



# Ana6: an IPv6 ad hoc addressing architecture

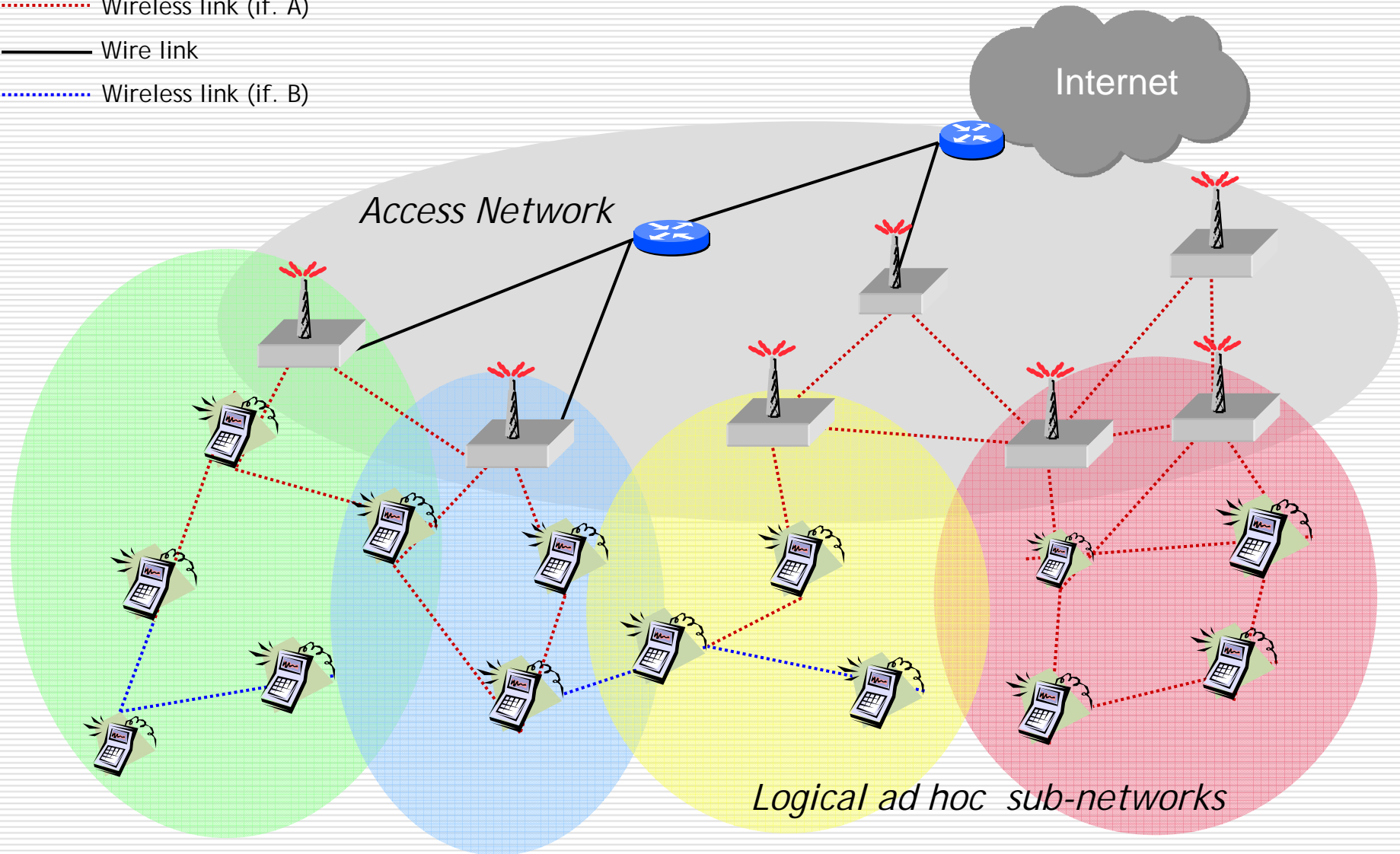
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Guillaume Chelius <[guillaume.chelius@insa-lyon.fr](mailto:guillaume.chelius@insa-lyon.fr)>

Eric Fleury <[Eric.Fleury@inria.fr](mailto:Eric.Fleury@inria.fr)>

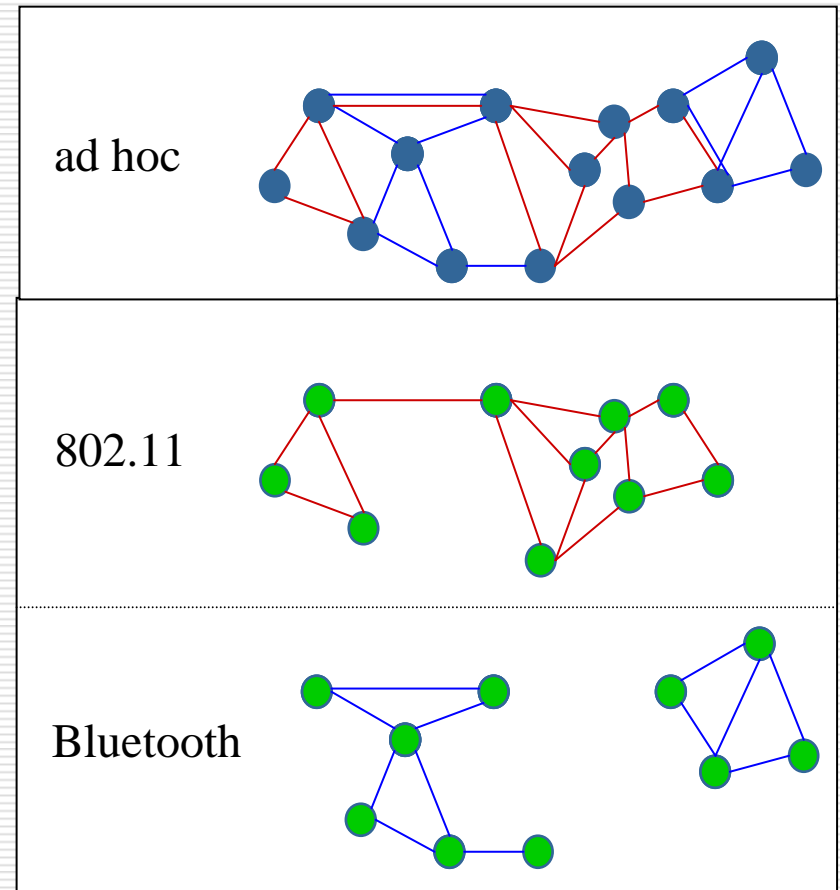
# My ad hoc Holy Grail

- ..... Wireless link (if. A)
- Wire link
- ..... Wireless link (if. B)



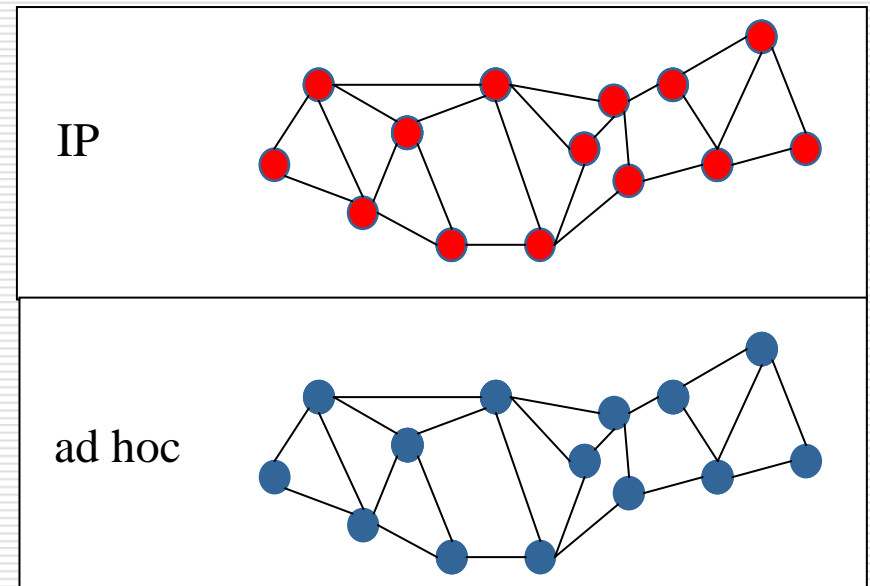
# Requests for an ad hoc architecture

- Intranet Connectivity on a multi-graph topology (unicast & multicast)
  - What is an ad hoc address ?
  - What is identified by an ad hoc address ?
  
- TCP/IP compatibility
  - Broadcast
  - Auto-configuration
  
- Internet connectivity
  - Global addressing
  - Service continuum
  
- Intra-node mobility
  - Interface switching
  - Related to the addressing issue
  
- Scalability
  - Support for logical ad hoc clusters



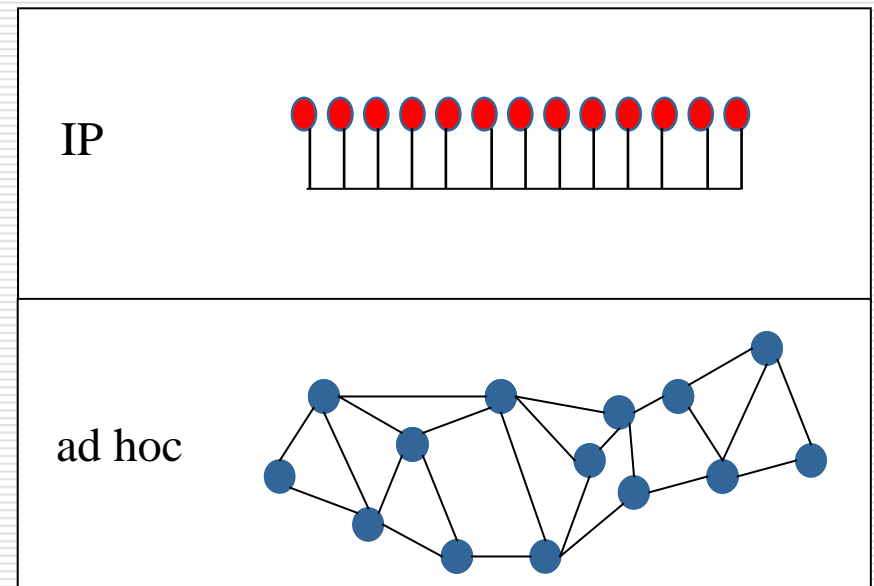
# State of the art: level 3

- *e.g.* MANet working group at the IETF
  - [RFC2502] says “use IP!”
  
- Design/implement MANet routing at the IP level
  - ad hoc addresses are IP addresses
  - ad hoc addresses identify network interfaces
  
- A MANet is handled as a multi-link network by IP
  
- Issues
  - Broadcast
  - Auto-configuration (chicken and egg)
  - No interface mobility
  - Subnet/prefix coherency



# State of the art: level 2

- *e.g.* HiperLan
- Design/implement MANet routing at the MAC level
  - ad hoc addresses are MAC addresses
  - ad hoc addresses identify ad hoc interfaces
- A MANet is handled as a local link by IP
- Issues
  - Hardly enables a multi-physical-graph topology.
- Solves IP compatibility problems
  - broadcast
  - auto-configuration



# IPv6 addressing architecture

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- Unicast addresses
  - Scope addresses
  - Global addresses
  
- Unicast addresses may identify several interfaces
  
- Multicast addresses
  - Scope addresses
  - Global addresses
  
- Scope
  - Link local
  - ...
  - Site local

# IPv6 scope

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- Scope addresses validity is restricted to the scope
  - A local link
  - A site
  
- Scope unicast addresses are auto-configured
  
- They are used to allow zero-conf networking in the scope

# AnaX: Ad hoc Network Architecture (X in {4,6})

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*Postulate: it is hard to enable multi-interfaces routing at the MAC level*

⇒ ad hoc level > MAC level

*IPv6 Postulate: IPv6 addresses may be auto-configured*

*IPv6 scopes enable networking in zero-configured networks*

*IPv6 addresses may identify several interfaces*

⇒ ad hoc level = IPv6 scope

Proposition:

⇒ The ad hoc network corresponds to an IPv6 scope in the IPv6 architecture (Ana6)

# Which IPv6 scope to use?

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- Link-local scope
  - Link local addresses **MUST NOT** be forwarded
  - Link local address identify one interface
  - Ad hoc scope != link local scope
  
- Site local scope
  - Site scope will probably be deprecated
  - An ad hoc network may belong to a larger site
  - Several site may spread on a single ad hoc network
  - Ad hoc scope != site local scope
  
- Introduction of an ad hoc scope
  - Prefix fe40::/64 for unicast addresses
  - Prefix ff03::/48 for multicast addresses (subnet scope)

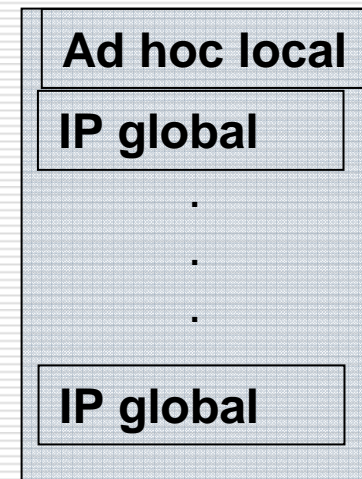
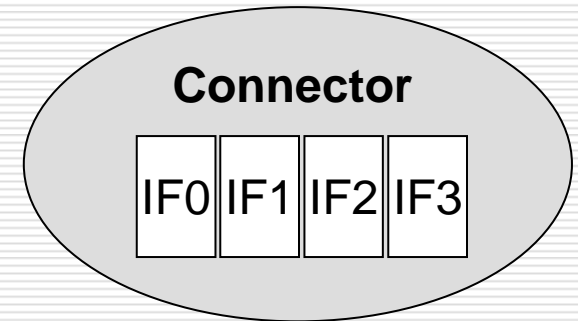
# From link local to ad hoc local

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- Ad hoc link local address
  
- Same philosophy as for the link local address
  - fe40::[connector id]/128
  - Routable only on ad hoc interfaces
  - Set as an OFF-LINK address (no route to the prefix)
  
- No boundary problem as for site local
  - An ad hoc network is a maximal connected set of ad hoc nodes

# Notion of connector

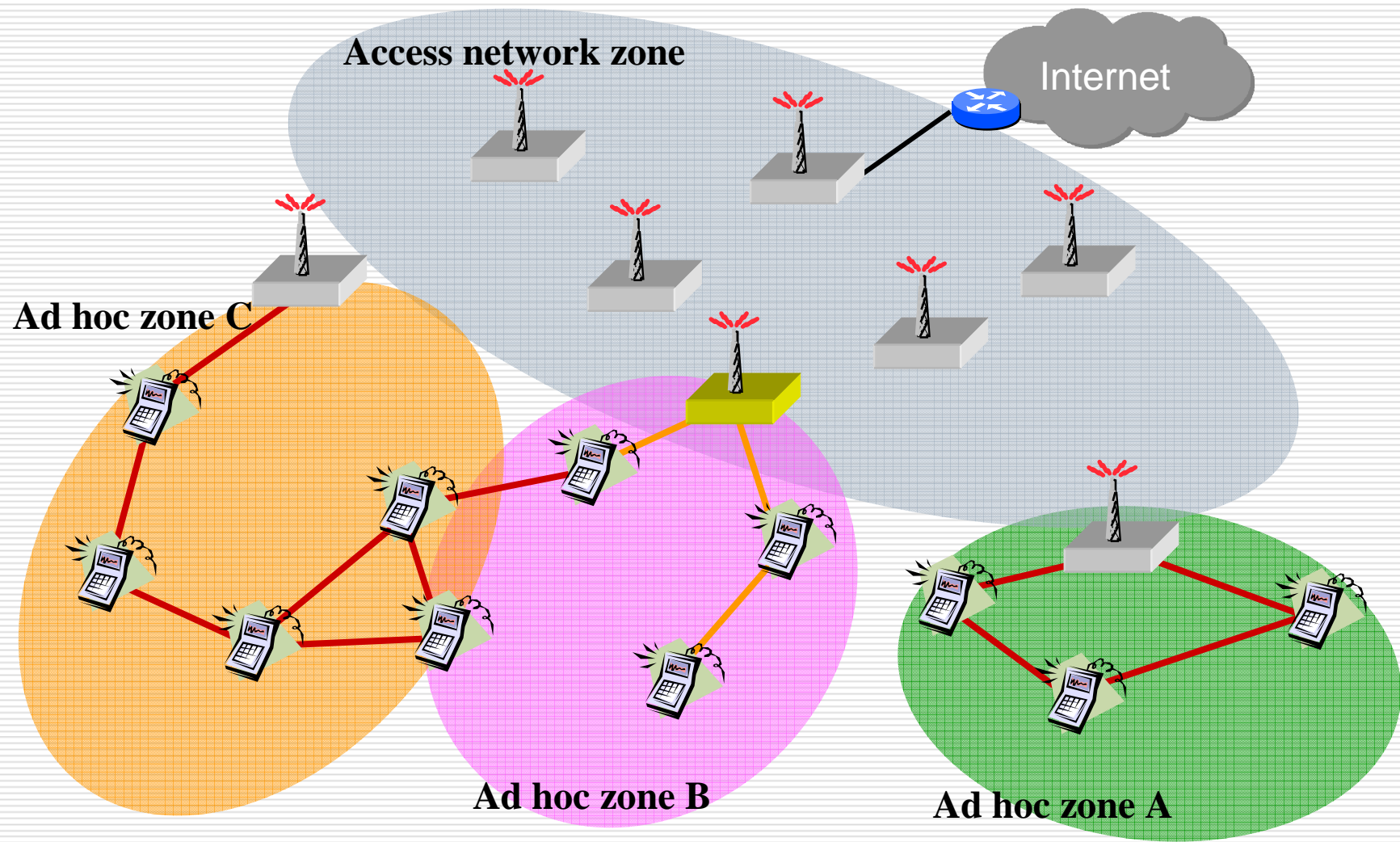
- ❑ A connector is associated to a connector ID
- ❑ Virtualizes the ad hoc node as a set of several IP interfaces
- ❑ Defines a set of IPv6 addresses
  - Ad hoc-local address
  - eventually one or more global addresses.
- ❑ Each IP interface uses/recognizes all connector addresses
- ❑ An interface may be connected to several connectors



# Notion of ad hoc multicast

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- Validity limited to the ad hoc network
  - MUST NOT be routed outside
  
- ad hoc multicast scope (FF03::)
  - All ad hoc nodes: FF03::1
  - All ad hoc routers: FF03::A



# Notion of channel

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- Each connector has a channel value
- Used to define limited connected zones regarding the diffusion of information
- Enables support for the multi-link multi-subnet vision
- logical ad hoc sub-networks
  - Def: **A channel is a maximal connected set of ad hoc connectors sharing a common channel value.**
- FF03:0:0:[channel value X]:0:0:0:0
- All ad hoc nodes of a sub-network address:
  - FF03:0:0:X:0:0:0:1
- Channel mobility does not lead to ad hoc local address changes as the channel value does not appear in the ad hoc-local unicast address

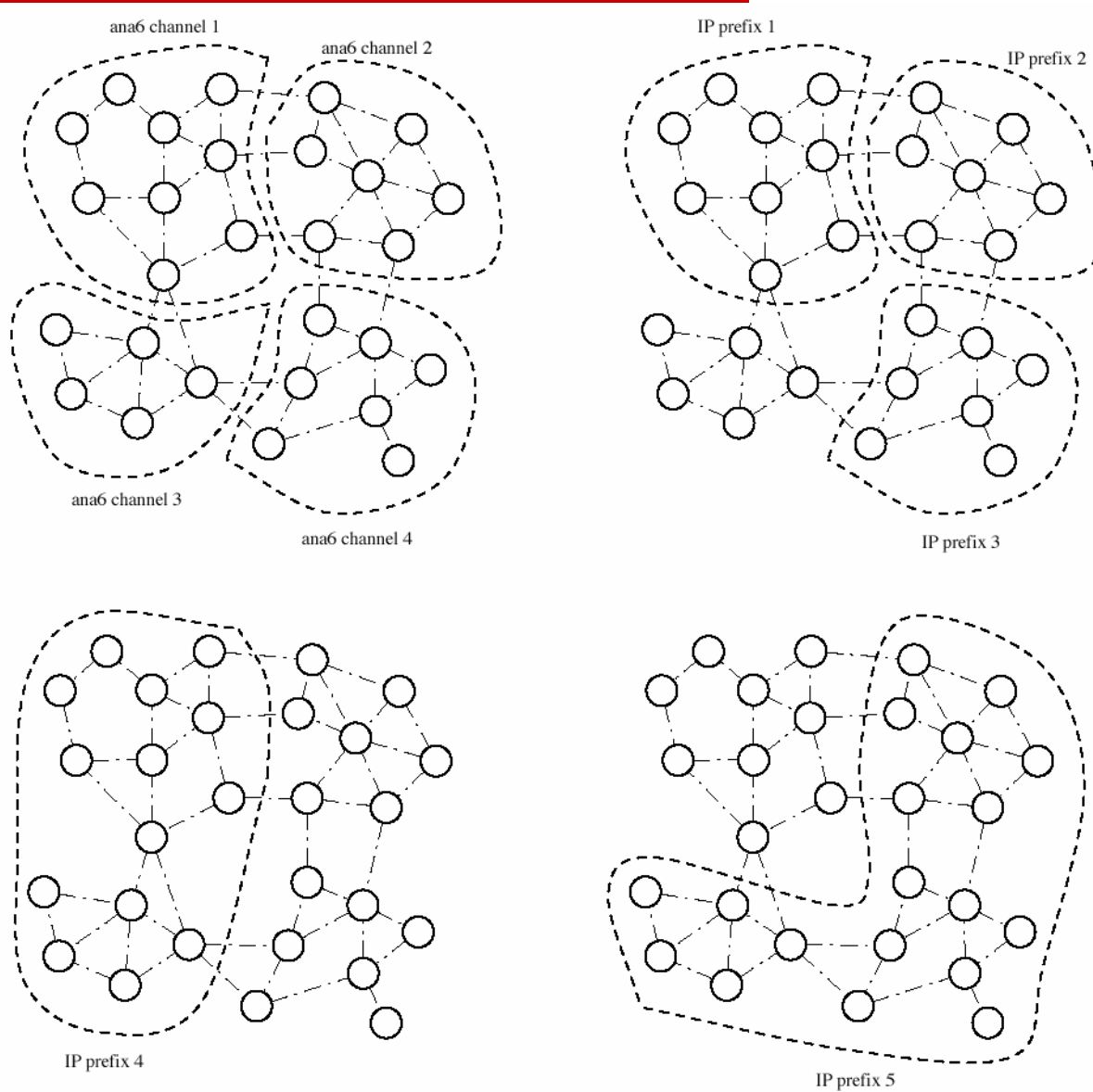
# Implementation

- ❑ FreeBSD 4.8
- ❑ IPv6 routing table
- ❑ Use host routes (/128)
- ❑ My ad hoc (global and ad hoc local) addresses are *off-link*

Dest	Next Hop
fe40::id/128	fe80::id%r10
Global	fe80::id%r10

- ❑ Ana6
  - Used in the Safari RNRT project

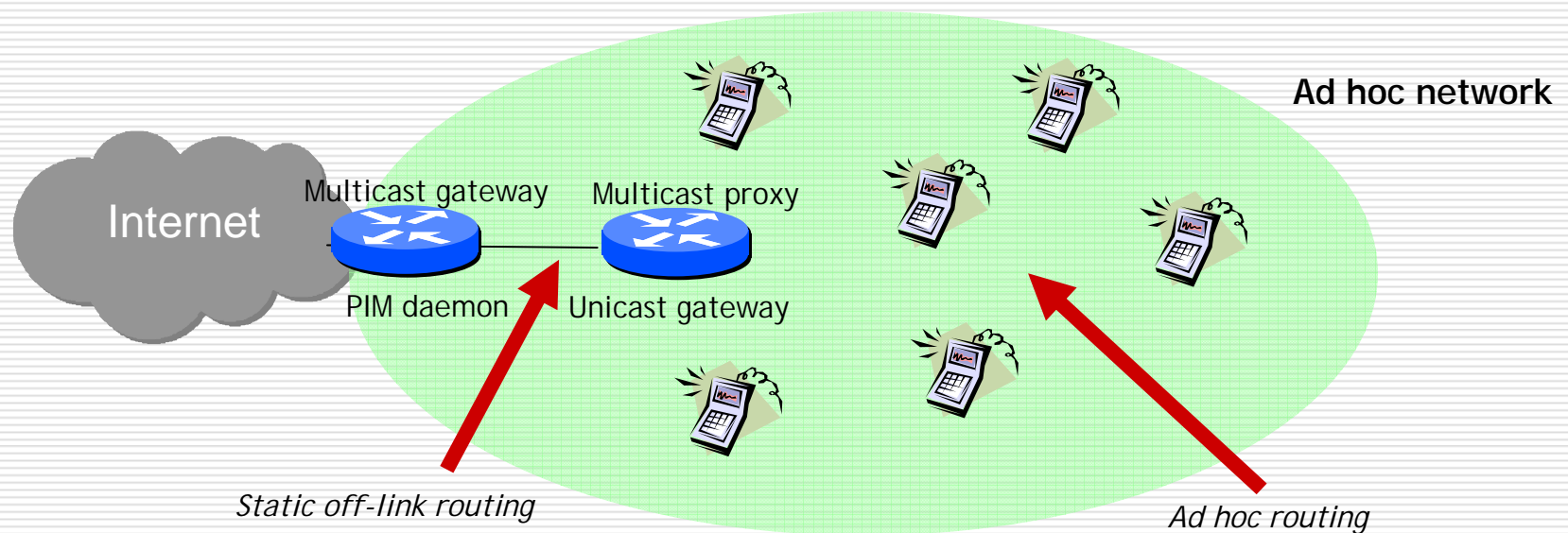
# Multipolar architecture in hybrid networks



Multi homing

# Application: service continuum

- Multicast gateway = PIM daemon
- Multicast proxy advertises itself to the PIM daemon
  - as a source if there is an ad hoc source
  - as a member if there is an ad hoc member
- Multicast gateway and Multicast proxy may be the same host



# Conclusion

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- Ana6 is an architecture inside the IPv6 protocol, thus it answers the “How?”
  - implementing efficient ad hoc networks using IPv6
- and only partially the “Why/When?” (deploying ad hoc
  -
  
- RNRT SAFARI
  - Railway station + museum
  
- easily support multi-interface routing or interface mobility (vertical handover).