RESEARCH PROJECT

TAKING A CLOSER LOOK AT IRATI

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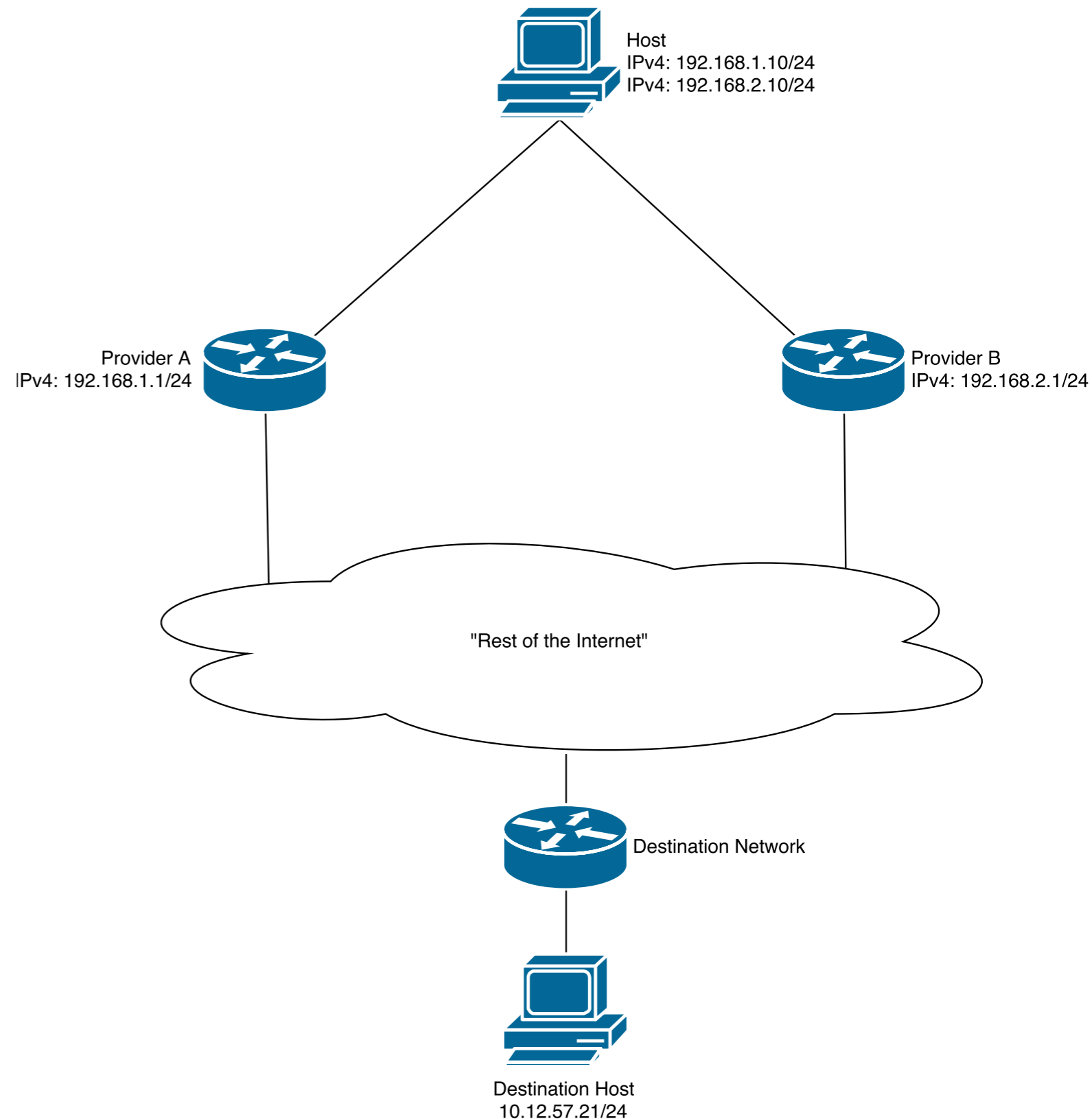
Supervisors:
Marijke Kaat - SURFnet
Ralph Koning - UvA

RESEARCH QUESTIONS

▸ **How does RINA solve the multihoming problem?**

    ▸ What are the problems with multihoming and mobility in the current Internet?

    ▸ What kind of solutions are proposed to solve the multihoming/mobility problem in the current Internet?

    ▸ To what extend is multihoming/mobility implemented in the IRATI implementation?

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MULTIHOMING

▸ *The practise of connecting a host or a computer to more than one network*

    ▸ *Creating reliability, performance improvements, or to reduce cost*

▸ Mobility

    ▸ "Special kind of multihoming"

Host
IPv4: 192.168.1.10/24
IPv4: 192.168.2.10/24

Provider A
IPv4: 192.168.1.1/24

Provider B
IPv4: 192.168.2.1/24

"Rest of the Internet"

Destination Network

Destination Host
10.12.57.21/24

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM

▸ 1972: Tinker Air Force Base joined ARPANET

    ▸ Connections to two IMPs for redundancy

    ▸ Problems with routing algorithm

    ▸ Naming the interface, not the node

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM
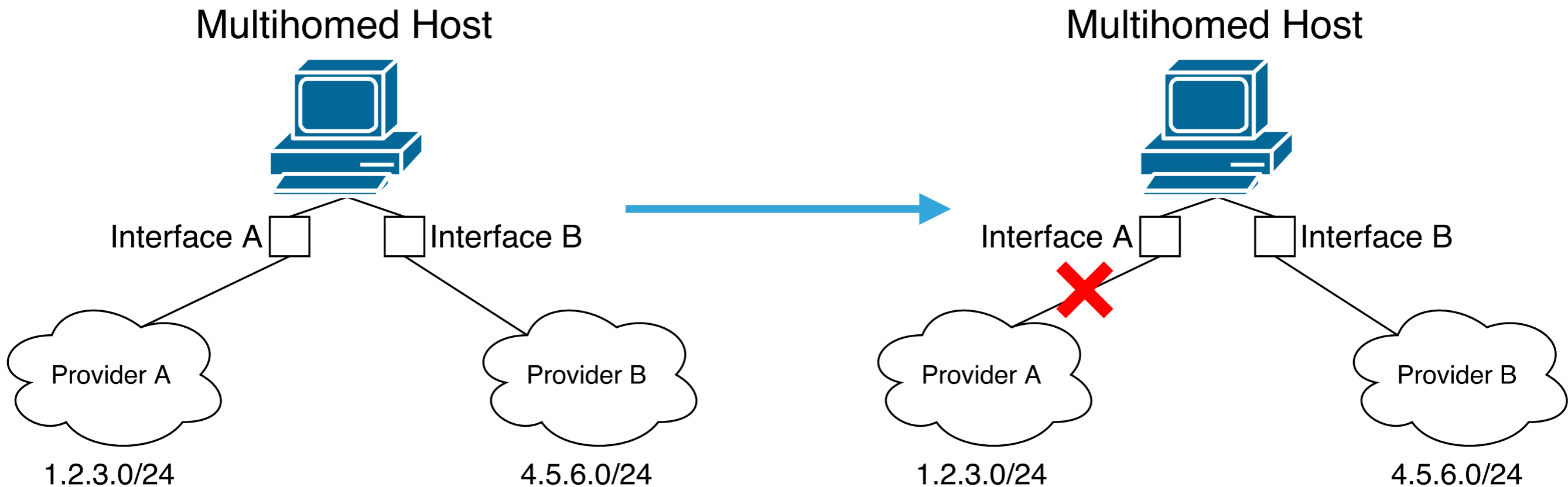
▸ What happens when one of the interfaces fails?

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM

▸ Mobile Node connected to its own "Home Network"

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM
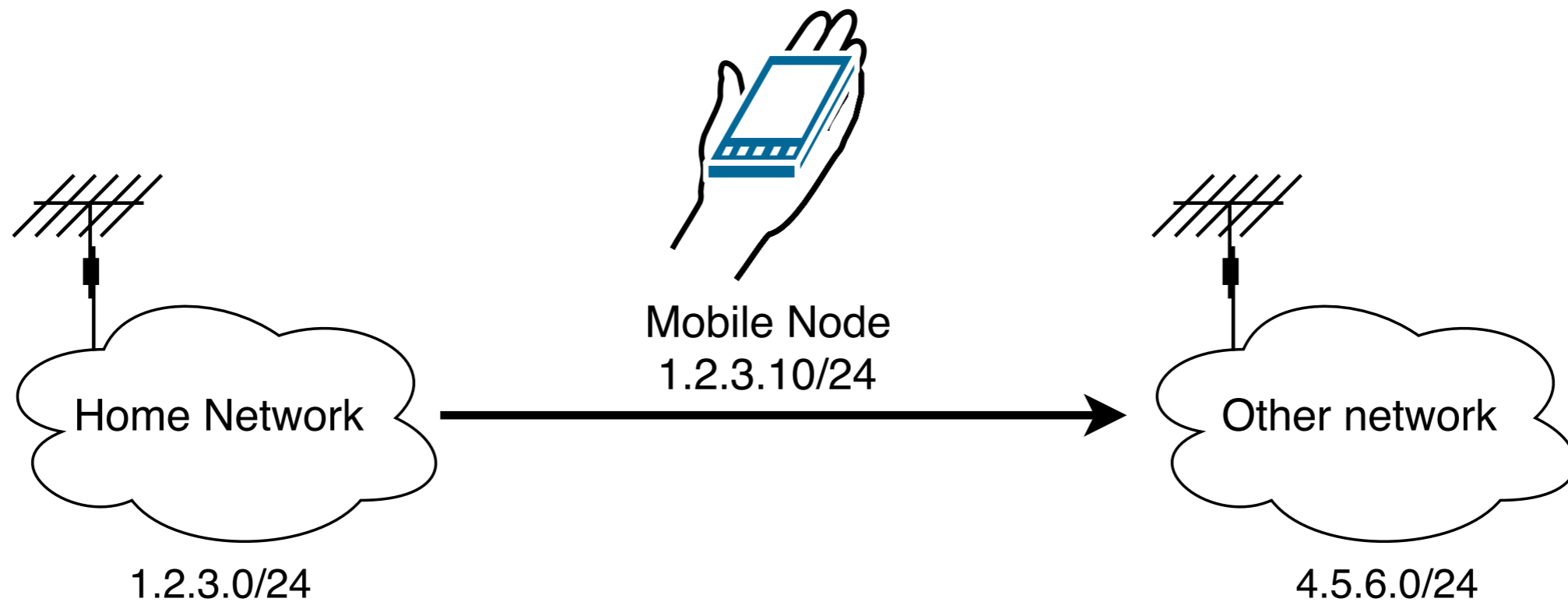
▸ Mobile Node starts moving around

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM

Home Network

1.2.3.0/24

Other network

4.5.6.0/24

Mobile Node
4.5.6.10/24
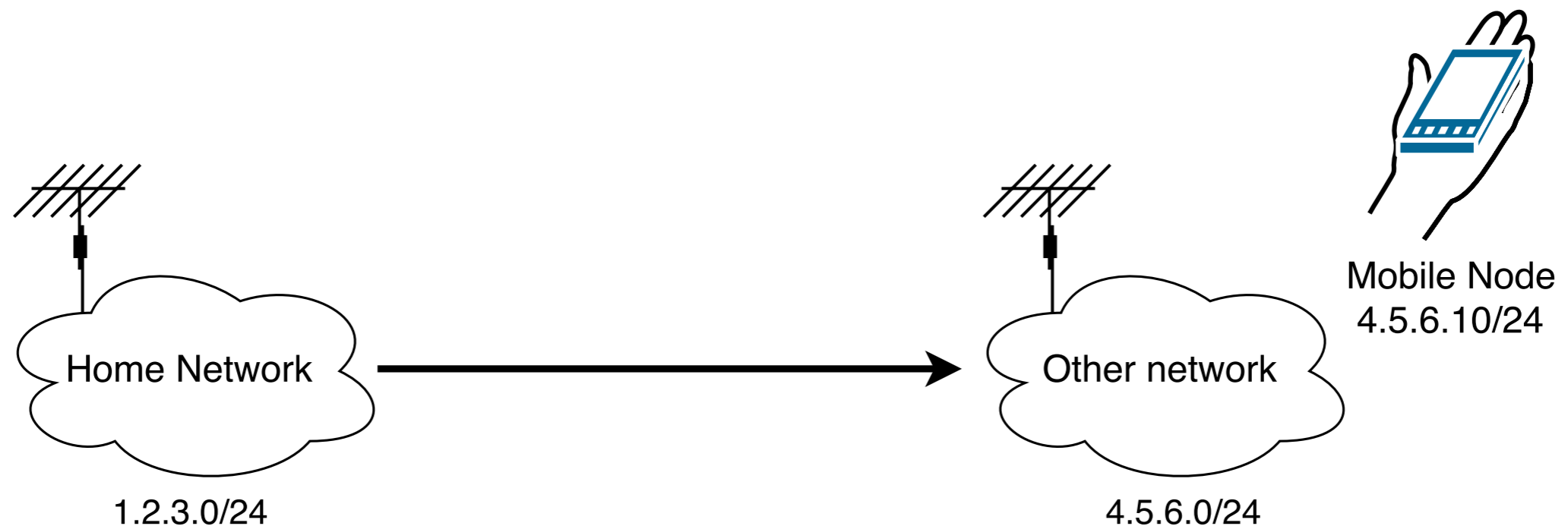
▸ Mobile Node connects to "Other Network". What happens?

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM

▸ 1978: TCP/IP was split

  ▸ TCP - Creating segments

  ▸ IP - Transmitting individual segments

▸ Big consequences for the Internet

  ▸ Layers are dependent on each other

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM
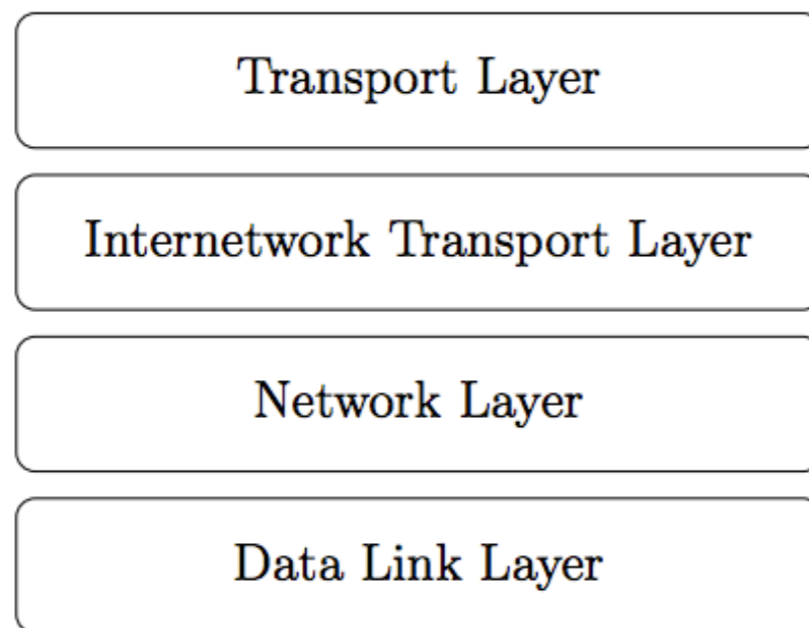

(a) The Internet layers before getting rid of NCP
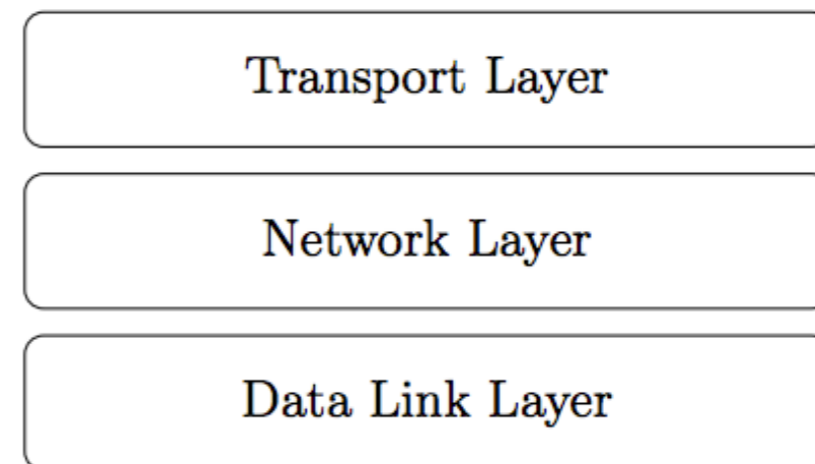
(b) The Internet layers after getting rid of NCP

▸ Before 1983: TCP/IP running over NCP

▸ 1st January 1983 - Flag Day: TCP/IP takes over!

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A BRIEF INTRODUCTION OF THE MULTIHOMING PROBLEM

▸ 1982: Jerry Saltzer describes naming and binding of network destinations

  ▸ Left: reality; Right: ideally

http://rina.tssg.org/docs/FutureNetTutorialPart2-100415.pdf

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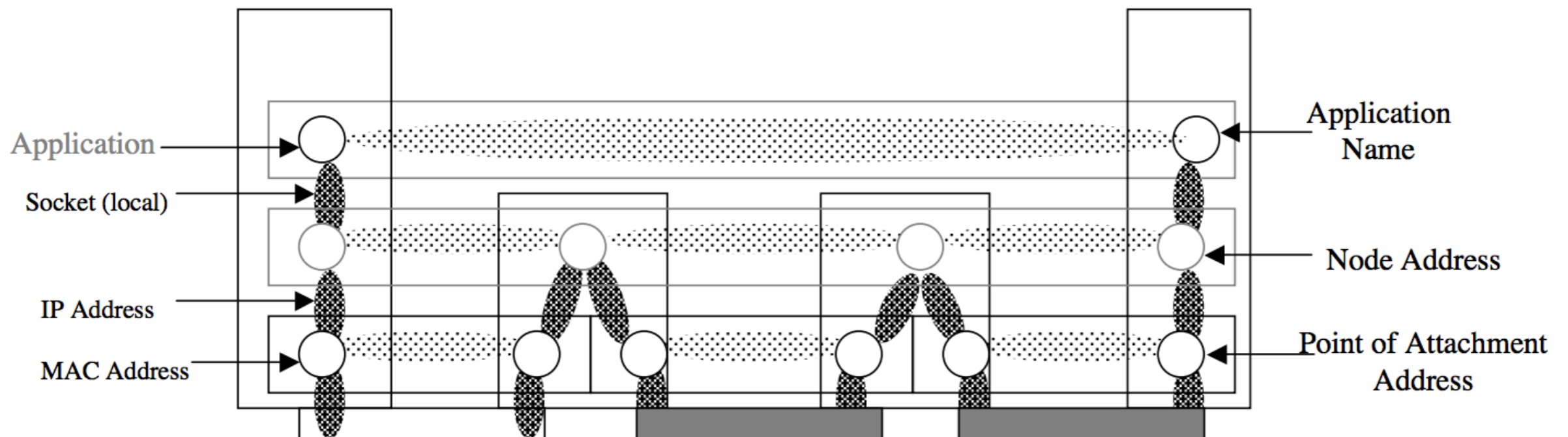
CURRENT "SOLUTION" TO THE MULTIHOMING/MOBILITY PROBLEM

▸ Multihoming IPv4/IPv6:

  ▸ Multiple physical connections to two different providers

▸ Multihoming IPv6:

  ▸ SHIM6

▸ Other solutions:

  ▸ MPTCP

  ▸ SCTP

  ▸ HIP

▸ Mobility:

  ▸ Mobile IP

  ▸ Mobile IPv6

  ▸ LISP

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PROBLEMS WITH CURRENT SOLUTIONS

▸ More complexity

▸ Decrease efficiency

▸ Does **not** actually solve the cause of the problem

▸ Will not scale

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RINA

Website: PRESENTATION AND MAJOR DESIGN ASPECTS OF THE CYCLADES COMPUTER NETWORK, Louis POUZIN. <http://www.rogerdmoore.ca/PS/CYCLB.html> en <http://www.cs.utexas.edu/users/chris/nph/>

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Paper: New Arch: Future Generation Internet Architecture. David Clark, Mark Handley, Noel Chiappa, etc. December 2003.

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Paper: Declarative Transport No more transport protocols to design, only policies to specify. G.Gursun, Ibrahim Matta, K. Mattar, John Day Technical Report BUCS-TR-2008-014. August 26, 2008

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Paper: OOI Recursive Inter-Network Architecture (RINA). John Day etc. december 2009.

Presentation: Networking is IPC and only IPC or How to Clean a Slate. John Day 2010

Presentation: Things They Never Taught You About Naming and Addressing. John Day. Feb 2010.

Paper: On Supporting Mobility and Multihoming in Recursive Internet Architectures. Ibrahim Matta. Technical Report BUCS-TR-2010-035. 2010.

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Paper: Moving beyond TCP/IP. Fred Goldstein and John Day for the Pouzin Society April 2010.

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Website: http://www.martingeddes.com/think-tank/network-architecture-research-tcp-ip-vs-rina/

Website: http://spectrum.ieee.org/computing/networks/osi-the-internet-that-wasnt

Website: NDN - Named Data Networking - <http://named-data.net/>

Website: NSF FUTURE INTERNET ARCHITECTURE PROJECT <http://www.nets-fia.net/>

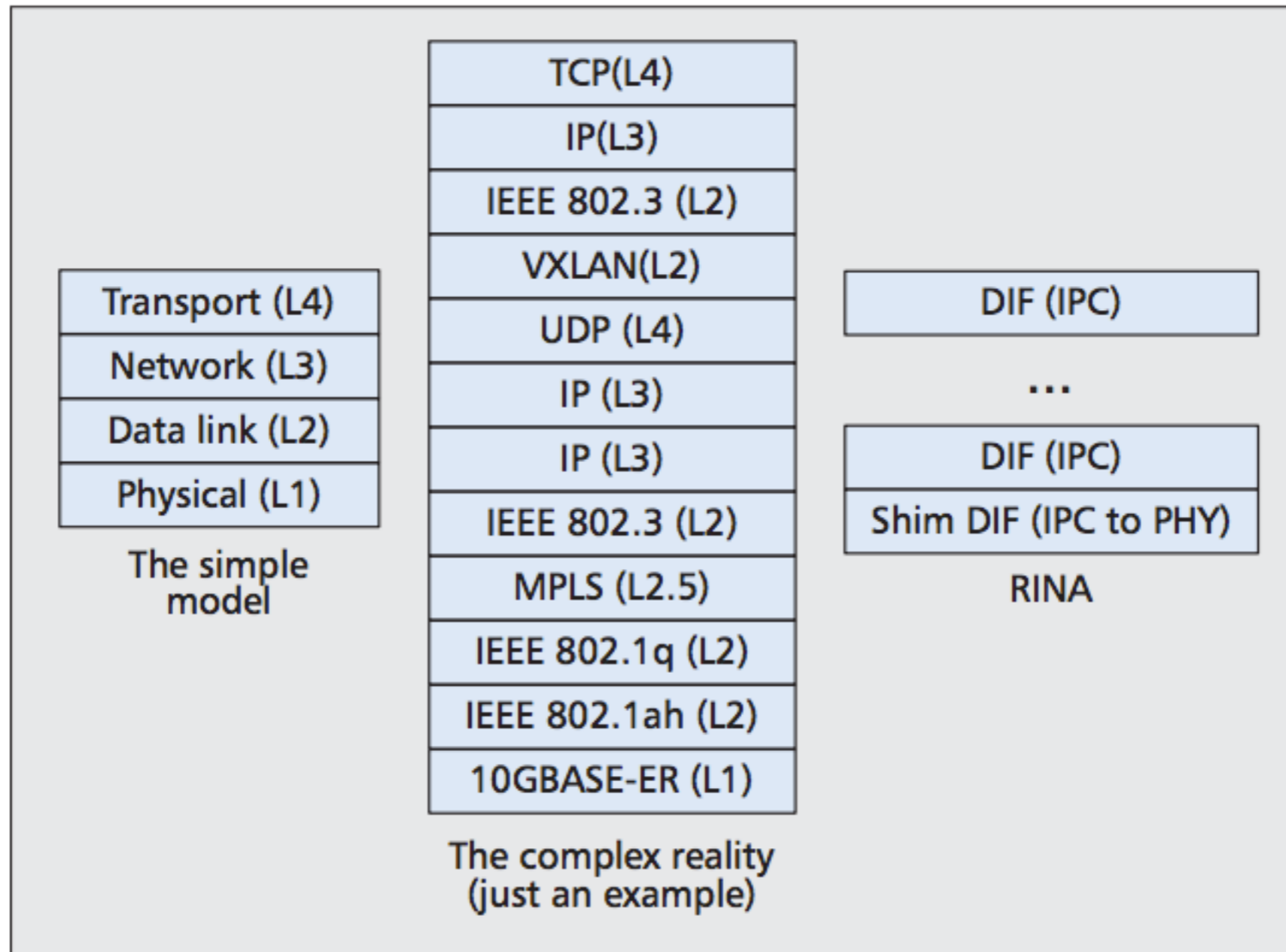Website: NewArch Project: Future-Generation Internet Architecture (2003). http://www.isi.edu/newarch/

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RECURSIVE INTERNETWORK ARCHITECTURE

▸ Programmable networking approach based on IPC

   ▸ High scalability

   ▸ **Multihoming**

   ▸ Built-in Security

   ▸ Seamless access to real-time information

   ▸ And more…

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RINA: IPC MODEL

▸ Inter Process Communication (IPC)

  ▸ "Networking provides the means by which processes on separate computer systems communicate, generalising the model of local inter-process communications"
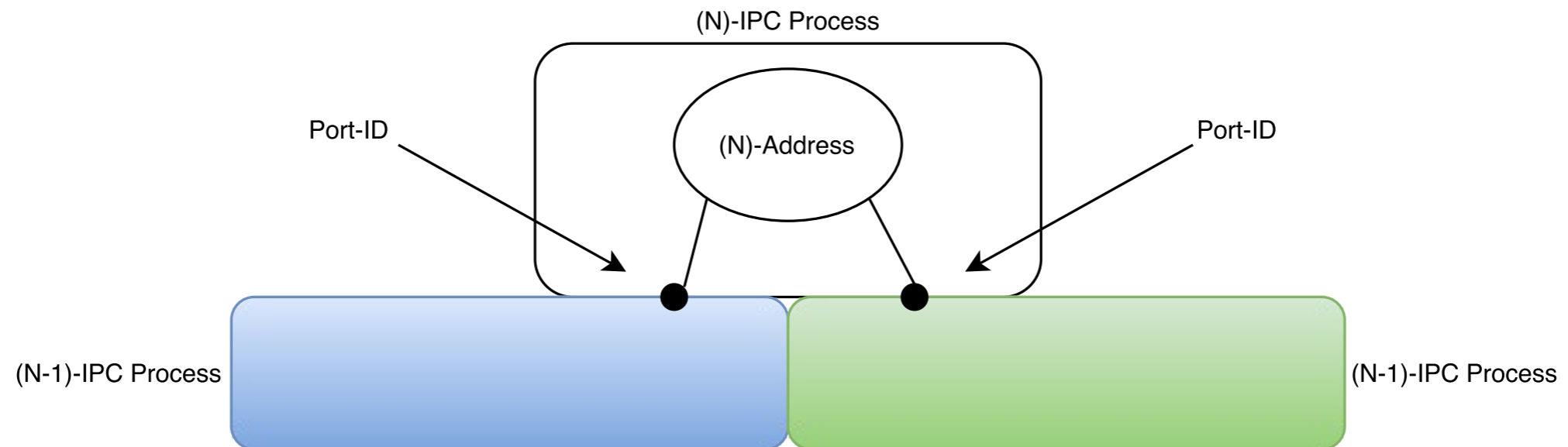
RINA

The simple model

The complex reality (just an example)

RINA

http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=6786609

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RINA: MULTIHOMING

▸ Each node has its own address

▸ A node can have multiple connections, each having a separate address

▸ A route to a destination node address is a sequence of intermediate node addresses

IRATI

▸ Investigating RINA as an Alternative to TCP/IP

▸ European Project (Framework Programme 7)

▸ Make enhancements of RINA architecture reference model and specification
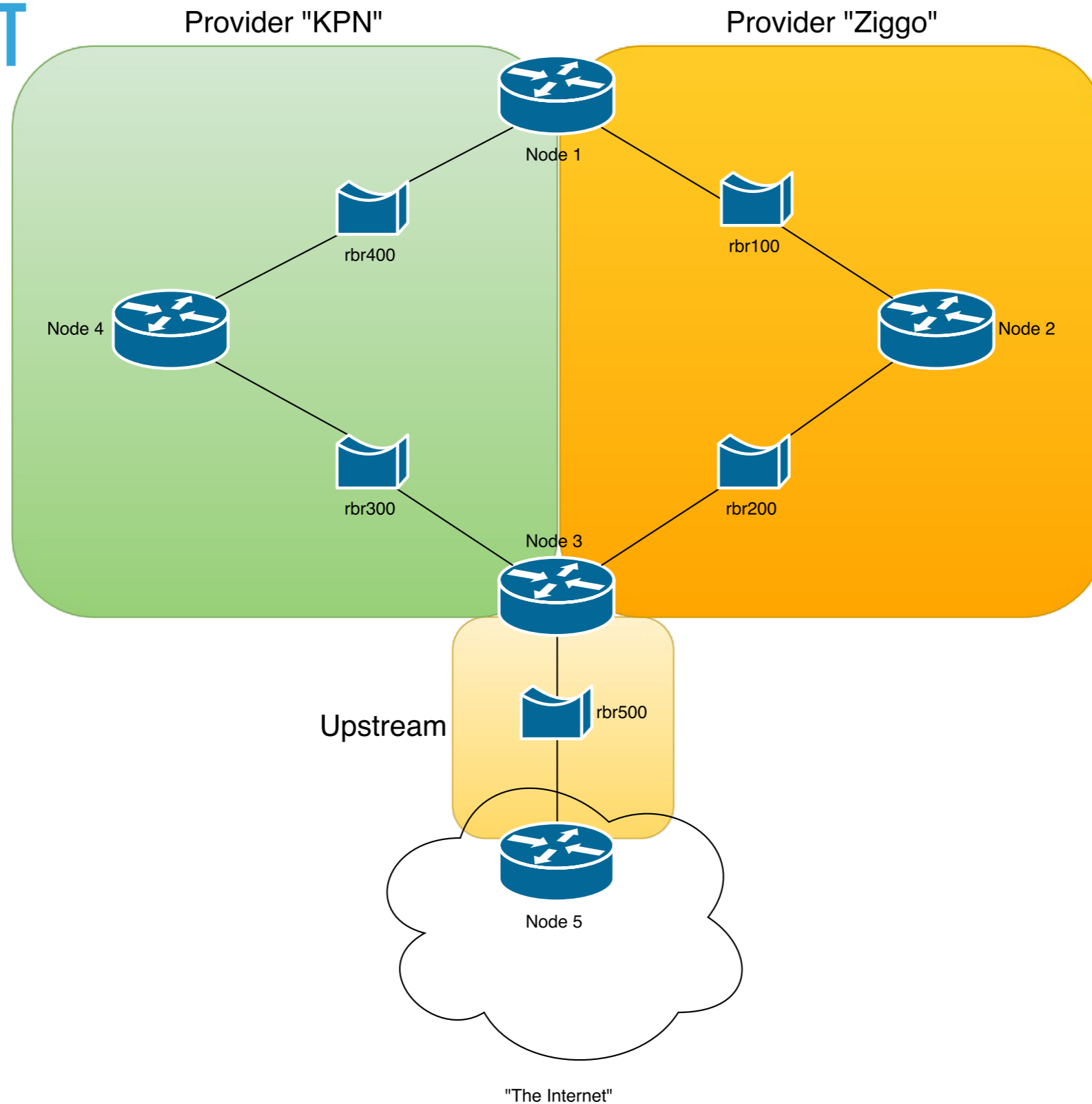
▸ Focussing on DIFs over Ethernet

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PRISTINE

▸ Closely related to IRATI

▸ European Project

▸ Creates programmable functions for congestion control

▸ Facilitating more efficient topological routing and multi-layer management

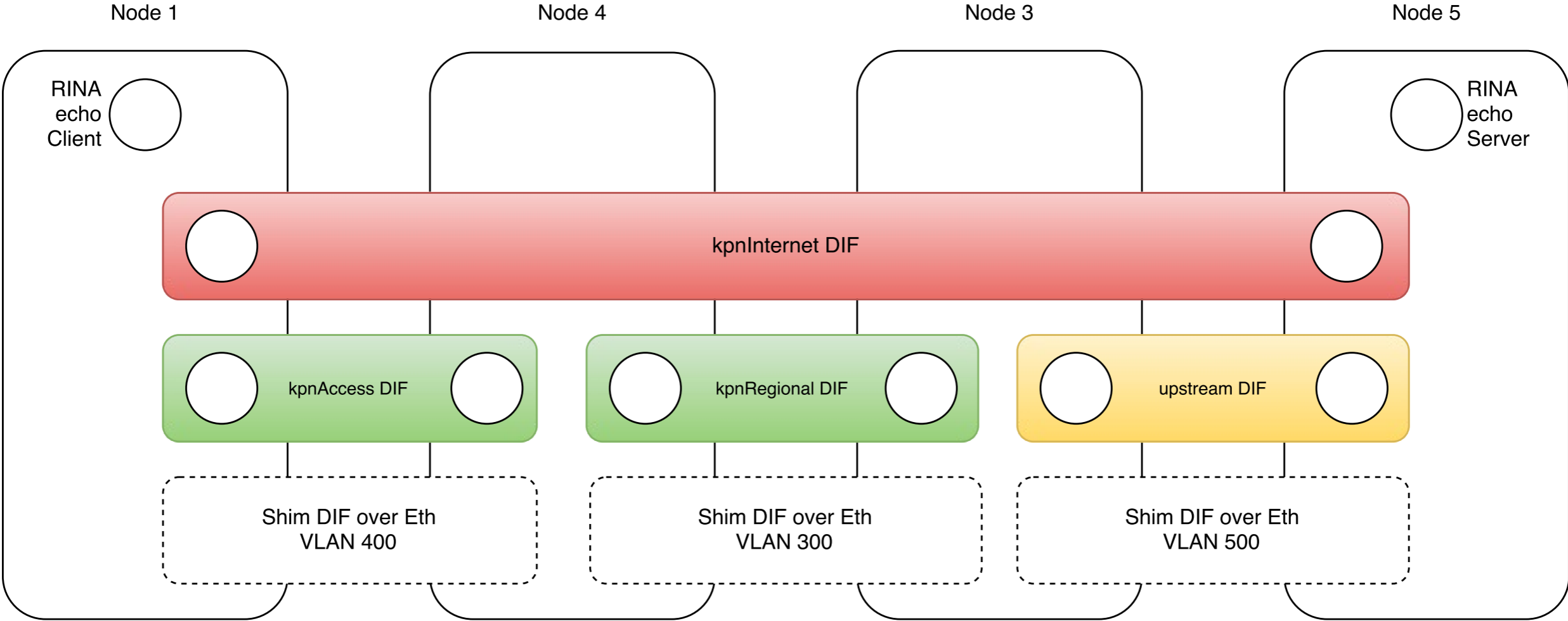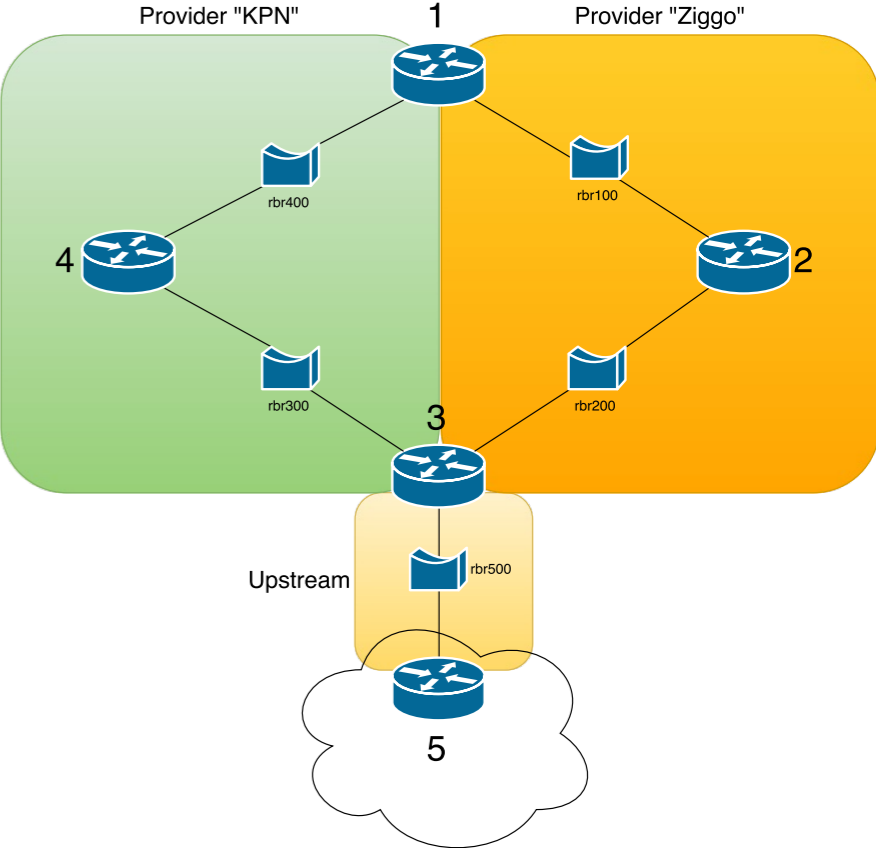▸ Continuation of work IRATI

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EXPERIMENT

▸ Testing multi-DIF environment

▸ Testing with IRATI Demonstrator and VMs with compiled stack (pristine-1.5 branch)

▸ Testing if IRATI supports multihoming

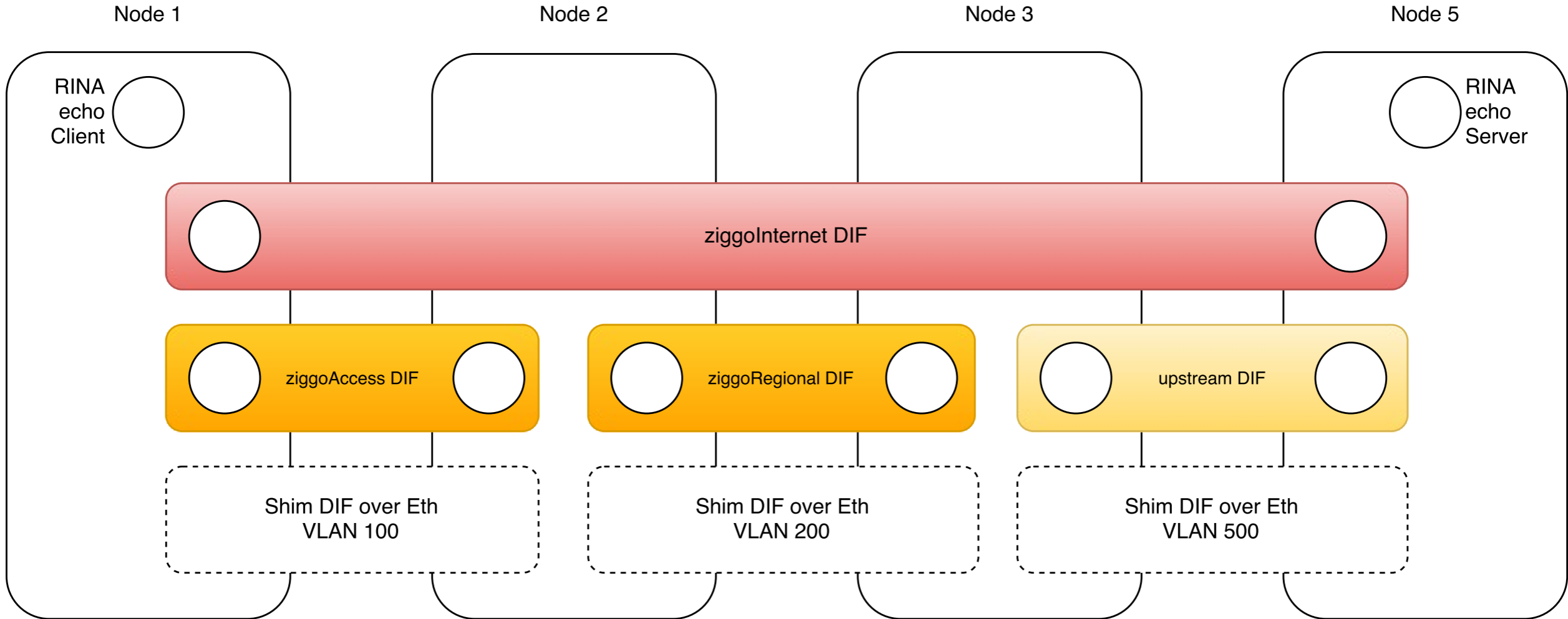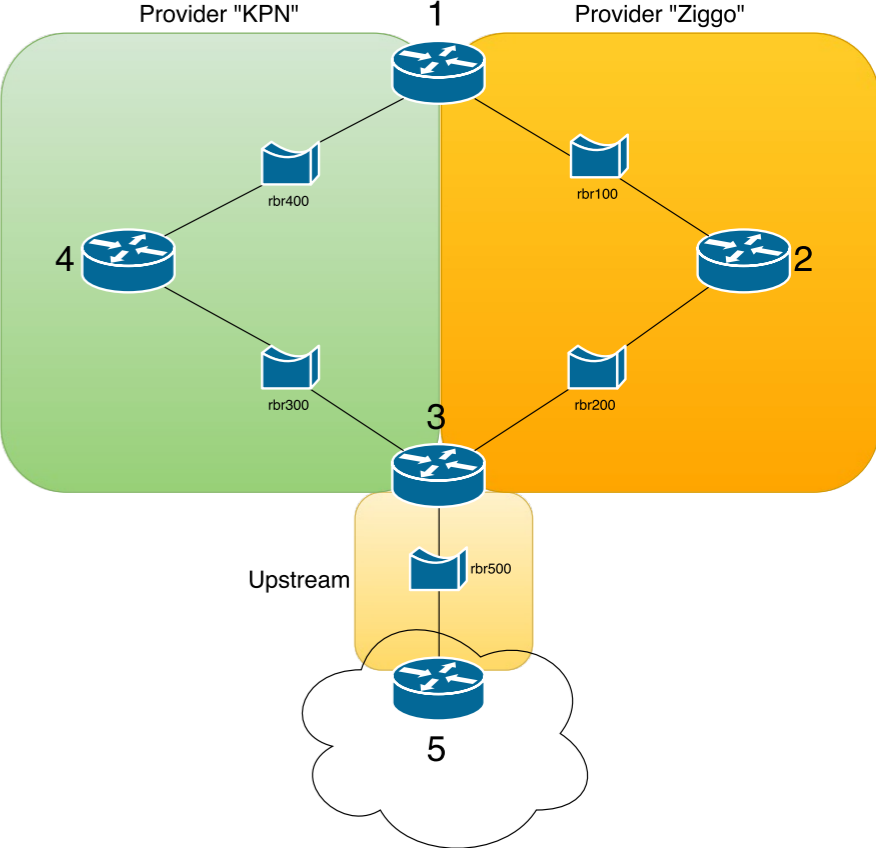UNIVERSITY OF AMSTERDAM

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EXPERIMENT

Provider "KPN"

Provider "Ziggo"

Node 1

rbr400

rbr100

Node 4

Node 2

rbr300

rbr200

Node 3

Upstream

rbr500

Node 5

"The Internet"

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SURF NET

EXPERIMENT

Provider "KPN"

Provider "Ziggo"

1

rbr400

rbr100

4

2

rbr300

rbr200

3

Upstream

rbr500

5

Node 1

Node 4

Node 3

Node 5

RINA echo Client

RINA echo Server

kpnInternet DIF

kpnAccess DIF

kpnRegional DIF

upstream DIF

Shim DIF over Eth
VLAN 400

Shim DIF over Eth
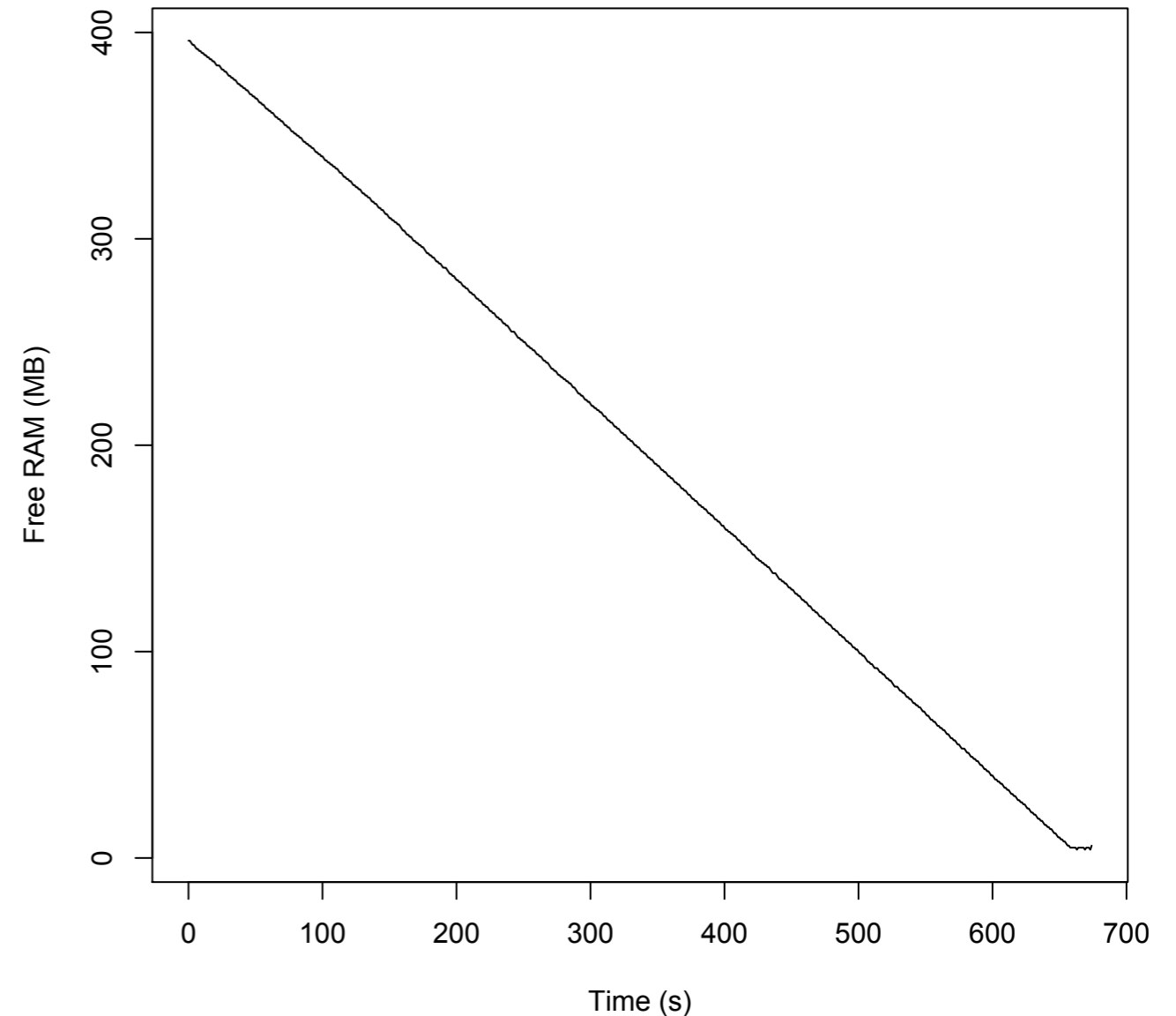VLAN 300

Shim DIF over Eth
VLAN 500

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RESULTS

▶ IRATI Demonstrator keeps consuming memory until crash

▶ VMs with compiled stack did not show this behaviour

▶ Mapping of applications is static

▶ RINA tools do not support registering at two DIFs at the same time (yet?)

IRATI Demonstrator: Free Memory

University of Amsterdam

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RESULTS

▸ DIF allocator will be properly implemented by H2020 ARCFIRE Project

▸ PRISTINE project further investigates and develops routing algorithms and routing information dissemination strategies that **optimally** exploits RINA's support of multihoming for load balancing and rapid recovery

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CONCLUSION

▸ Current Internet has some serious problems, including the multihoming problem

▸ Current solutions for multihoming/mobility create a more complex Internet and do not solve the actual problem(s)

▸ Since Klomp/van Leur's research in January a lot of improvements have been made in IRATI stack, yet still very experimental

▸ At this moment IRATI is not able to do multihoming yet

   ▸ Mapping of applications still static

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FUTURE WORK

▸ Documentation is still quite poor

▸ DIF allocation is still static…

▸ RINA tools are not able to register to multiple DIFs at the same time (yet)

▸ PRISTINE and H2020 ARCFIRE are actively improving IRATI

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QUESTIONS?