



UNIVERSITÀ
DEGLI STUDI
DI PADOVA



Master's degree ICT Internet Multimedia Engineering

Department of Information Engineering (DEI)
Master degree on ICT for Internet and Multimedia Engineering (MIME)

Internet

Introduction on LAB1

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About computer networks

Computer networks are quite complex

- several devices (computers, routers, etc.)
- several interfaces (Ethernet, Wi-Fi, etc.)
- several protocols running
- physical interconnections originate complex topologies

Performing experiments may be unfeasible

- network equipment is expensive
- sometimes, even for performing simple experiments, several equipment should be available in the same test bed

SOLUTION: NETWORK EMULATOR

About network emulators

Emulation systems aim at accurately **reproducing** the functionalities of a real-life system (configurations, architectures, protocols)

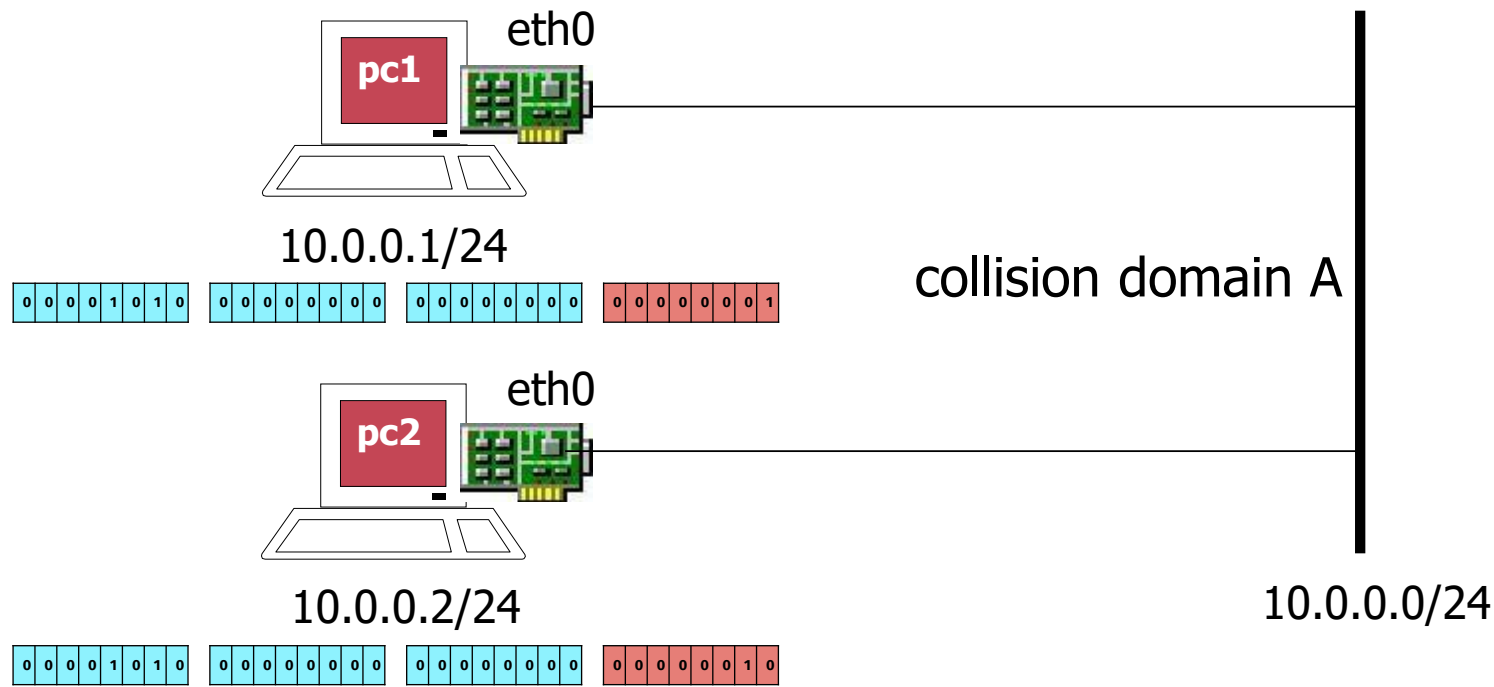
The network emulator we will use in our LAB experiences is **Kathará** (which implements the notorious Netkit using Python and Docker)

- each emulated network device (host, router, server, ...) is a **container**
- several containers are created inside a single host machine
- containers are connected to virtual collision domains (IP networks) and thus can communicate with each other



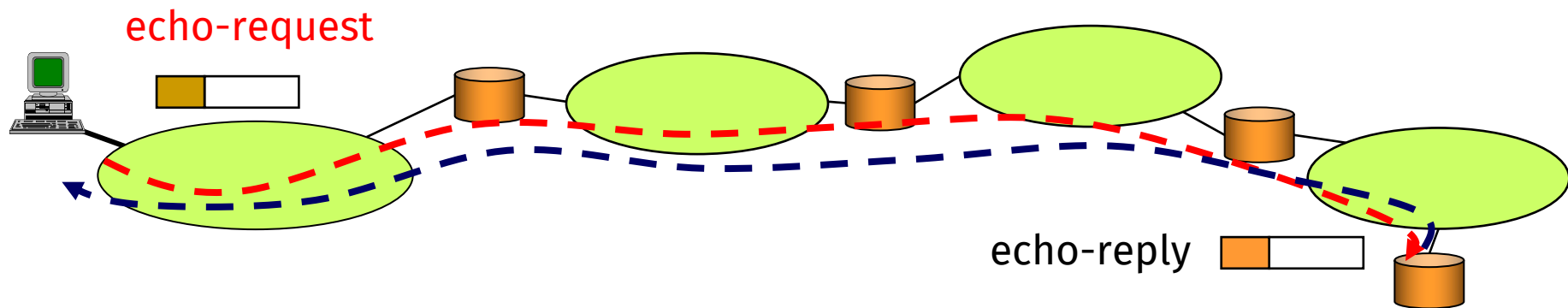
LAB1 Experience: Two Hosts

- Create a network with two hosts connected to the same collision domain
- Ensure that the two hosts can communicate with each other → **PING**



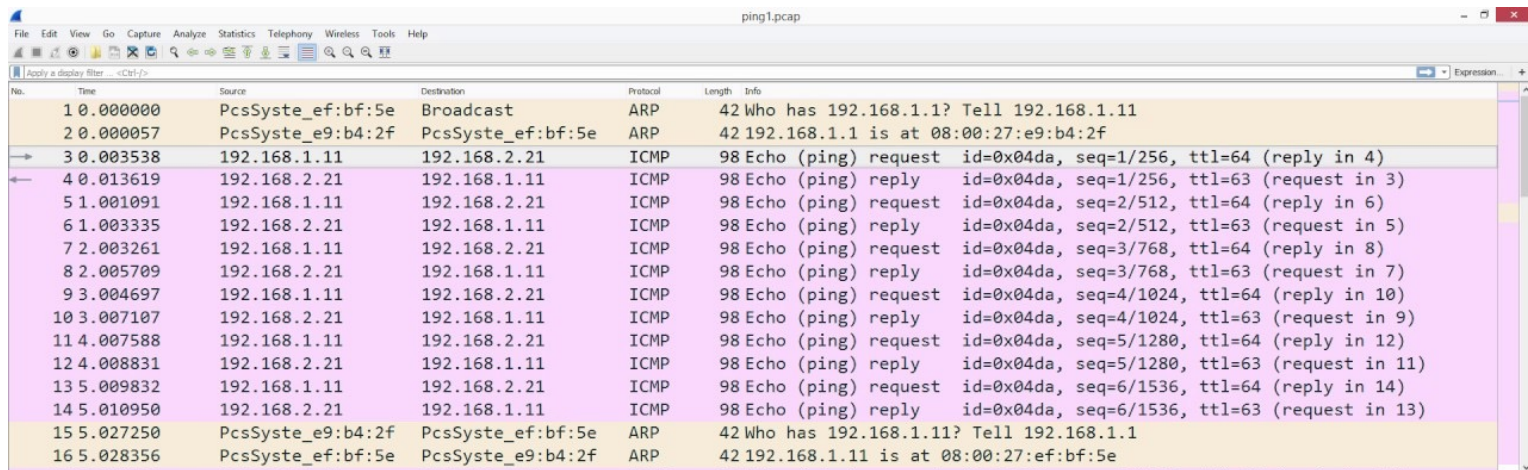
PING message

- The IPv4 has no error-reporting error-correcting mechanism. It also lacks a mechanism for host and management queries.
- The **Internet Control Message Protocol (ICMP)** has been designed to compensate for the above two deficiencies.
- ICMP allows a host/router to send **echo request** messages to another host or router; if the latter is alive, it responds with an **echo reply** message (ping)



tcpdump and Wireshark

- When one host is pinging another host, we can capture all packets exchanged on the collision domain
- We use **tcpdump**, a network sniffer that is widely available on Linux
- tcpdump results are saved in a .pcap file, that can be opened using a packet dissector → we will use **Wireshark**
- Using Wireshark, you can go into the packet (looking at each header field at every level of the ISO/OSI stack, and the payload)



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	PcsSyste_ef:bf:5e	Broadcast	ARP	42	Who has 192.168.1.1? Tell 192.168.1.11
2	0.000057	PcsSyste_e9:b4:2f	PcsSyste_ef:bf:5e	ARP	42	192.168.1.1 is at 08:00:27:e9:b4:2f
3	0.003538	192.168.1.11	192.168.2.21	ICMP	98	Echo (ping) request id=0x04da, seq=1/256, ttl=64 (reply in 4)
4	0.013619	192.168.2.21	192.168.1.11	ICMP	98	Echo (ping) reply id=0x04da, seq=1/256, ttl=63 (request in 3)
5	1.001091	192.168.1.11	192.168.2.21	ICMP	98	Echo (ping) request id=0x04da, seq=2/512, ttl=64 (reply in 6)
6	1.003335	192.168.2.21	192.168.1.11	ICMP	98	Echo (ping) reply id=0x04da, seq=2/512, ttl=63 (request in 5)
7	2.003261	192.168.1.11	192.168.2.21	ICMP	98	Echo (ping) request id=0x04da, seq=3/768, ttl=64 (reply in 8)
8	2.005709	192.168.2.21	192.168.1.11	ICMP	98	Echo (ping) reply id=0x04da, seq=3/768, ttl=63 (request in 7)
9	3.004697	192.168.1.11	192.168.2.21	ICMP	98	Echo (ping) request id=0x04da, seq=4/1024, ttl=64 (reply in 10)
10	3.007107	192.168.2.21	192.168.1.11	ICMP	98	Echo (ping) reply id=0x04da, seq=4/1024, ttl=63 (request in 9)
11	4.007588	192.168.1.11	192.168.2.21	ICMP	98	Echo (ping) request id=0x04da, seq=5/1280, ttl=64 (reply in 12)
12	4.008831	192.168.2.21	192.168.1.11	ICMP	98	Echo (ping) reply id=0x04da, seq=5/1280, ttl=63 (request in 11)
13	5.009832	192.168.1.11	192.168.2.21	ICMP	98	Echo (ping) request id=0x04da, seq=6/1536, ttl=64 (reply in 14)
14	5.010950	192.168.2.21	192.168.1.11	ICMP	98	Echo (ping) reply id=0x04da, seq=6/1536, ttl=63 (request in 13)
15	5.027250	PcsSyste_e9:b4:2f	PcsSyste_ef:bf:5e	ARP	42	Who has 192.168.1.11? Tell 192.168.1.1
16	5.028356	PcsSyste_ef:bf:5e	PcsSyste_e9:b4:2f	ARP	42	192.168.1.11 is at 08:00:27:ef:bf:5e