

ATMOS: A middleware for Transparent MOBILE ad-hoc networking Systems

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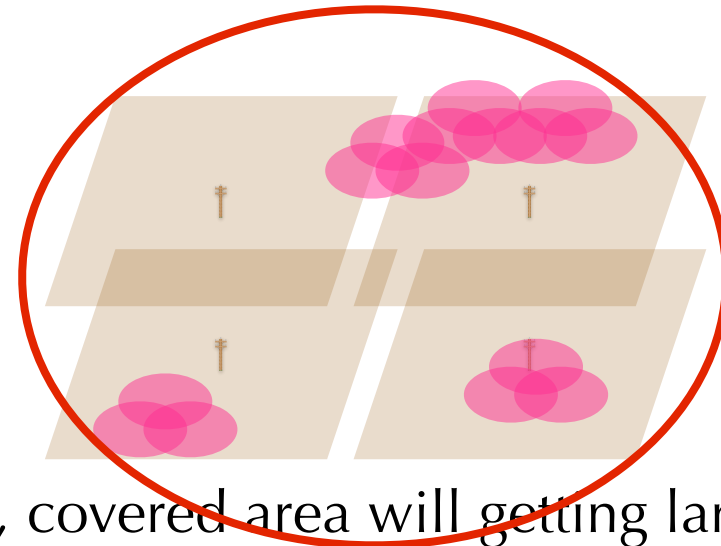
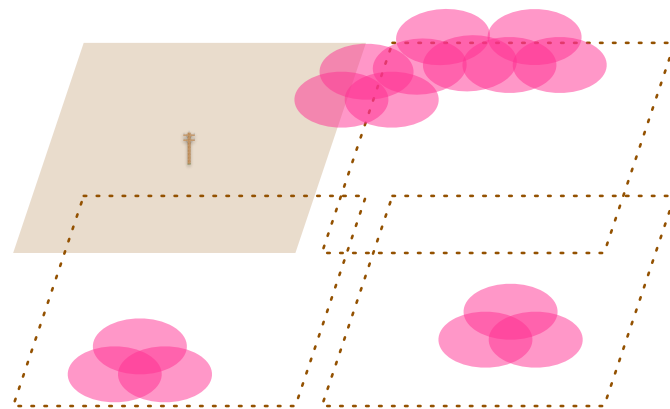
Graduate School of Information Science and Technology
the University of Tokyo,
National Institute of Information and Communications Technology

Outline

- Background & Problems
- ATMOS
 - Link Complement Layer
 - Implementation
- Discussion

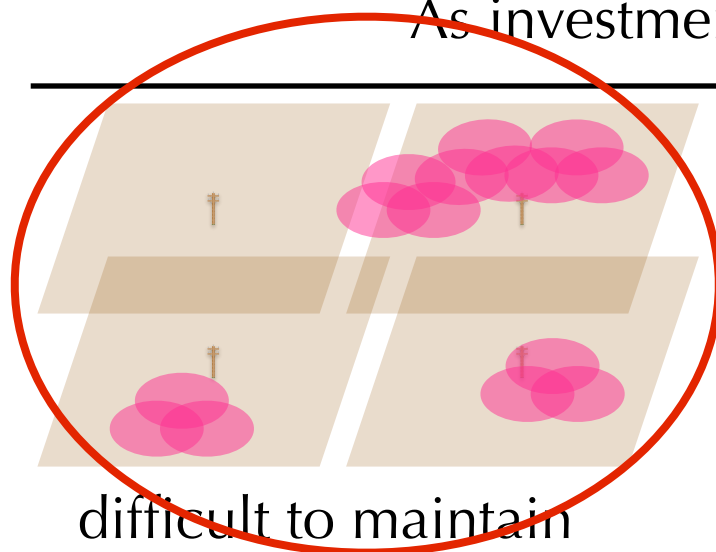
Background

in developing countries

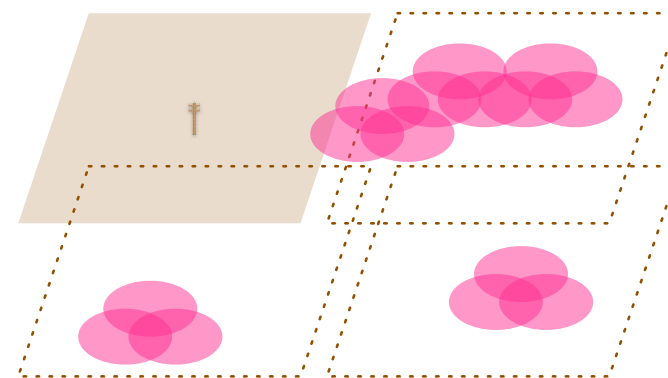


As investment increases, covered area will get larger

under disasters

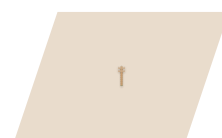


difficult to maintain
backup systems



difficult to distribute
software

t



covered area

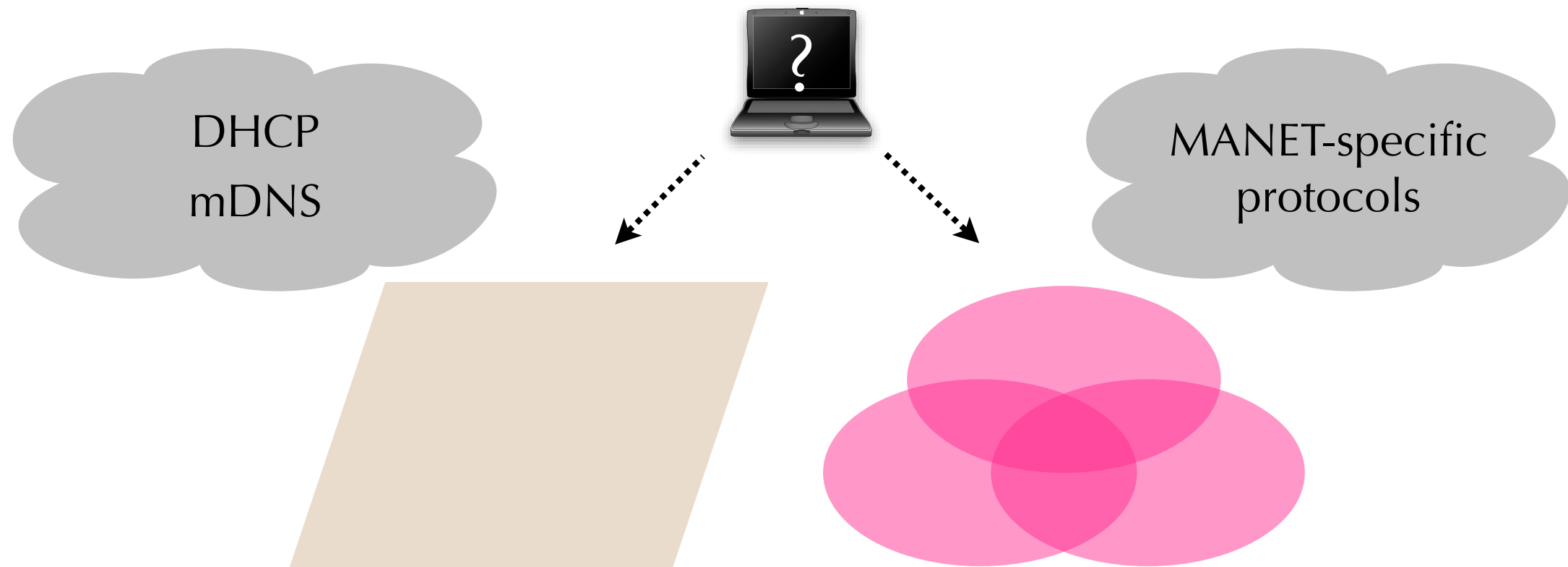


uncovered area

Traditional networks and MANETs will co-exist

Issues(1)

How to know whether the node is connected to a traditional network or a MANET?



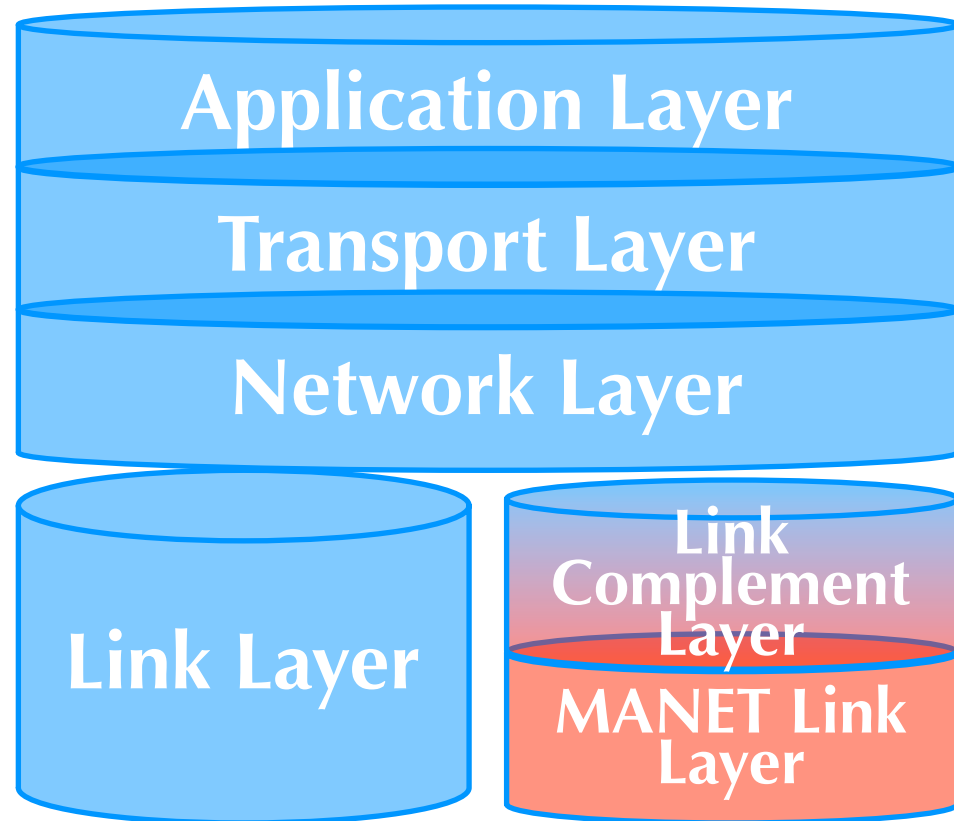
Issues(2)

- It is difficult to maintain two protocol suites which are not compatible with each other
- We have been focusing on the reuse of existing software assets

Outline

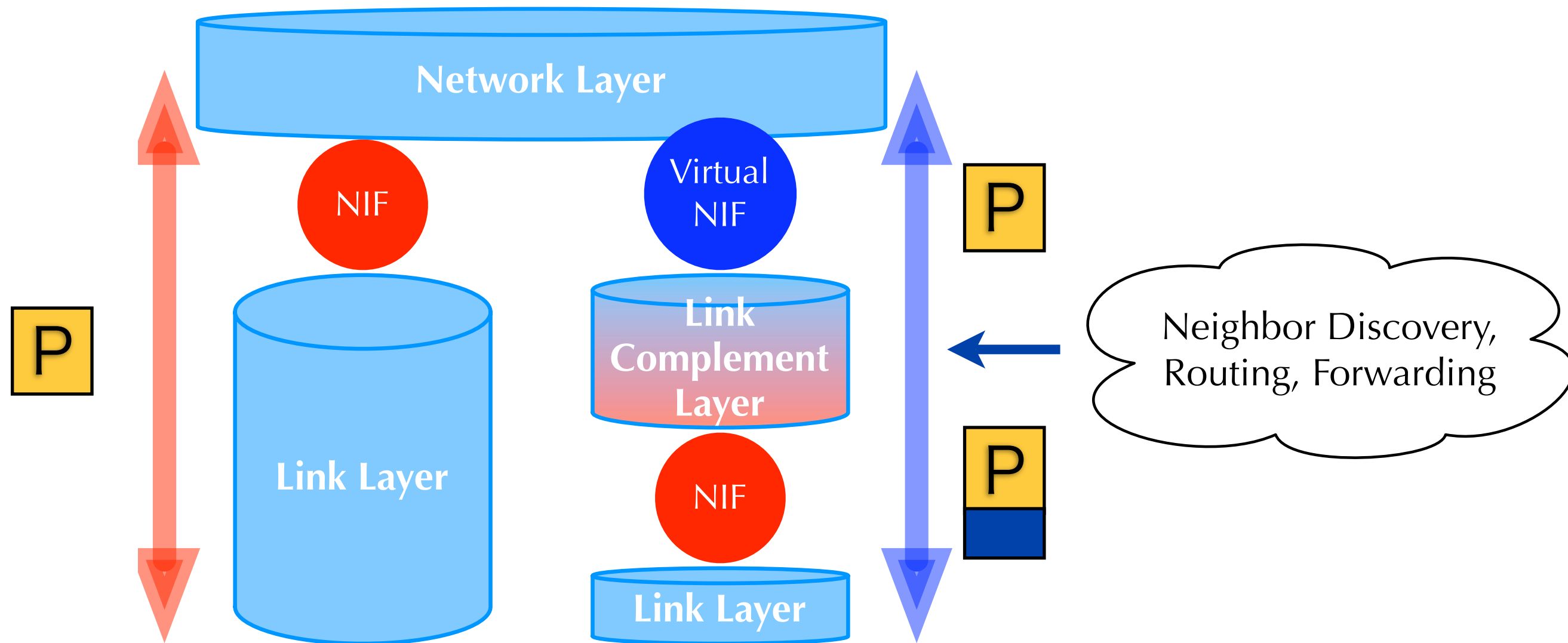
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Link Complement Layer(1)

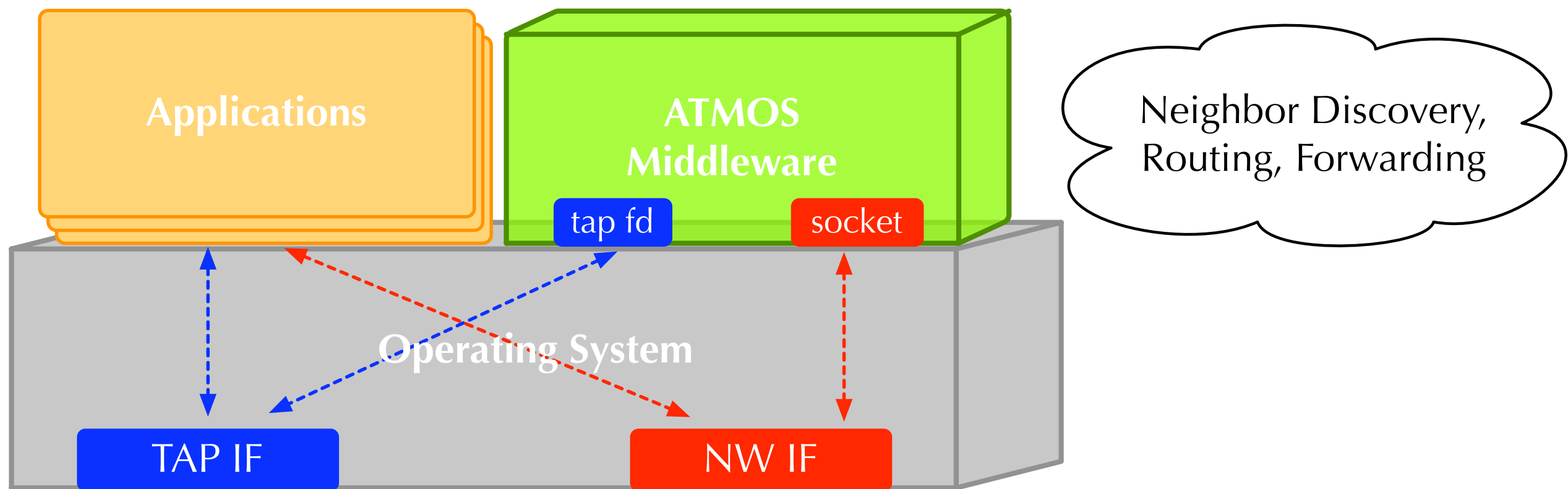


- Complements the ad-hoc nature of links in MANETs
- Shows the ethernet-like interfaces to the upper layers

Link Complement Layer(2)



The structure of the Implementation



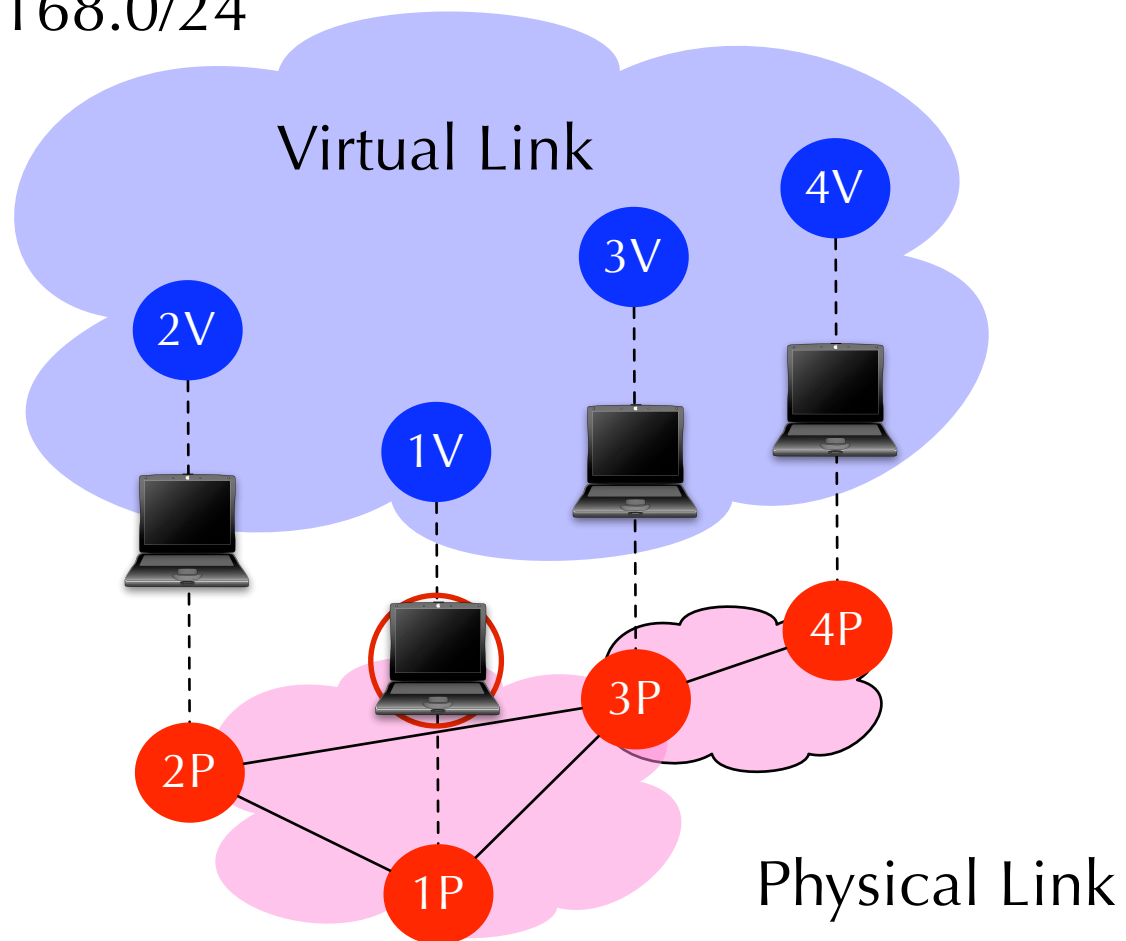
virtual network interfaces are made by
the universal TUN/TAP device

Implementation Status

- The middleware
 - Implements a unicast routing module of DYMO[draft-ietf-manet-dymo-14]
 - Implements a multicast module of SMF[draft-ietf-manet-smf-05]
 - Runs on Linux and *BSD(including OSX)

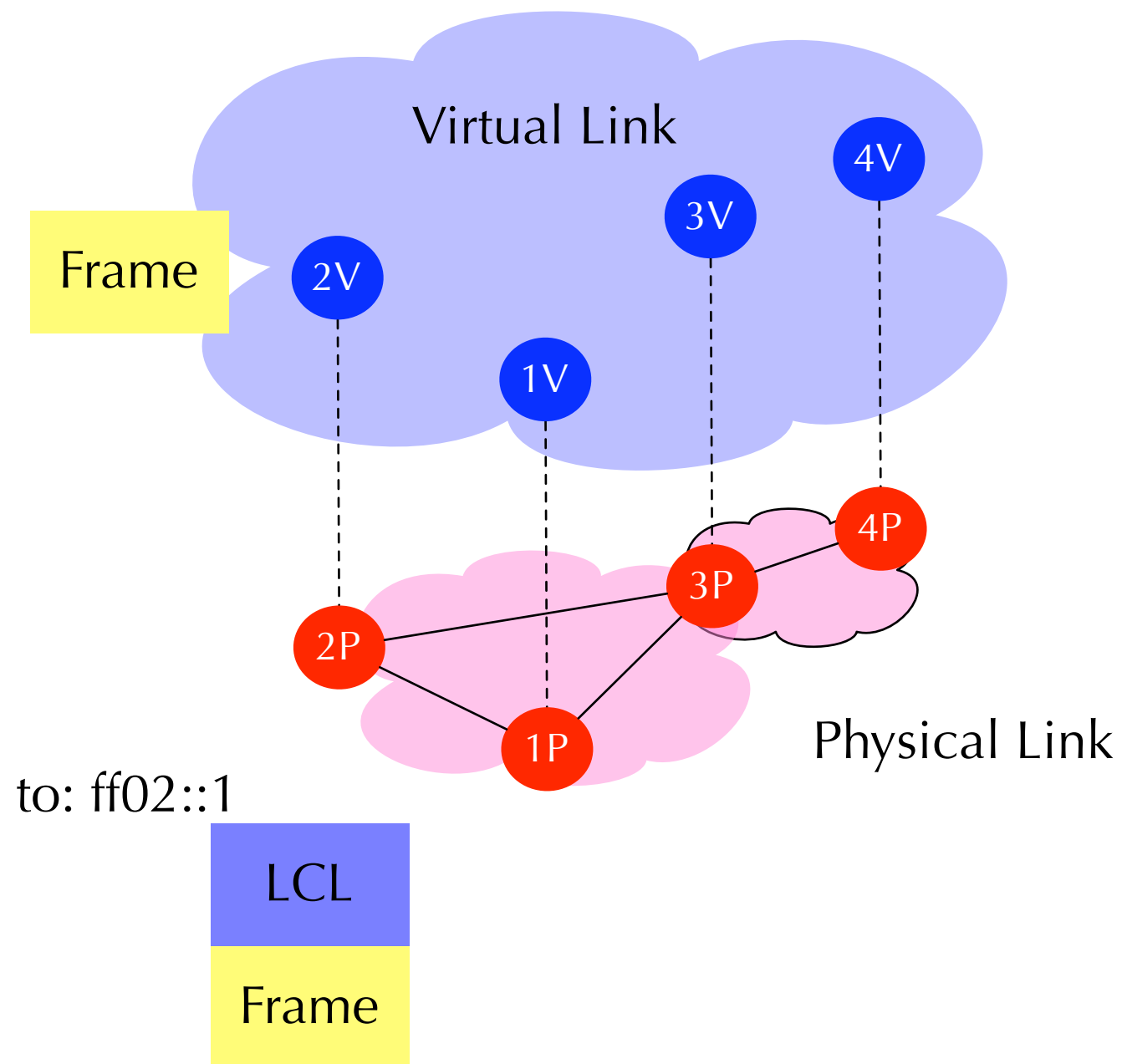
Ex. Multicast Ping

192.168.0/24



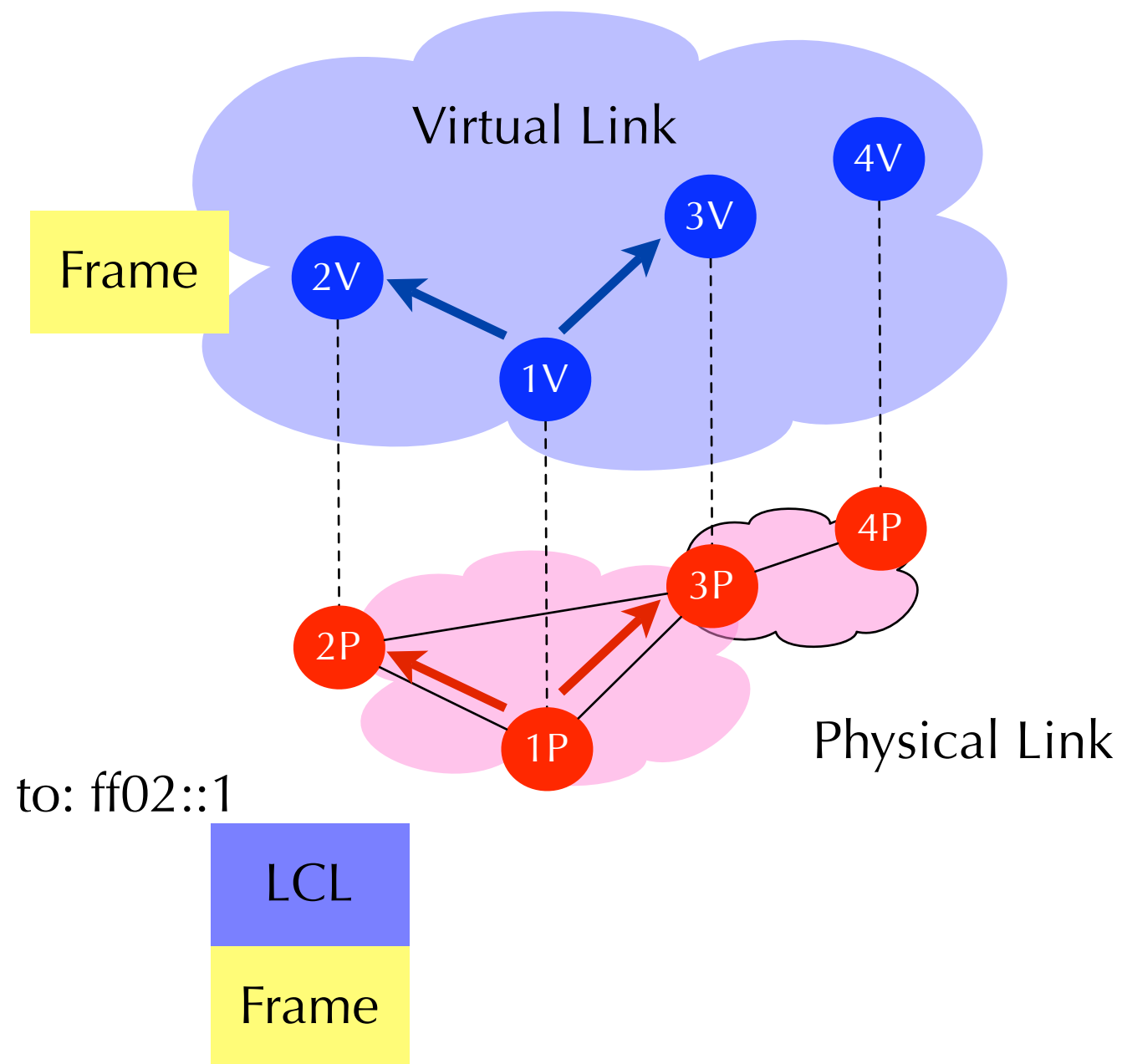
- The node with an IP address of 192.168.0.1 sends a ICMP echo request packet
 - to multicast address of 224.0.0.1 (all-system-multicast)
 - via its virtual network interface

Multicast



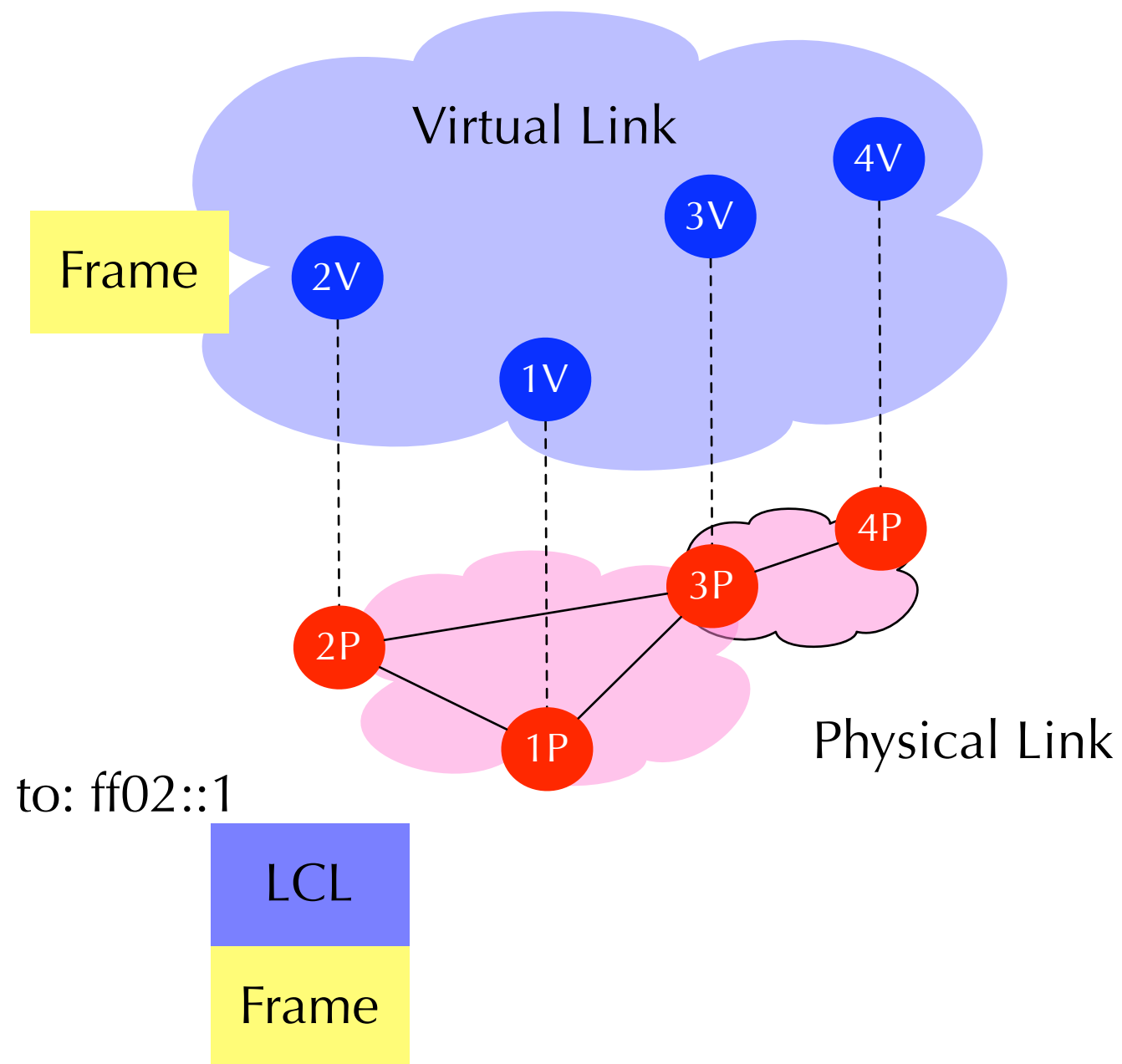
- The packets to the multicast address are processed by the SMF module of ATMOS
- If the hash value of the packet header is already recorded, a node discards the packet; otherwise it forwards it.

Multicast



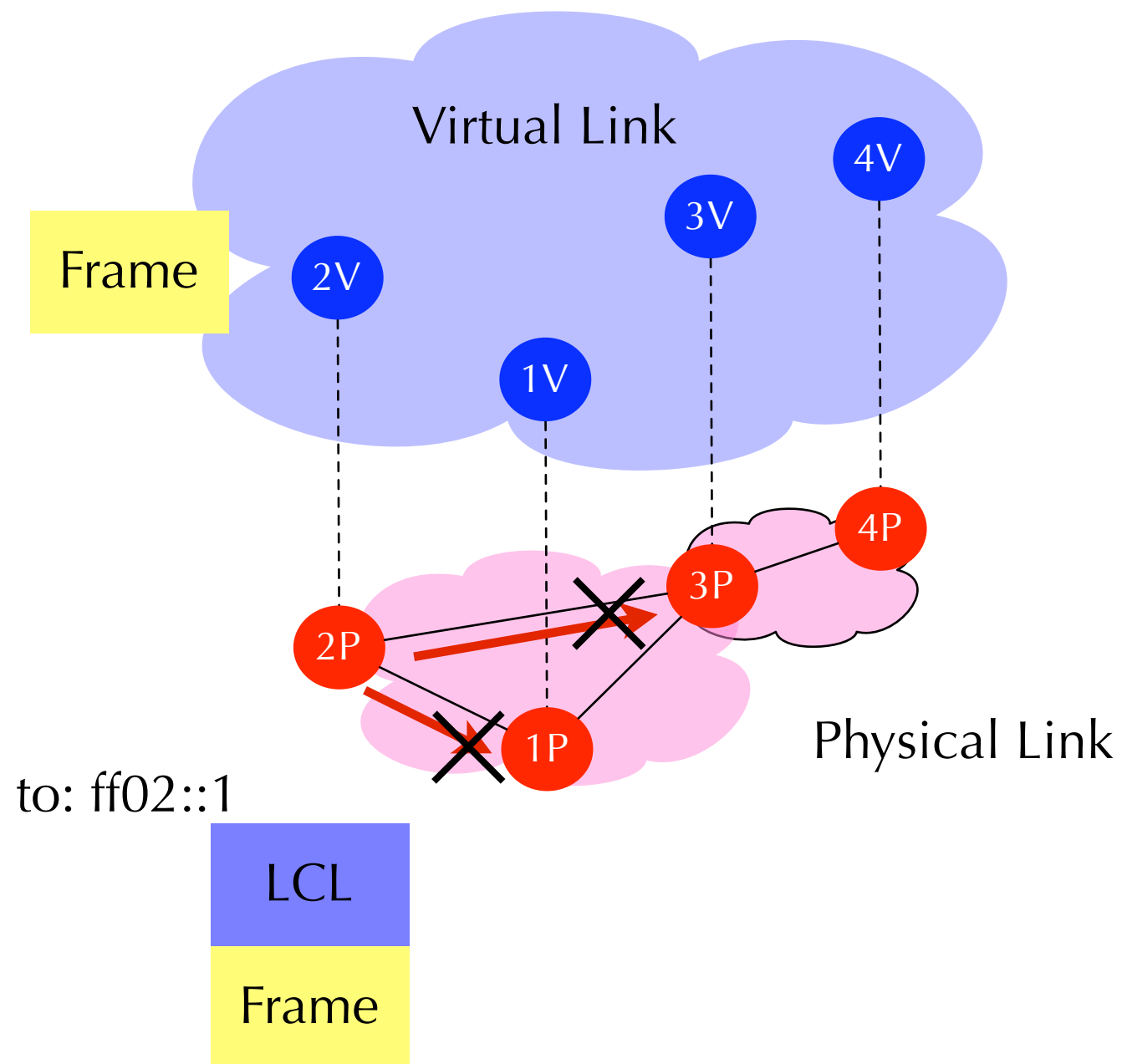
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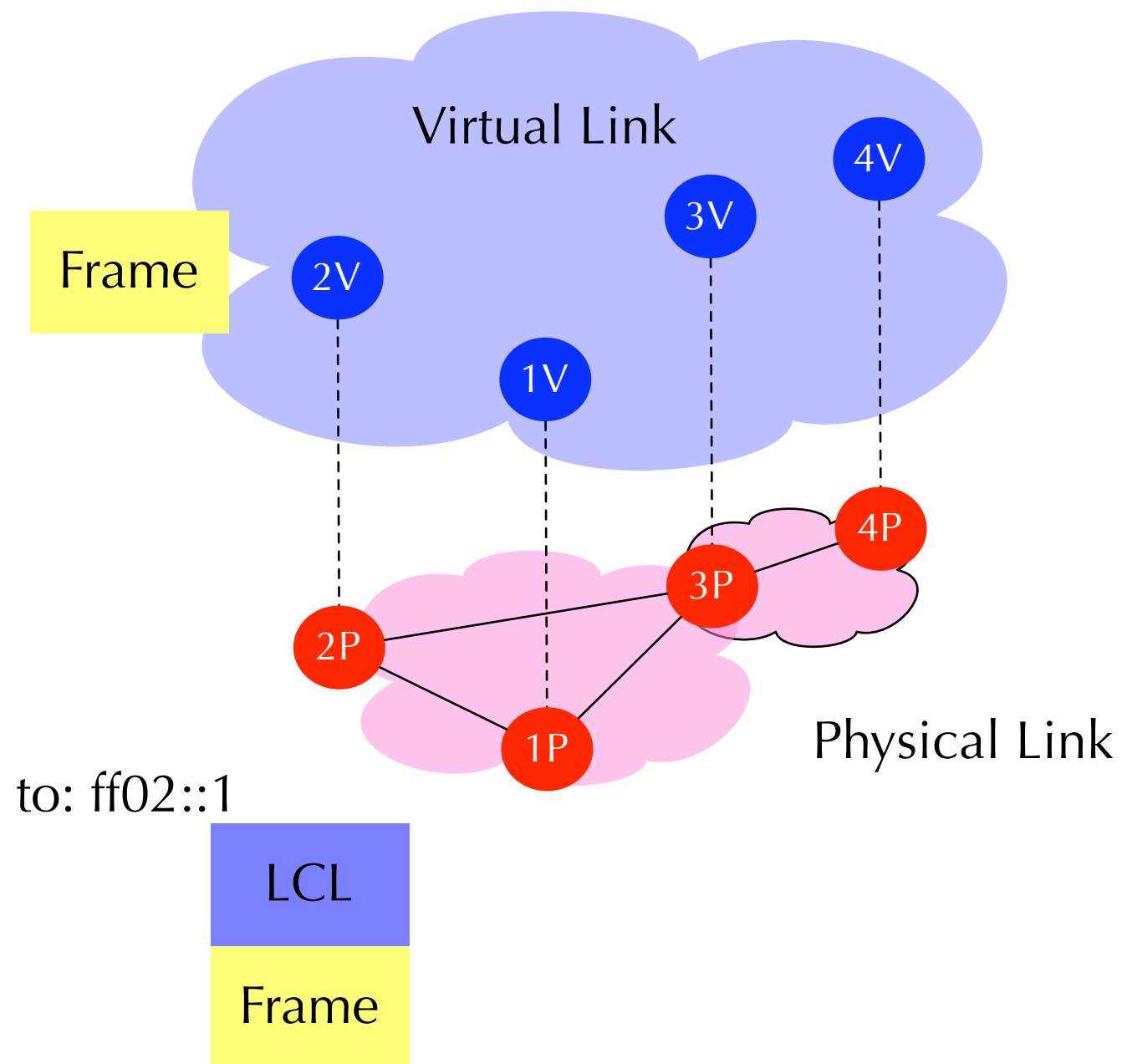
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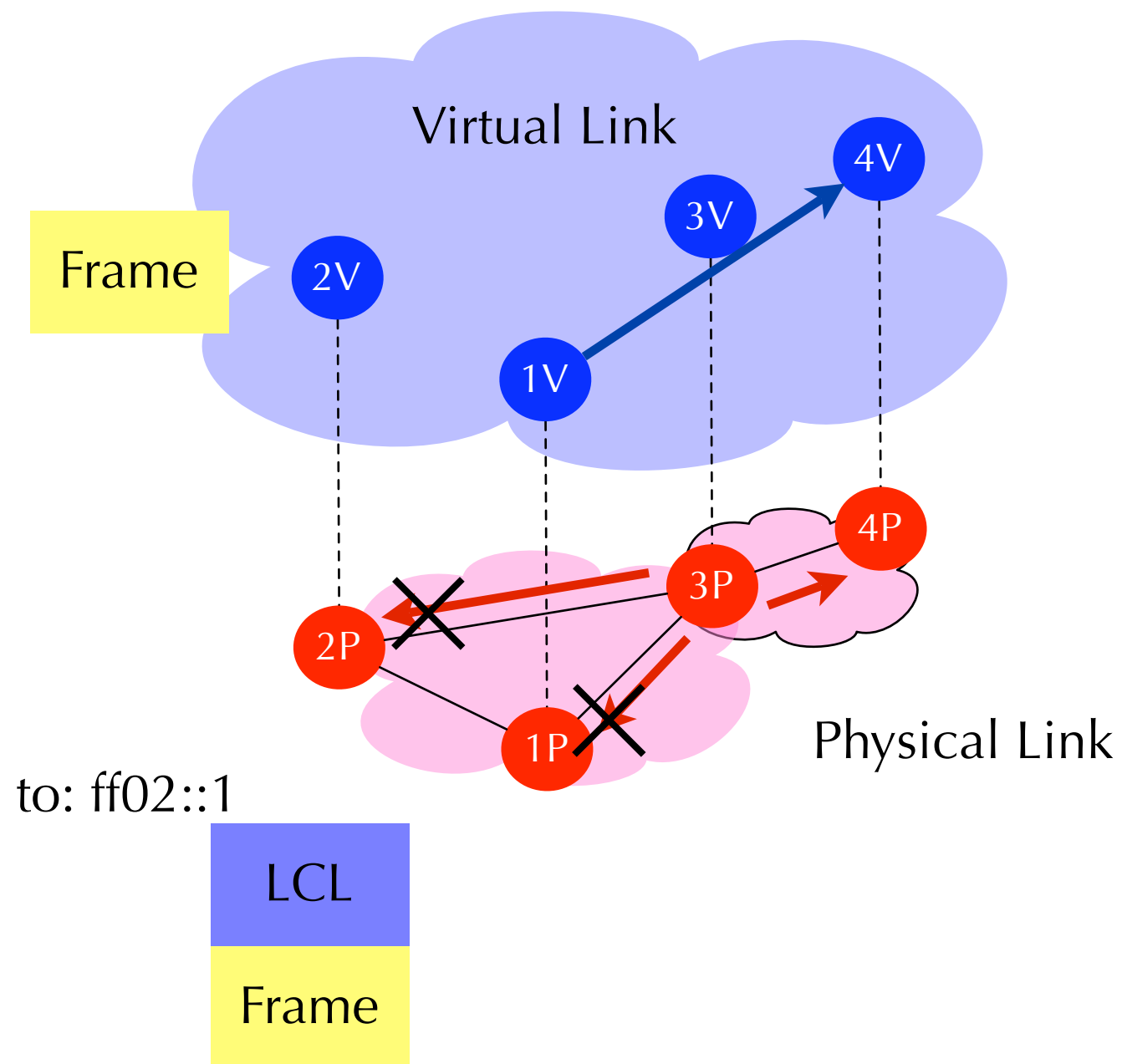
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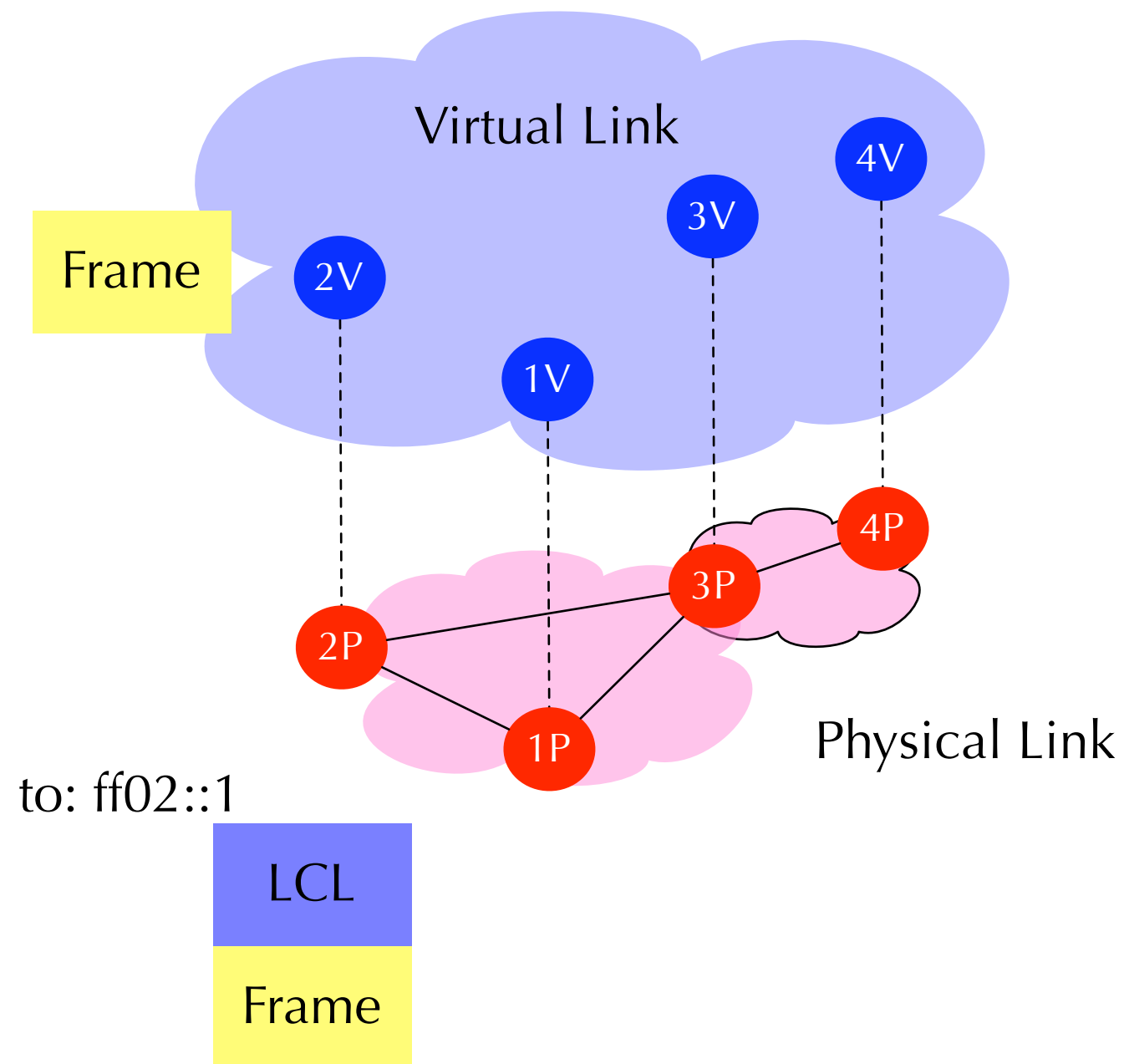
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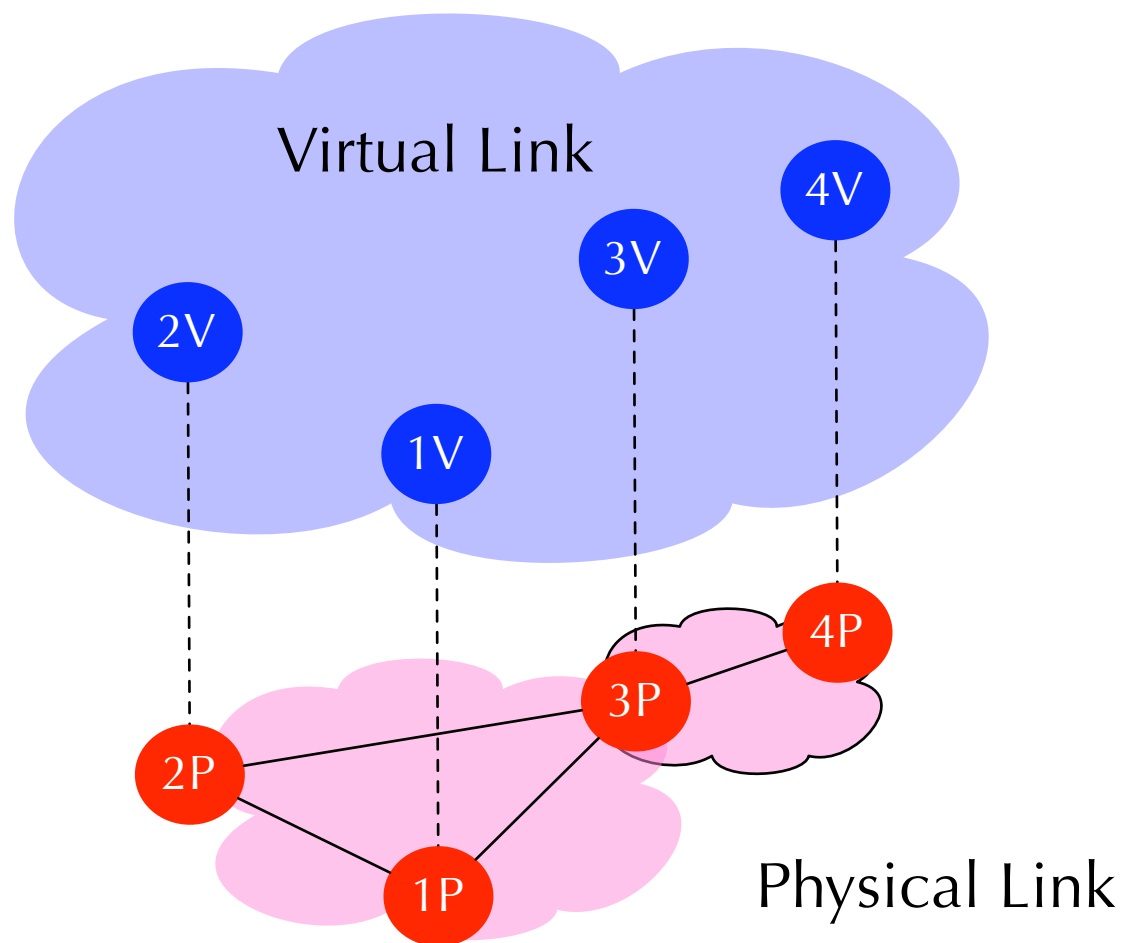
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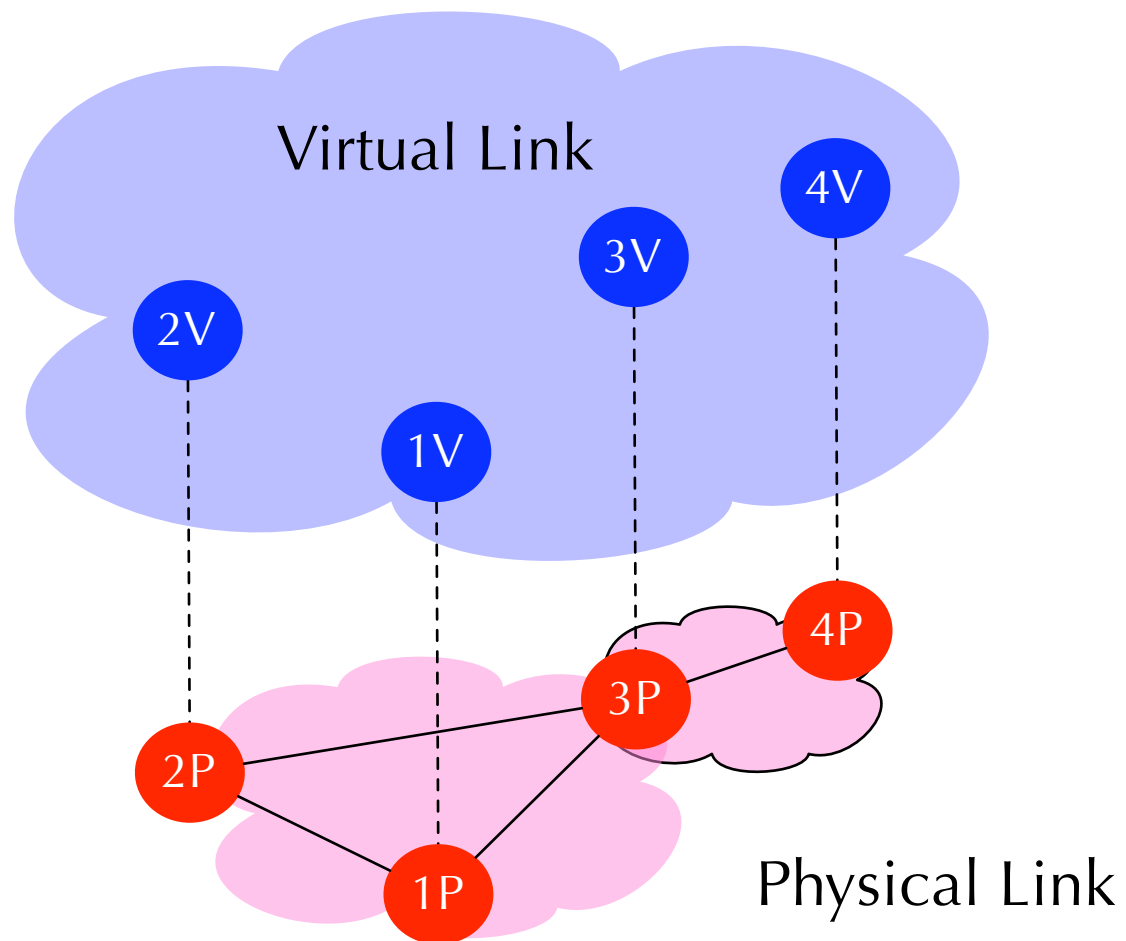
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Unicast (1/4)



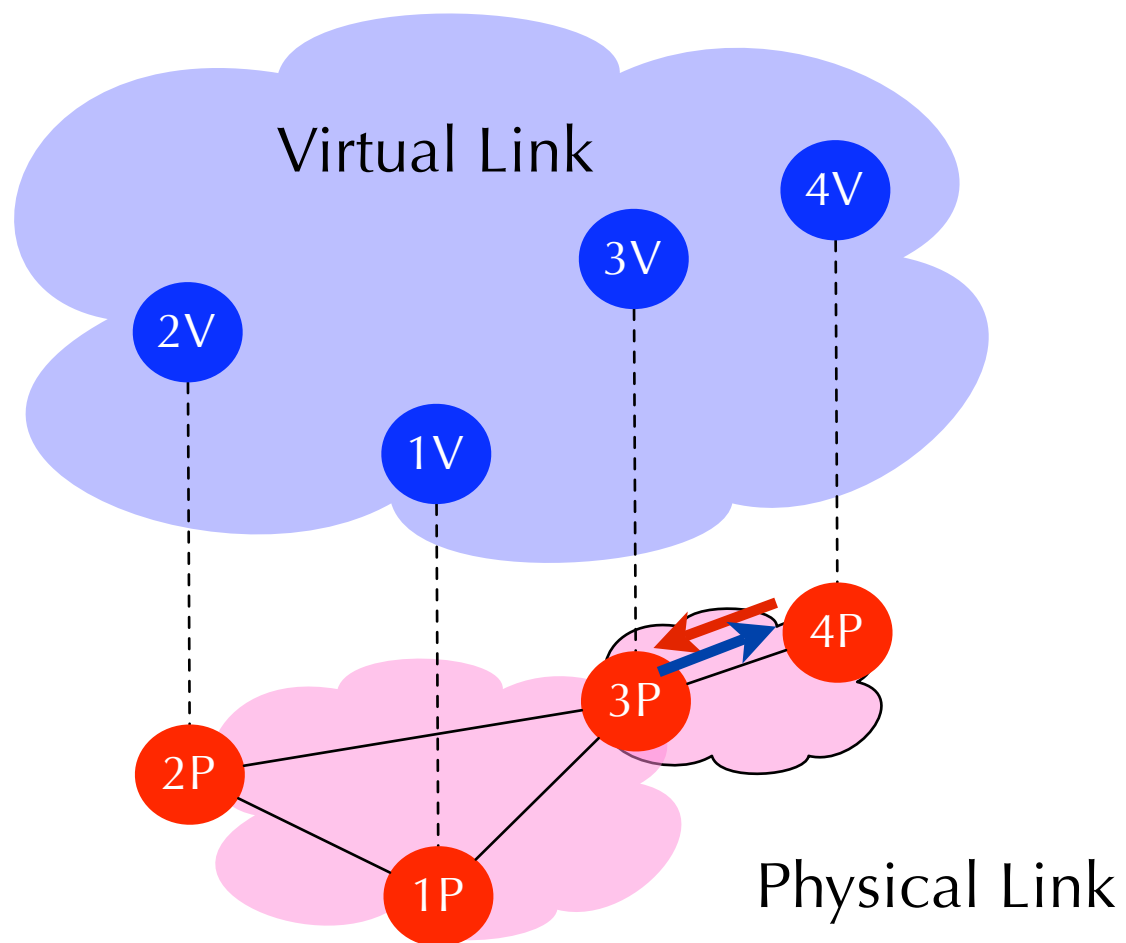
- the node which received the ICMP echo request packet replies to this packet by sending a ICMP echo response packet to the sender

Unicast (2/4)



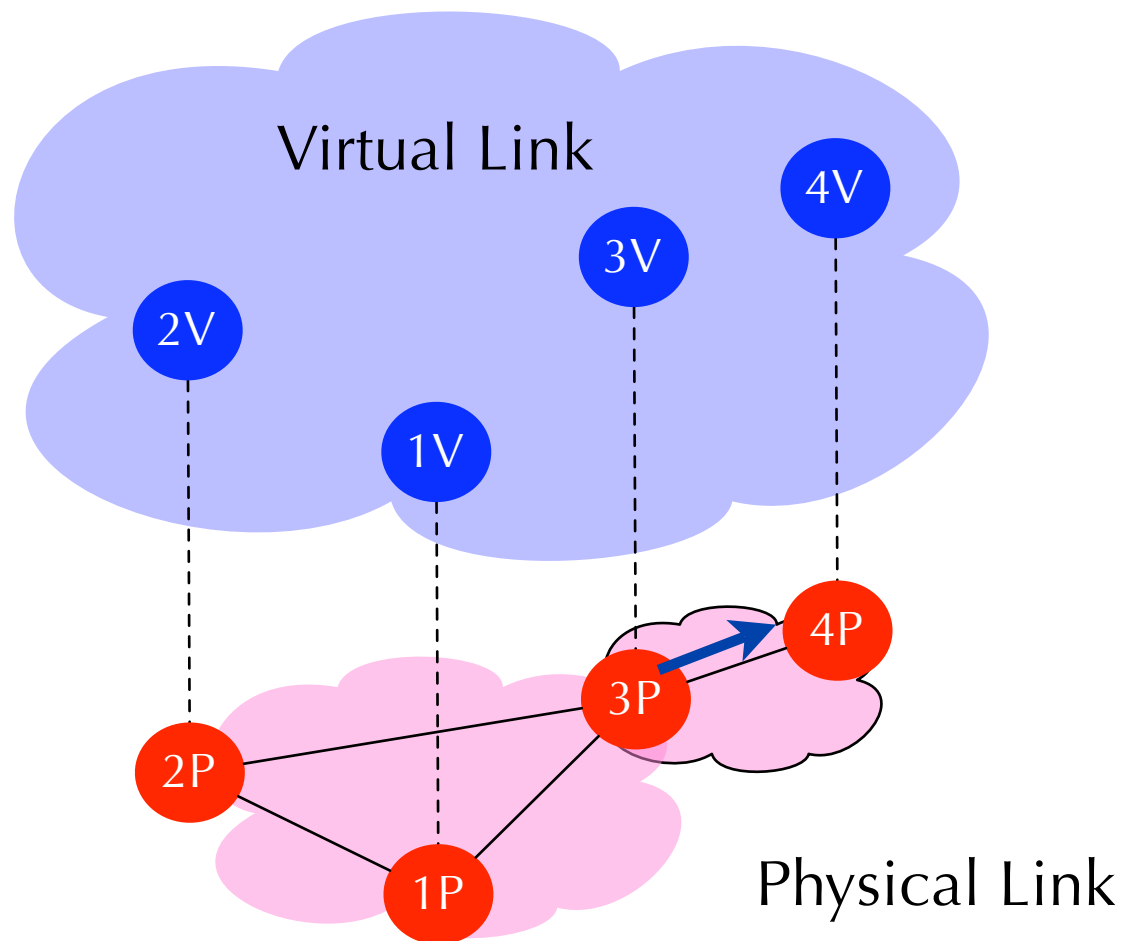
- Since node 4 does not have a routing entry for Node 1
 - it searches for the route to node 1 by flooding DYMO Route Request (RREQ) messages
- The nodes that received the RREQ messages learn the route to node 4

Unicast (2/4)



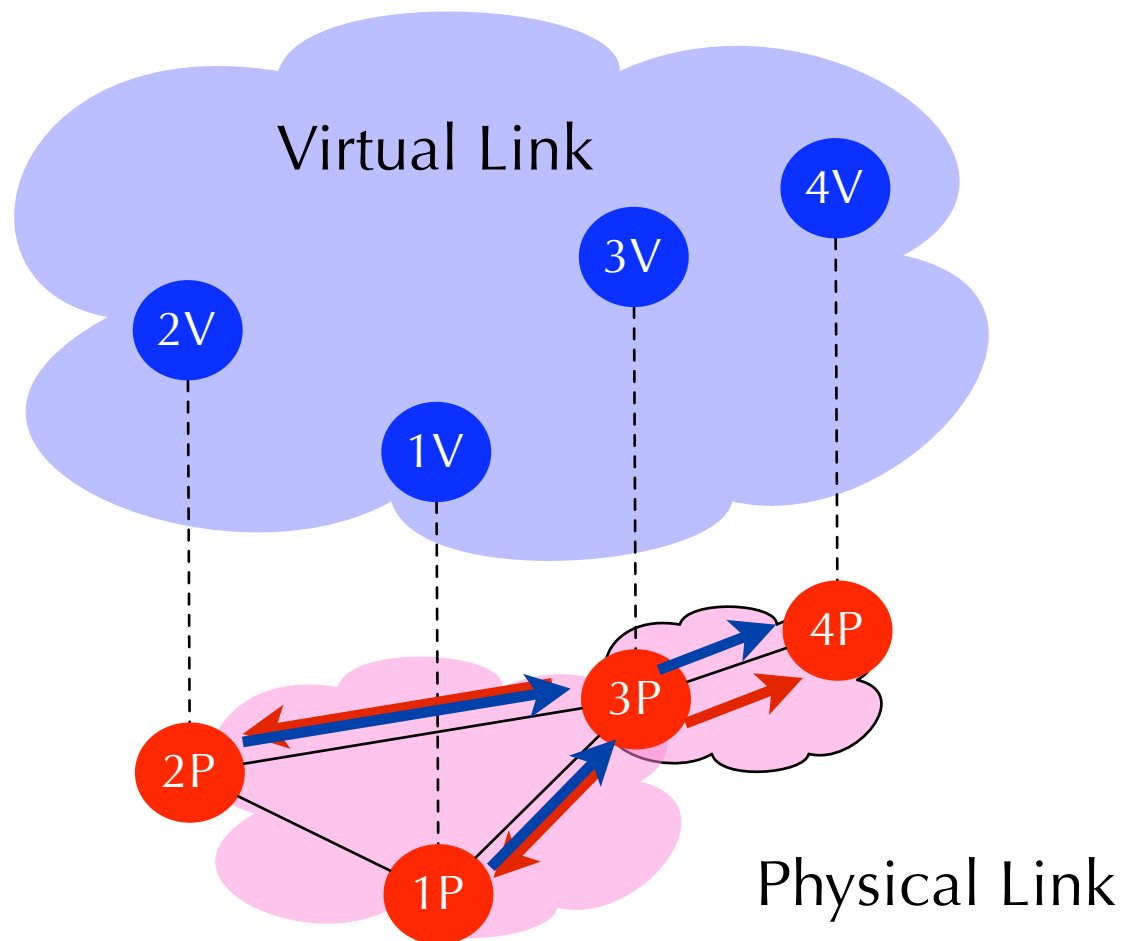
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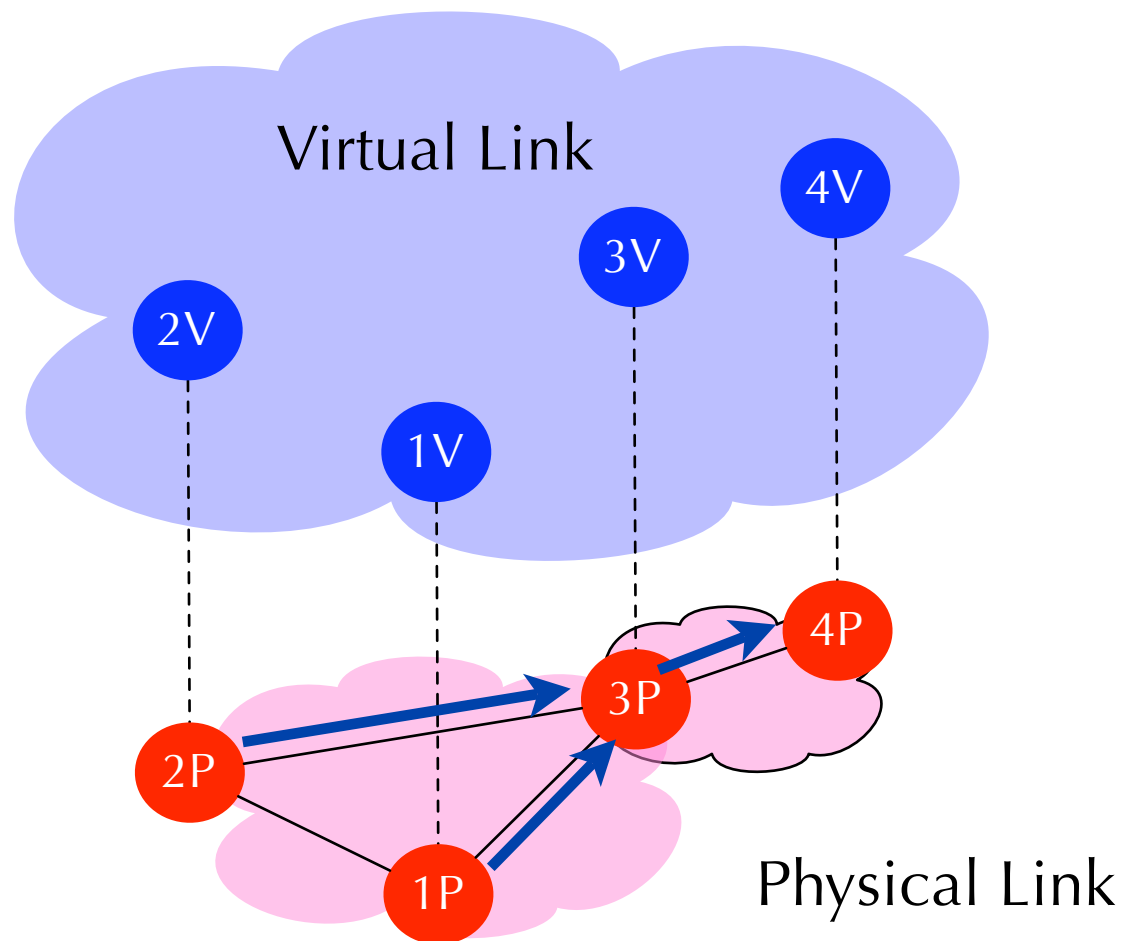
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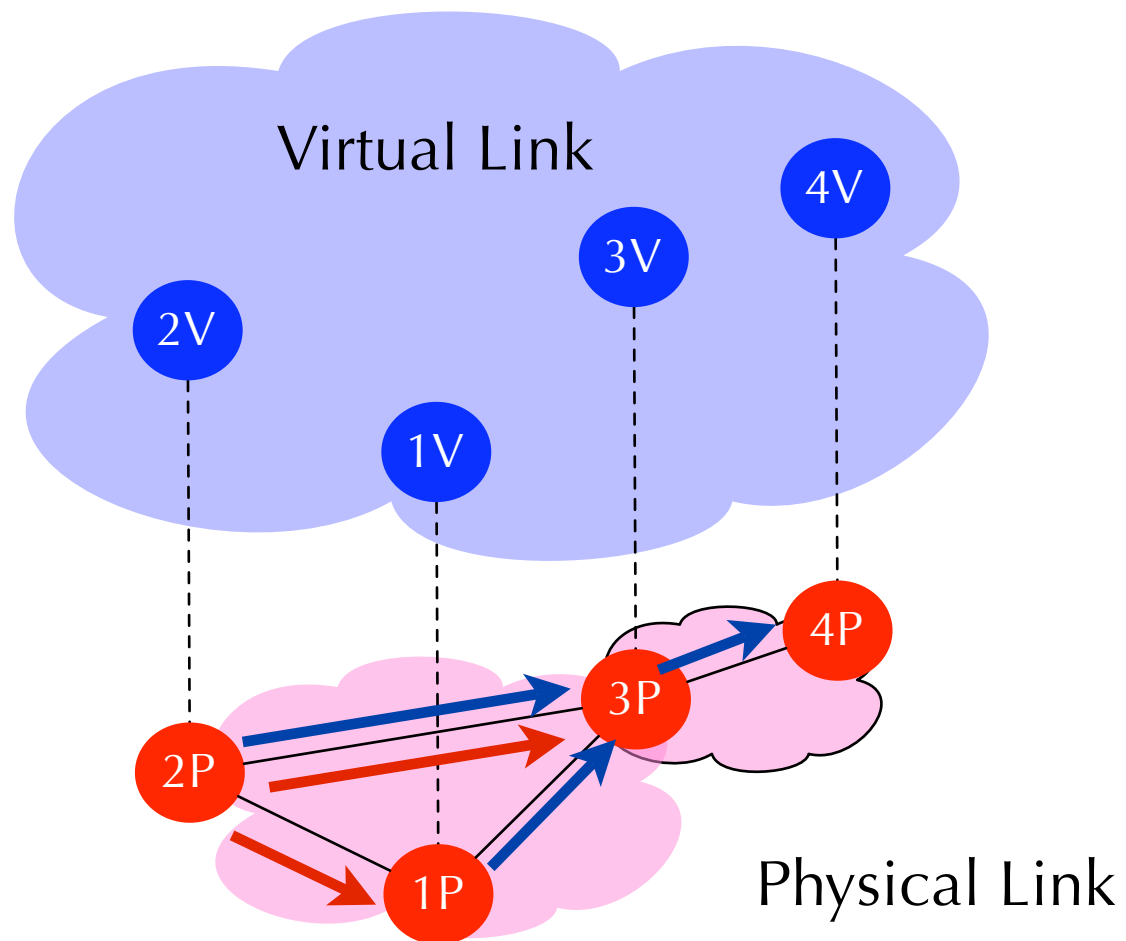
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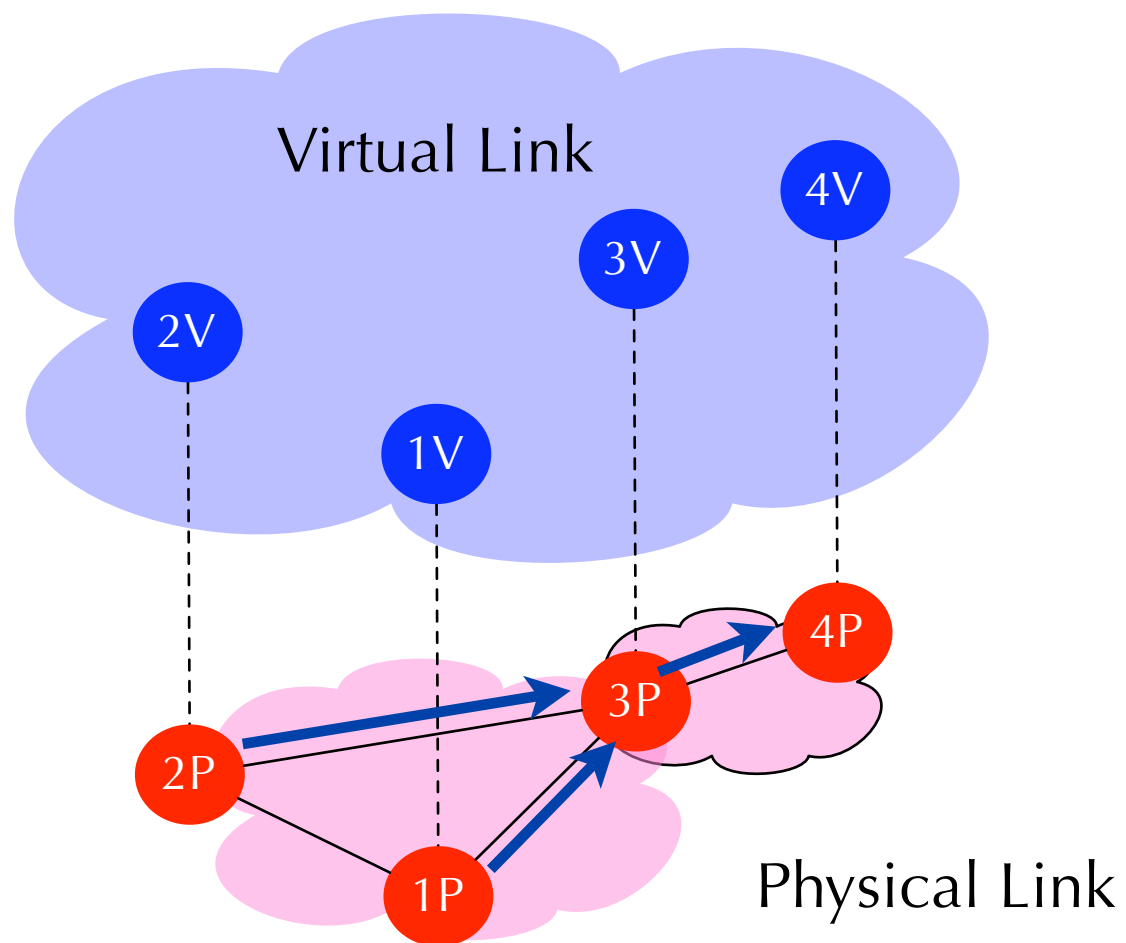
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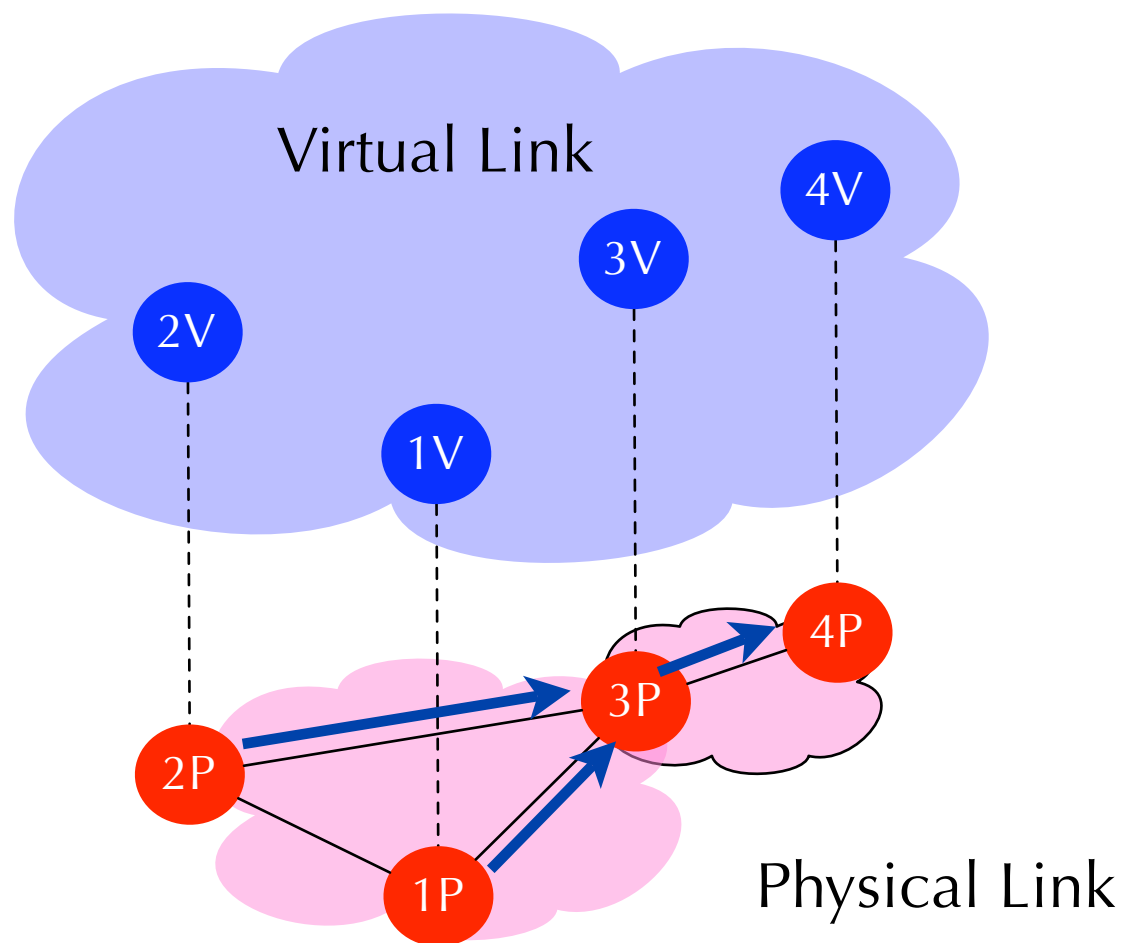
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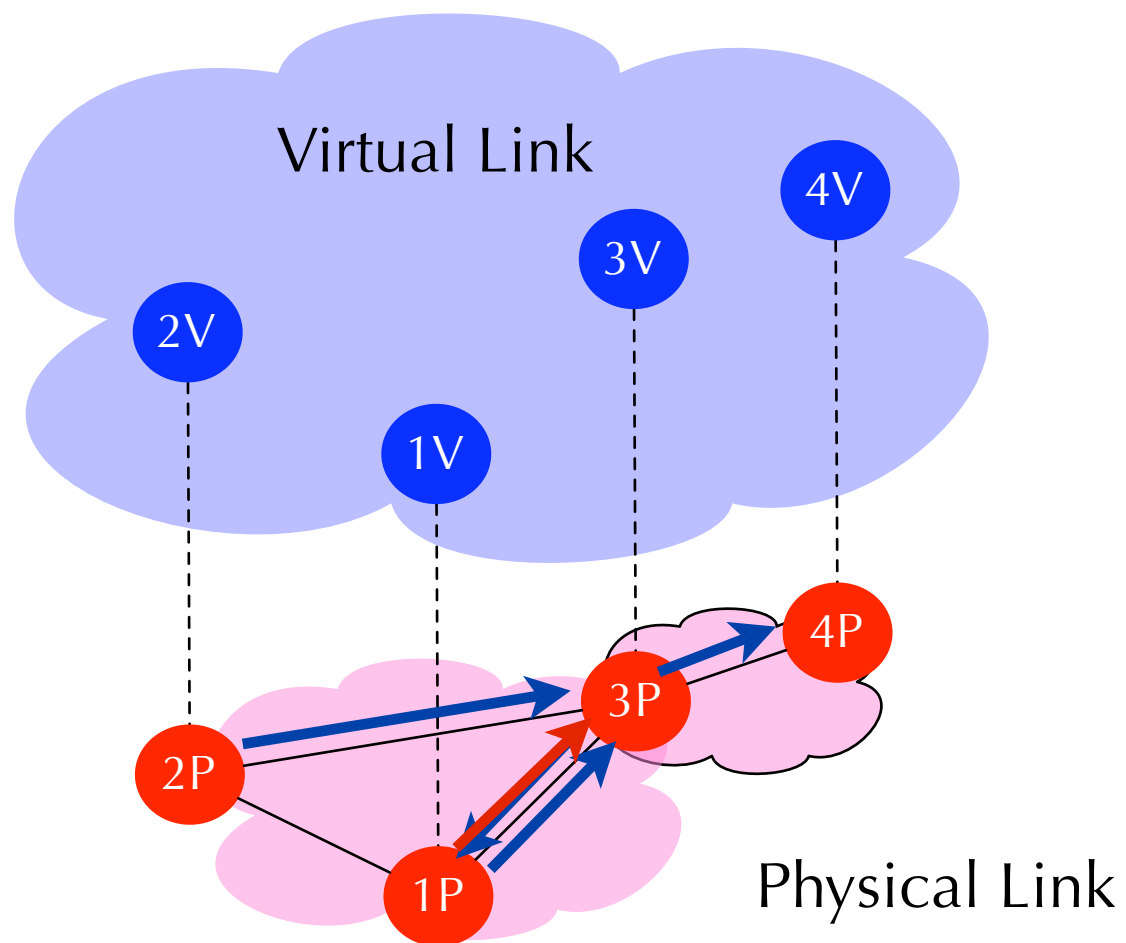
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Unicast (3/4)



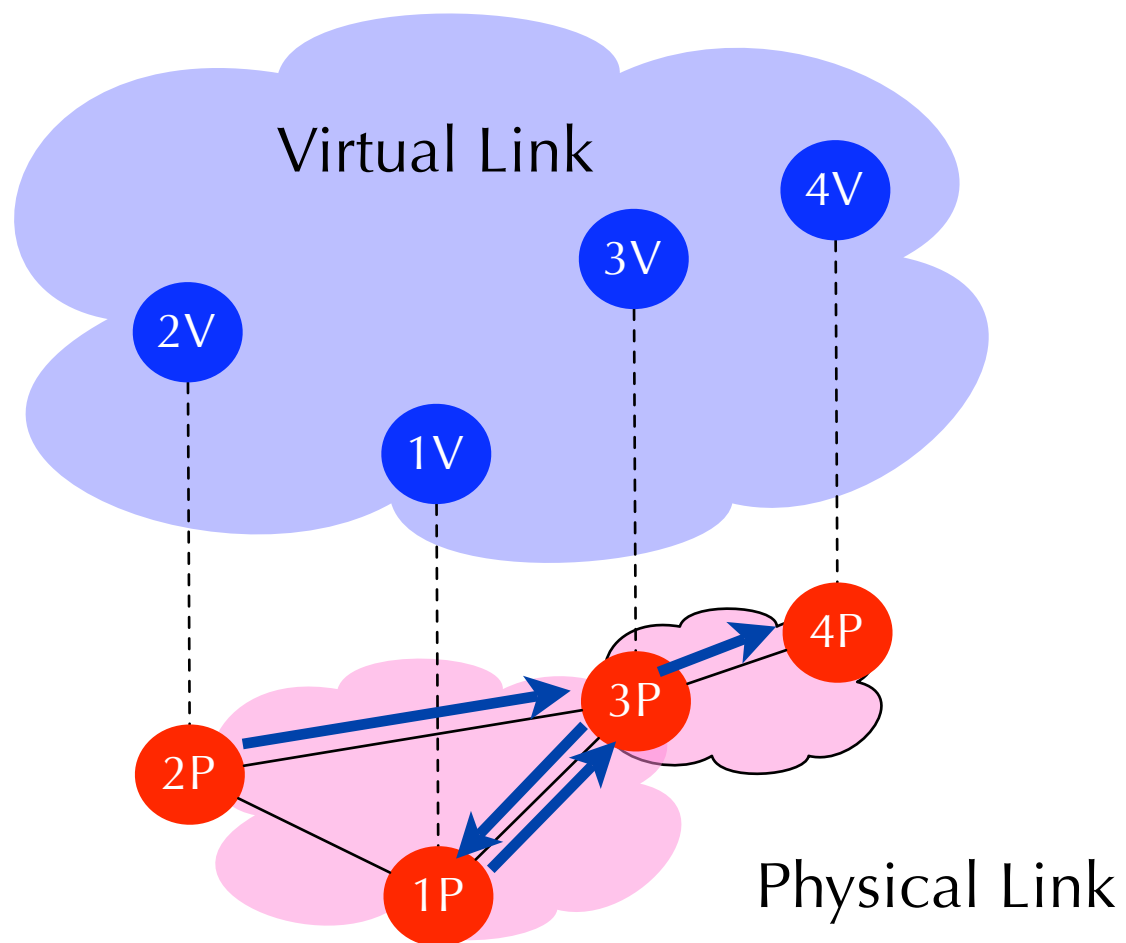
- Node 1 replied to the RREQ message by a sending Route Response(RREP) message
 - the nodes that received the RREP message learn the route to node 1
- bi-directional path between node 1 and node 4 has been established

Unicast (3/4)



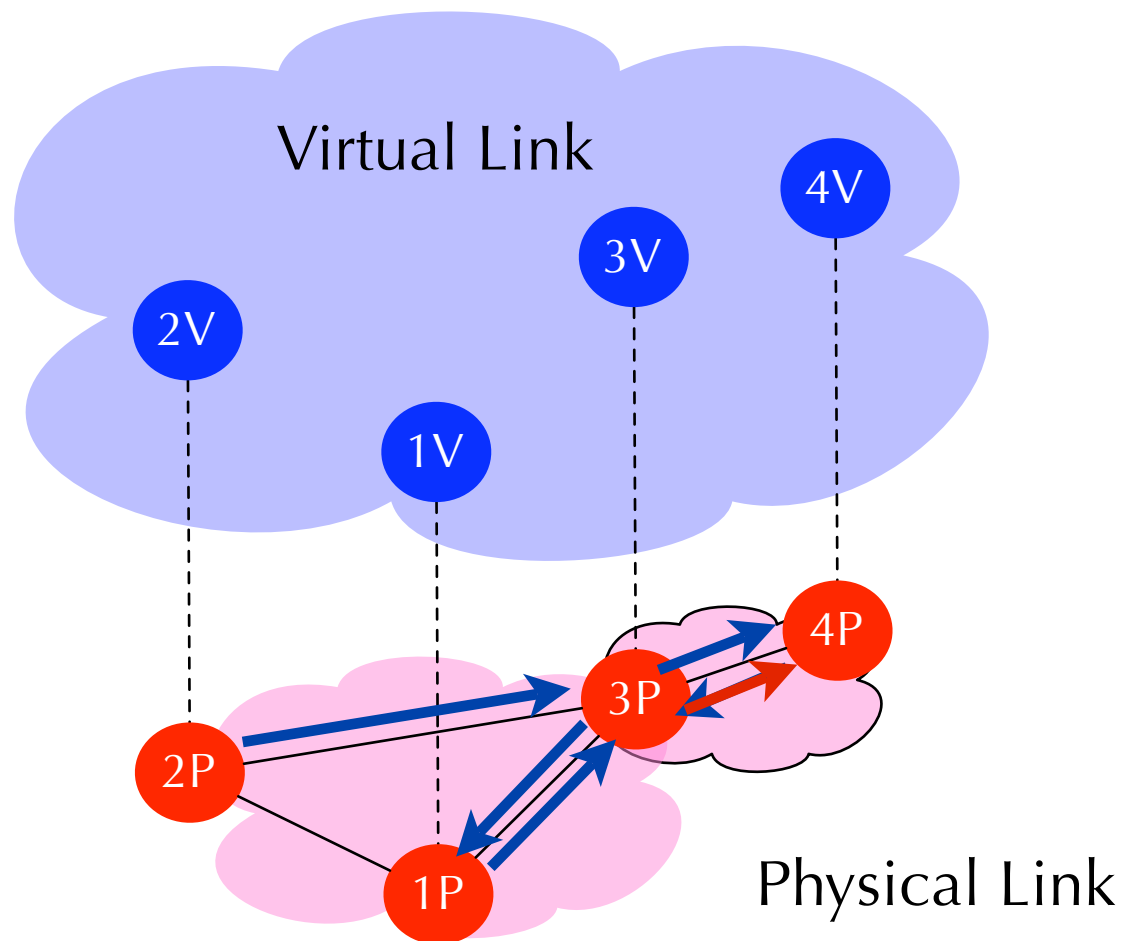
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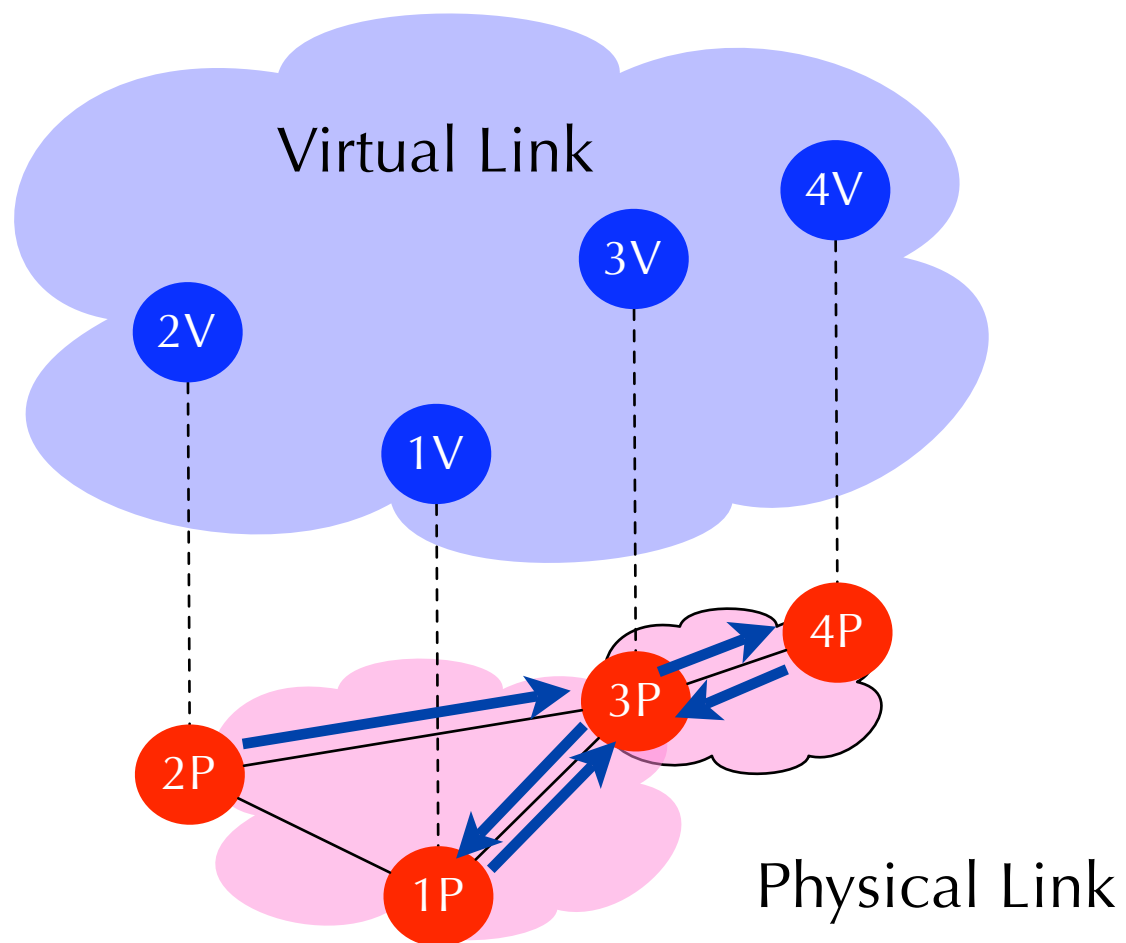
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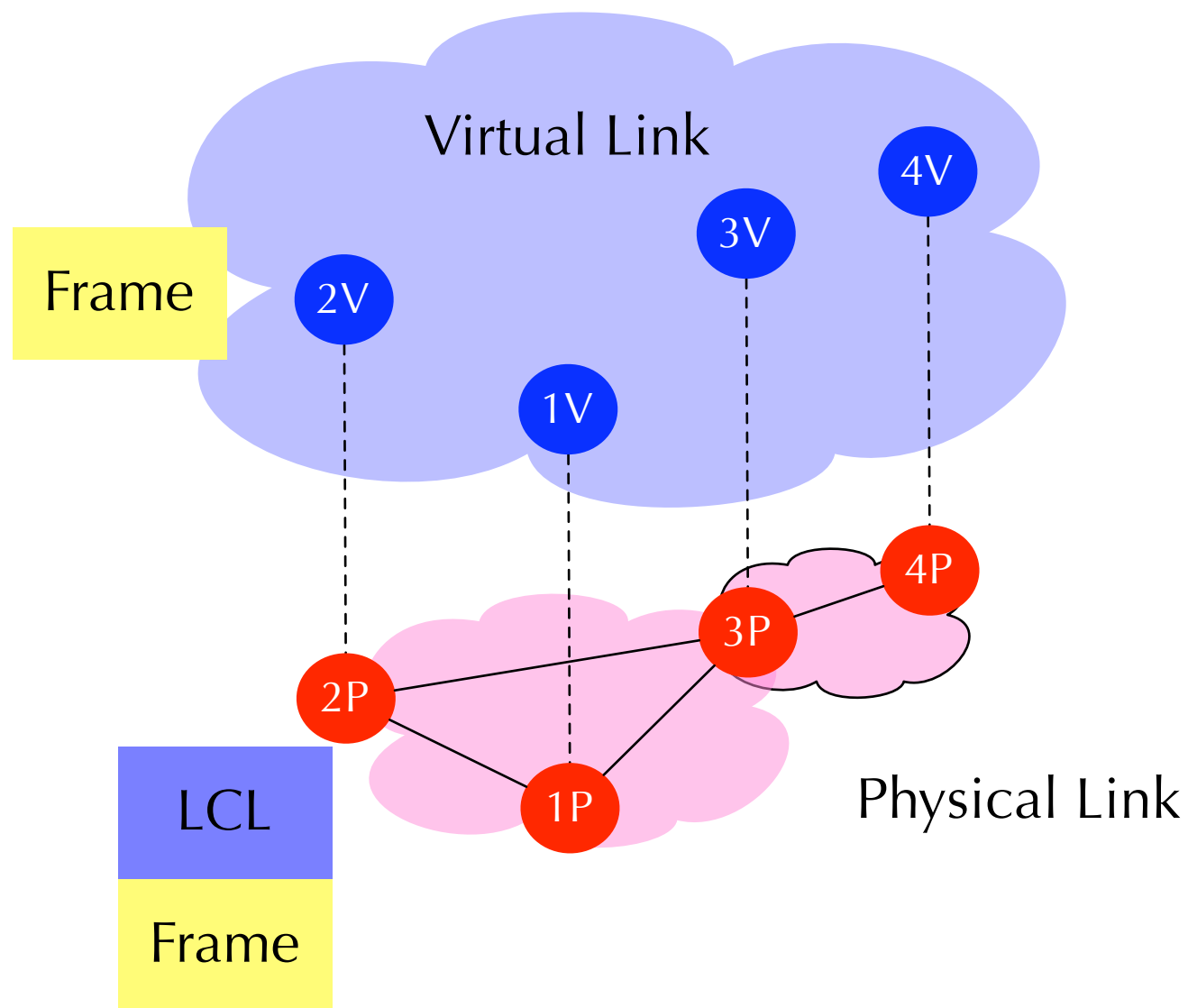
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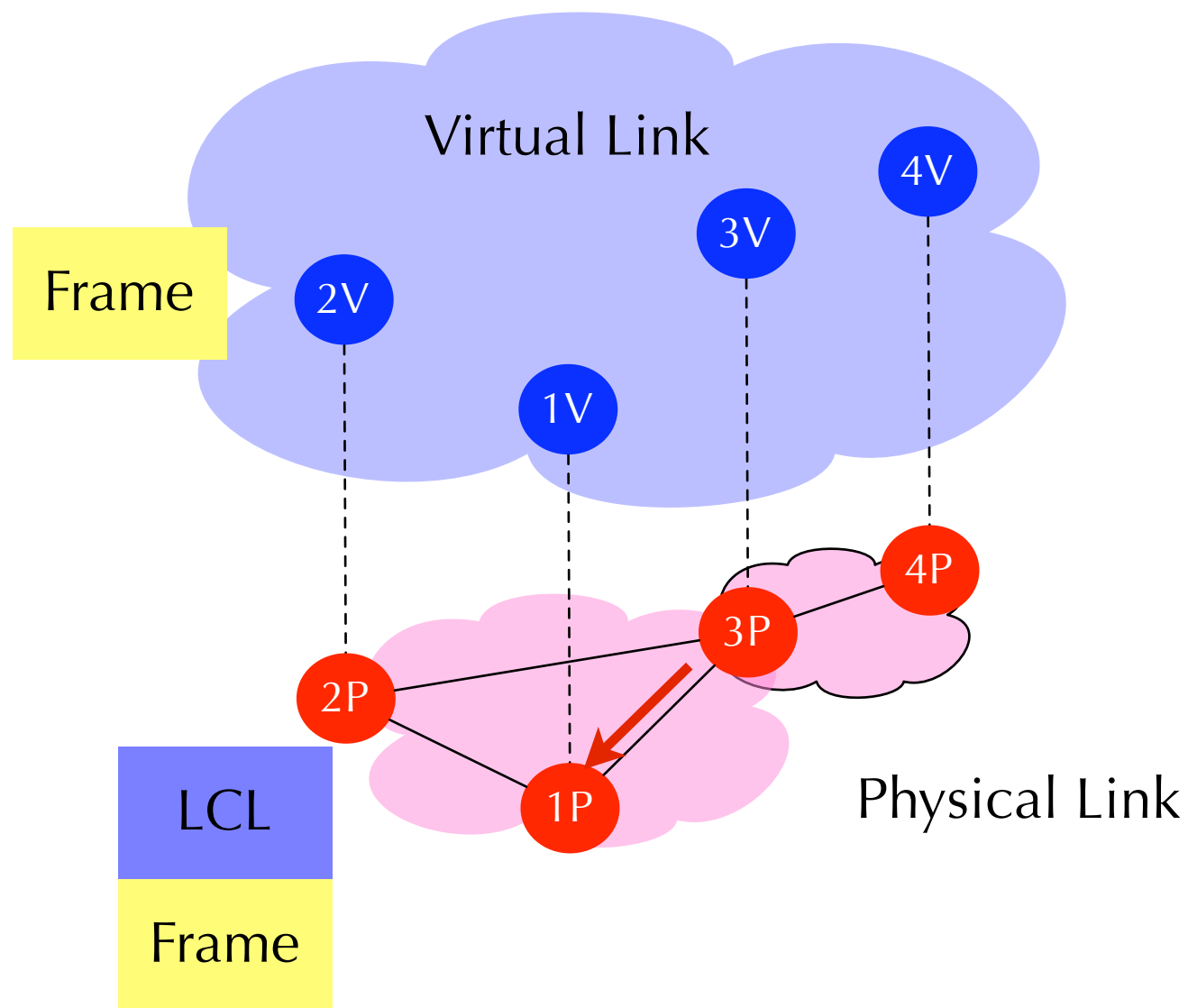
Unicast (4/4)



- the ICMP echo reply is forwarded through the established path

ATMOS establishes L2 Tunnels between neighbors dynamically

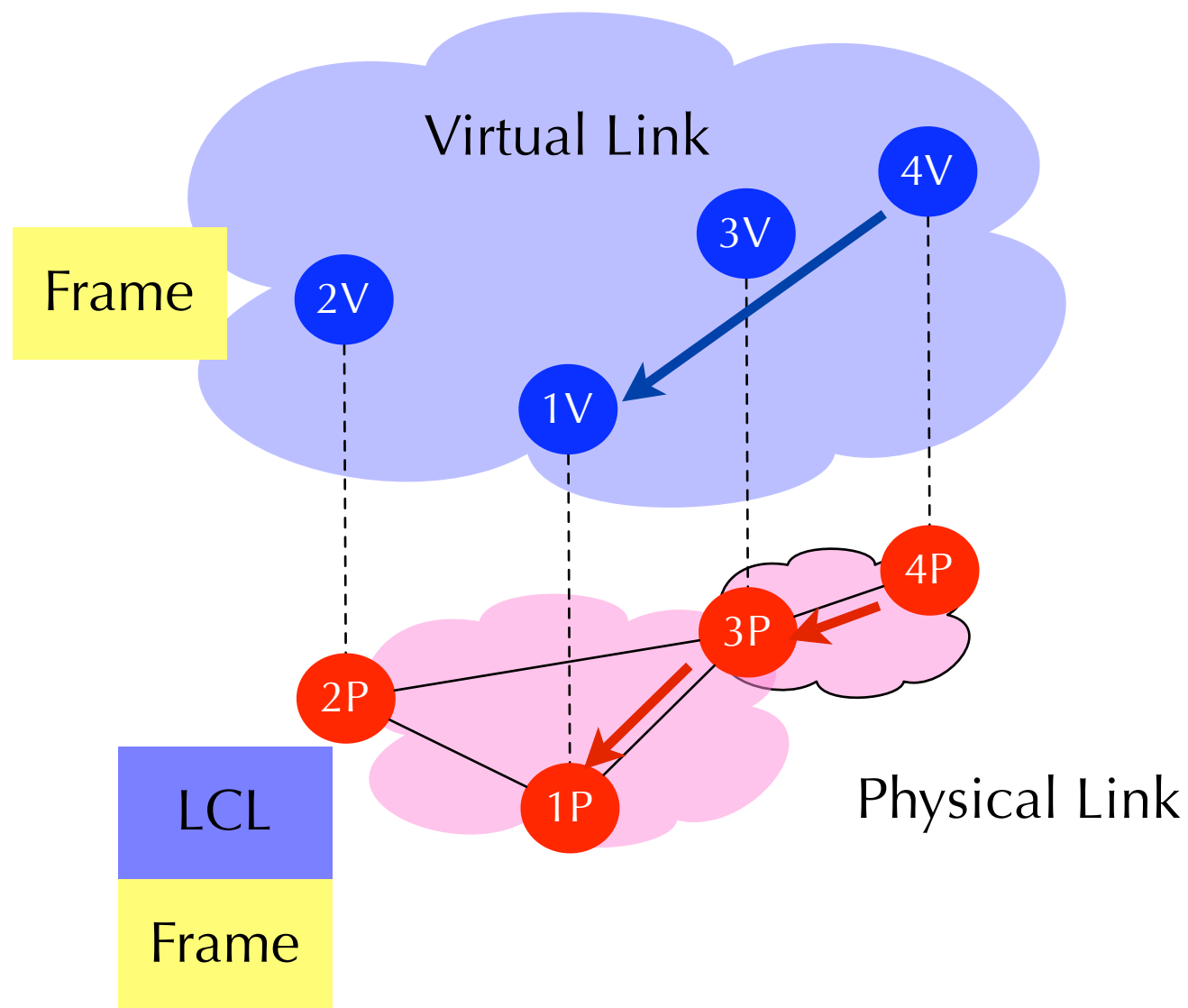
Unicast (4/4)



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Unicast (4/4)



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Discussion

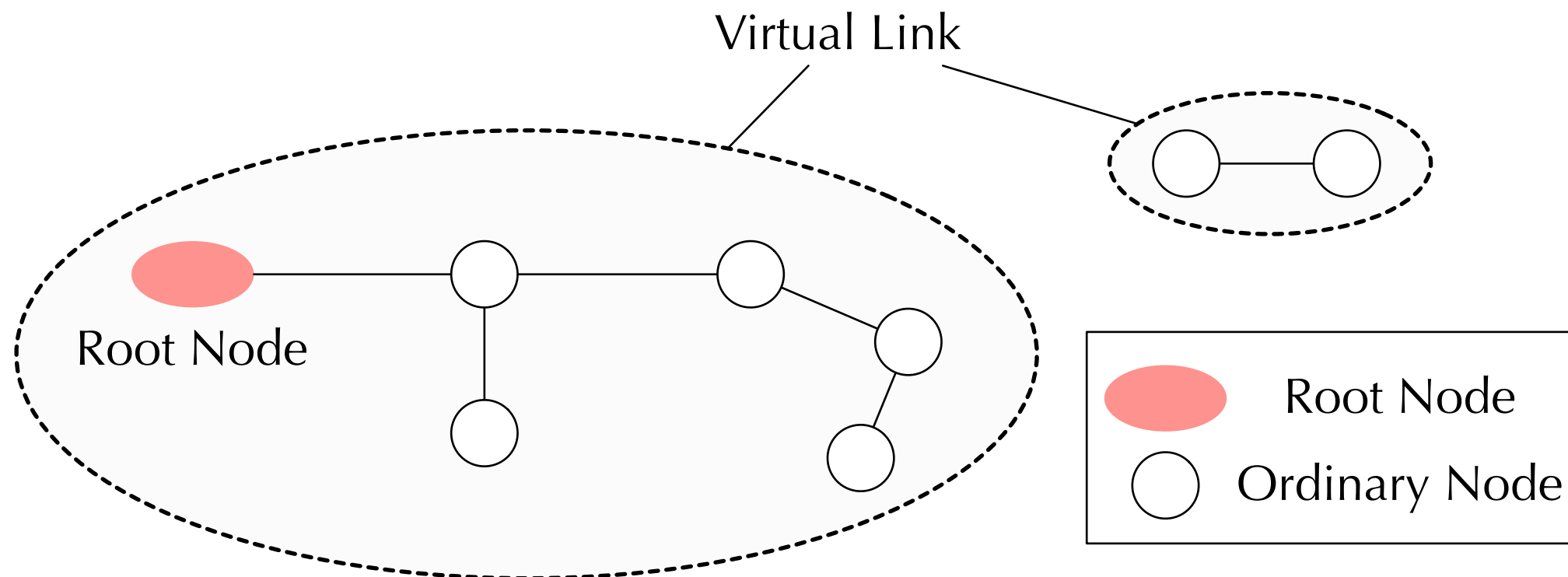
- Limitation of the adaptation
- Further researches direction

Limitation of the Adaptation

- Some existing applications are centralized
- Network partitioning can break these applications

Rooted MANET

- One or multiple root nodes, which have essential centralized services
- A node can join the network only if it has bidirectional connectivity to the root node



The Further Researches

- Evaluation of the quality of the connectivity to the root node
 - Connectivity
 - Stability: the number of paths to the root might help
 - Bandwidth: link quality metric, such as ETX/ETT, might help

Thank you for Listening!

Q & A

To multiple MANETs

