

*International Workshop on Wireless Ad-hoc Networks*

# Service Discovery in Heterogeneous Wireless Networks

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# Overview

- Possible approaches to handling vertical handovers.
- SPEARS architecture.
- Service discovery concepts in SPEARS.
- Implementation details.
- Experimental results.
- Conclusions and future work.

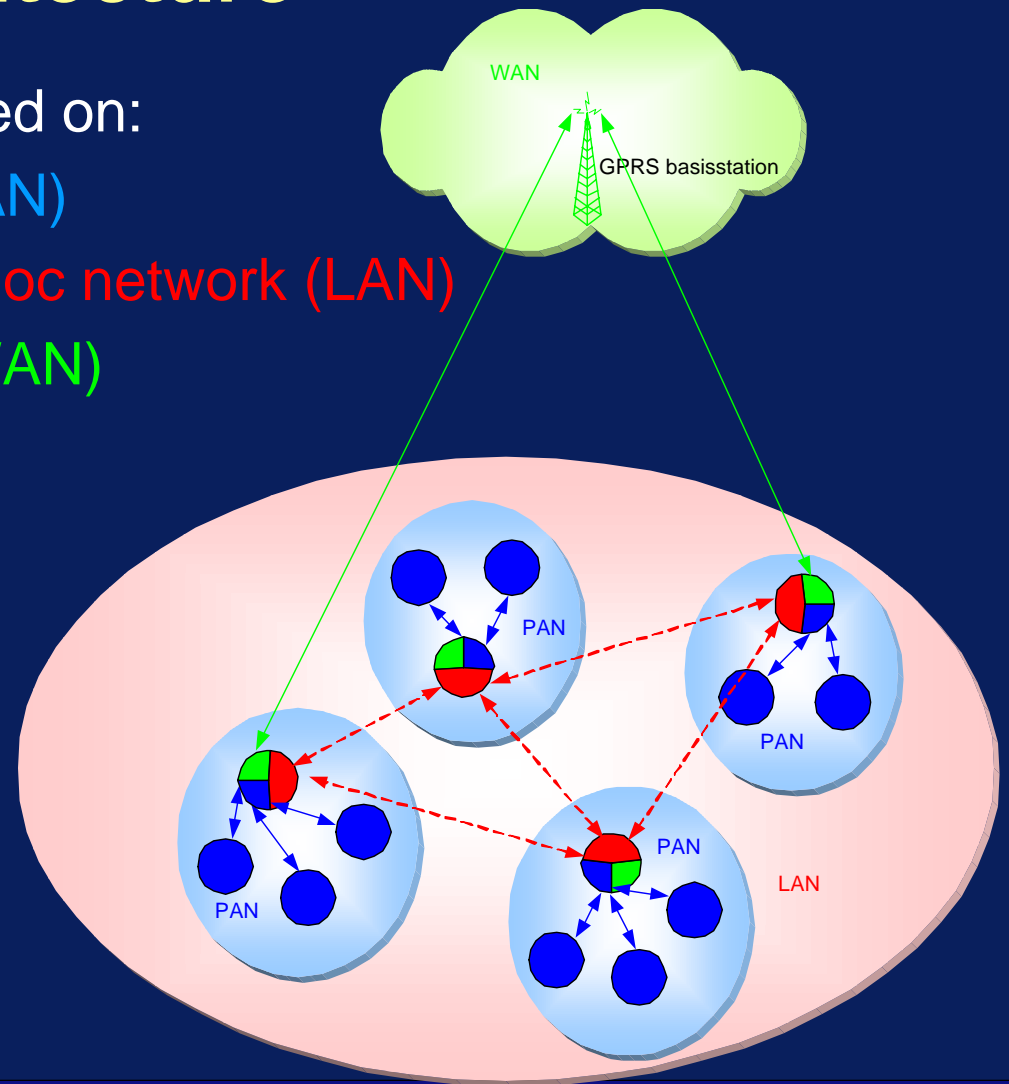
# Vertical handovers

- Lower levels of the OSI protocol stack.
- IP layer.
- **Middleware layer between networking protocols and application.**

# The SPEARS architecture

Current implementation based on:

- Within IMT: Bluetooth (PAN)
- Between IMT's: WiFi ad-hoc network (LAN)
- Public network: GPRS (WAN)

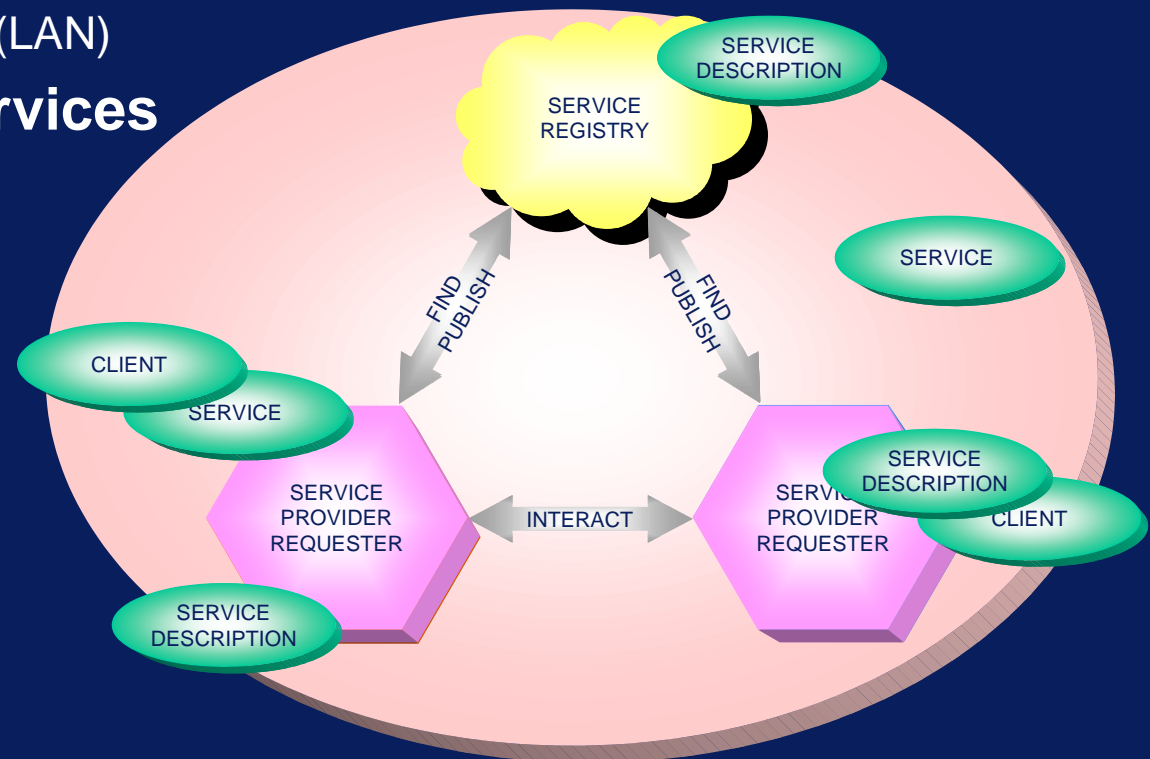


# Motivation

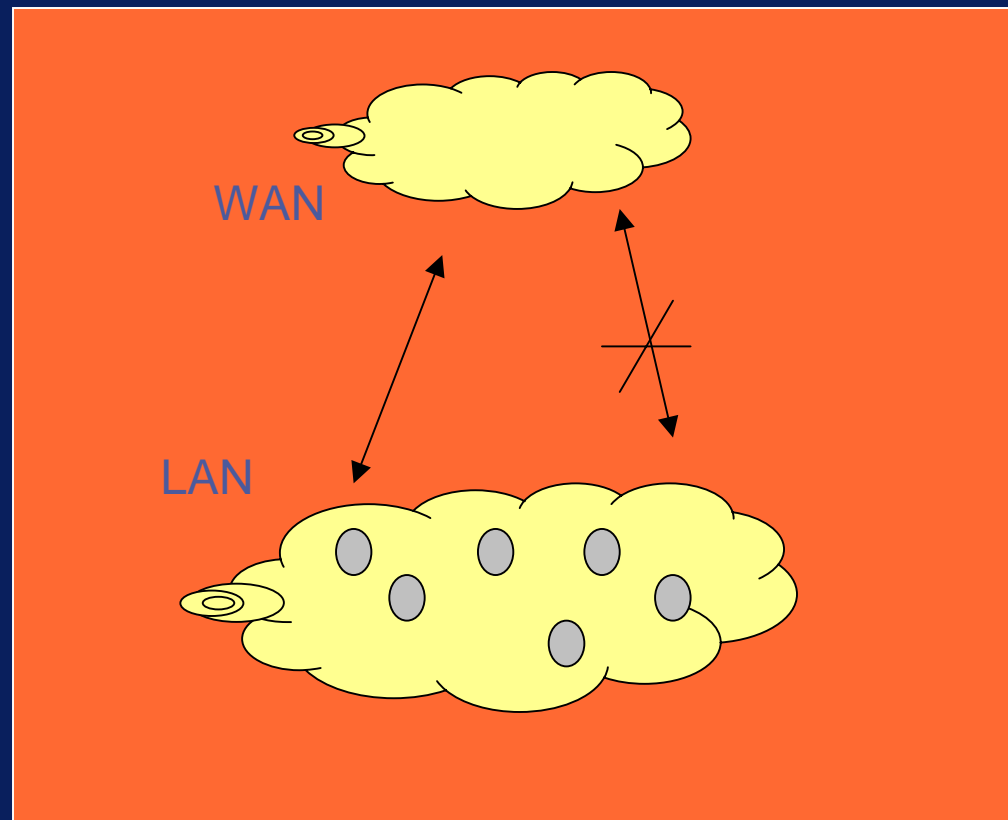
- Robustness
- No central server
- Flexibility of the network configuration.

# Service discovery middleware

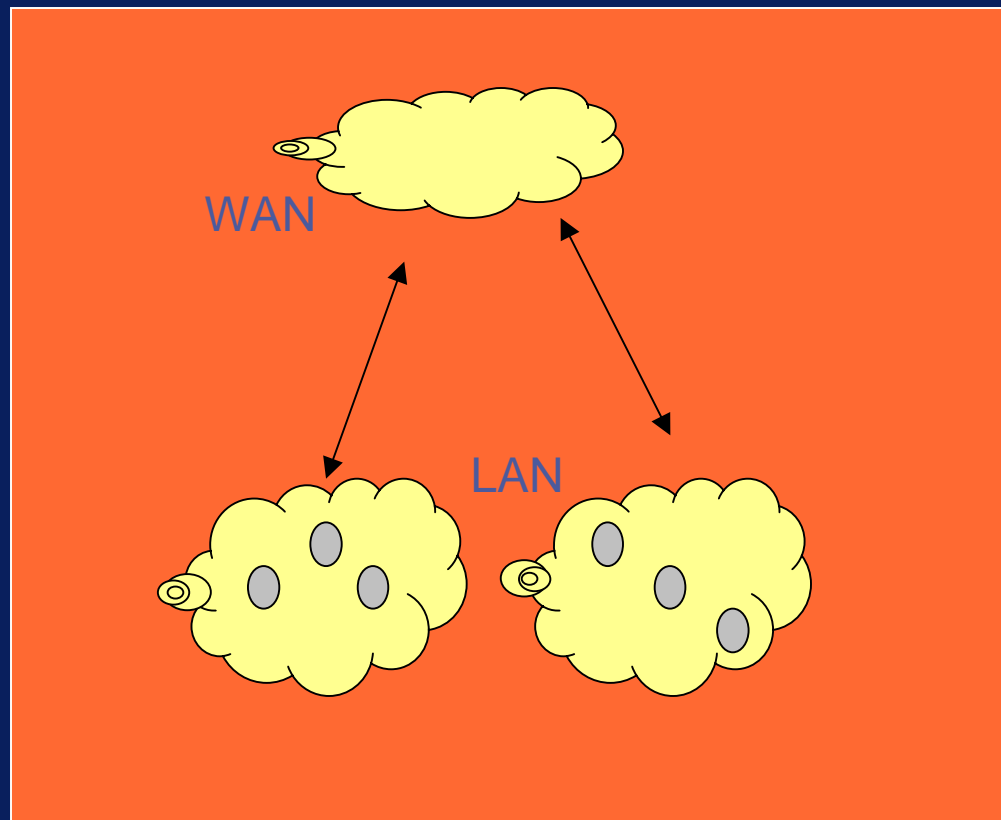
- Services
- Lookup servers
  - Global lookup server (WAN)
  - Local lookup servers (LAN)
- Registration of services
- Usage of services



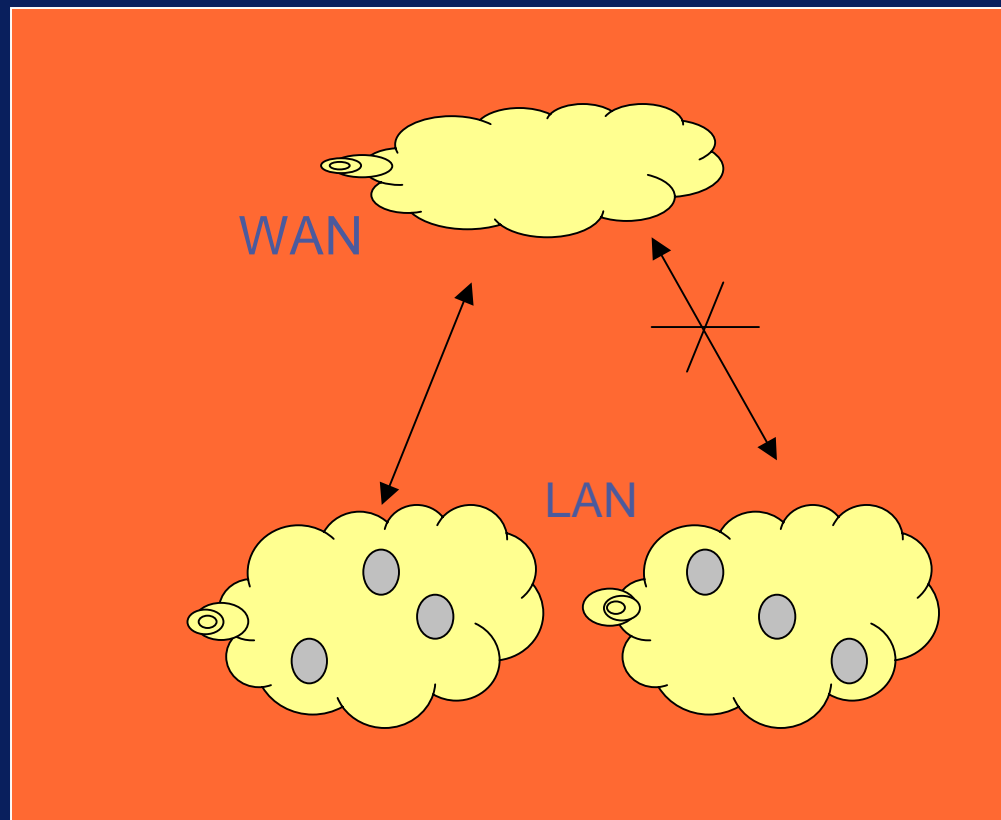
# Service / Network Outage (Case 1)



# Service / Network Outage (Case 2)



# Service / Network Outage (Case 3)



# SPEARS Implementation of Service Discovery

## Essential requirements:

- Multicasting support.
- Restricting multicast to LAN.
- Routing of IP packages between mobile nodes through WAN.

## Highlights:

- Combination of AODV & Mobile IP.
- Based on Jini™ from Sun Microsystems.
- SPEARS specific extensions.

# Implementation aspects

- **'Codebase' problem** - must be different in WAN and LAN registrations.
  - SpearsClassLoader
  - setCodebase() member function.
  - First register at WAN, then LAN.
- **Service type identification** - applications must be able to see which service version (LAN or WAN) they are about to use.
  - Services annotated with an attribute indicating service type.

# Experimental results

The screenshot displays a complex software interface for fire command. On the left, a floor plan is shown with various symbols like fire extinguishers and doors. A central panel lists users such as 'brandweerman1' through 'brandweerman3', 'Commandant', and 'Officier Gevaarlijke Officier van Dienst'. On the right, three video feeds show firefighters in action. A bottom panel displays a log of messages, including 'A pressure-alarm for brandweerman3 - action: rep...'. The system tray at the bottom shows the date and time as 'Thu Feb 19, 9:02 AM'.

Timestamp	Service	Message
19-01-2004 09:01:36	PlotBoard	A pressure-alarm for brandweerman3 - action: rep...
19-01-2004 09:01:51	PlotBoard	A pressure-alarm for brandweerman2 - action: rep...
19-01-2004 09:01:51	PlotBoard	A pressure-alarm for brandweerman2 - action: rep...

# Conclusions

- Vertical handovers at middleware layer.
- Practical implementation in Jini.