performing databases

Gateway to Hell
-
Networking Basics for DBAs, DEVs and DEVOPs

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and
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Mitterteich / Germany

Speaker

- Martin Klier
- Solution Architect and Database Expert
- My focus:
  - Performance + Tuning
  - Highly available systems
  - Cluster and Replication
- Linux since 1997
- Oracle Database since 2003

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The German Oracle Database Community

Oracle ACE Director

SYMPOSIUM 42
Proud Member of symposium42

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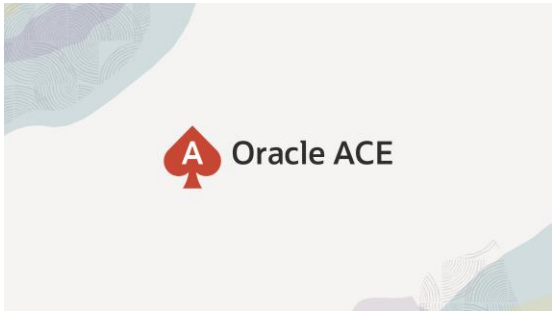
Performing Databases

- Three Experts for Database technology
  - Concepts and Project Competence
  - Architecture- and System planning
  - Licensing
  - Implementation and Troubleshooting

- Get in touch
  - Performing Databases GmbH
    Wiesauer Strasse 27
    95666 Mitterteich // Germany
  - http://www.performing-databases.com
  - Social: @PerformingDB

starting 01/2025
Managed Services

… it‘s all about Community!



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https://www.ora2know.de

Good communication
is the bridge between
Confusion and Clarity

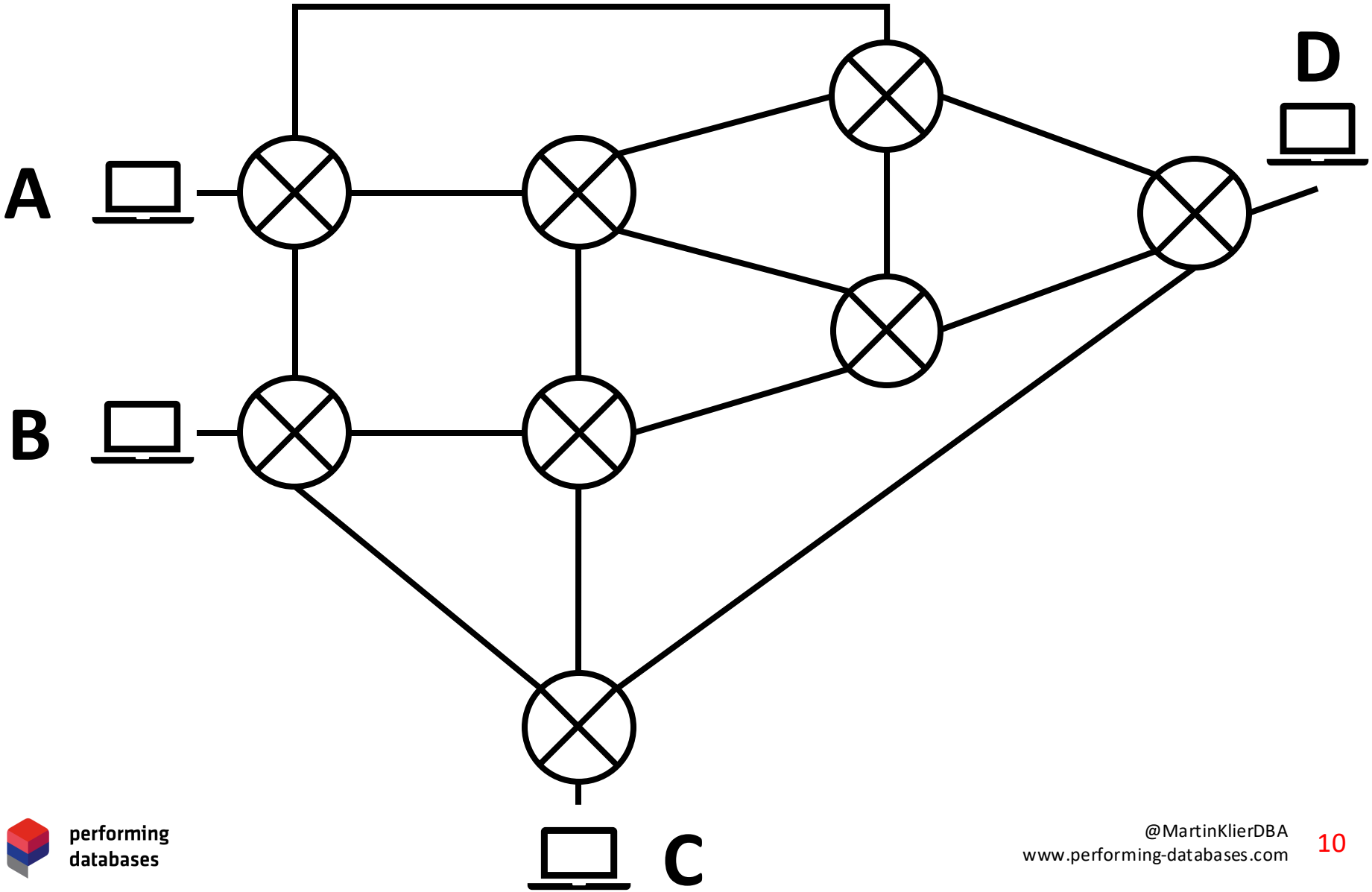
~ Nat Turner, Slave Rebel

The Idea of an "Internet Protocol" (IP)


SHALL WE PLAY A GAME

IP's Mission: Survive Hell

IP's Mission: Survive Hell



IP's Mission: Survive Hell

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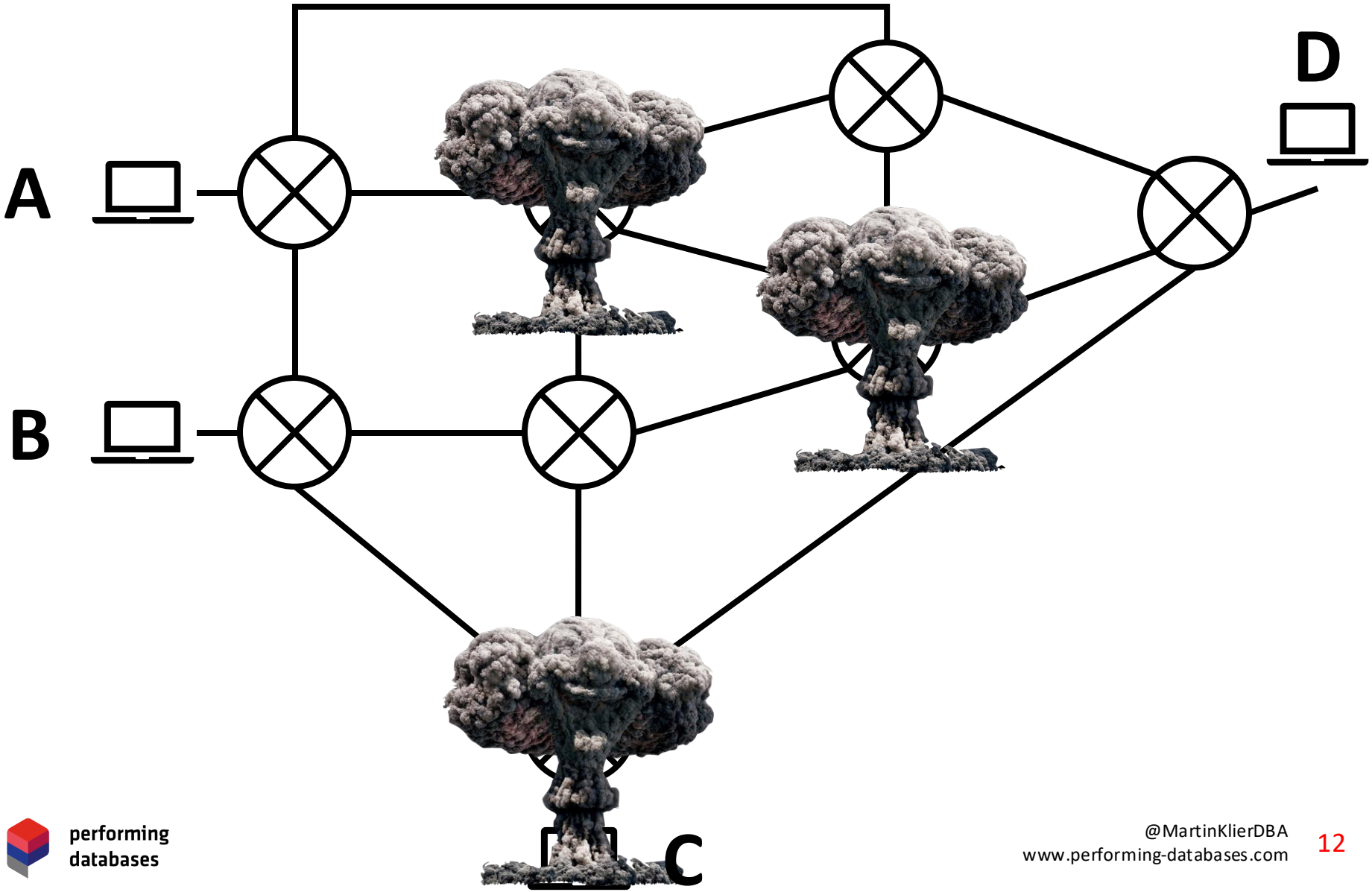
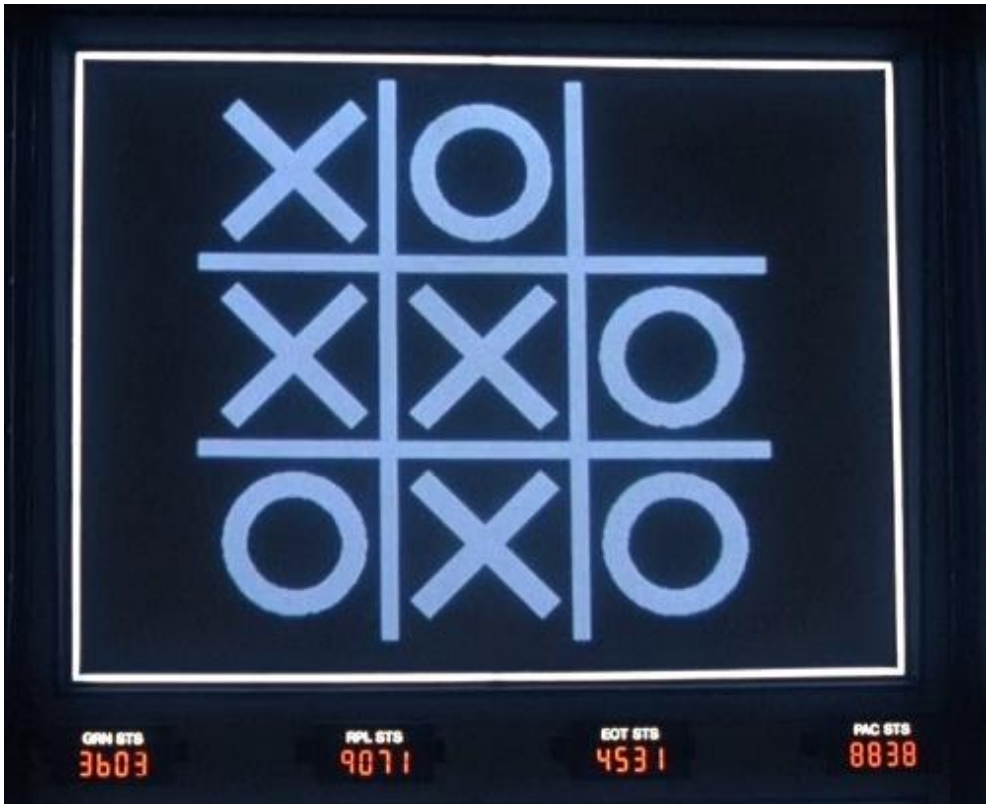


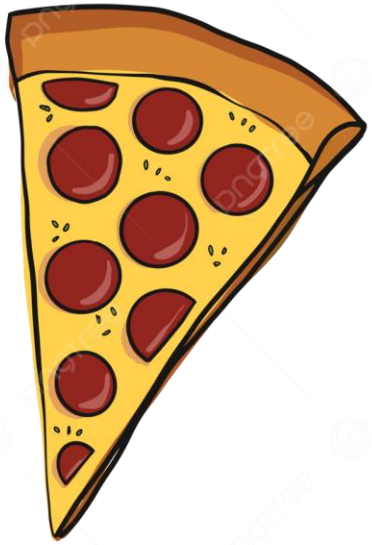
Disclaimer



The only winning move is not to play.

First Things First: Basics

ISO/OSI's 7 Layer Model



Away!
Pizza
Sausage
Throw
Not
Do
Please

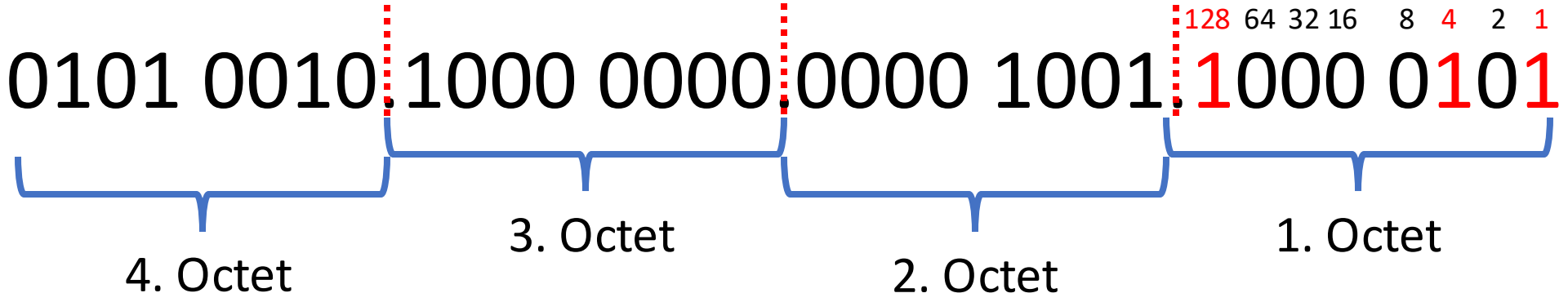
Application	Database
Presentation	Database
Session	Oracle TNS
Transport	TCP, UDP
Network	IP
Data Link	Ethernet Proto.
Physical	Ethernet/Cable

IP and all the stuff...

The IP Address

82.128.9.133

082.128.009.133



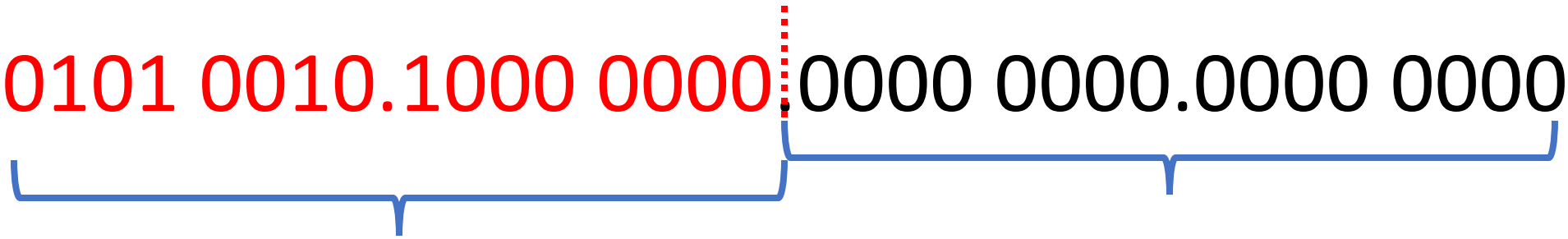
(IPv4 example, concept in IPv6 is similar)

The IP Network

82.128.0.0/16

082.128.000.000

0101 0010.1000 0000.0000 0000.0000 0000



16-bit network part

host part

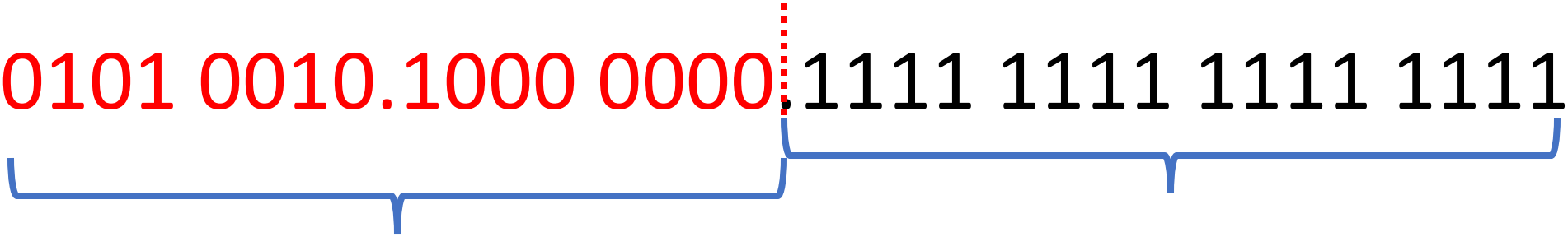
= the “network address”

The IP Network

82.128.255.255/16

082.128.255.255

0101 0010.1000 0000.1111 1111 1111 1111



16-bit network part

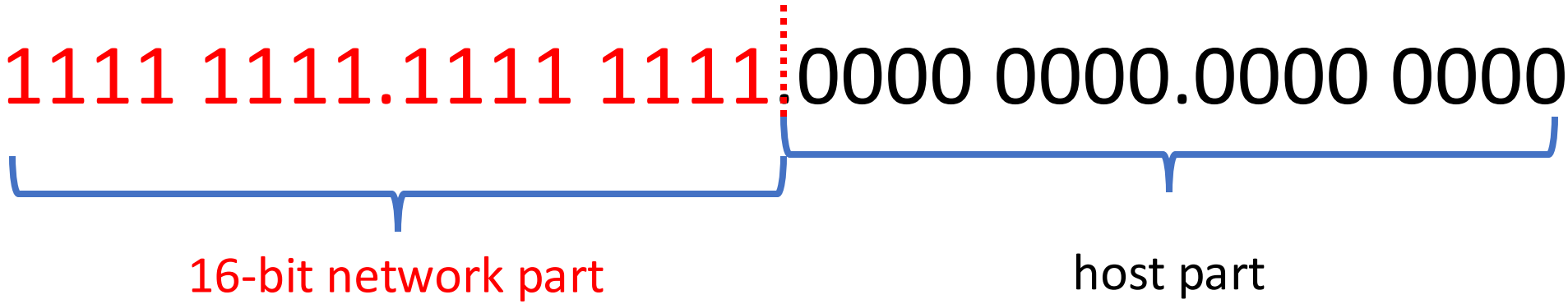
host part all “1”
all hosts reached

= the “broadcast address”

The IP Network Mask

Tell the machine where the network part ends

255.255.000.000



~~The IP Network Classes~~

(worked without network masks ...)

255.000.000.000	8bit	~~Class A~~
255.255.000.000	16bit	~~Class B~~
255.255.255.000	24bit	~~Class C~~

Not used for Internet Routing any more

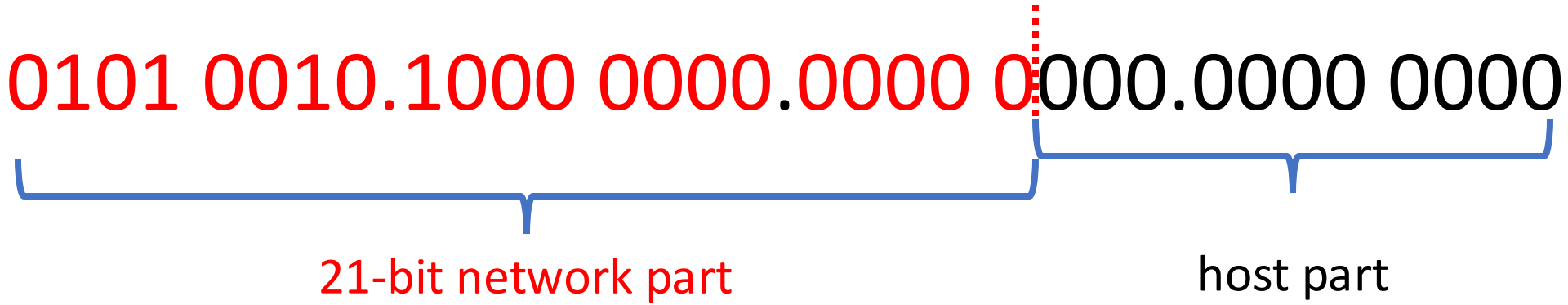
In practice often Octet-Delimiters = Network-Delimiters

We all are lazy. ☺

Classless Inter-Domain Routing CIDR

82.128/21

082.128.000.000



= Network Mask: 255.255.248.0

Sub and Super

Subnetting

082.128.000.000/21

0101 0010.1000 0000.0000 0000.0000 0000

fixed / foreign-owned 21bits

flexible / my own 11bits

0101 0010.1000 0000.0000 0000.0000 0000

my subnet

my hosts

21+4 bits used for the network now:
82.128.0.0/25

Supernetting

082.128.000.000/21

0101 0010.1000 0000.0000 0000.0000 0000

Network 21bit

Hosts 11bits

0101 0010.0000 0000.0000 0000.0000 0000

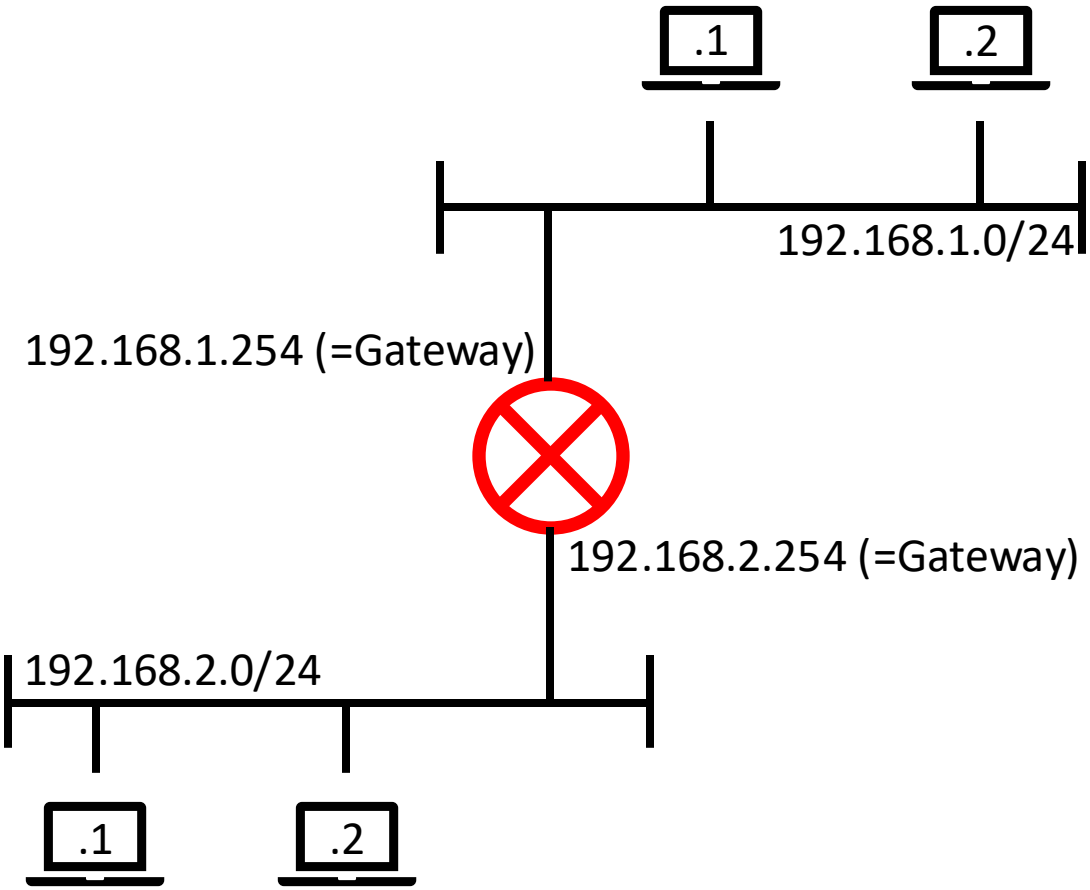
supernet

Subnets and Hosts 24bits

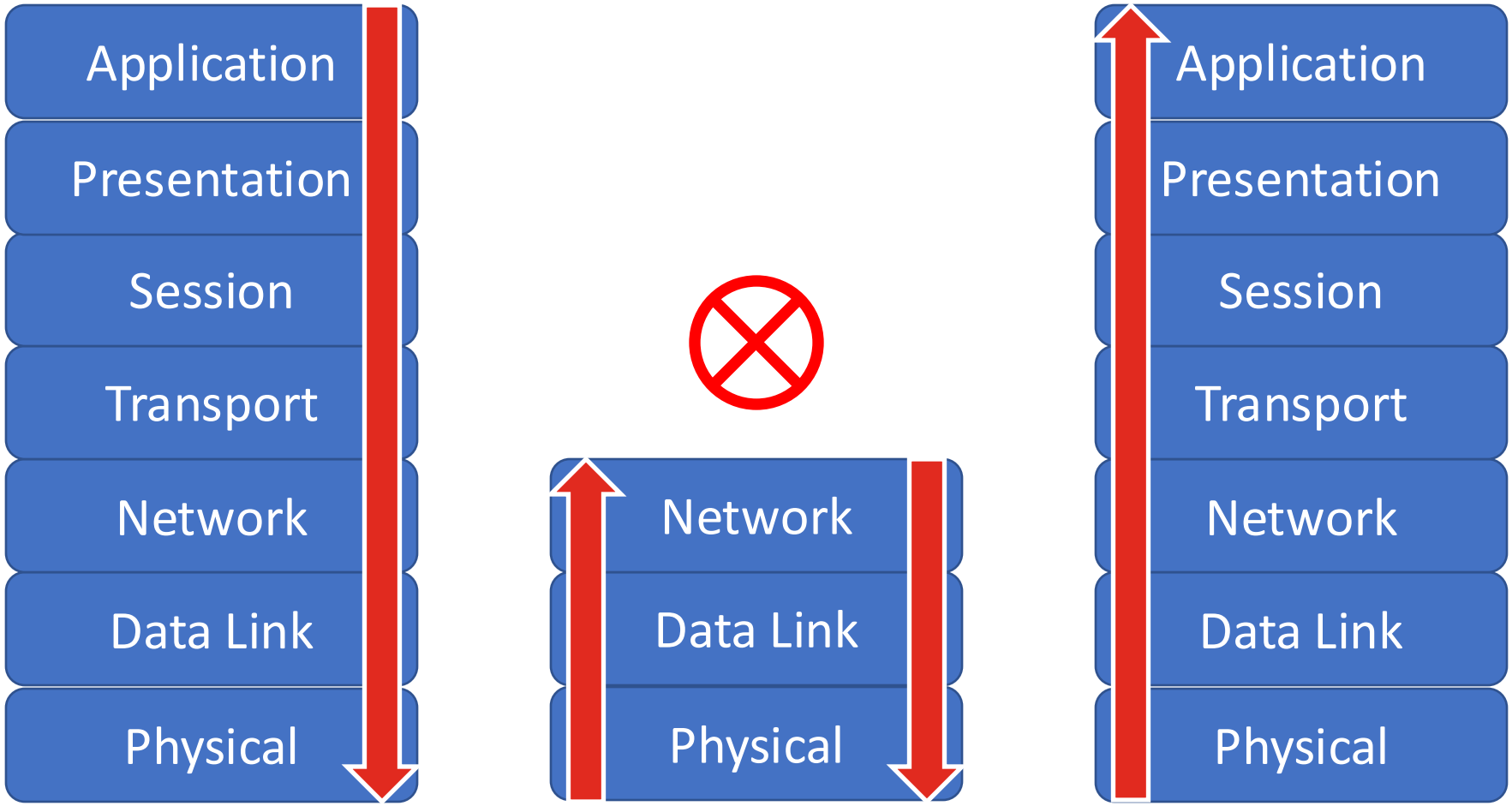
8 bits used for the network now:
82.0.0.0/8 contains 82.128/21 and many more

Routing

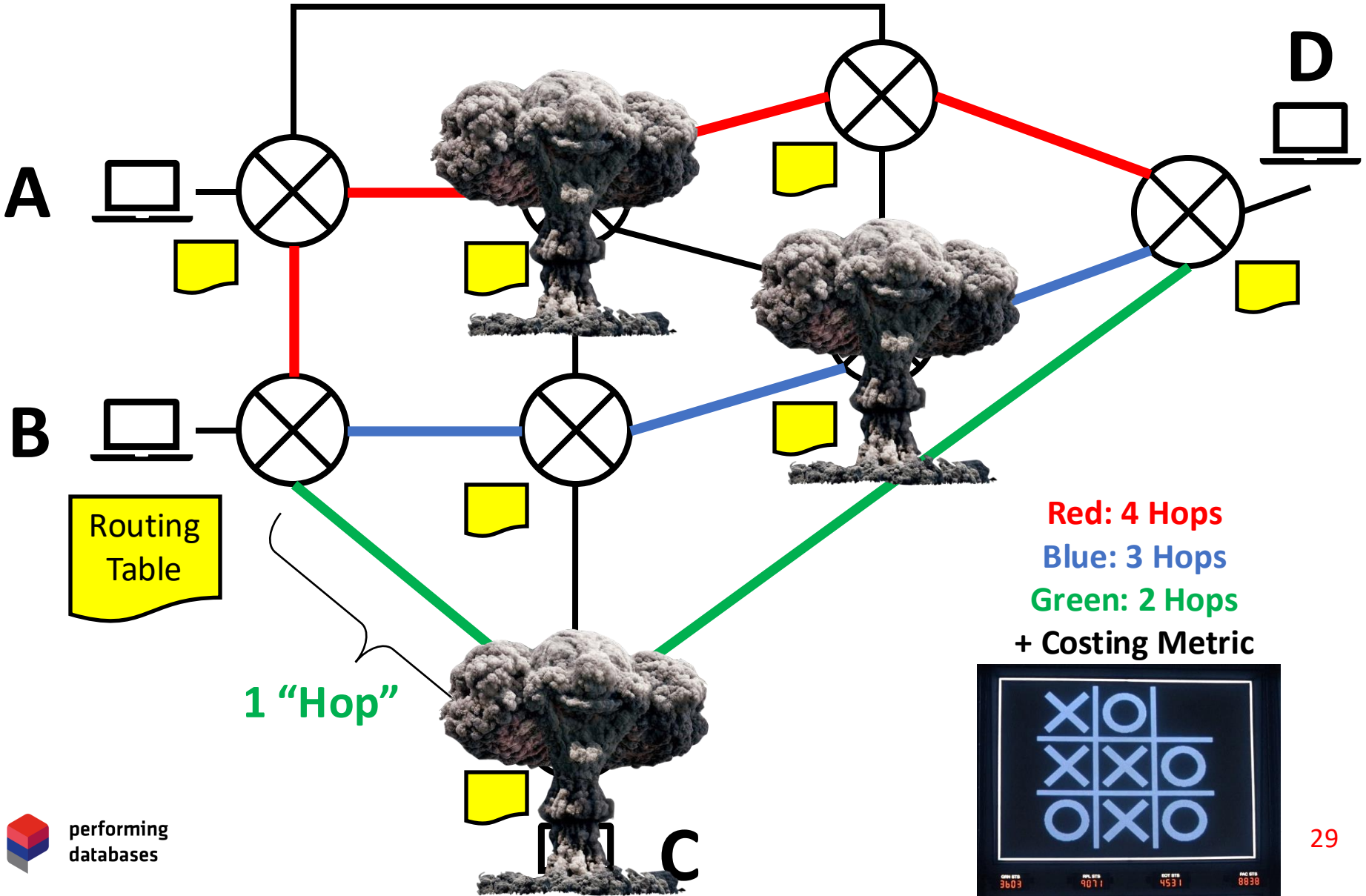
Routing: Connecting Networks



Routing in Layers

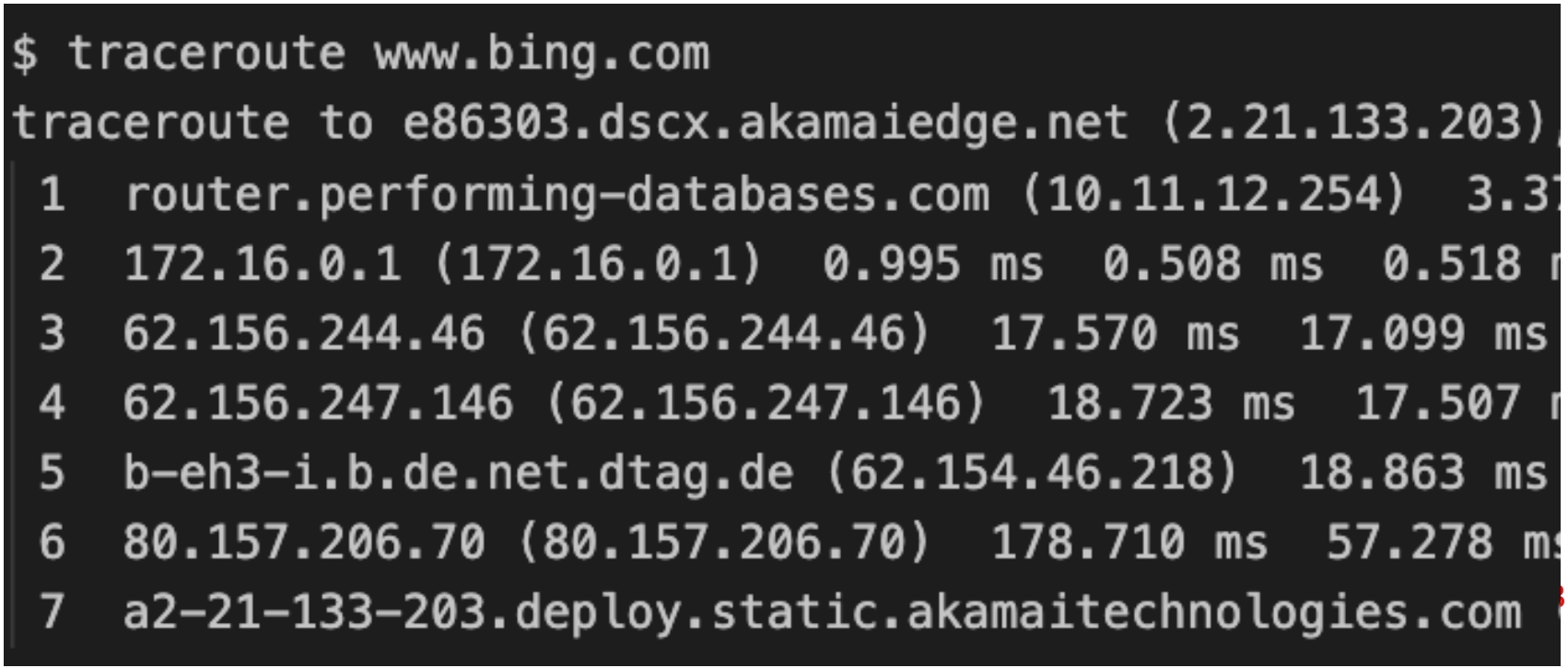


IP: Routing Around Hell



Finding Hops: traceroute

```
$ traceroute www.bing.com
traceroute to e86303.dscx.akamaiedge.net (2.21.133.203), 64 hops max, 52 byte packets
 1  router.performing-databases.com (10.11.12.254)  3.372 ms  0.302 ms  0.284 ms
 2  172.16.0.1 (172.16.0.1)  0.995 ms  0.508 ms  0.518 ms
 3  62.156.244.46 (62.156.244.46)  17.570 ms  17.099 ms  16.433 ms
 4  62.156.247.146 (62.156.247.146)  18.723 ms  17.507 ms  17.264 ms
 5  b-eh3-i.b.de.net.dtag.de (62.154.46.218)  18.863 ms  17.948 ms  17.900 ms
 6  80.157.206.70 (80.157.206.70)  178.710 ms  57.278 ms  305.652 ms
 7  a2-21-133-203.deploy.static.akamaitechnologies.com (2.21.133.203)  18.831 ms  17.479 ms  17.002 ms
```



Local Addresses

10.0.0.0/8
172.16.0.0/12
192.168.0.0/16

= not routed on the internet

Reserved private IPv4 network ranges[2]

Name	CIDR block	Address range	Number of addresses	*Classful* description
24-bit block	10.0.0.0/8	10.0.0.0 – 10.255.255.255	16 777 216	Single Class A.
20-bit block	172.16.0.0/12	172.16.0.0 – 172.31.255.255	1 048 576	Contiguous range of 16 Class B blocks.
16-bit block	192.168.0.0/16	192.168.0.0 – 192.168.255.255	65 536	Contiguous range of 256 Class C blocks.

Socket Communication

The Socket

describes a connection unambiguously

ClientIP:ClientPort – ServerIP:ServerPort

My Macbook connected to an HTTPS Server on the Internet:
192.168.118.120:50479 connected to 149.154.167.41:443

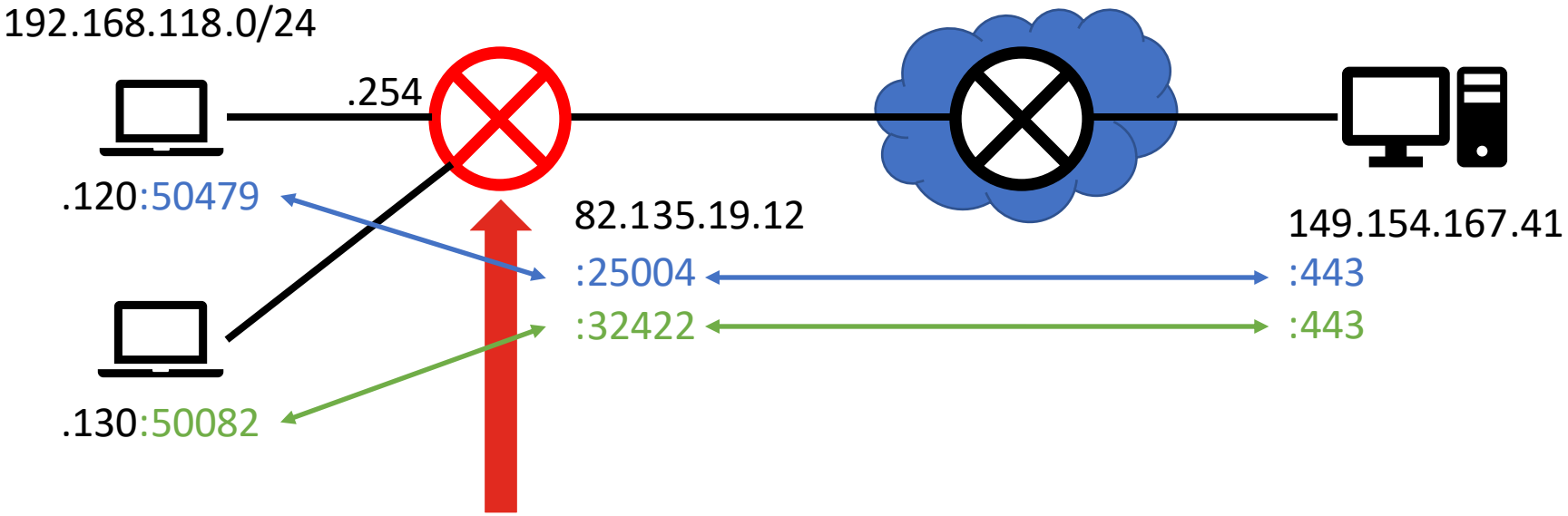
```
$ netstat -tn | grep tcp4
tcp4       0      0  192.168.118.120.50479  149.154.167.41.443     ESTABLISHED
tcp4       0      0  192.168.118.120.50082  149.154.167.41.443     ESTABLISHED
```

Network Address Translation (NAT)

(simplified)

```
$ netstat -tn | grep tcp4
tcp4       0      0  192.168.118.120.50479  149.154.167.41.443     ESTABLISHED
tcp4       0      0  192.168.118.120.50082  149.154.167.41.443     ESTABLISHED
```

But wait – Local Address...?



Good spot for the Firewall!

“The single biggest problem
in communications is the illusion
that it had taken place.”

~ George Bernard Shaw, Pacifist, Nobel Prize- and Oscar Winner

=> Use TCP for peace!

Domain Name System (DNS)

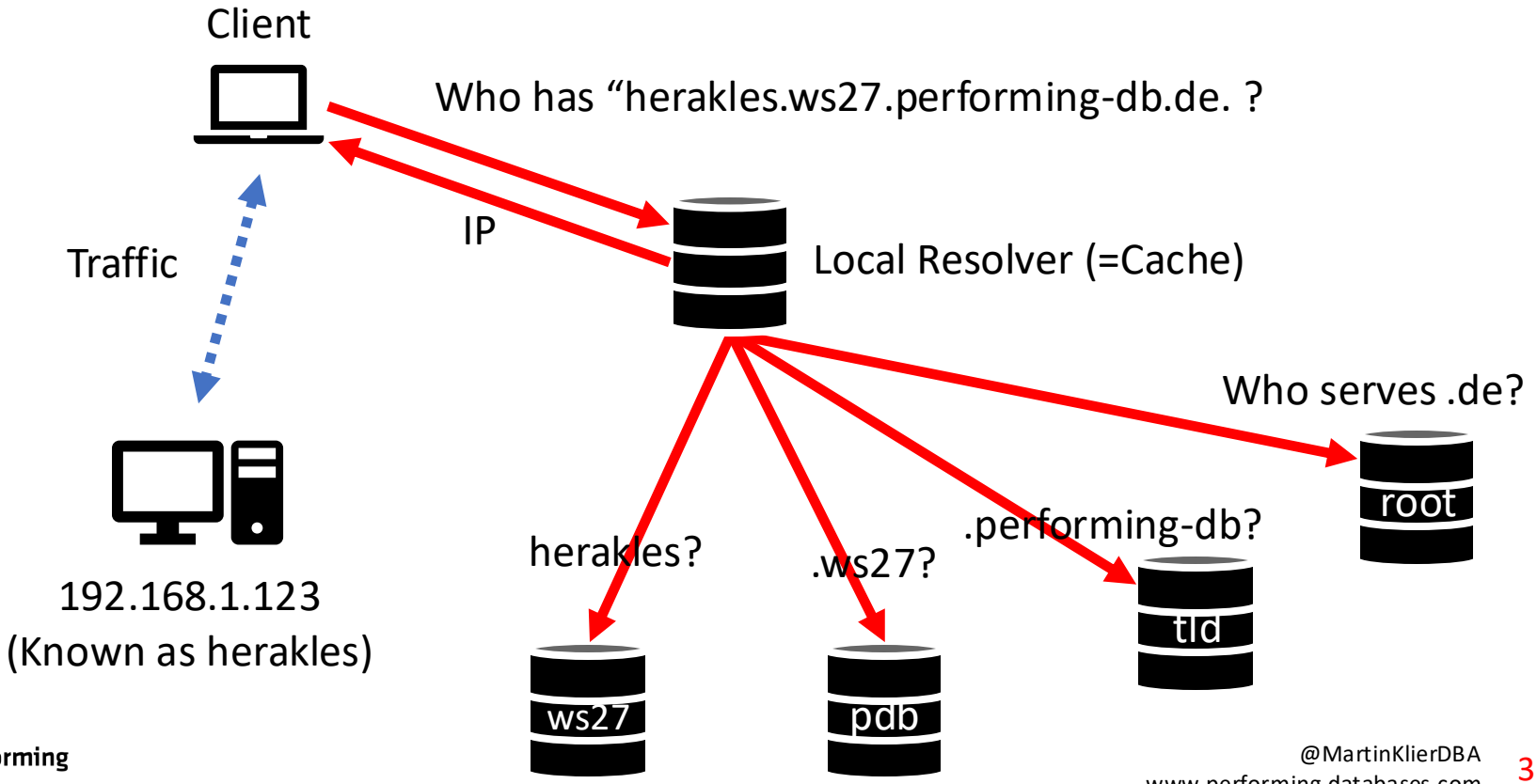
Domain Name

"Full Qualified Domain Name" (FQDN)

Forward Resolution

herakles.ws27.performing-db.de.

hostname sub domain domain top level root



Forward Resolution

```
$ dig www.performing-databases.com @8.8.8.8

; <<>> DiG 9.10.6 <<>> www.performing-databases.com @8.8.8.8
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 27924
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;www.performing-databases.com.  IN  A

;; ANSWER SECTION:
www.performing-databases.com. 600 IN    A   83.243.40.67

;; Query time: 81 msec
;; SERVER: 8.8.8.8#53(8.8.8.8)
;; WHEN: Wed May 24 22:37:52 CEST 2023
;; MSG SIZE  rcvd: 73
```

Oracle SCAN uses Forward Resolution

```
;; QUESTION SECTION:
;scan.mydomain. IN  A

;; ANSWER SECTION:
scan.mydomain. 600 IN   A   10.0.0.102
scan.mydomain. 600 IN   A   10.0.0.103
scan.mydomain. 600 IN   A   10.0.0.101
```

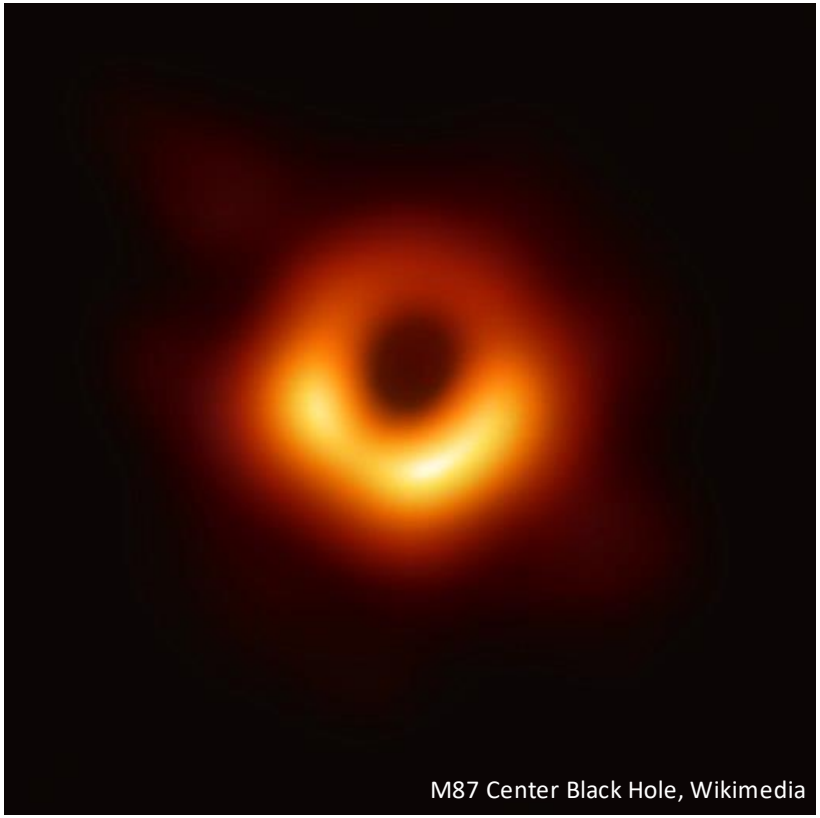
If done by any TNS EZconnect client, this leads to a tnsnames.ora-like ADDRESS_LIST:

```
(ADDRESS_LIST =    (ADDRESS = (Host = 10.0.0.102))
                   (ADDRESS = (Host = 10.0.0.103))
                   (ADDRESS = (Host = 10.0.0.101)))
```

Reverse Resolution

```
$ dig -x 217.237.148.70

; <<>> DiG 9.10.6 <<>> -x 217.237.148.70
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 29500
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;70.148.237.217.in-addr.arpa.   IN   PTR

;; ANSWER SECTION:
70.148.237.217.in-addr.arpa. 15337 IN   PTR d-lb-a01.isp.t-ipnet.de.

;; Query time: 311 msec
;; SERVER: 2a01:598:b037:d768::49#53(2a01:598:b037:d768::49)
;; WHEN: Wed May 24 23:06:07 CEST 2023
;; MSG SIZE  rcvd: 93
```

The Black Hole

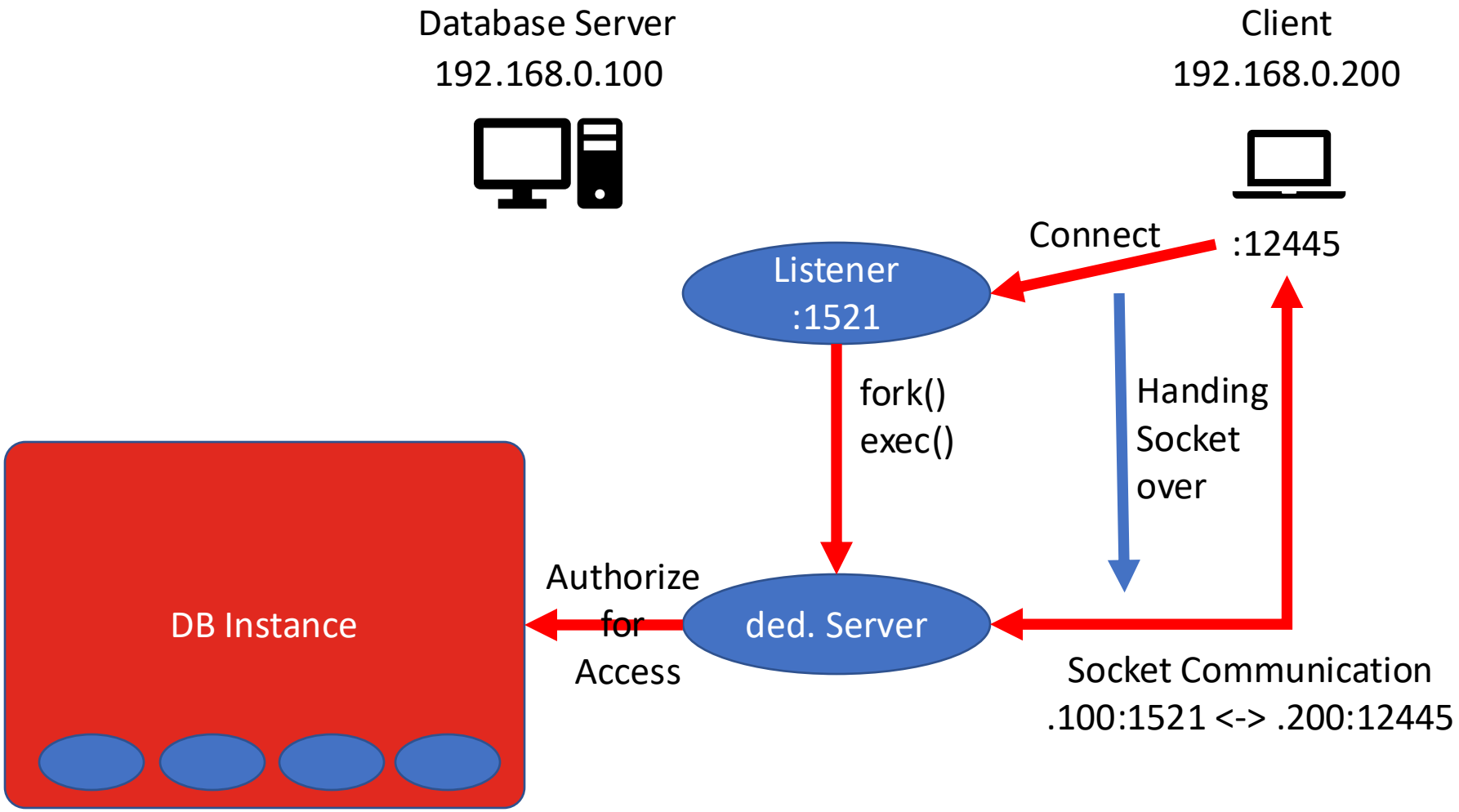


blackhole-1.iana.org (*192.175.48.6*)
blackhole-2.iana.org (*192.175.48.42*)
prisoner.iana.org (*192.175.48.1*)

DNS Reverse Lookup for Local Addresses

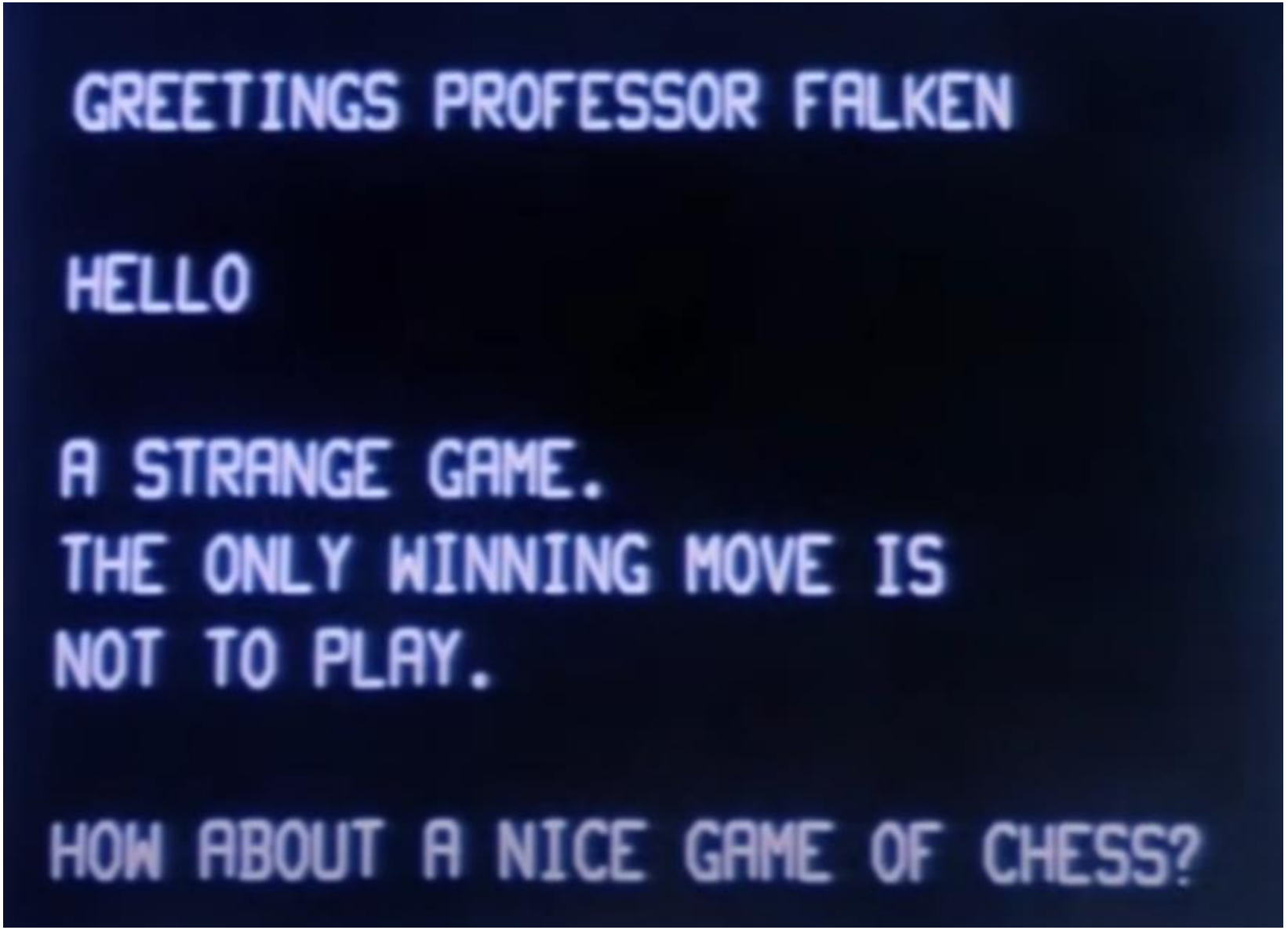
1% of Practice

Connecting via Listener



What we did today...

- Learned about the idea of IP to route around hell
- 7 Layers of Pain
- IP Addresses, Networks, Subs and Supers
- Translating Network Addresses for your safety
- Domain Names and where to find them
- The Black Hole of the Internet
- DO NOT PLAY!


GREETINGS PROFESSOR FALKEN
HELLO
A STRANGE GAME.
THE ONLY WINNING MOVE IS
NOT TO PLAY.
HOW ABOUT A NICE GAME OF CHESS?

Meet & Greet

martin.klier@performing-db.com
www.performing-databases.com

Many national // international events

ora2know all-day event in planning

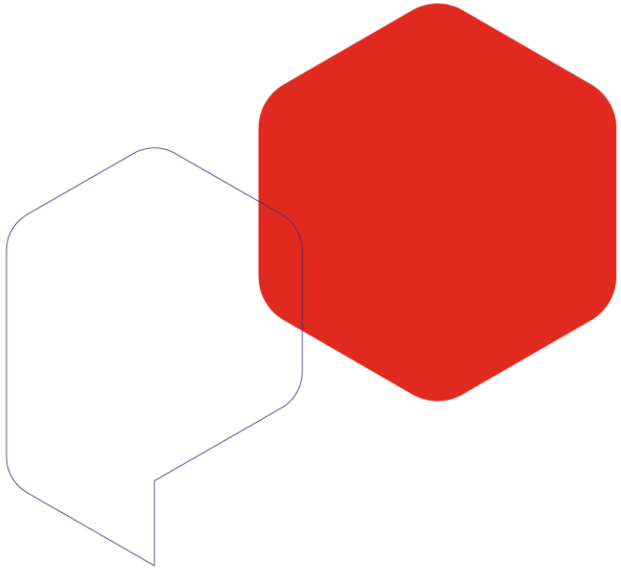
Planned / Save the Dates:

- UTOUG, Salt Lake City, March
- ~~KSAOUG, Riyadh, April~~
- SWEOUG Meetup, Stockholm, May
- OUGN, Oslo, May
- Oracle Cloud World, Las Vegas, September

Bonus: Who spotted the Clown?

Fast Data Platforms.

Made in Bavaria/Germany!



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