Active network support for deployment of Java-based games on mobile platforms

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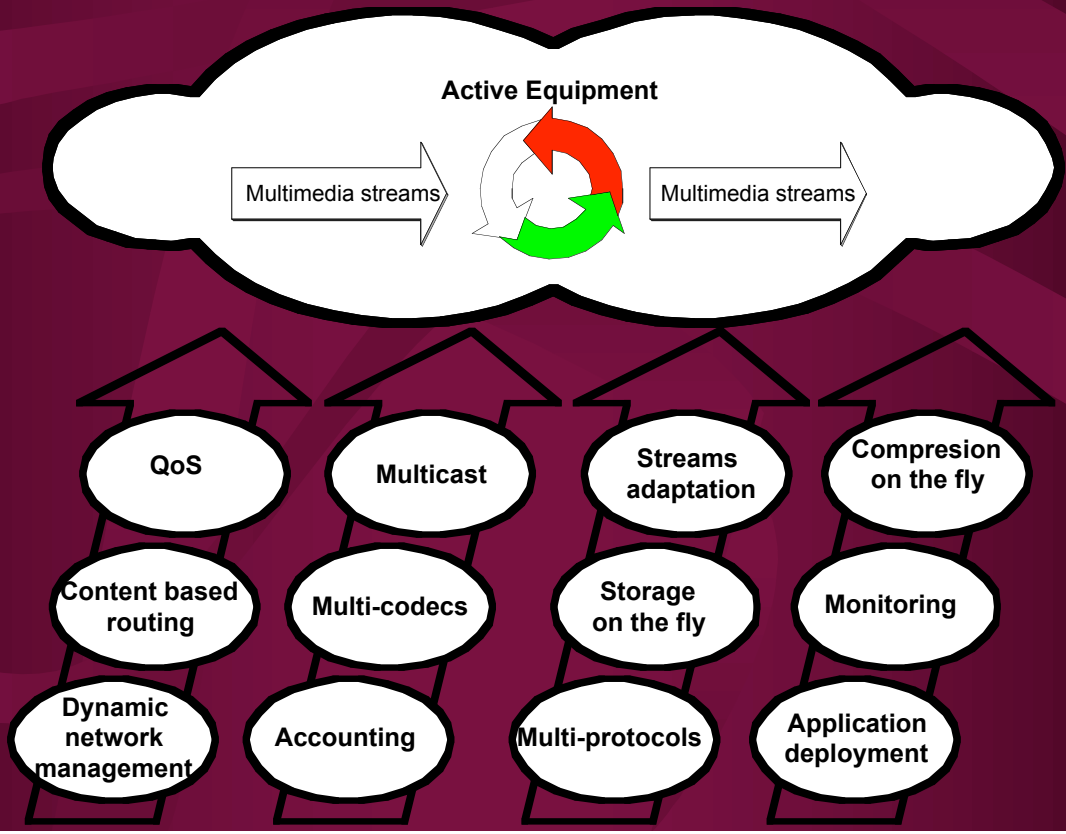
Roadmap

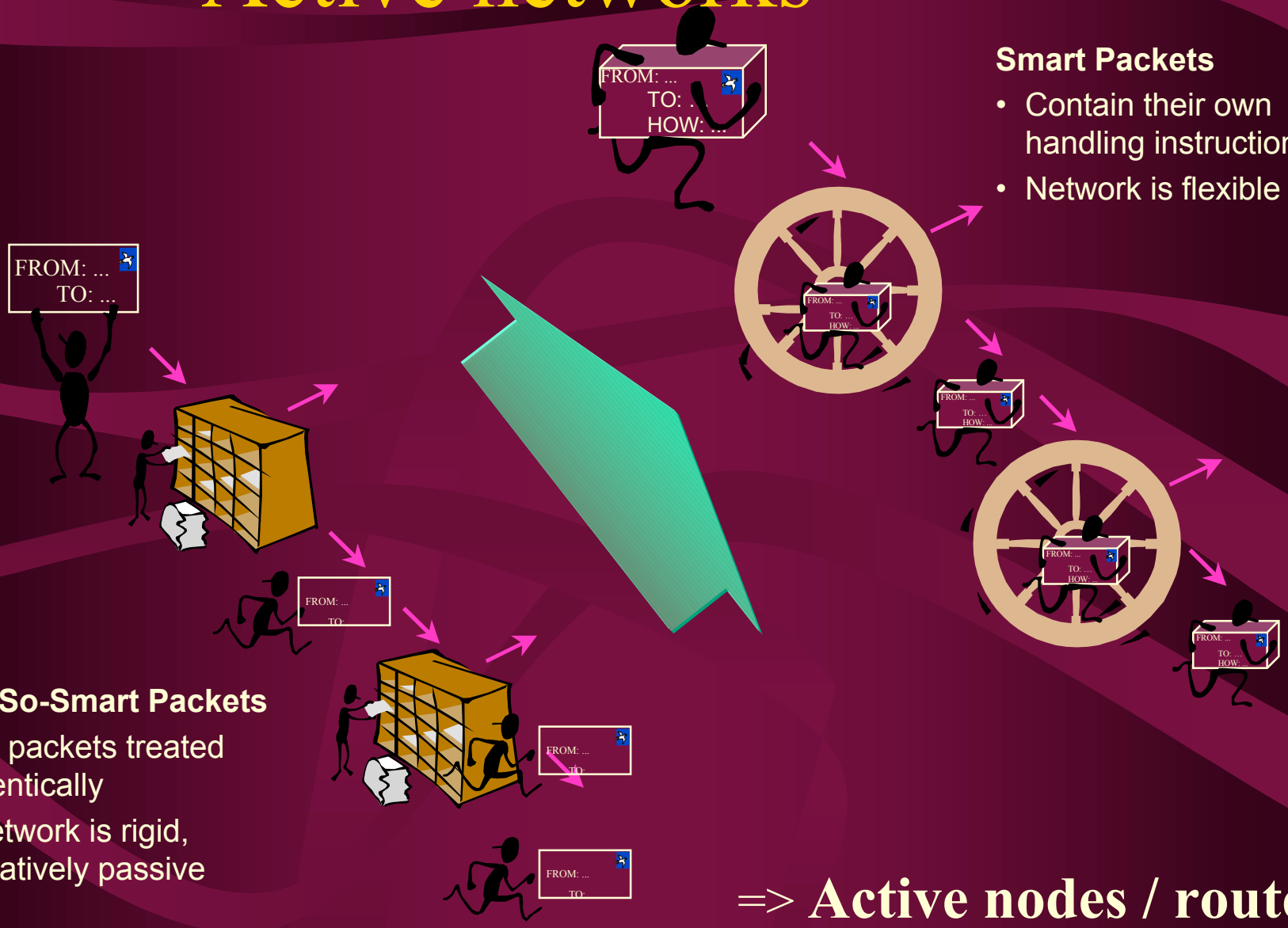
- Active networks
- Games deployment on mobile platforms
- Tamanoir Active Node architecture
- Active network support for games deployment
- Experimental results
- Conclusion and future works

Introduction

- Active networks
- From E2E to Hop by Hop
- In search of applications (multimedia, Grid…)
- Collaboration with SME : 3DDL



Active networks



Smart Packets

- Contain their own handling instructions
- Network is flexible

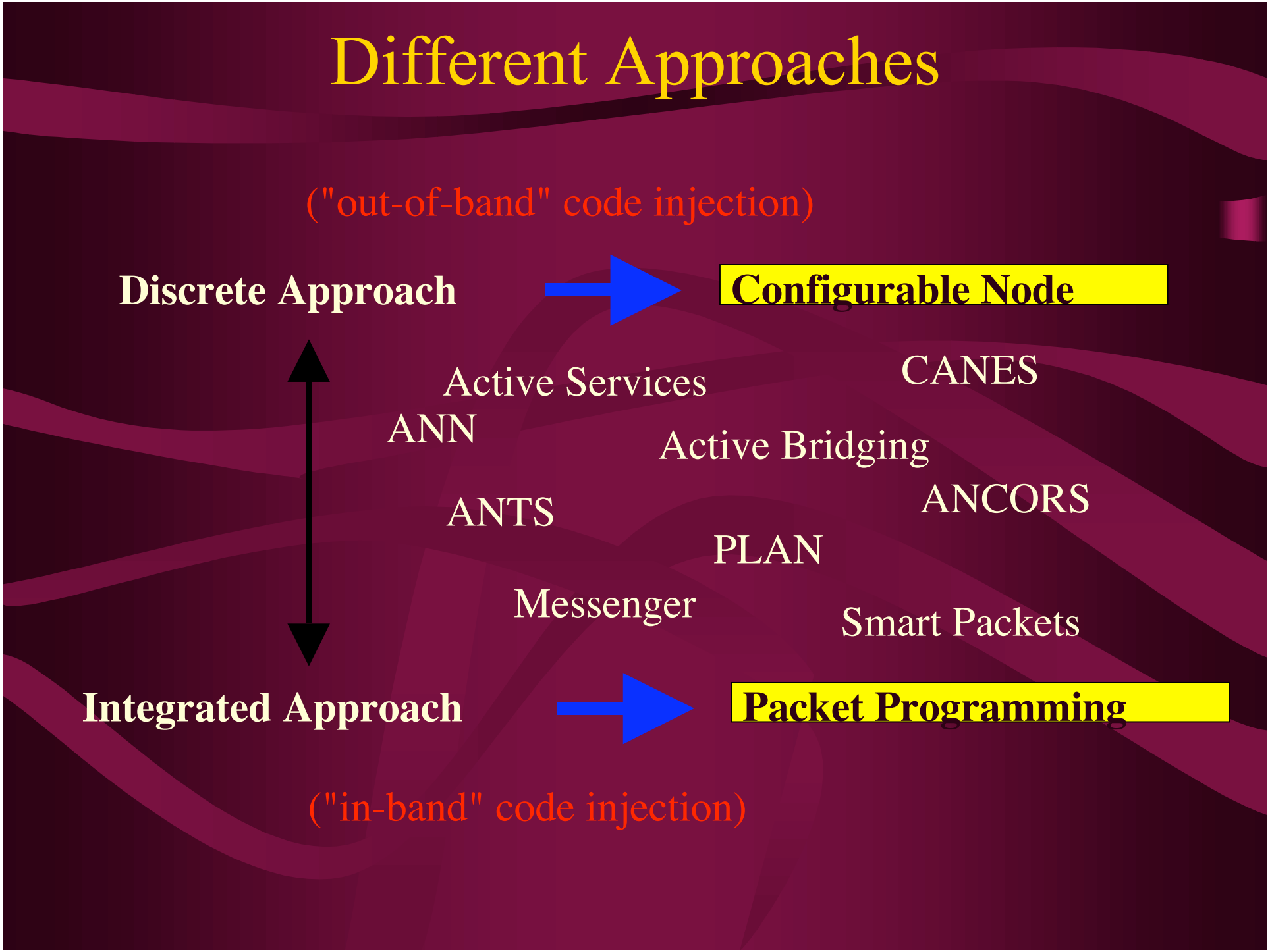
Not-So-Smart Packets

- All packets treated identically
- Network is rigid, relatively passive

- D. Tennehouse slides

=> Active nodes / routers

Different Approaches



Introduction

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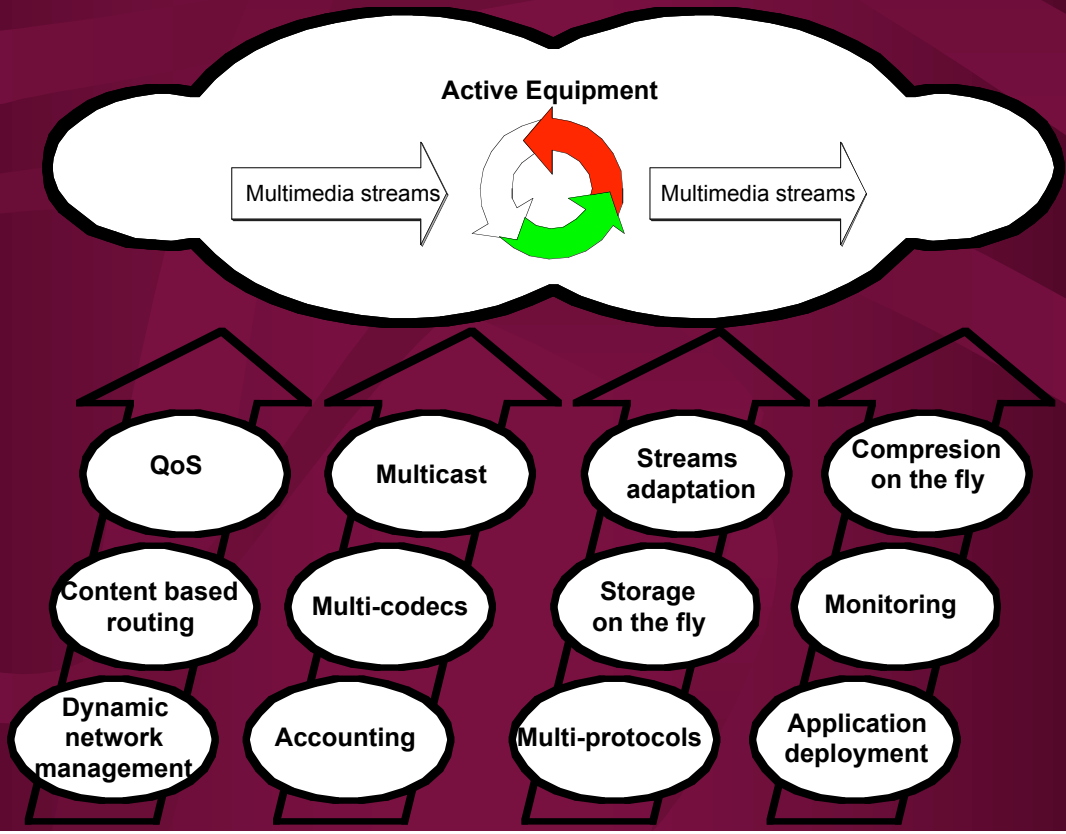
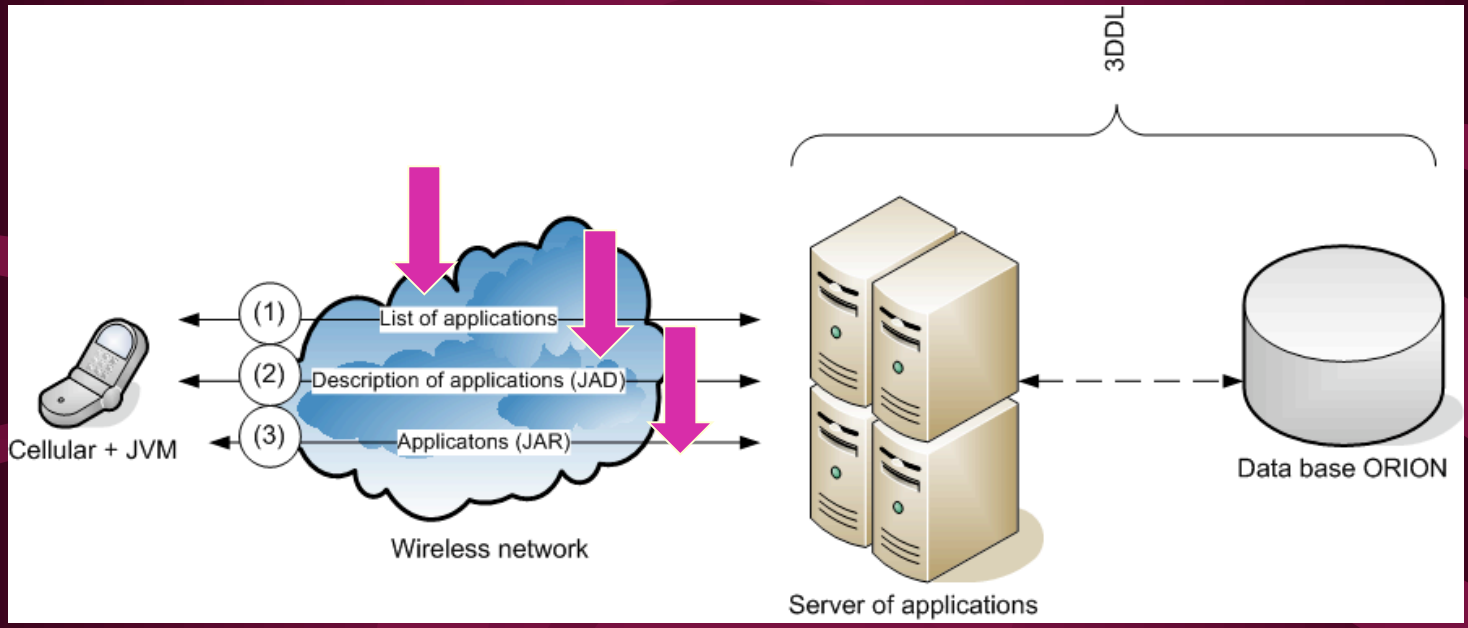
- From E2E to Hop by Hop
- In search of (killer) applications (multimedia, Grid…)
- Collaboration with SME : 3DDL : development of applications for mobile platforms



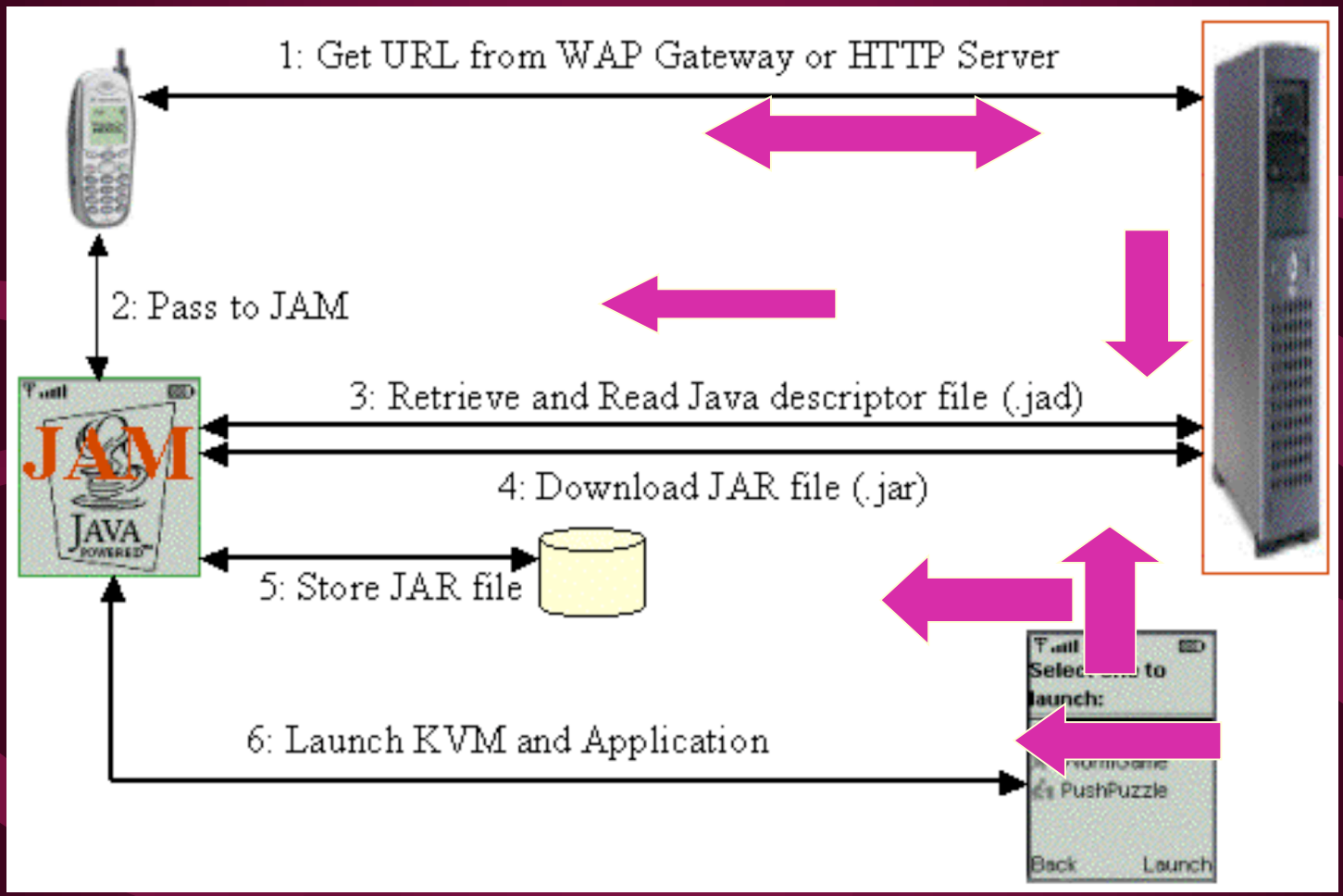
Game design for mobile platforms

- Heterogeneous cellulars
- Multiple version of same application / Java
- Development time
- Java2 Micro Edition / J2ME
  - Specific APIs
  - MIDP : Mobile Information Device Profile -
  - Suite MIDDlets (JAD & JAR)
    - JAR : archive of classes of applications
    - JAD : description of JAR (name, version, vendor, profile…)
  - Over The Air provisionning : install, actualize, delete applications on mobiles

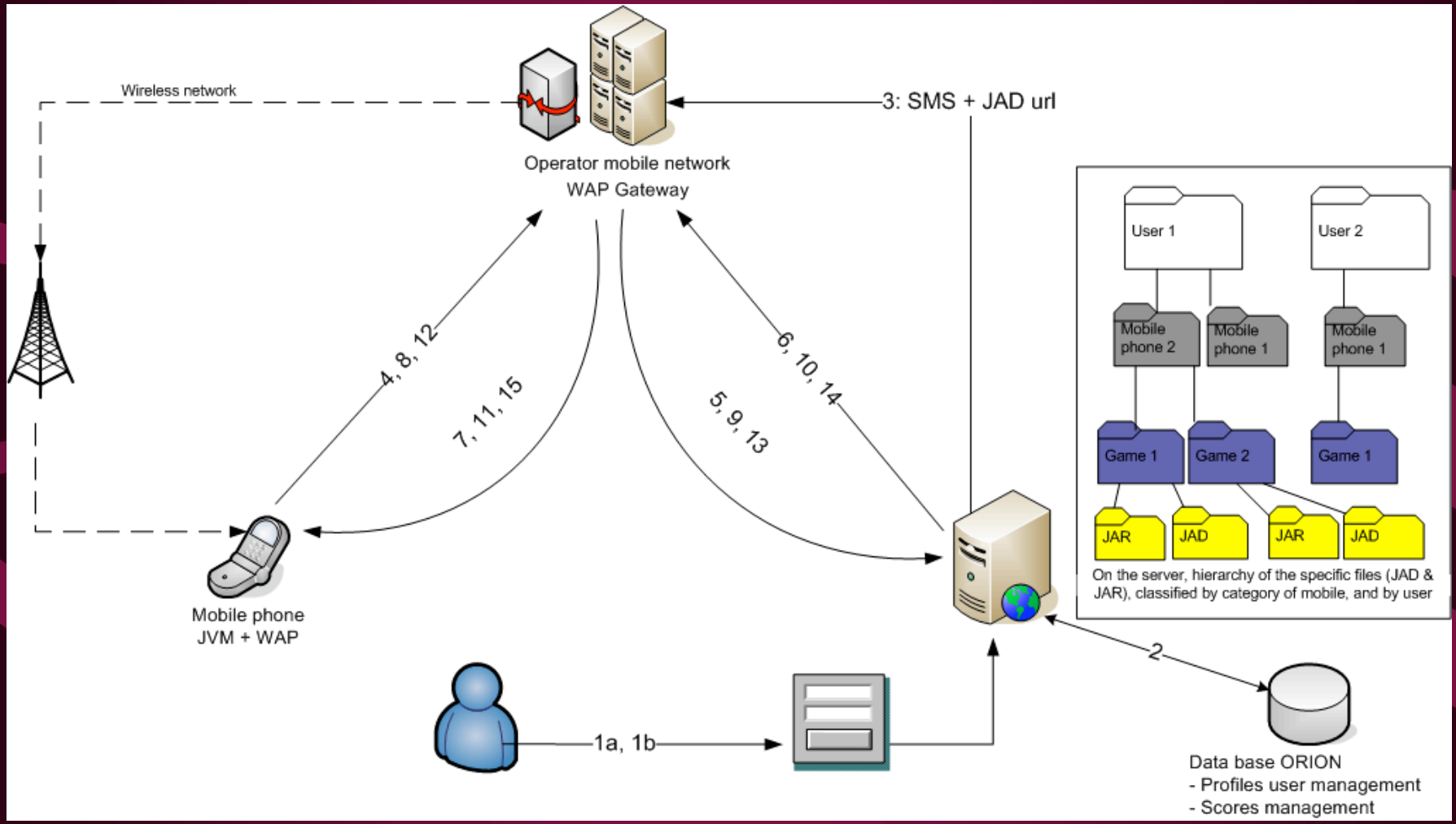
Games deployment on mobile nodes



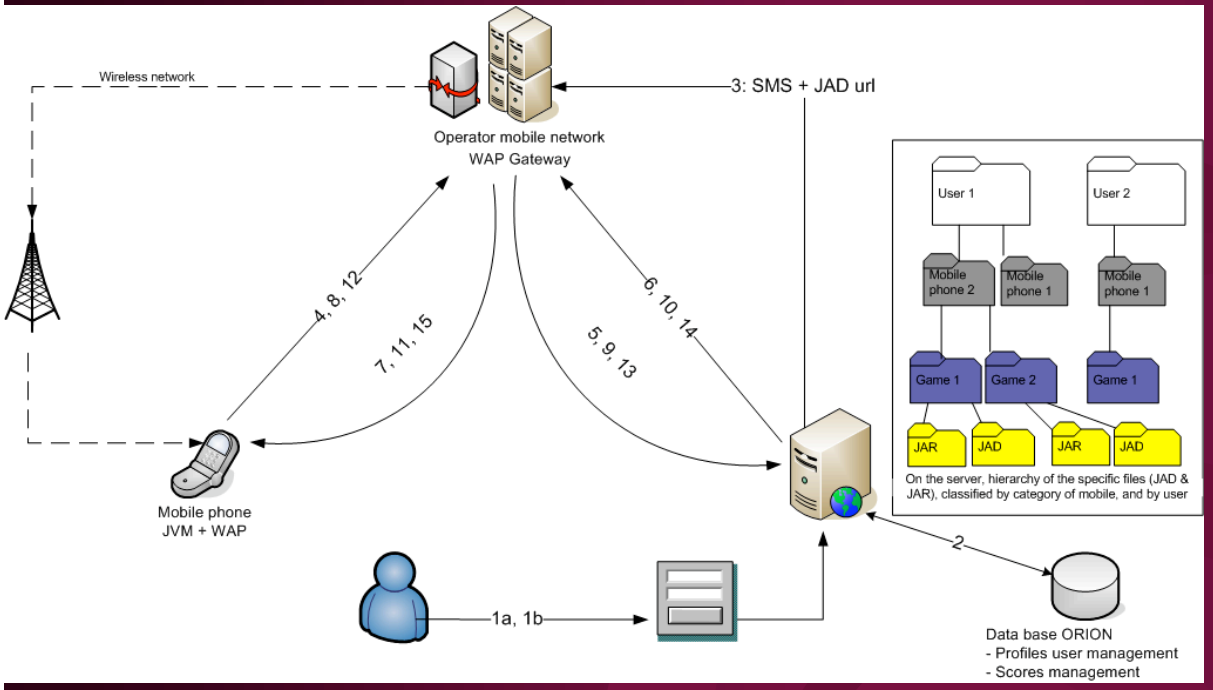
Games deployment on mobile nodes



Without active network support



Game deployment without active network support



1a: Enrollment
1b: Downloading game
2: Creation of the temporary directories (user/mobile/game) and copy of the JAD and JAR files of requested game
3: Send SMS via mobile operator
4,8,12 : Request for WML, JAD, JAR files
5,9 : Request for JAD, JAR files
6,10 : JAD, and JAR files
7,11 : JAD, and JAR files

Active networtk support for deployment of mobile games : goals

- Reducing development time : one version of the application
- Modifying data/applications on the fly
- Limiting usage bandwith and interactions between clients and servers
- Support deployment of games without adding too much latency

Tamanoir Active Network

- Tamanoir : a complete software environment to deploy *active routers* and *services*.
- Handle different streams and applications in parallel.
- TCP and UDP support
- Provides a fast and performant Execution Environment.
- *Dedicated to high performance networking*

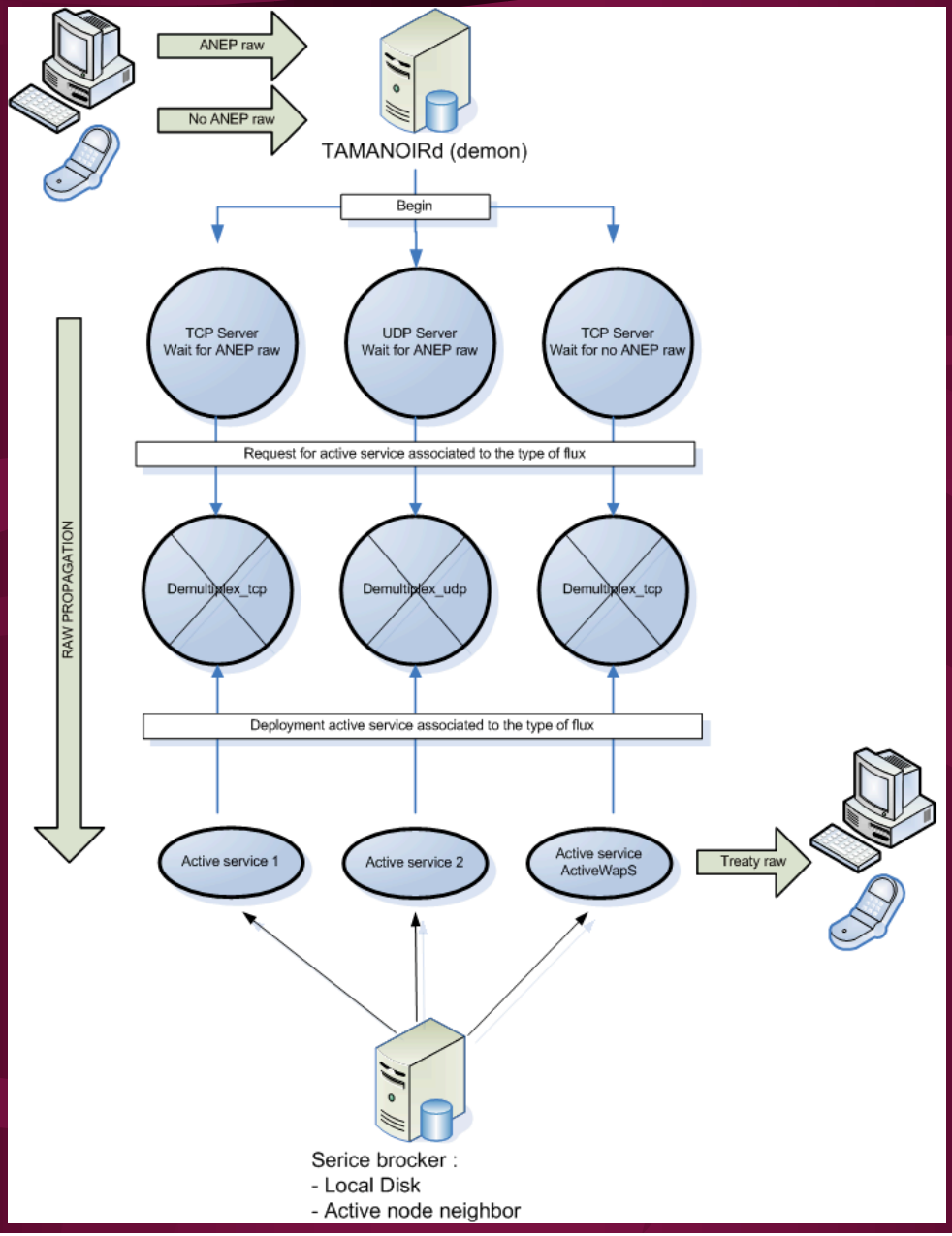
Tamanoir EE

- Active services can be deployed on Tamanoir node on various level.
  - programmable network interface card (Myrinet, Network Proc.)
  - kernel space (Netfilter)
  - user space (Java)
  - clustered architecture (LVS)

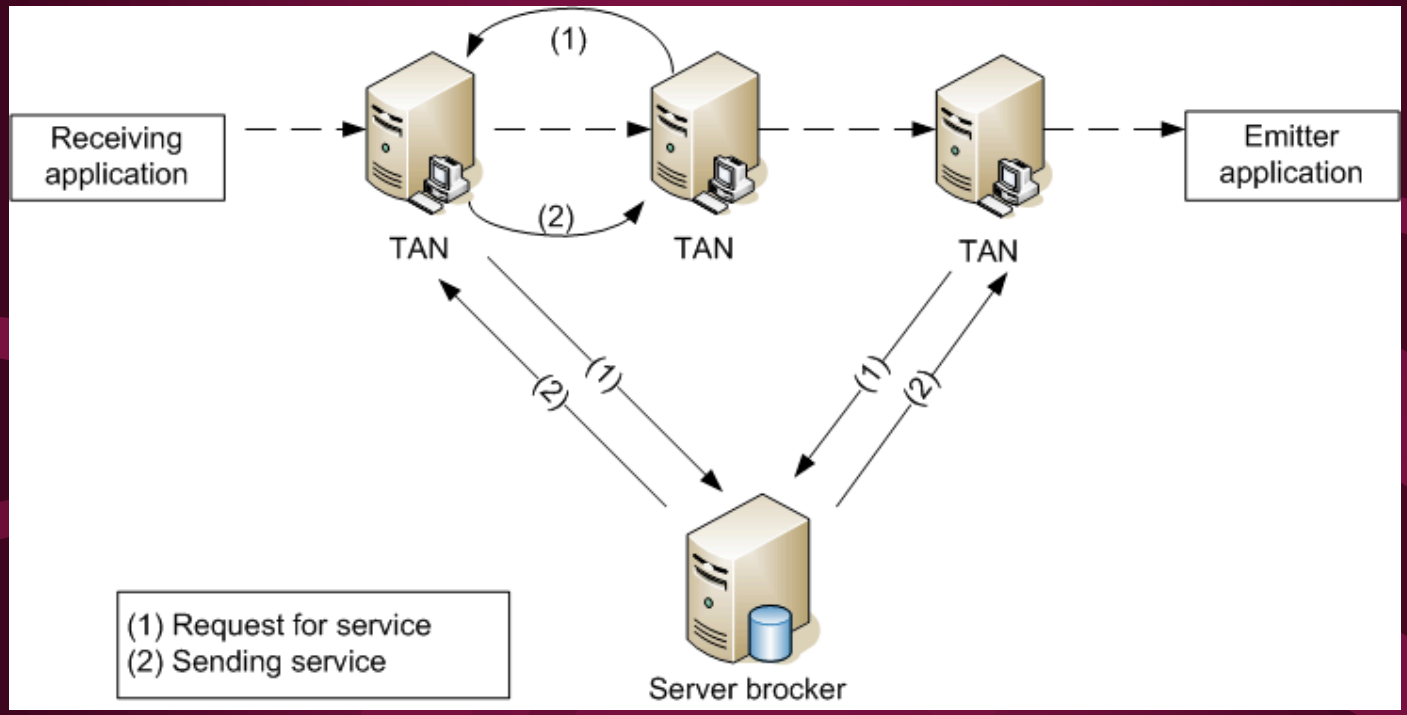
Tamanoir Architecture : adapted for heterogeneous services

- Resources consuming services : distributed storage, streams transcoding, on the fly compression, cryptography…
- Services deployment / linked with middleware : reliable multicast…
- Middle services : content based routing, QoS...
- Light network services : packet marking, QoS…

Architecture of Tamanoir Active Node

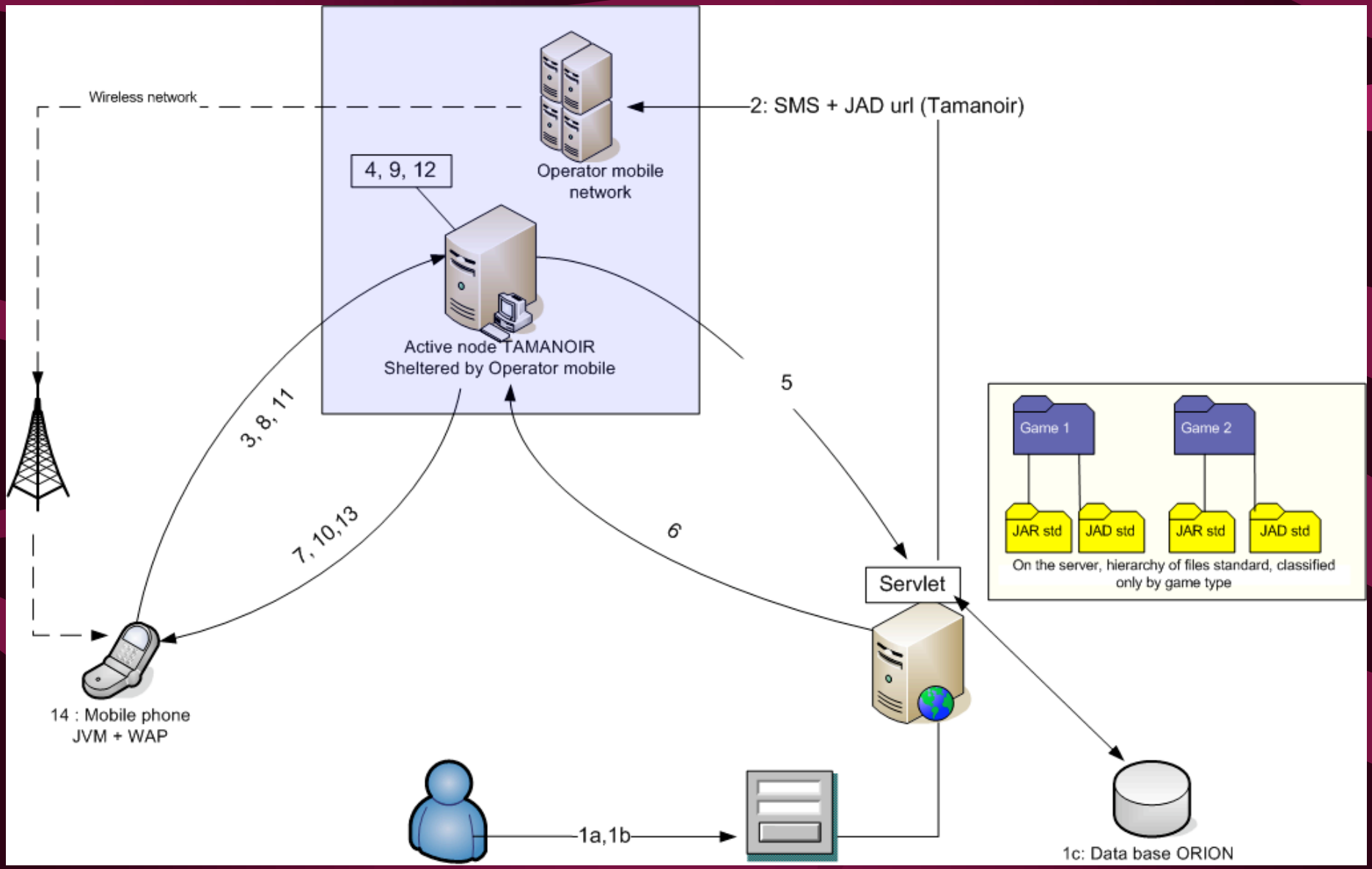


Deployment of services

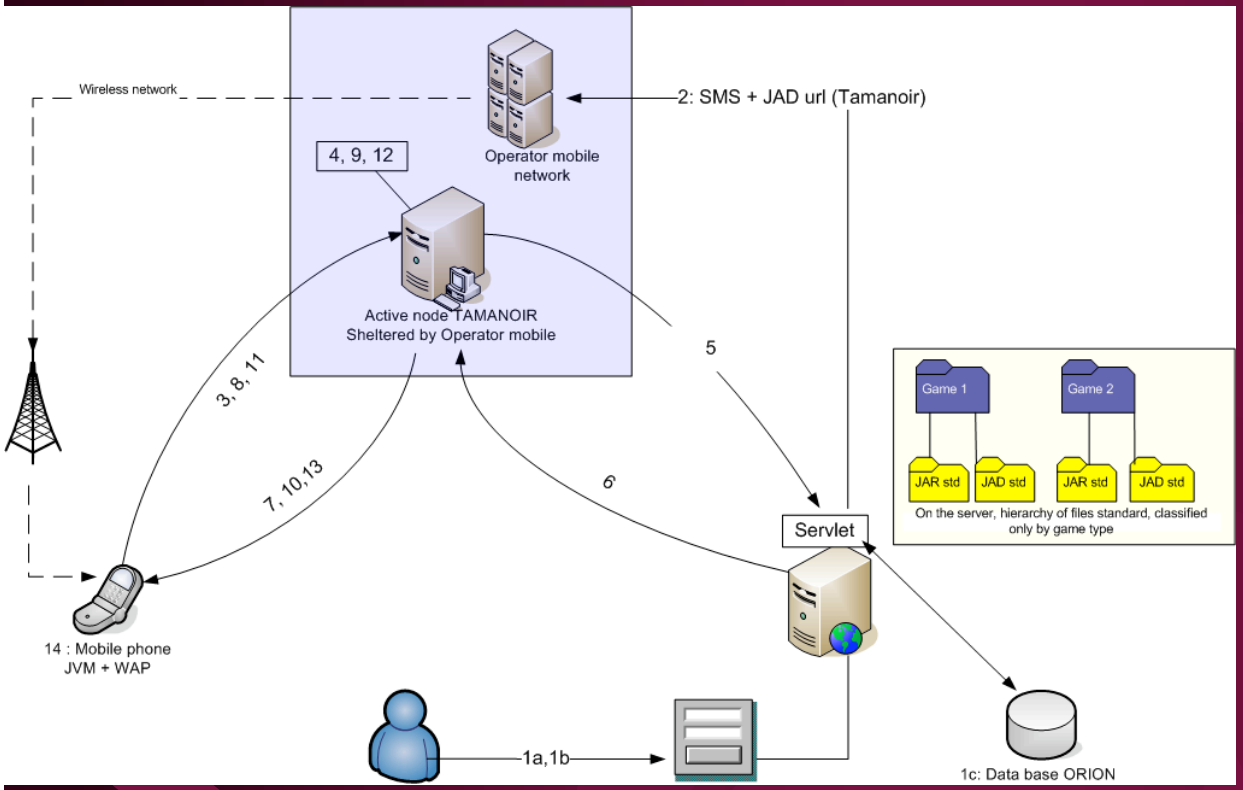


- Service broker
- Node 2 node

Game deployment with active network support



Game deployment with active network support



1a: Registration, 1b: Download game, 1c:Registration profile
2: Send SMS via operator mobile + URL of the JAD file on Tamanoir
3, 8: Request for JAD file
4: Extraction of the user_agent + identifying user from the URL
5: Request for file Standard JAD + Sending of user_agent,User_ID, Game_ID to the servlet
6: Sending of JAD and JAR files (standard)
9,10: Adaptation of the JAD content switch user ID and mobile type + Sending
11: Verifying JAD information, if OK request for JAR file
12: Adapt JAR file
13: Sending adapted JAR
14: Verifying + game installing

Software

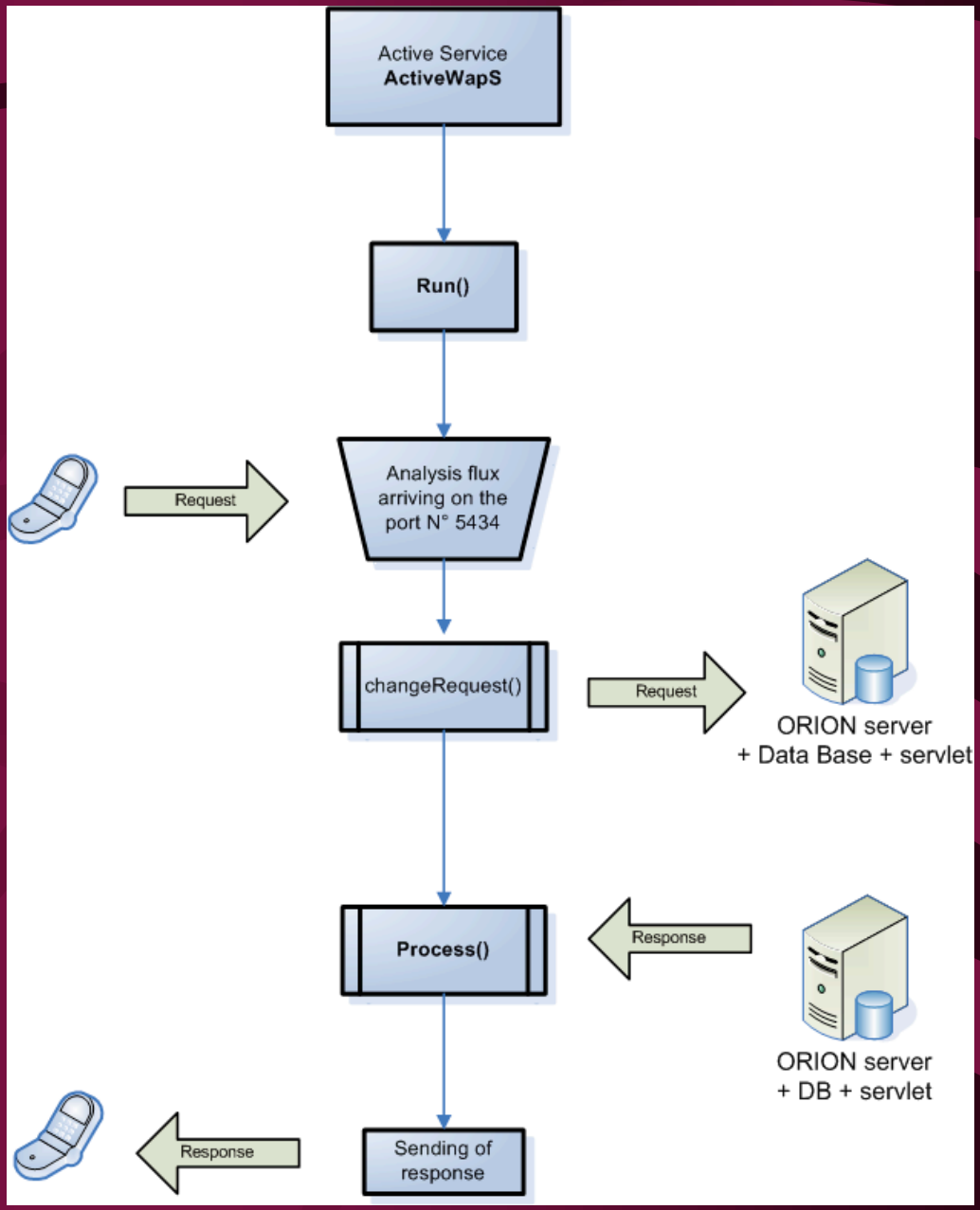
- ActiveWapS : active service deployed in Tamanoir node
  - On the fly modification of JAD files
  - On the fly modification of JAR files (pruning, re-archiving…)
- Servlet
  - DB accesses (EJBs)

-Stream intercept

-Stream analysis
  -JAR
  -JAD

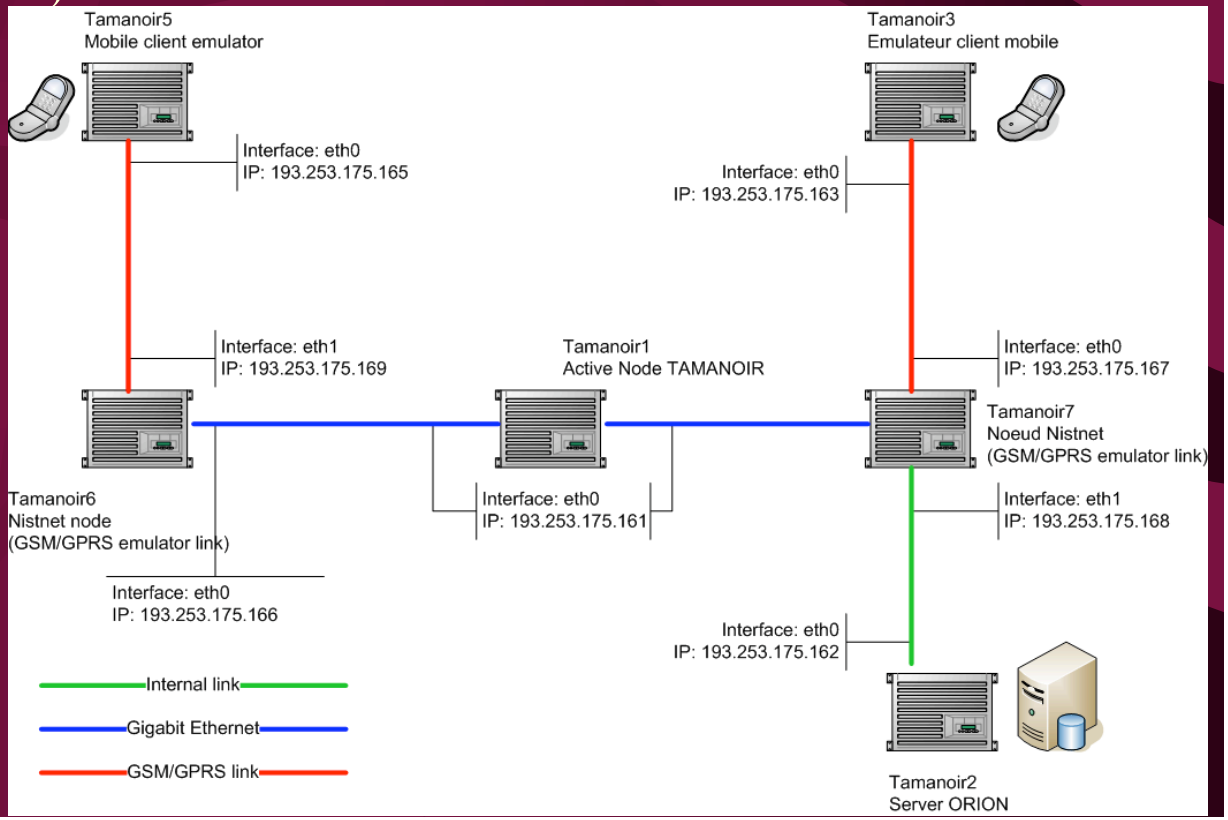
-JAD / JAR processing
  -Servlet request
  -JAD/JAR adapt

-Data send back to mobile platform



Experiments

- Local platform
- Gbits links
- Mobile networks emulation (with software link emulator NistNet)
- Experiments on various scenario
  - GSM (9,6 Kb/s)
  - GPRS (30 – 128 Kb/s)
  - UMTS (250 Kb/s – 1Mb/s)
- Values :
  - JAD : 0.5 KB
  - JAR : 45 KB



N°test	Nb clients	Messages	Tps total	Nb Threads	NbMax threads	Tps/JAD
1	1		75	3	1	25
2	10		3049	25	9	121
3	25		8570	63	25	136
4	50		22652	126	50	181
5	100		31045	250	100	124
6	200	Tamanoir :				
		OutOfMemoryError	56550	469	200	120
7	500	Tamanoir :				
		OutOfMemoryError	76671	581	474	131

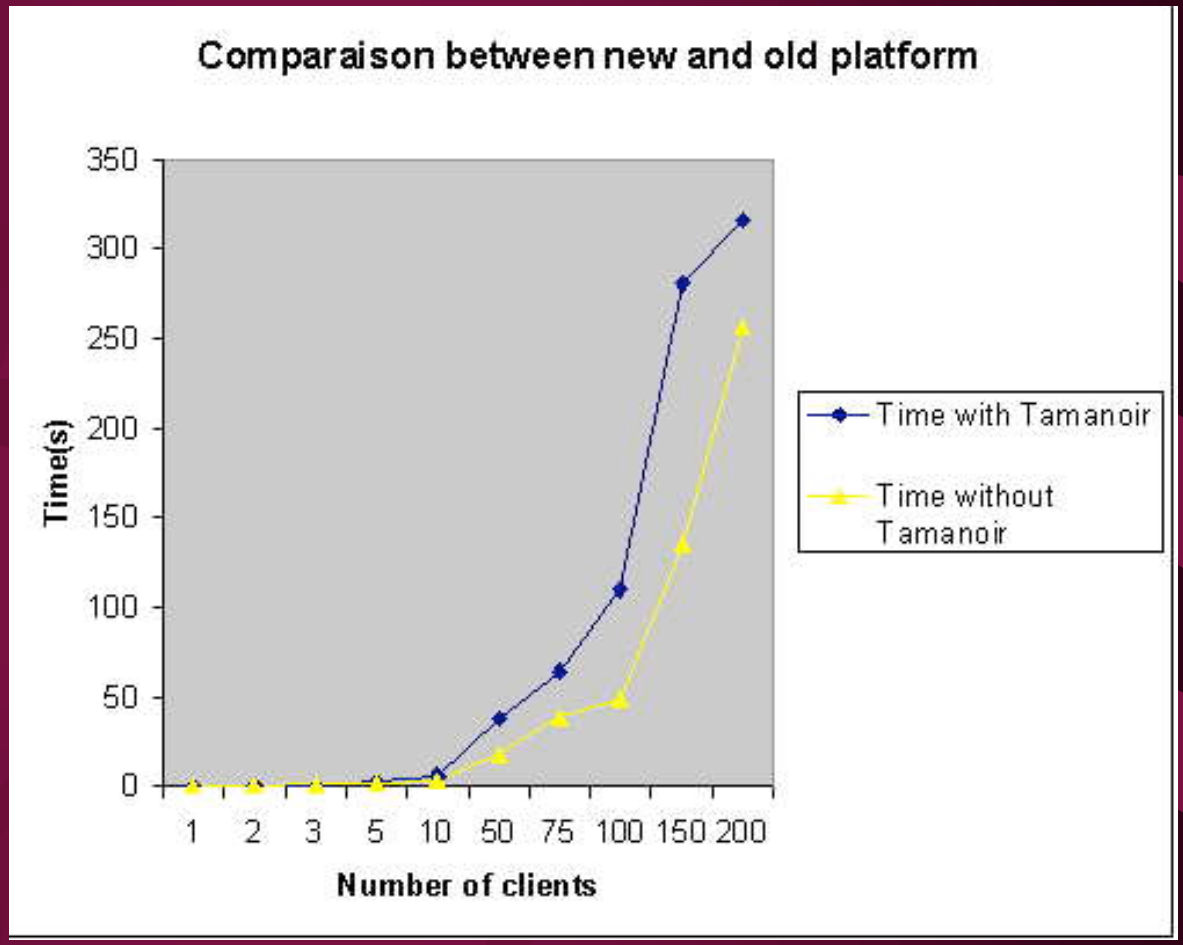
Supported load

N°test	Nb clients	Tps Tamanoir	Tps ancienne version	Ratio
1	1	0m0.450s	0m0.266s	1.69
2	2	0m0.807s	0m0.687s	1.17
3	3	0m0.989s	0m1.342s	0.73
4	5	0m2.827s	0m2.302s	1.22
5	10	0m6.086s	0m3.446s	1.76
6	50	Om37.764s	0m18.029s	2.09
7	75	1m4.660s	0m38.725s	1.66
8	100	1m50.188s	0m49.226s	2.23
9	150	java.lang.OutOfMemoryError		
		4m40.171s	2m15.503s	2.06
10	200	java.lang.OutOfMemoryError		
		5m15.988s	4m16.406s	1.23

Performances (with NistNet)

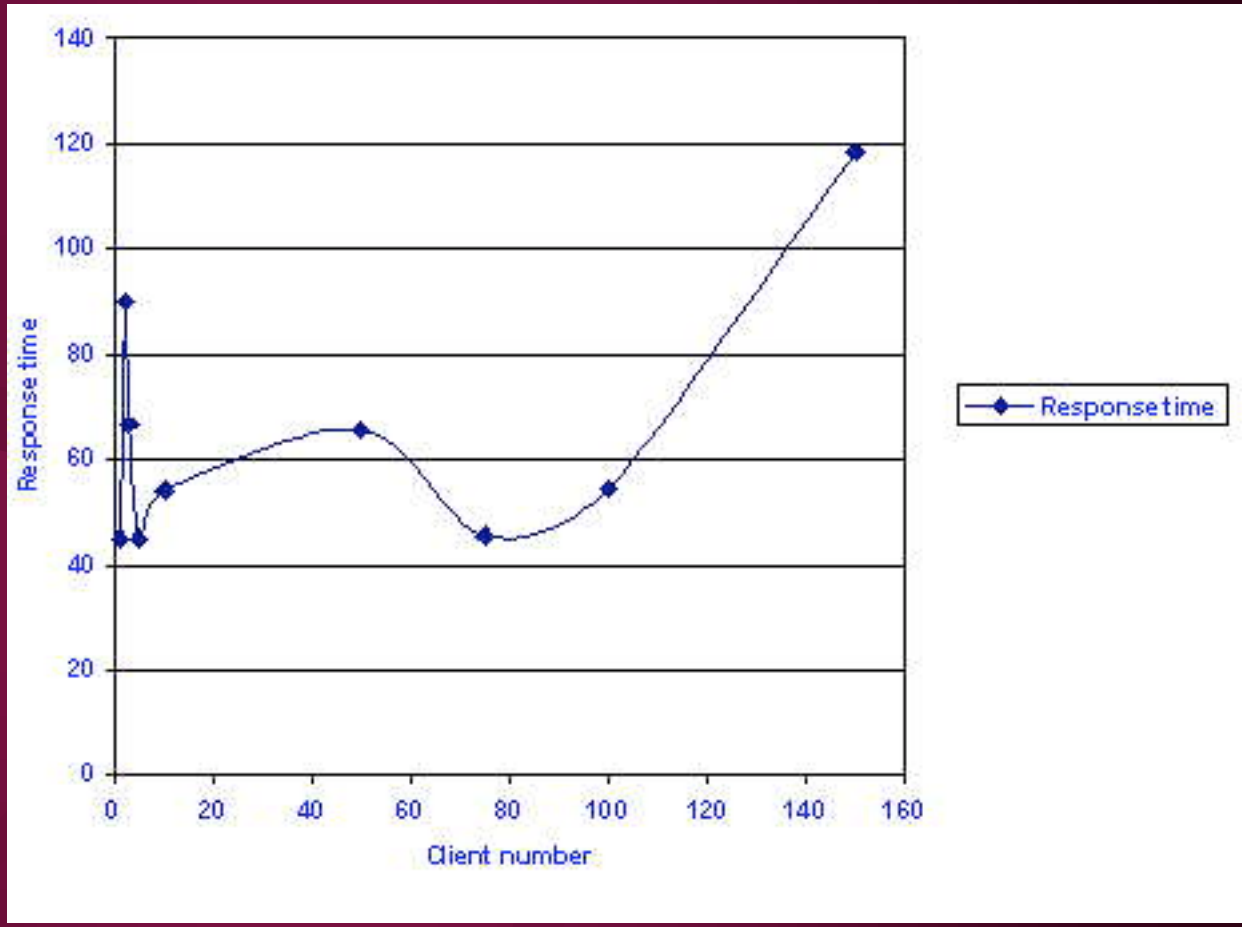
Experiments

- “Local hero test” : all clients are on 100Mb network
- After 100 clients : latency increases



Experiments

- With NistNet emulation
- Clients are connected through a “perfect” GSM network
- OK for 100 clients : 45 s for game deployment



Ongoing work

- *Continuing network emulation for other scenario*
  - *Software (Nistnet) and hardware (Gnet) network emulator*
- *Operational deployment during game campaign*
- *Cache support in active node*

Future works

- *Experiments on large scale platform (Grid5000)*
- *Scalability : cluster-based Tamanoir active node*
- *Adapting multimedia streams for mobile cellulars*
- *More information :*
  - *http://www.ens-lyon.fr/LIP/RESO/Tamanoir*