Multicast Support in Ad hoc Wireless Extensions to Fixed IP Networks: The MIND Approach

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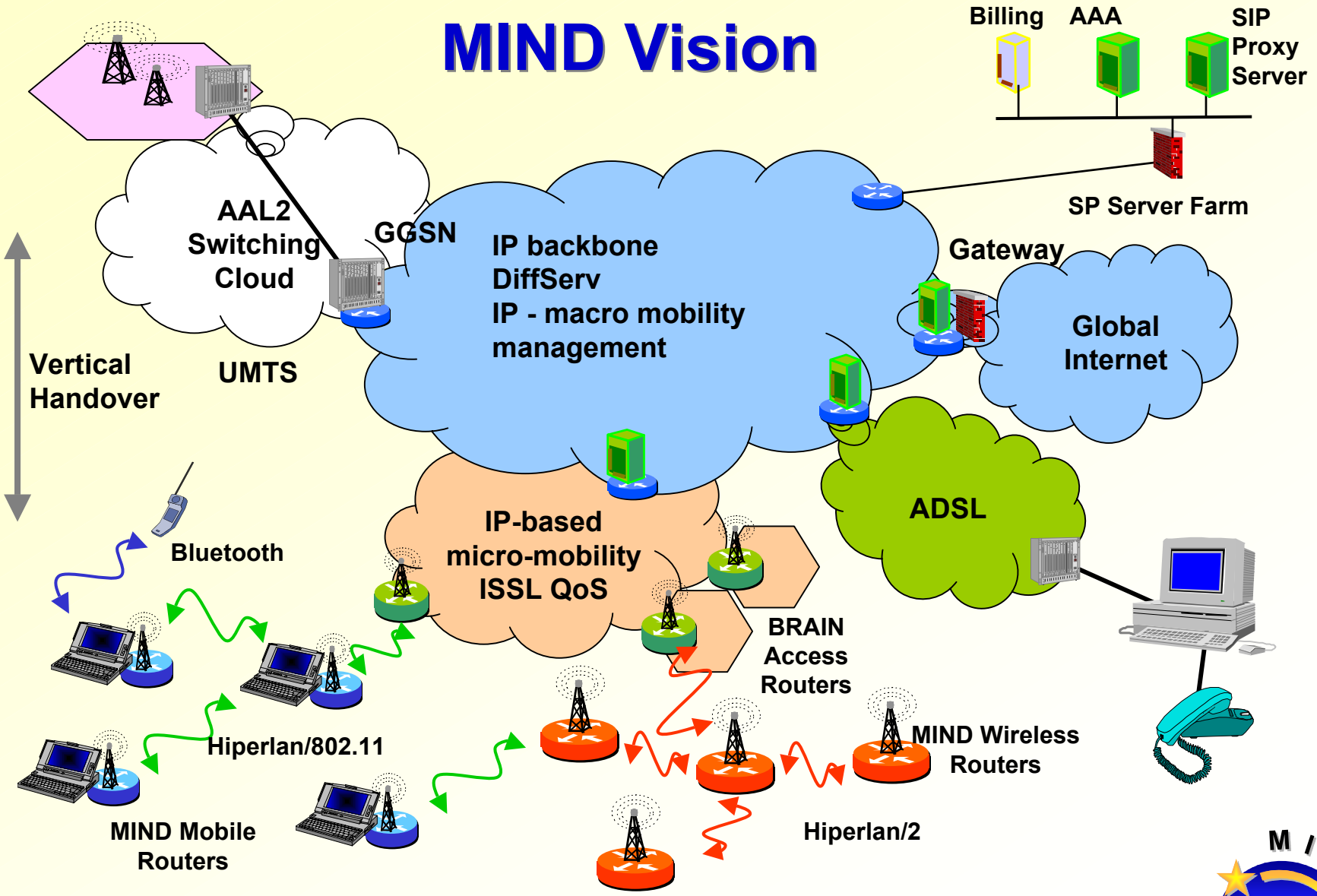
Outline

- Introduction to MIND
- Introduction and problem definition
- Multicast requirements and interoperation issues
- Proposed multicast architecture
- Operation of the MMARP protocol
- Conclusions and future work

MIND Project Structure

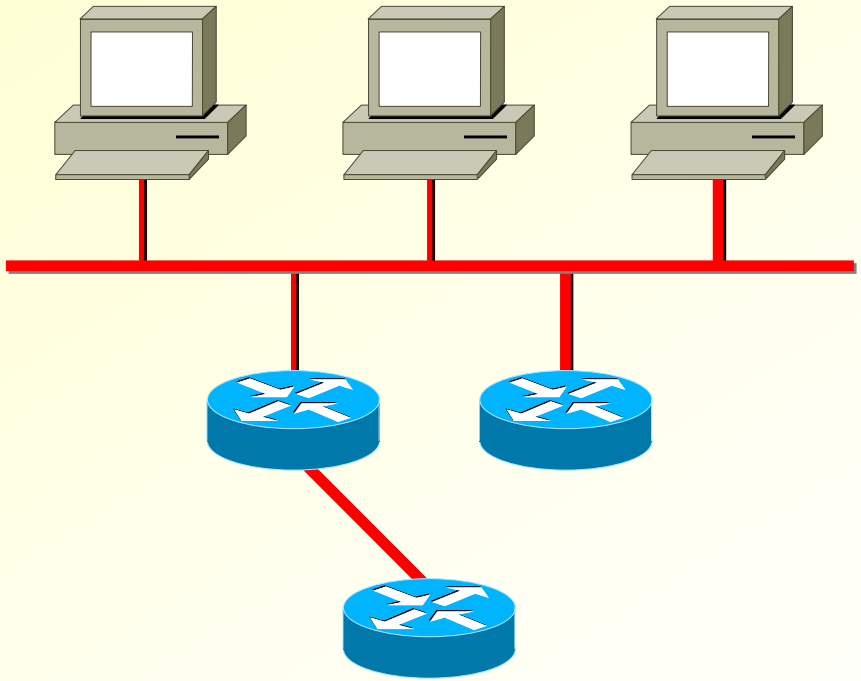
- RTD project of the IST Programme of the EU
- Duration: Jun 01 - Nov 02
- Website: http://www.ist-mind.org

MIND Vision


Billing
AAA
SIP Proxy Server
SP Server Farm
AAL2 Switching Cloud
GGSN
IP backbone
DiffServ
IP - macro mobility management
Gateway
Global Internet
Vertical Handover
UMTS
ADSL
IP-based micro-mobility ISSL QoS
Bluetooth
BRAIN Access Routers
Hiperlan/802.11
MIND Wireless Routers
MIND Mobile Routers
Hiperlan/2

The IP Multicast model

Protocols between Hosts and Routers (IGMP)



Hosts

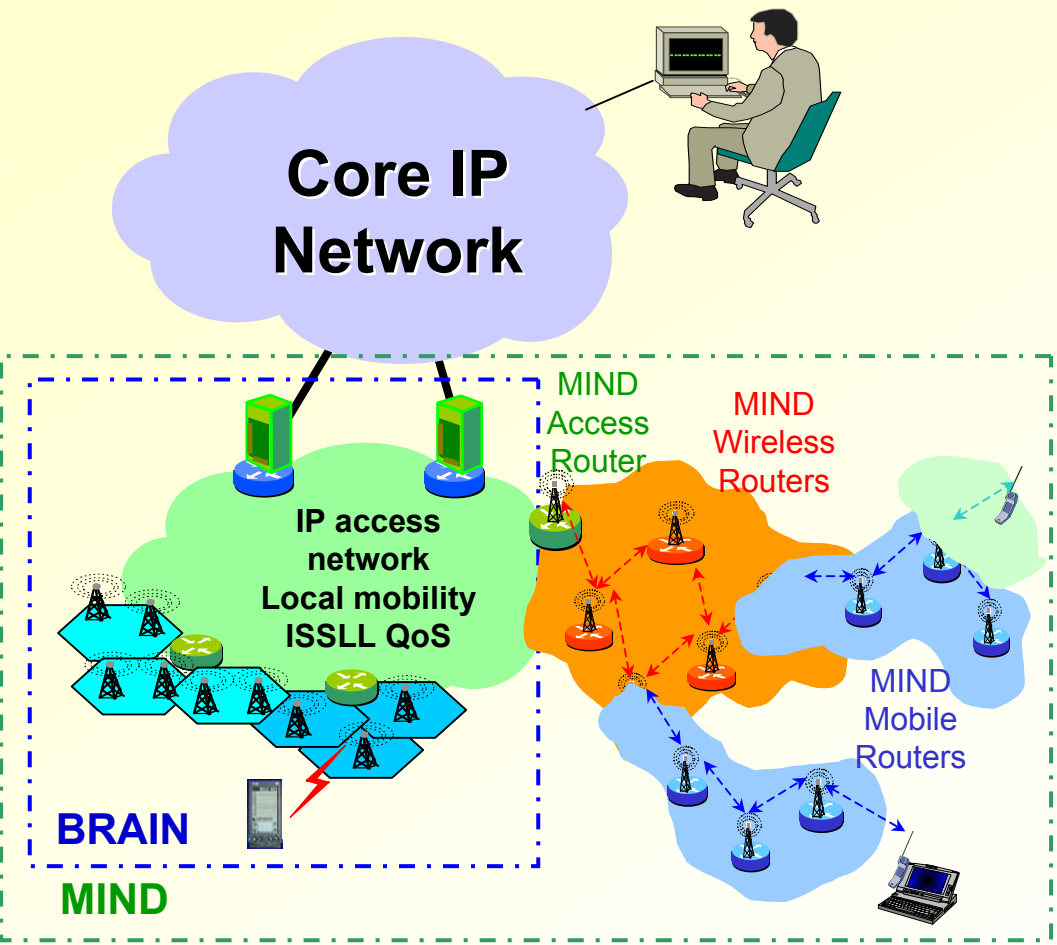
Routers

Multicast Routing Protocols (PIM, DVMRP, CBT,...)

Requirements

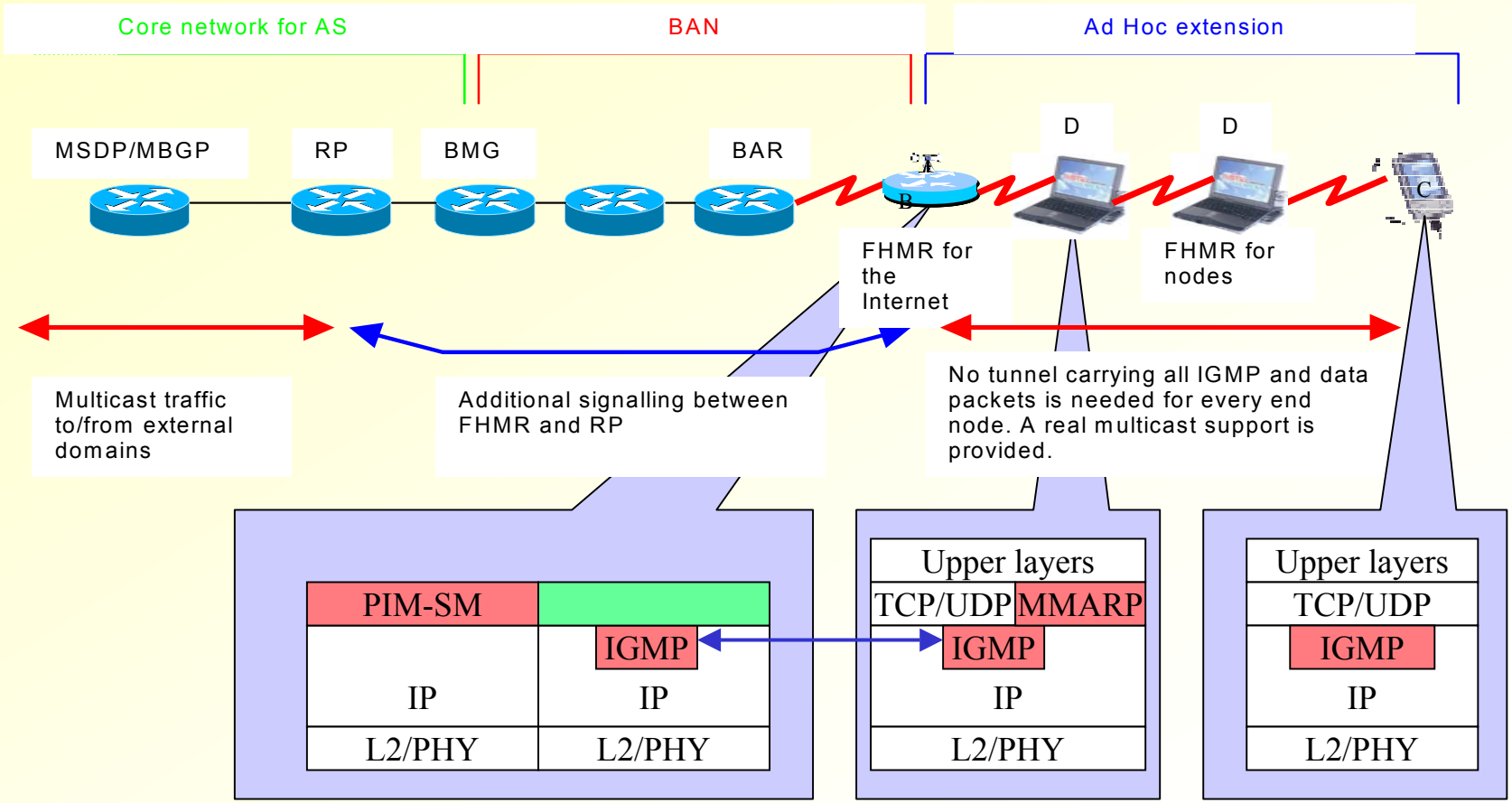
- Compatibility with IP multicast protocols
- Unchanged terminal APIs
- RPF-Check compatible address management
- Efficient routing inside the ad hoc fringe
- Scalability
- Low signalling overhead
- Resilience
- Robustness
- Interdomain multicast routing compatibility

MIND Multicast Scenario and problems



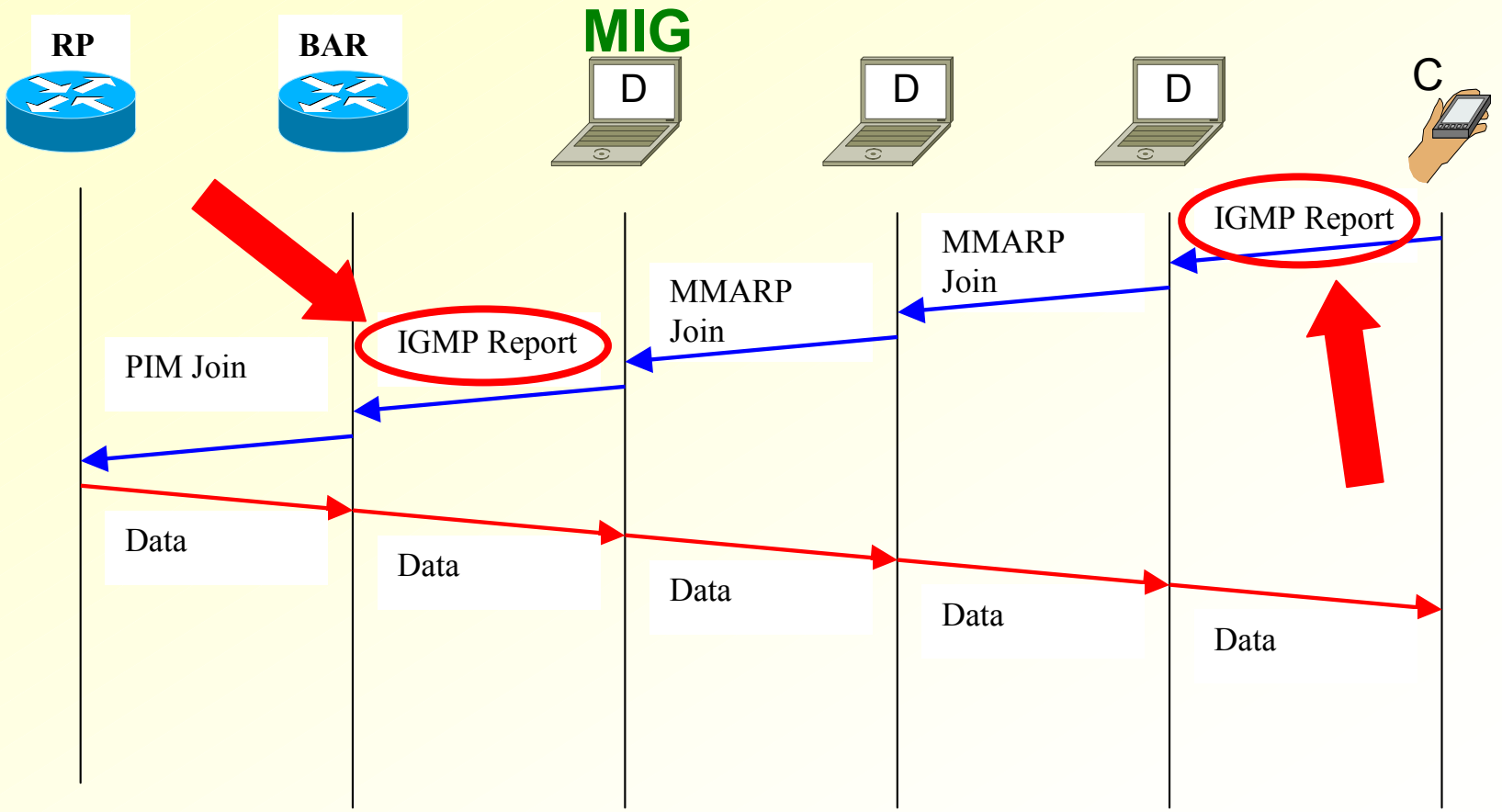
- TTL and shared medium issues of IGMP
- Responsiveness of IGMP
- Support of a multi-homed AHF
- Uplink and downlink multicast support
- Having a single group management protocol
- Multicast routing protocol for fixed networks are not suitable for ad hoc networks

Proposed architecture

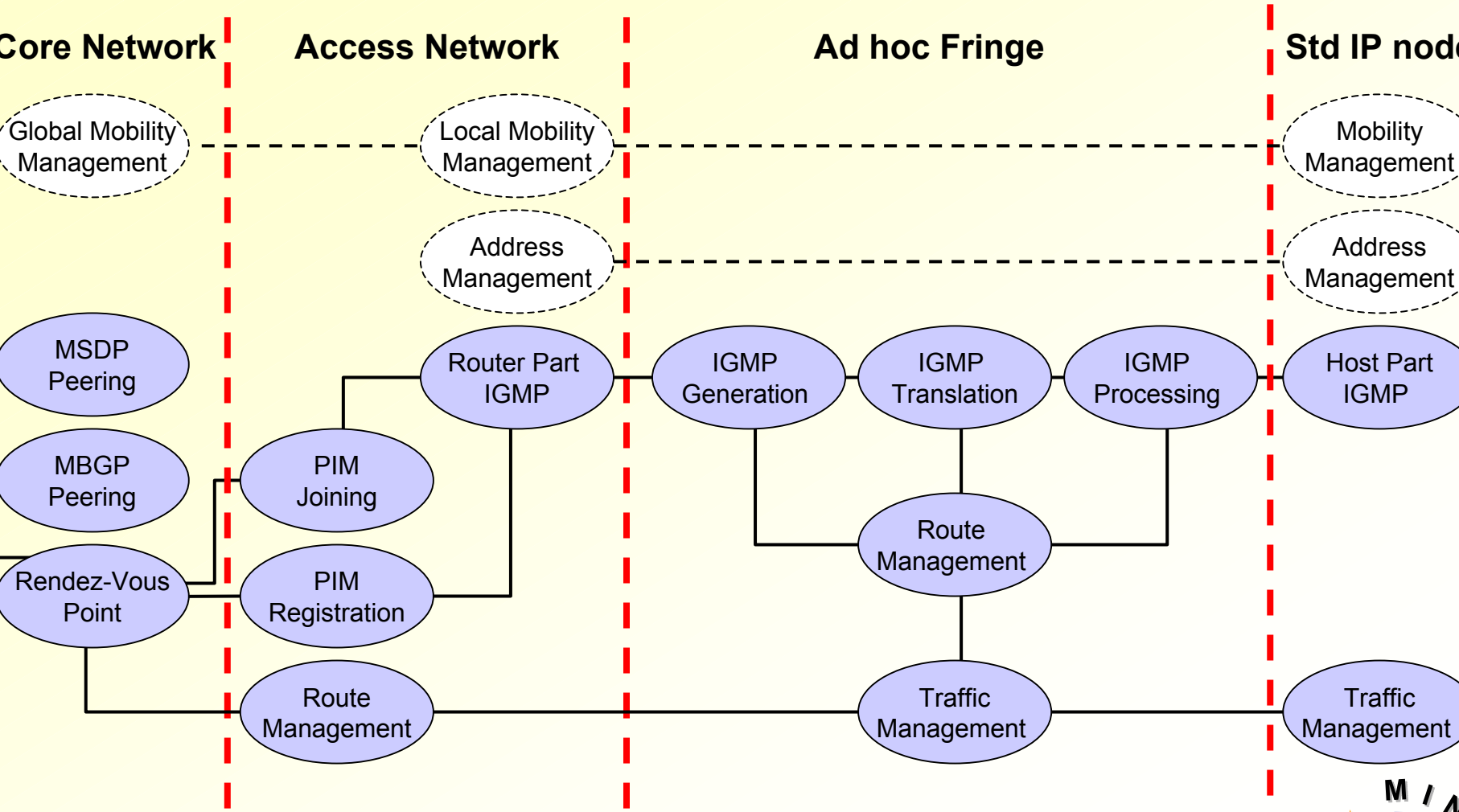


MMARP.- Multicast MAnet Routing Protocol

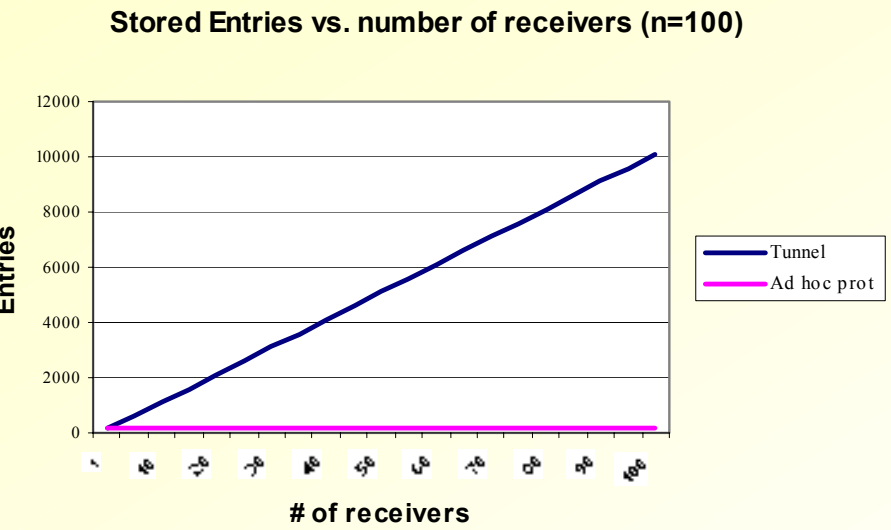
Example of AHF multicasting

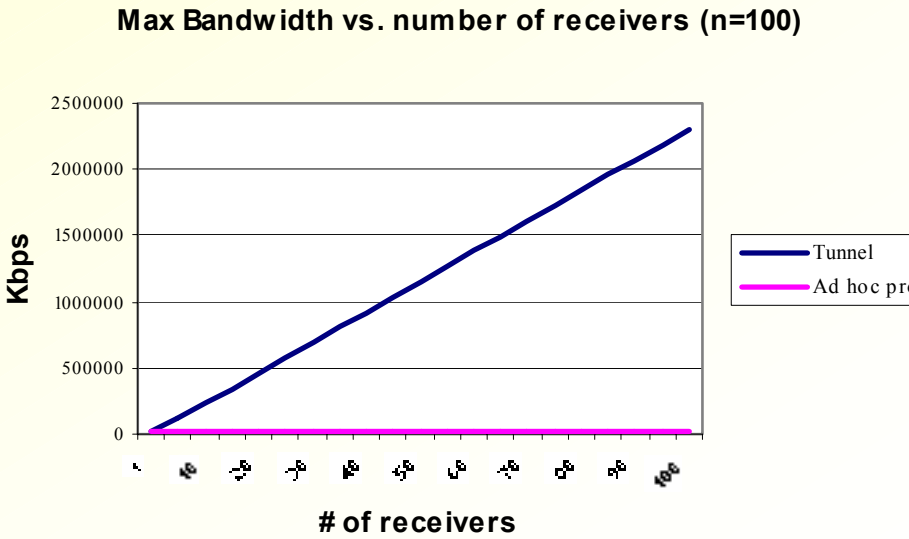


Functional Model for the Mcast Arch

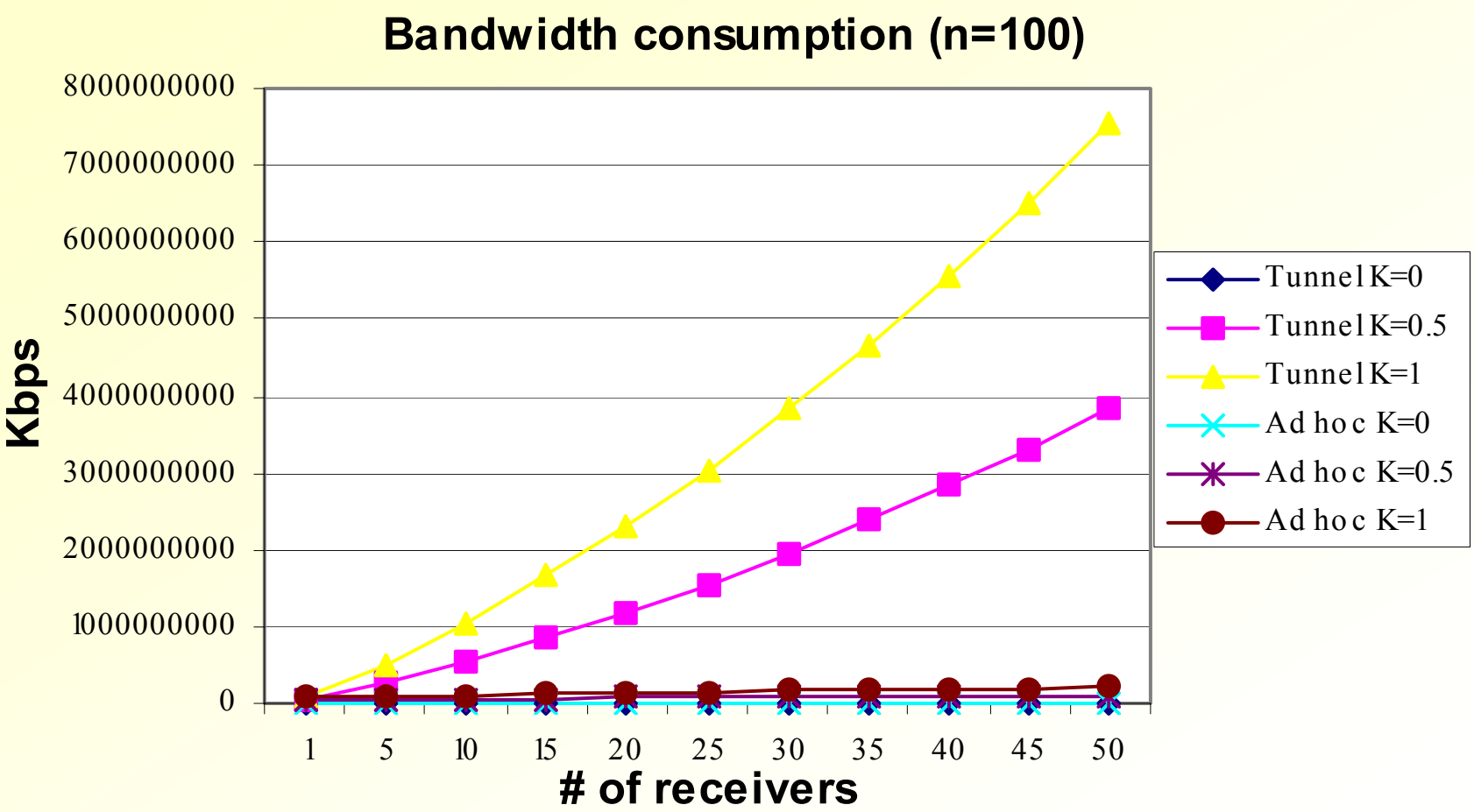


Escalability and Max. Bandwidth





Escalability (100 groups)



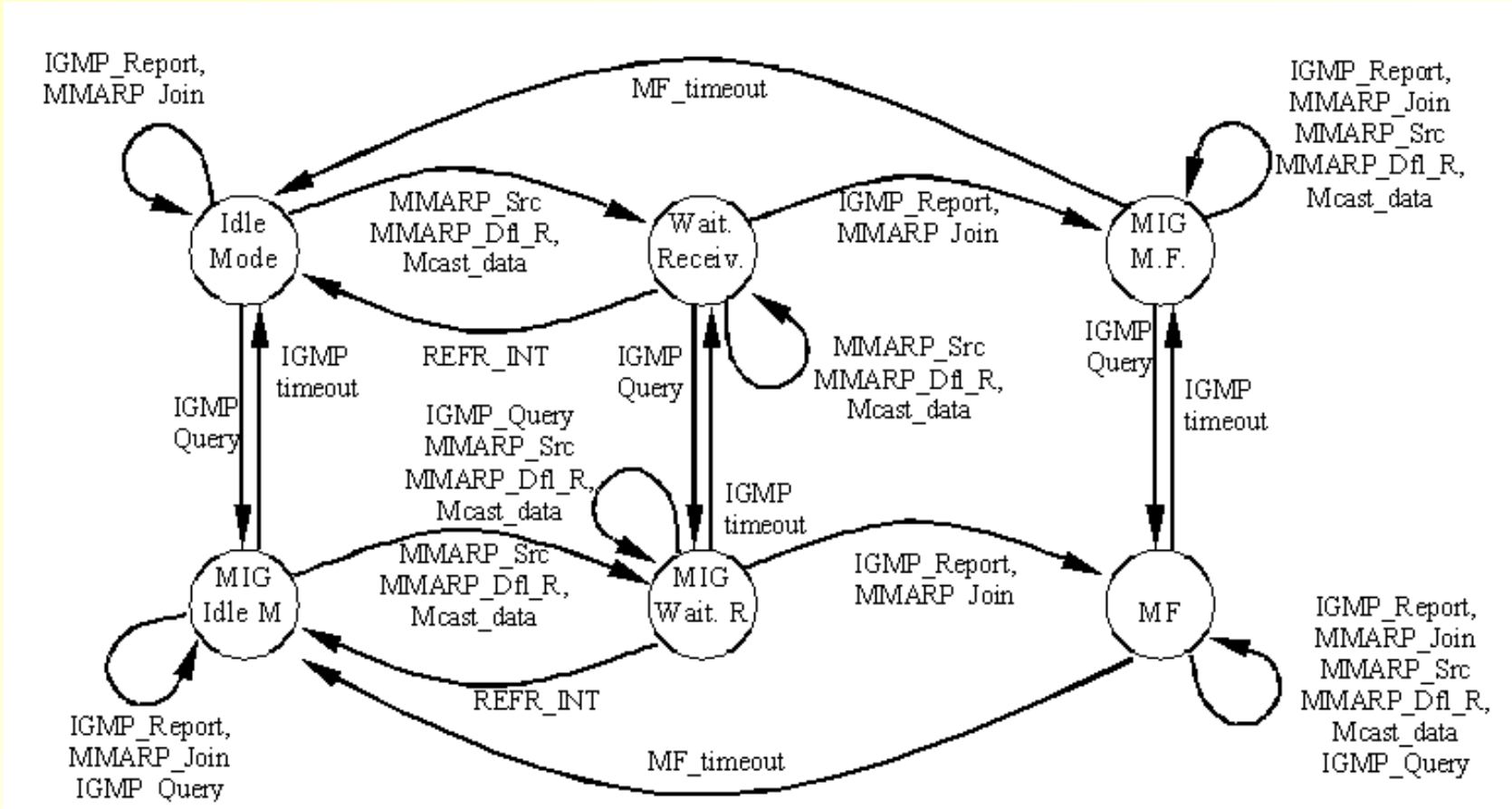
The MMARP Protocol

- Specially designed for Mobile Ad hoc network extensions
- Completely compatible with the standard IP multicast model
- Introduces the concept of MIG (Multicast Internet Gateways)
- MMARP Nodes are challenged with IGMP processing capabilities
- Compatible with any IP Multicast routing protocol in the fixed network
- Routes to the fixed network are kept proactively while the ad hoc ones are learnt “on-demand”.
- Preserves the efficiency of ad hoc multicast routing and offers support of standard IP nodes.

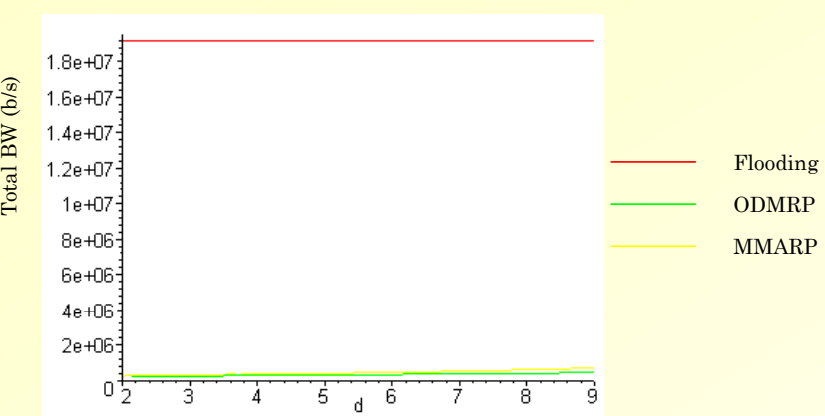
MMARP Messages

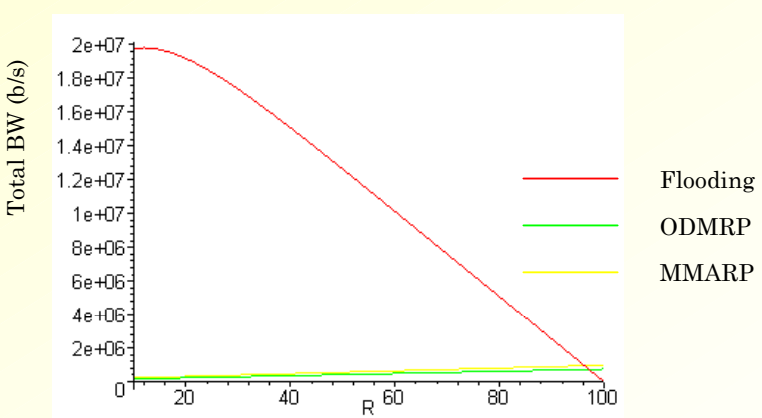
- **MMARP_Source**
  - Used by sources to initiate backward learning
- **MMARP_Join**
  - Used by receivers to create multicast paths
- **MMARP_Dfl_Route**
  - Used by MIGs to advertise Internet connections
- **MMARP_ACK**
  - Active acknowledgement of MMARP_Joins
- **MMARP_NACK**
  - Link break recovery during the joining process

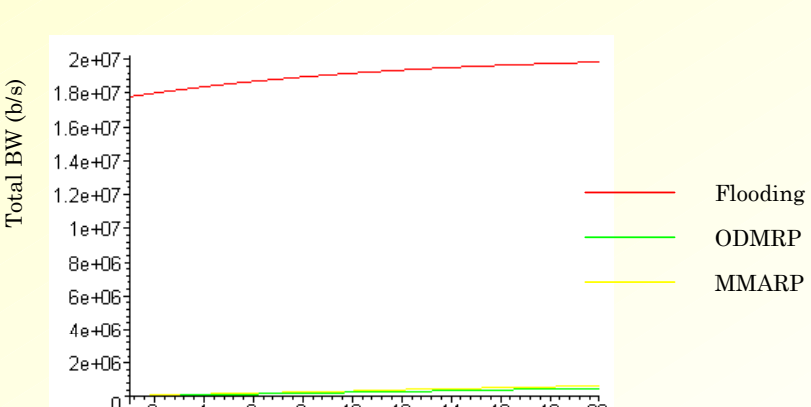
MMARP State diagram

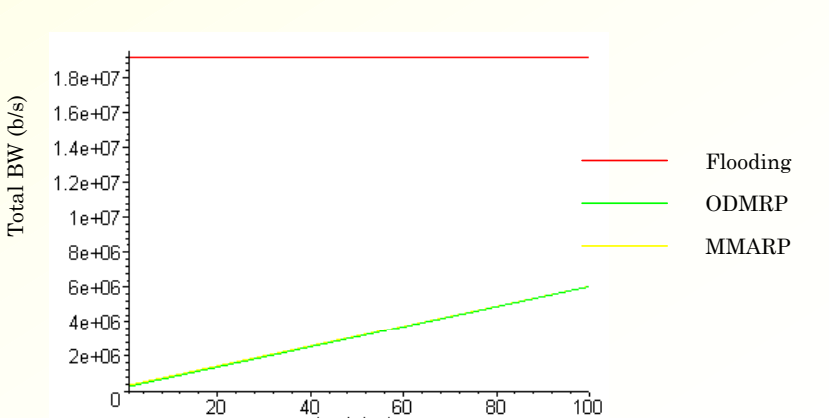


MMARP Overhead









Conclusions

- We’ve analysed the problem multicasting in ad hoc extensions to fixed IP networks
- We’ve designed an architecture which we demonstrated to be very efficient and scalable
- MMARP becomes a key piece for our multicast solution.
- To preserve compatibility, ad hoc multicast routing protocols should be challenged with new functionalities as in the case of MMARP
- Overhead analysis and trials demonstrate a good scalability and performance compared with well-known multicast ad hoc routing protocols, like ODMRP.
- Other IST-projects have expressed their interest in this protocol

Acknowledgements

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