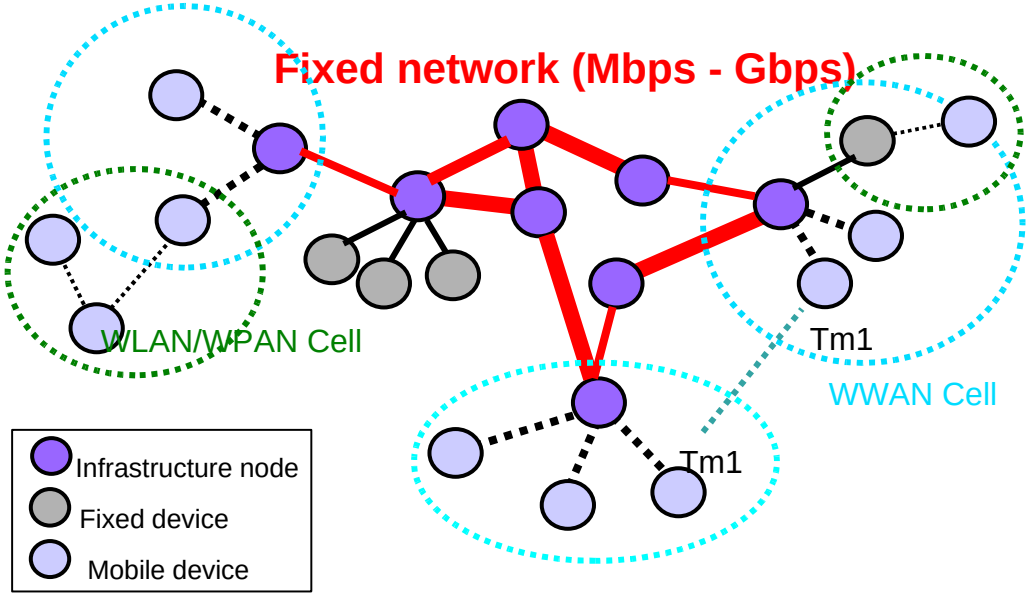
- Applications (Phone directory, Diary, Photo Album, etc.)
- Shared data, Available data ⇒ Data replication and consistency are necessary



⇒ An application must be adapted to each context

# Problem background

- Fixed environment **vs** Mobile environment
- Data replication (nature of data, Context)




⇒ Data replication must be adapted to the change in context

# Description of the research work

- Design and implementation of an adaptive data replication system that takes into account resource variability and data semantics in order to ensure :
  - The data availability and the work in disconnected mode
  - The data consistency
  - An adaptive replication and consistency management
  - A transparent management of data replication
  - An optimal use of resources

# Work directions

- An initial study to establish the state of the art of existing solutions for the data replication and consistency management
  - Existing replication techniques
  - Context-awareness works and context description approaches
  - Adaptation and dynamic reconfiguration mechanisms
- Proposition of a context-aware replication system
- Implementation and experiments

# Outline of the talk

- The state of the art
- Our contribution
  - Execution context
  - Internal view of our replication system
    - Architecture of the system
    - Adaptation process
  - External view of our replication system
- Conclusion
- Future work

# The state of the art (1)
## Replication and consistency systems

- Fault-tolerant services [Coulouris et al.]
- Distributed databases [Gray et al.]
- Distributed files [Satyanarayanan et al.]
- Content delivery networks [Sivasubramanian et al.]

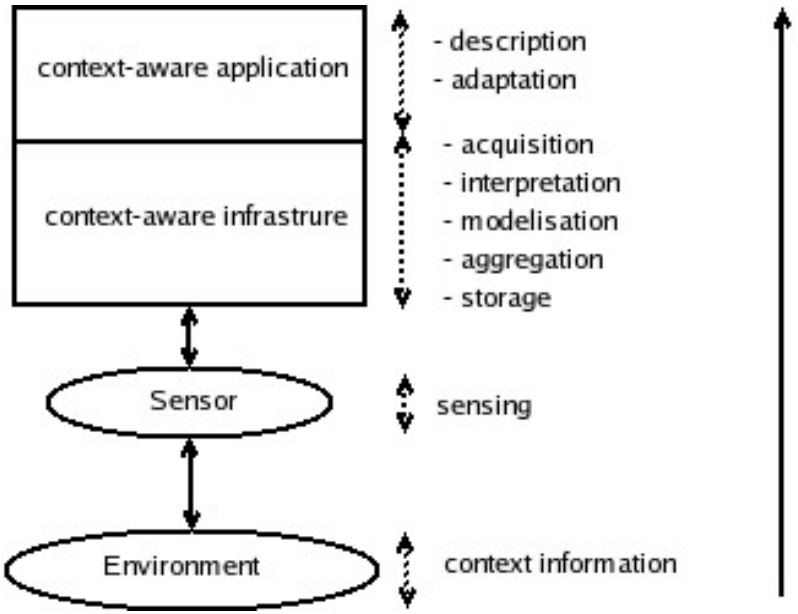
⇒ Replication system functionalities : creation, placement, read/write, consistency

- Their limitations in mobile environments
  - Nature of data
  - Context

⇒ Proposition of a context-aware replication system

# The state of the art (2)

## Context-awareness works [Dey et al.][Schmidt et al.]




⇒ Proposition of meta-models for context description

# The state of the art (3)

## Adaptation and reconfiguration mechanisms

- Adaptation and dynamic reconfiguration algorithms (policy choice algorithm [Capra et al., 2002], placement algorithm [Beloued et al.], ...etc.)

- Adaptation and dynamic reconfiguration infrastructures [Capra et al., 2003] [Ayed et al.], ...etc.

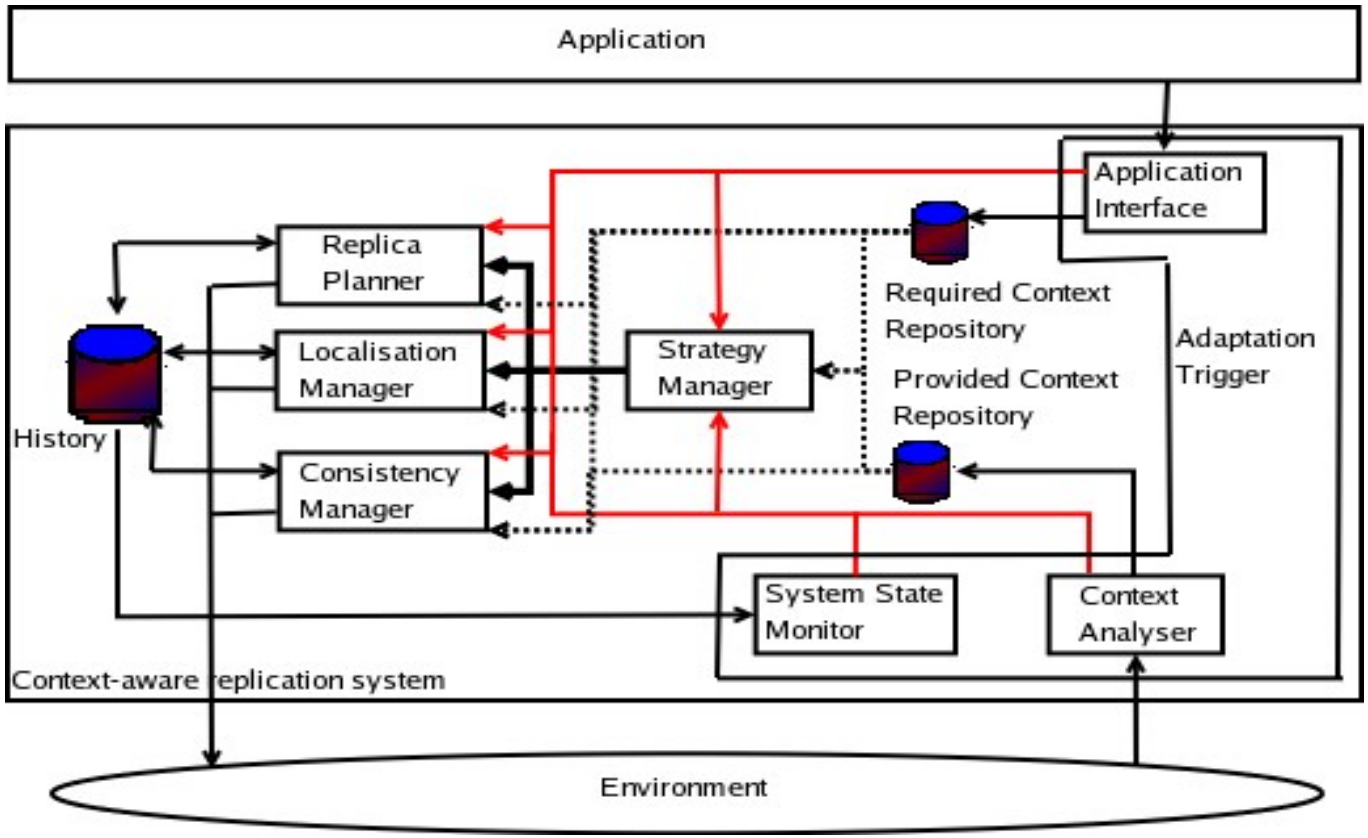
$\Rightarrow$ Identification of the necessary adaptation classes

# Our Contribution (1)

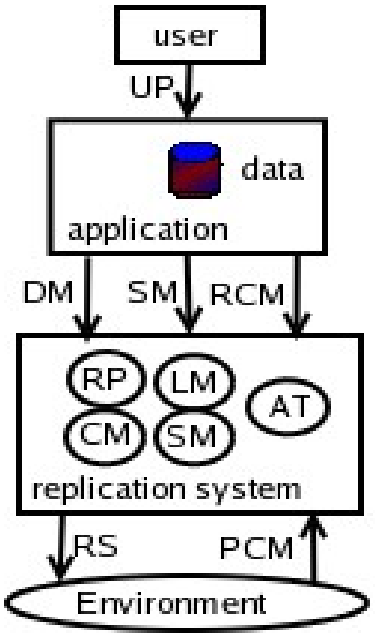
## Classification of context information [Beloued et al.]

- Required context
  - Data constraints
  - User preferences
- Provided context
  - Software properties
  - Hardware properties
  - Physical environment properties
  - User profile

# Our Contribution (2)
## Internal view of our replication system



# Our Contribution (3)
## External view of our replication system




UP : User Preferences
DM : Data Model
SM : Strategy Model
RCM : Required Context Model
PCM : Provided Context Model
RS : Replication Scheme
RP : Replica Planner
LM : Localization Manager
CM : Consistency Manager
SM : Strategy Manager
AT : Adaptation Trigger Modules

# Conclusion

- Architecture of the context-aware replication system
- Adaptation classes
- Necessary meta-models

# Future work

- Strategy choice and consensus problem
- Context-aware creation and placement of replicas
- Context-aware localisation and consistency management of replicas
- Strategy reconfiguration and system consistency problem
- Replica placement, localisation and consistency reconfiguration

# Questions

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