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Soviel ist sicher.

IT Security
Made in Germany

IP-Switch: network security by SDN

BMBF project vmFire

Andreas Brinner <andreas_brinner@genua.de>

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The vmFire project

vmFire: a BMBF funded research project
startet July 2012 until June 2014

b-tu Brandenburgische Technische Universität Cottbus - Senftenberg

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Radoslaw Cwalinski
Rene Rietz

Andreas Brinner

vmFire: Firewalling in virtualized environments

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Security threats

Are there any new security threats induced by virtualization?

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⇒ Yes, of course!

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Are there any new security threats induced by virtualization?
⇒ Yes, of course!

Which of these threats are exploitable by network and can be prevented by a firewall?

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Security threats

Are there any new security threats induced by virtualization?
⇒ Yes, of course!

Which of these threats are exploitable by network and can be prevented by a firewall?
⇒ Basically none!

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Relevant threats

1. MAC spoofing
2. ARP spoofing
3. ARP flooding
4. Rogue DHCP server
5. Insecure system services

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Relevant threats

1. MAC spoofing
2. ARP spoofing
3. ARP flooding
4. Rogue DHCP server
5. Insecure system services

⇒ standard network flaws

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Solutions in physical systems

dividing the network in smaller chunks by using:

- cabling
- configuring subnets
- intelligent switches
- router
- packet filter
- statefull firewalls
- application level gateways
- intrusion prevention systems

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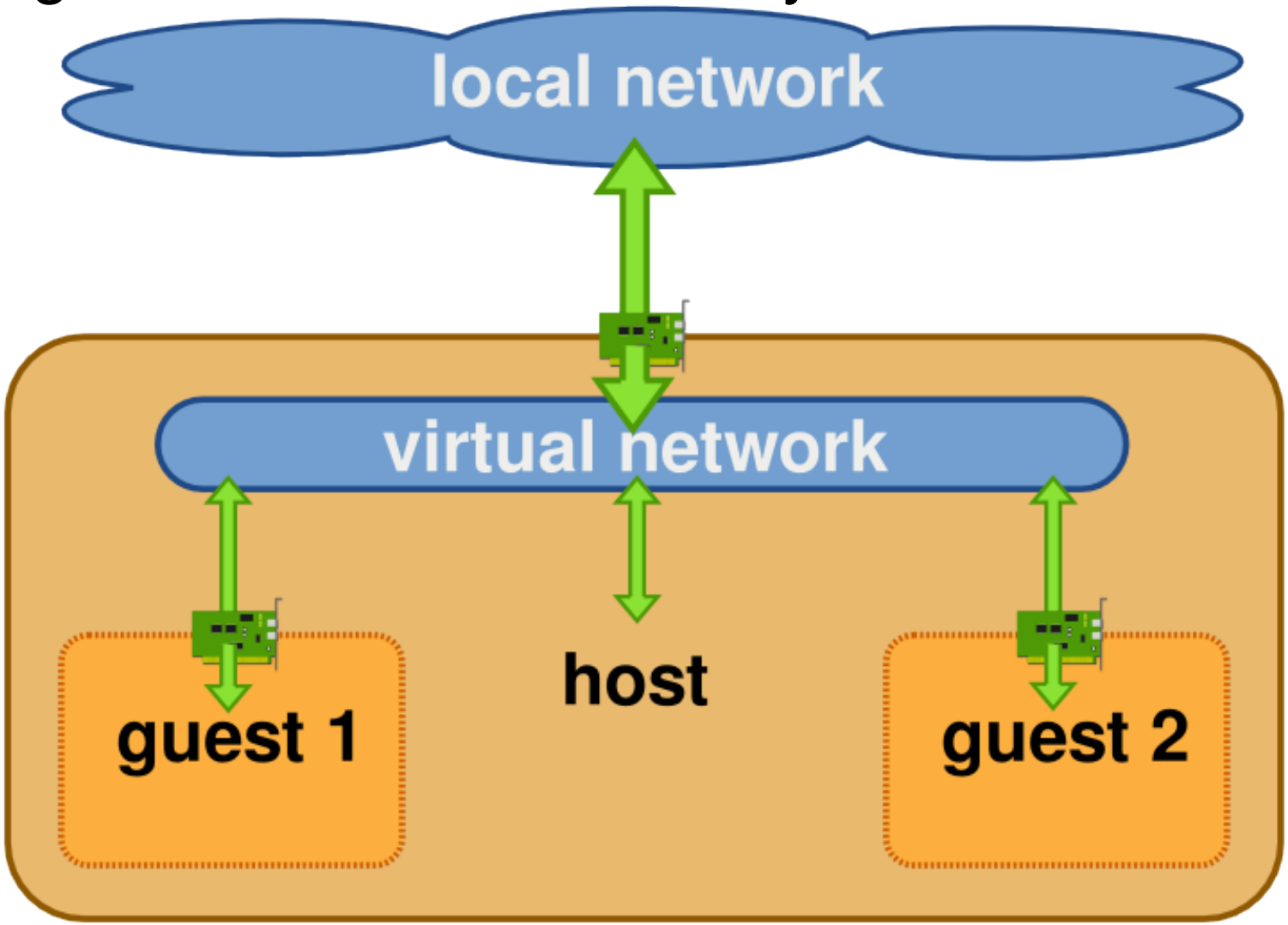
Using firewalls in virtualized systems



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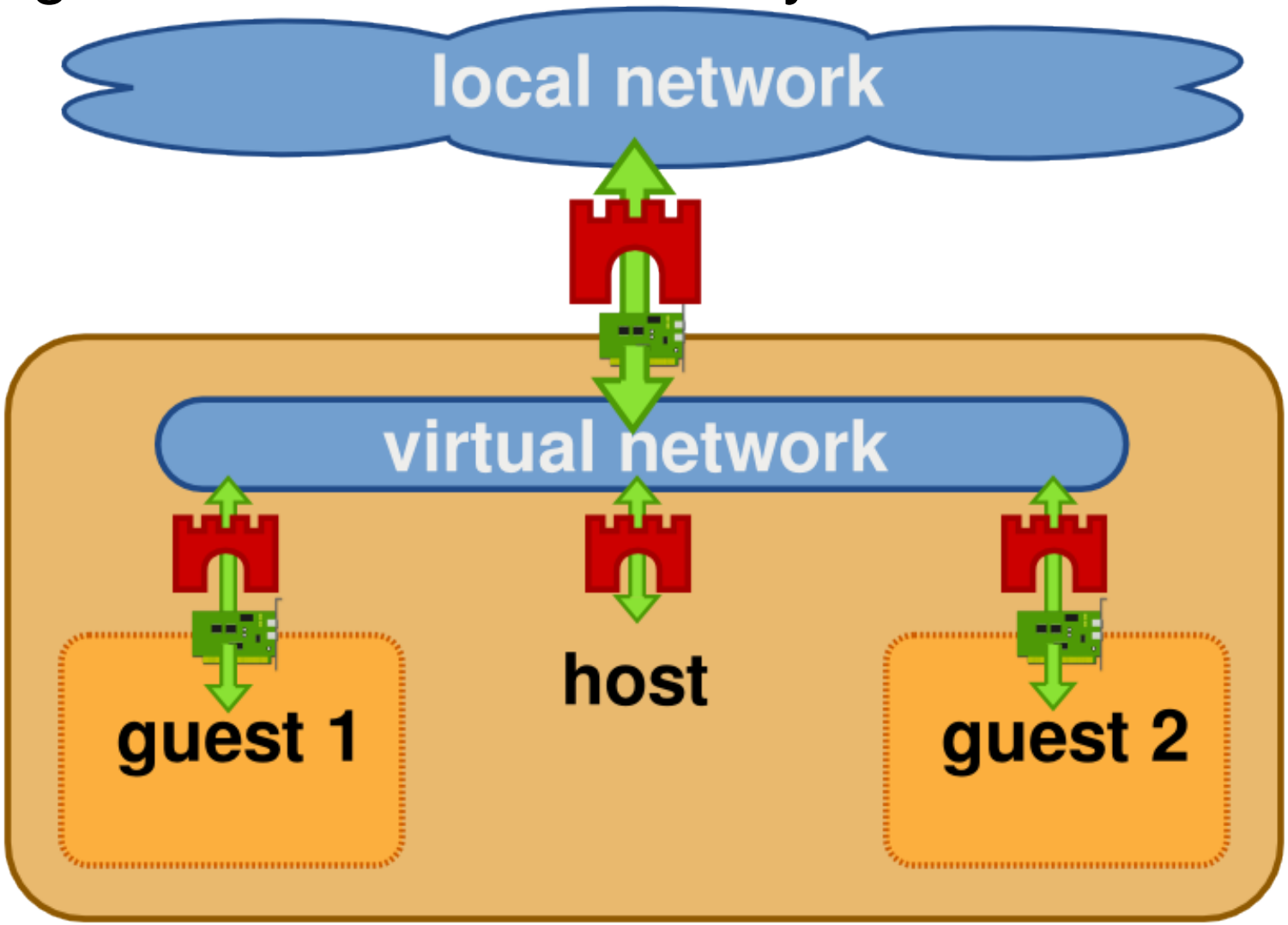
Using firewalls in virtualized systems



IP-Switch

Security by using SDN

a special OpenFlow controller which implements

- ARP server
- DHCP server
- topology detection
- shortest path routing
- authorisation

OpenFlow switches act as gateways.

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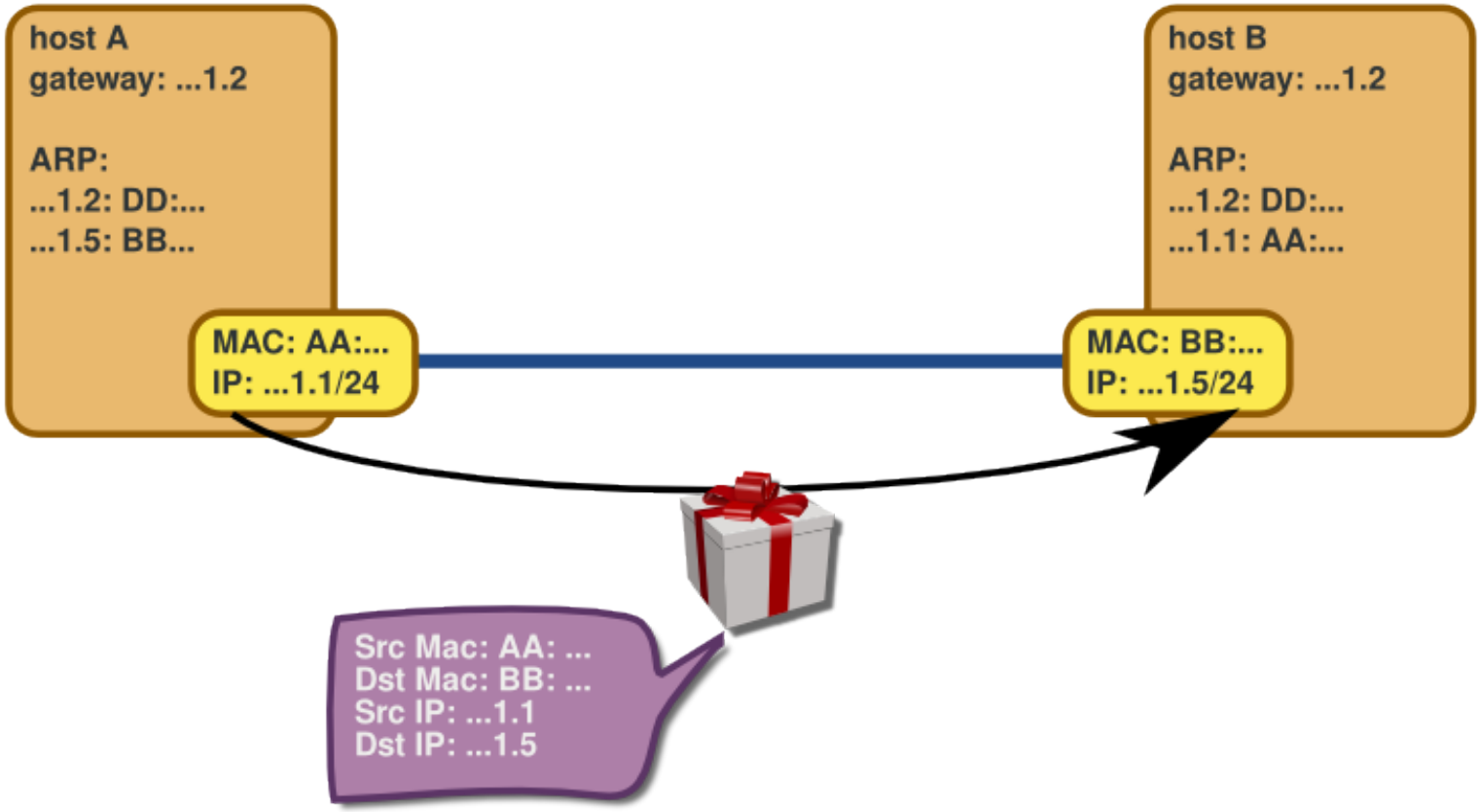
Same subnet

Same subnet


host A
gateway: ...1.2
ARP:
...1.2: DD:...
...1.5: BB...
MAC: AA:...
IP: ...1.1/24
host B
gateway: ...1.2
ARP:
...1.2: DD:...
...1.1: AA:...
MAC: BB:...
IP: ...1.5/24
Src Mac: AA: ...
Dst Mac: BB: ...
Src IP: ...1.1
Dst IP: ...1.5

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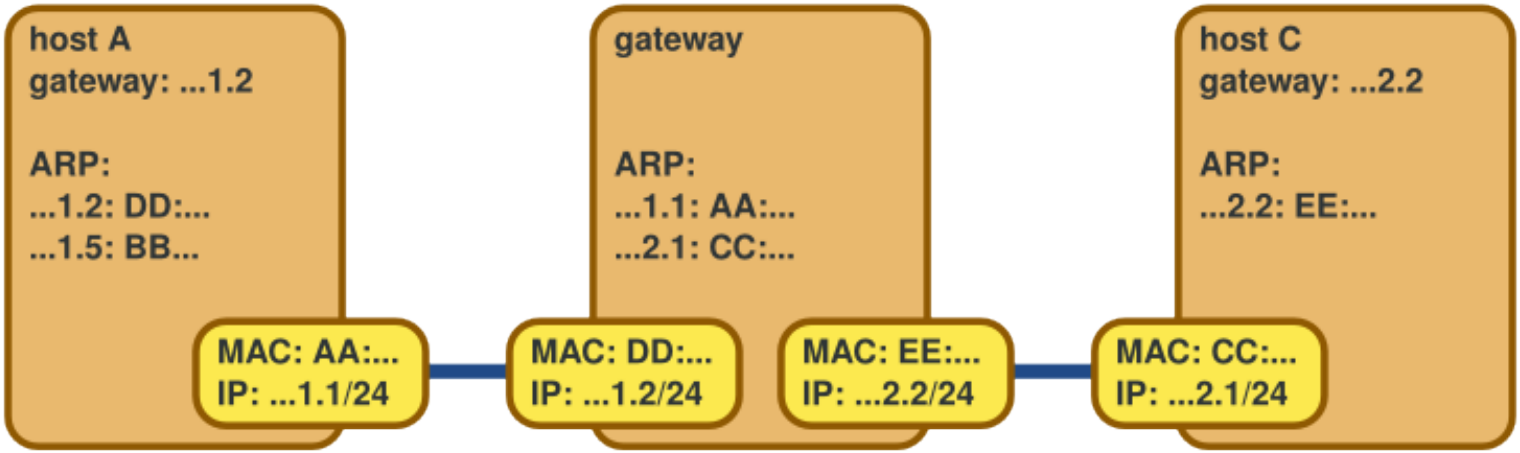
Different subnets connected by a gateway



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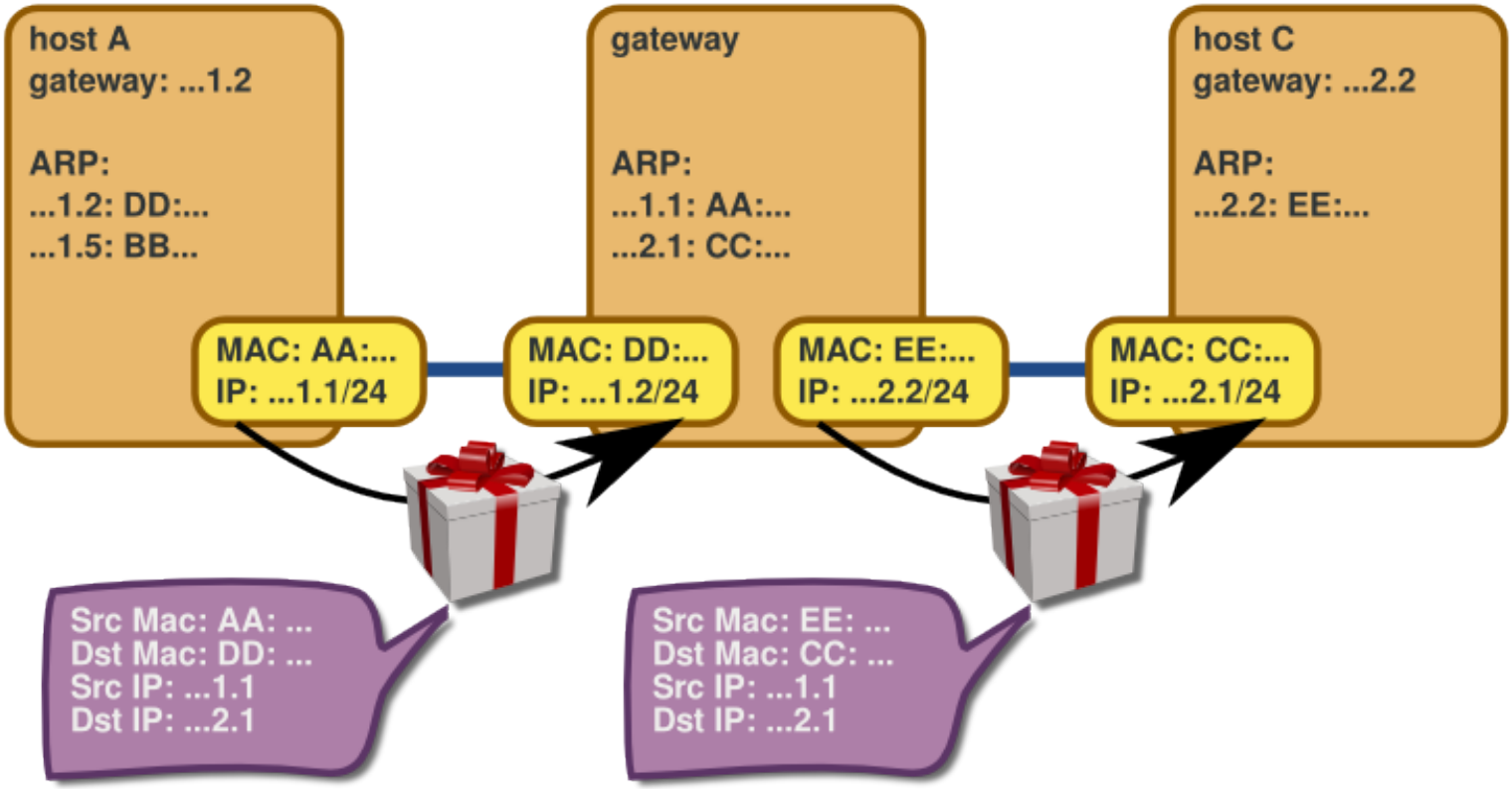
Different subnets connected by a gateway



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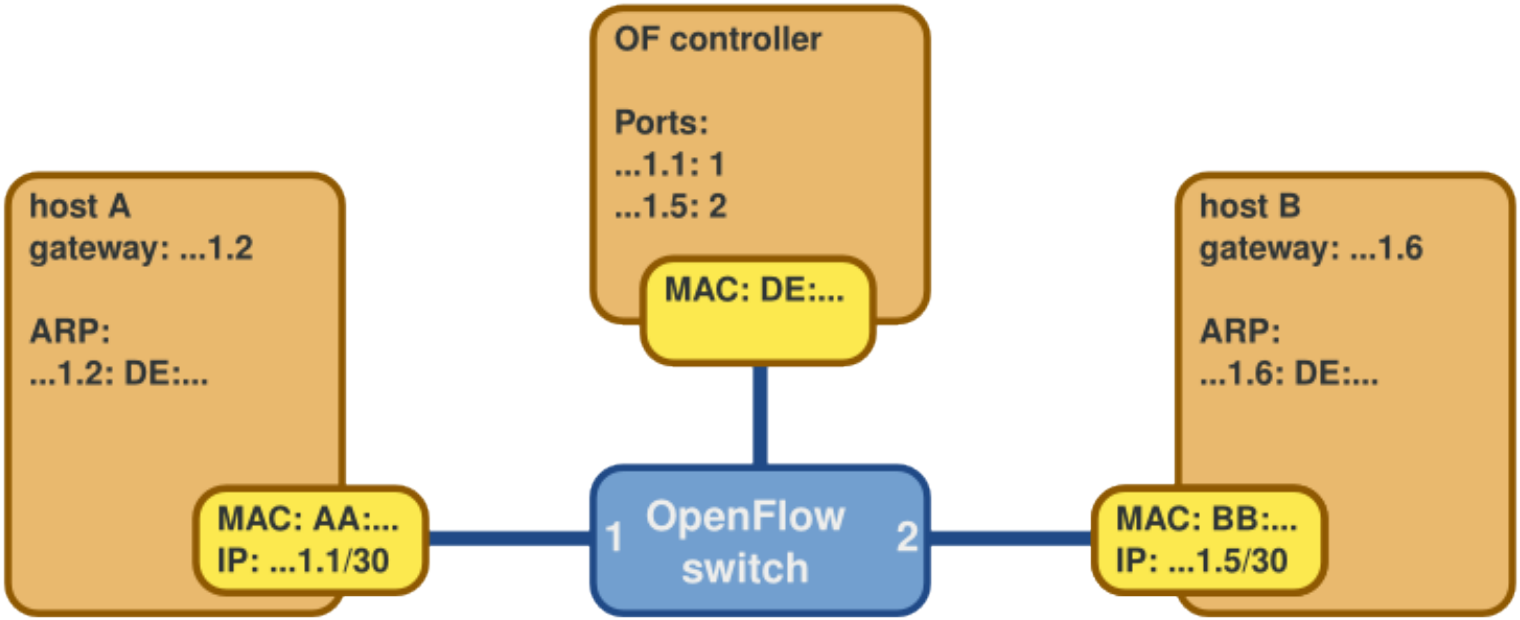
IP Switching



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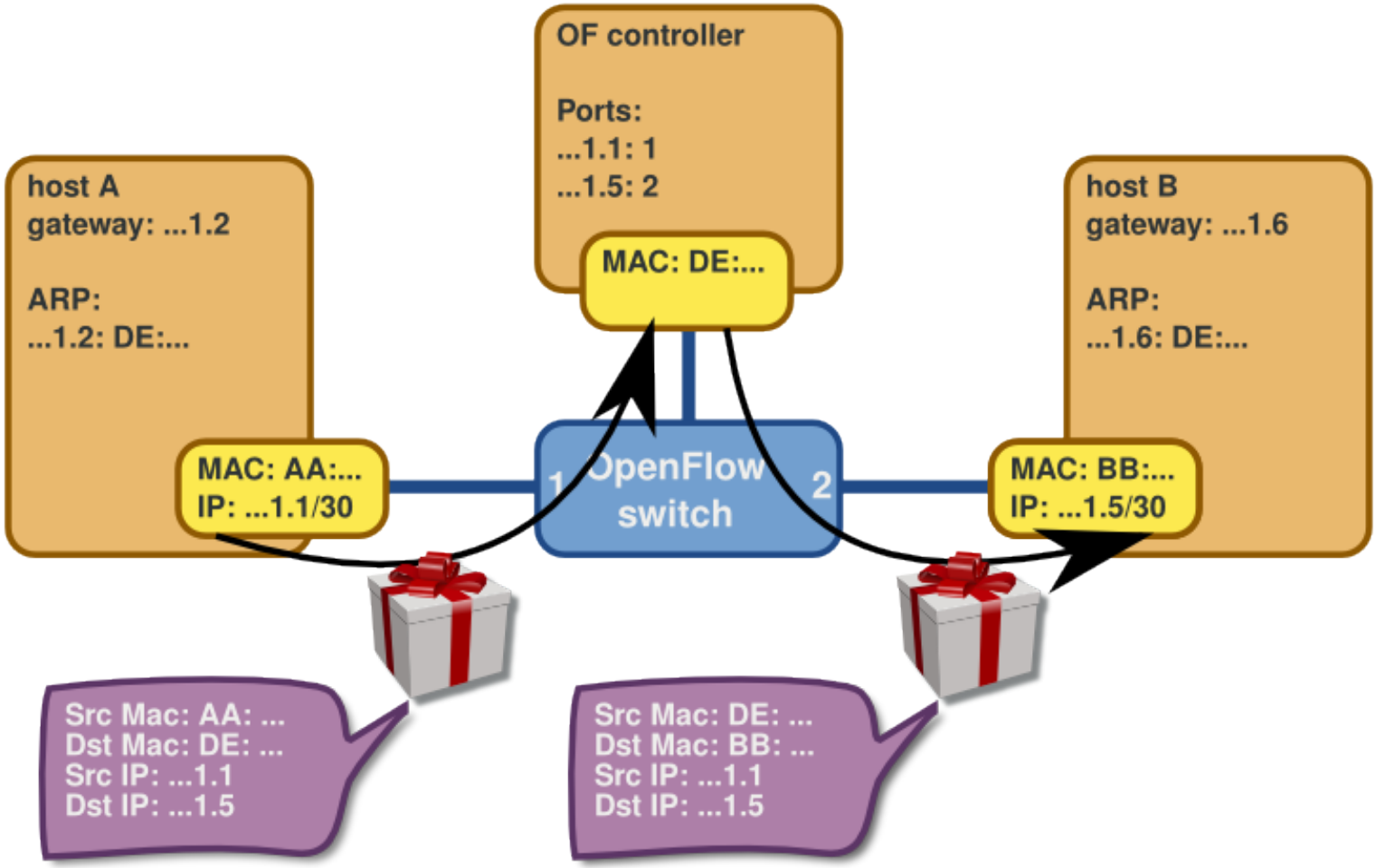
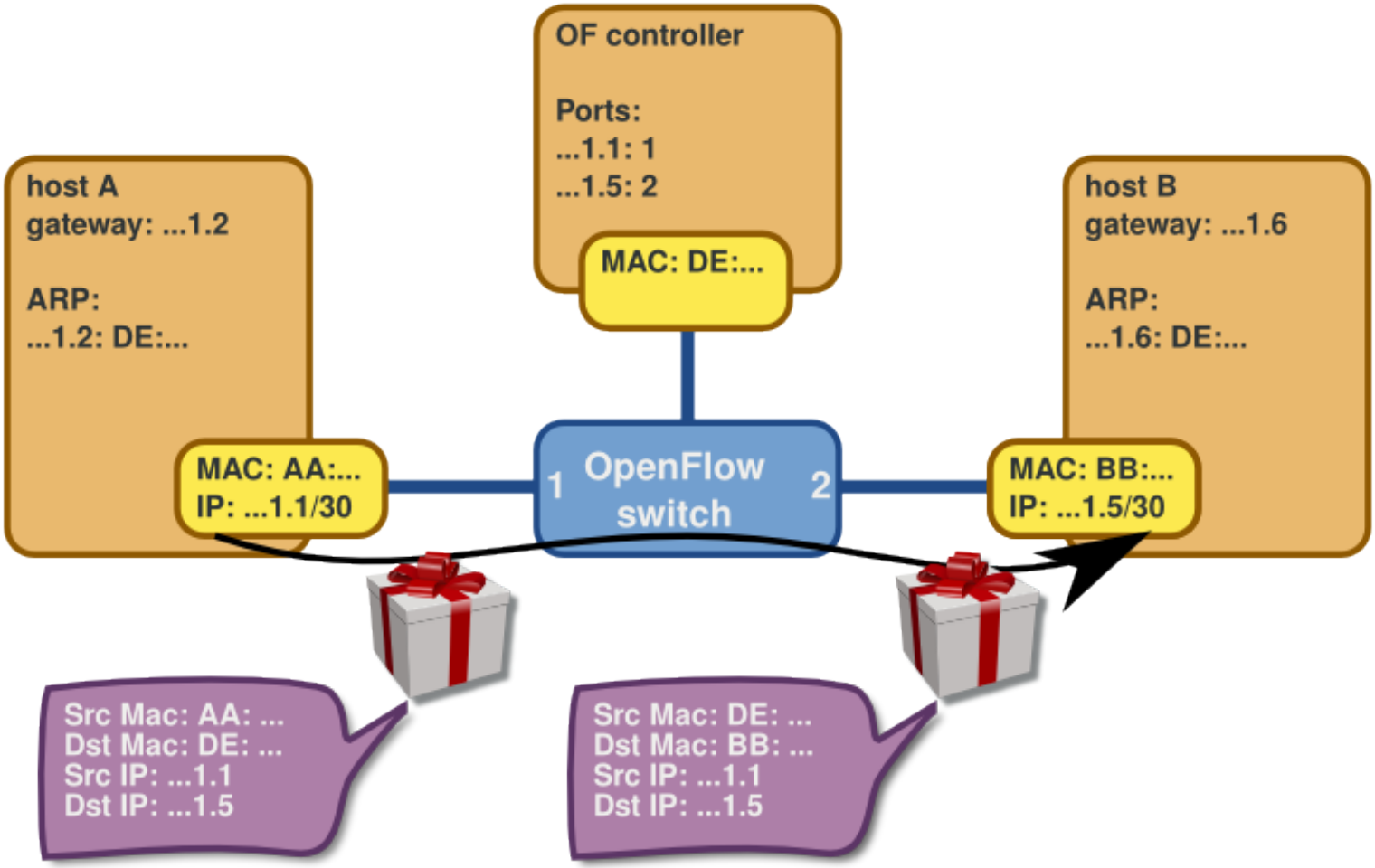


IP Switching



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Evaluation: goals achieved?

dividing the network in smaller chunks by using:

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- configuring subnets
- intelligent switches

- router
- packet filter

- statefull firewalls

- application level gateways

- intrusion prevention systems

Evaluation: goals achieved?

dividing the network in smaller chunks by using:

- cabling ⇒ setting up connections with Open vSwitch
- configuring subnets
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Evaluation: goals achieved?

dividing the network in smaller chunks by using:

- cabling ⇒ setting up connections with Open vSwitch
- configuring subnets ⇒ not applicable
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dividing the network in smaller chunks by using:

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- statefull firewalls ⇒ can be implemented by the OpenFlow controller
- application level gateways ⇒ can be implemented by the OpenFlow controller
- intrusion prevention systems ⇒ can be implemented by the OpenFlow controller

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Feasability studies

- performance measurements
- testing the counteractions
- simulation with Mininet
- real world tests with a physical WiFi

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Testing with Mininet

- rapid prototyping for Software Defined Networks
- network emulation with hosts, switches and links
- Python based
- uses process based virtualization and network namespaces

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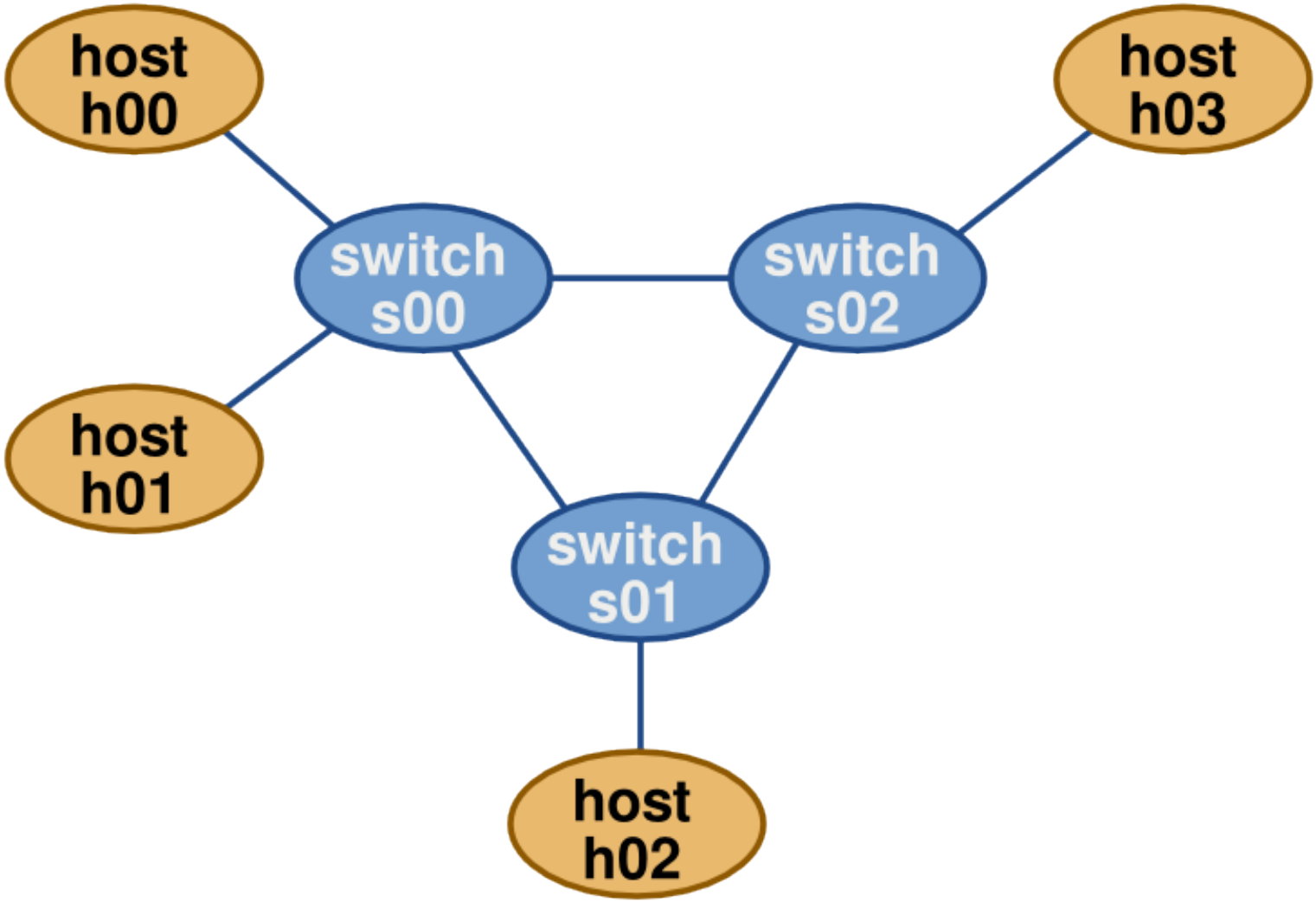
Demonstration OpenFlow Controller



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Questions?