

SoftNet2013 MultiConference

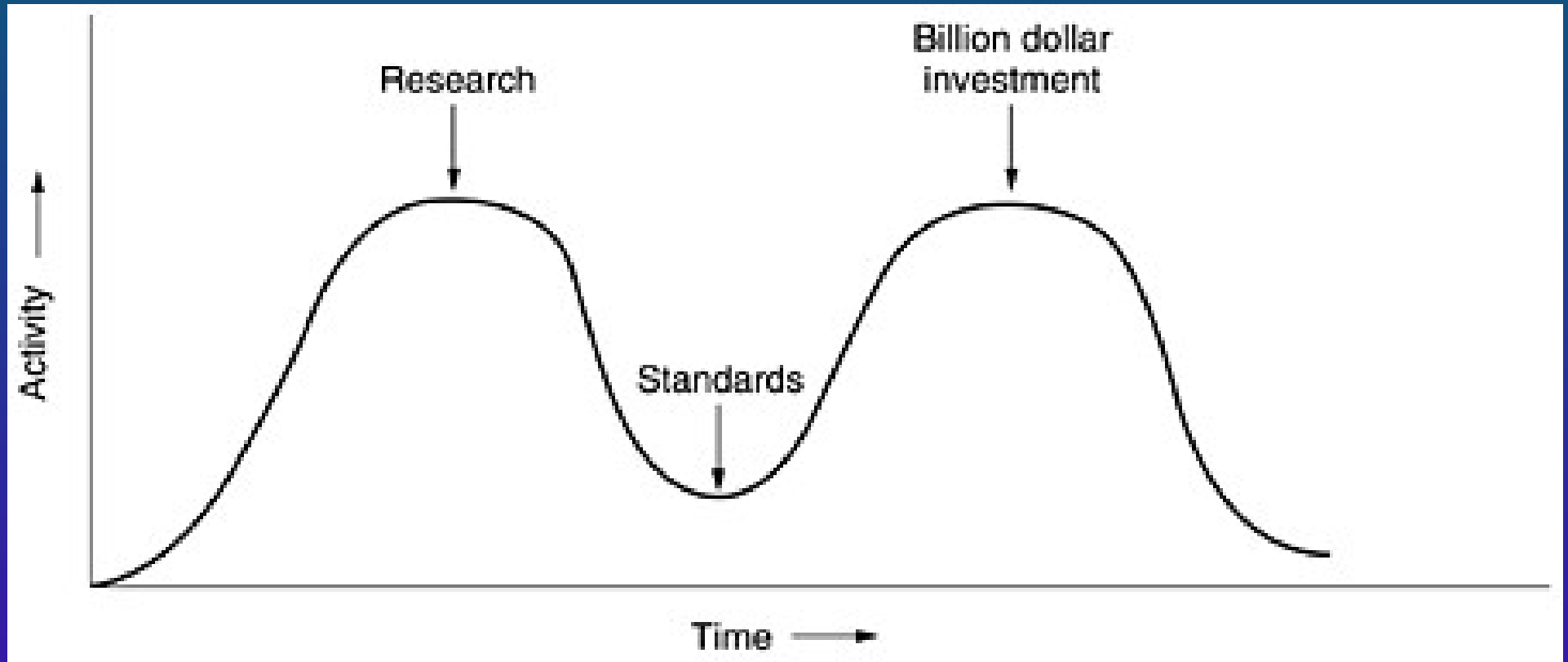
Rethinking the Network Basics

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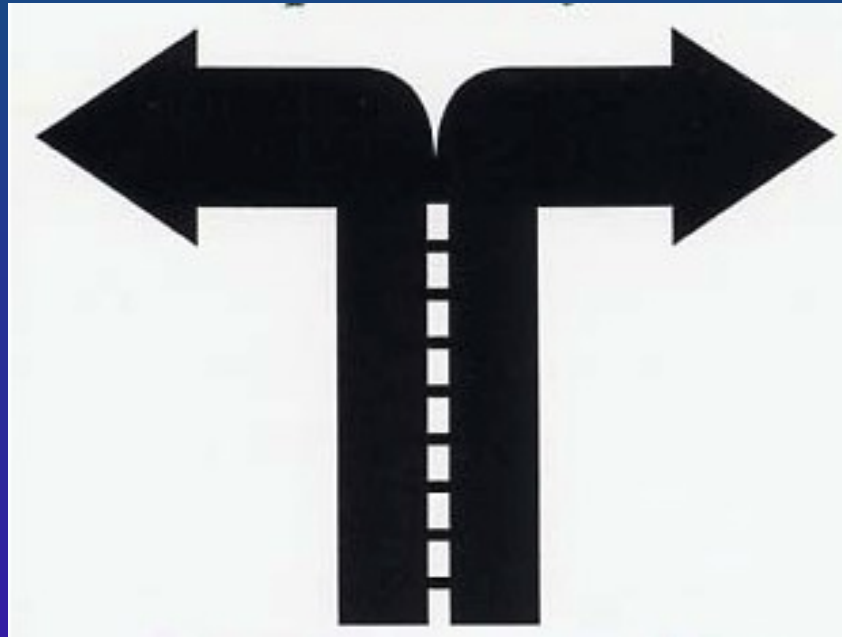
Mestre, October 29th 2013

The *apocalypse of the two elephants*



No fashion in Science! No legacy.

LEGACY



SCIENCE



I HATE
PERFORMANCE
EVALUATION!



The value of a protocol, a language, an algorithm depends on:

- the range of problems it is able to solve
- and then its performance.

Image by: Nikodem Nijaki CC-BY-SA

The best compression Algorithm

- Input: a file N bytes long (maybe GiB, TiB, PiB, EiB)
- Output size: 1 bit
- Time Complexity $O(N)$



Core Networking Questions

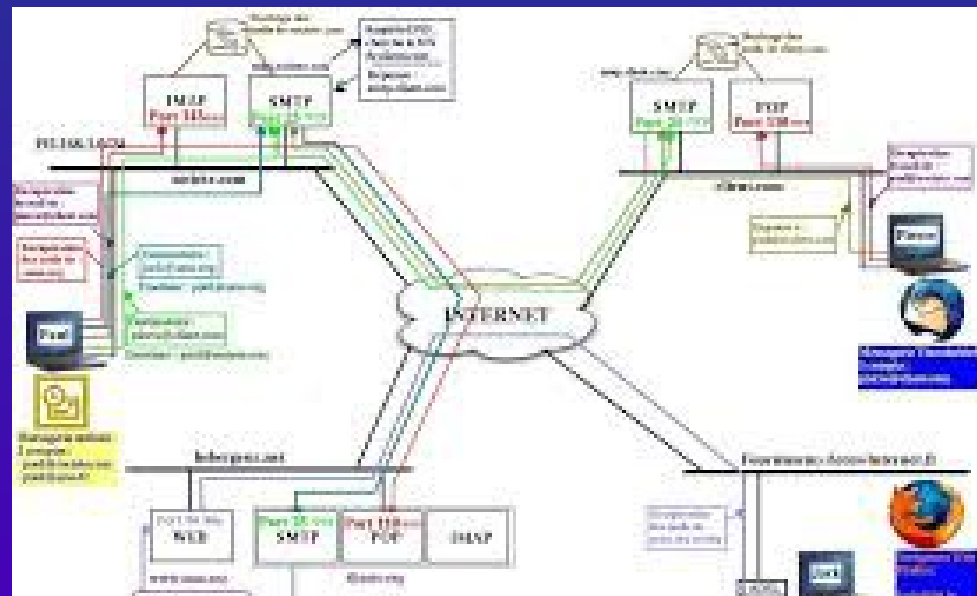
- - how many protocol stacks/protocol stack implementations should exist in a system? (I mean for the same protocol family)
- - which component of an operating system should provide networking services?
- - what is the networking layer exposed to the processes?
- - what should an IP address point to?
- - should networking configuration be a privileged operation?

Networking

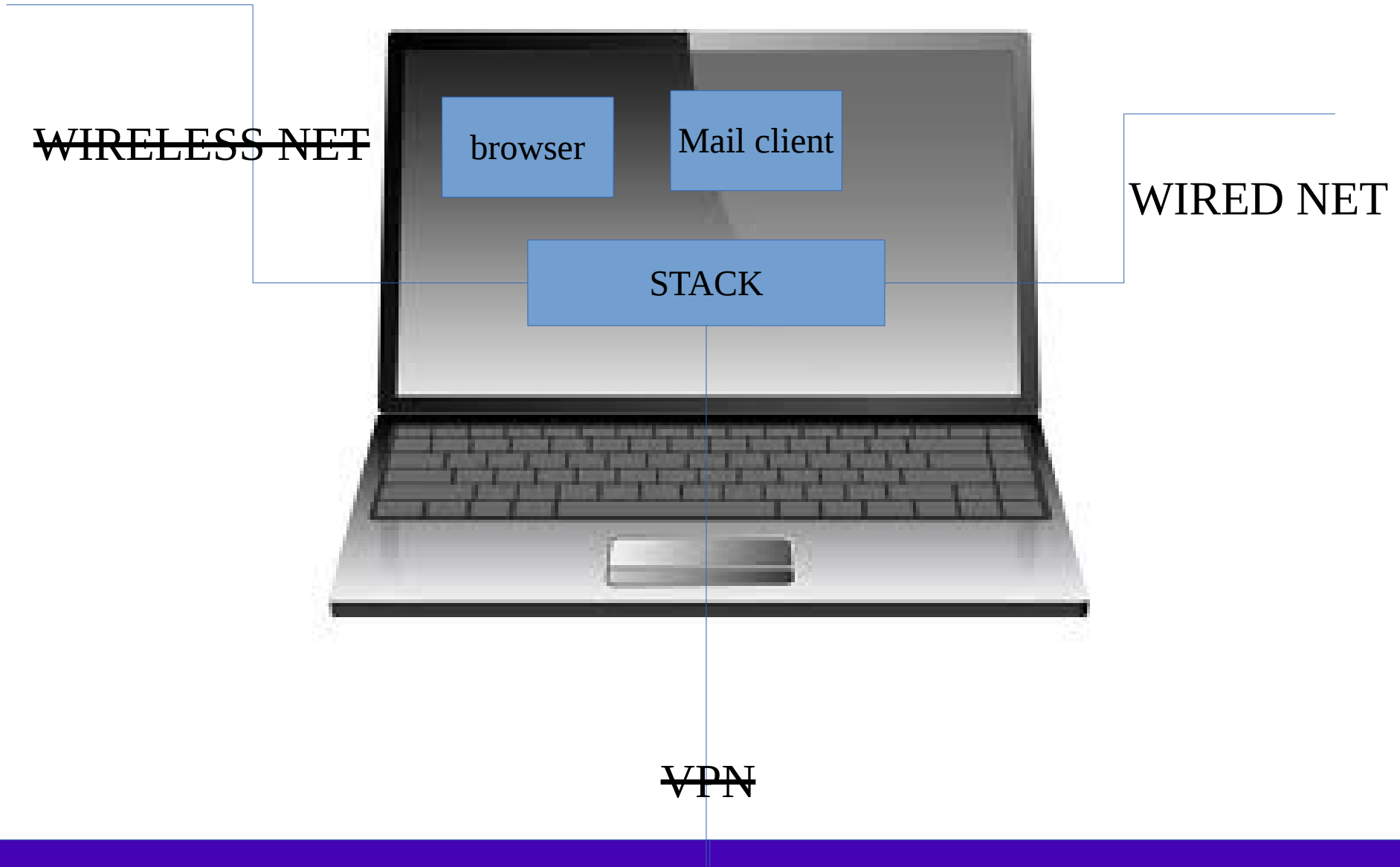
In the 80's



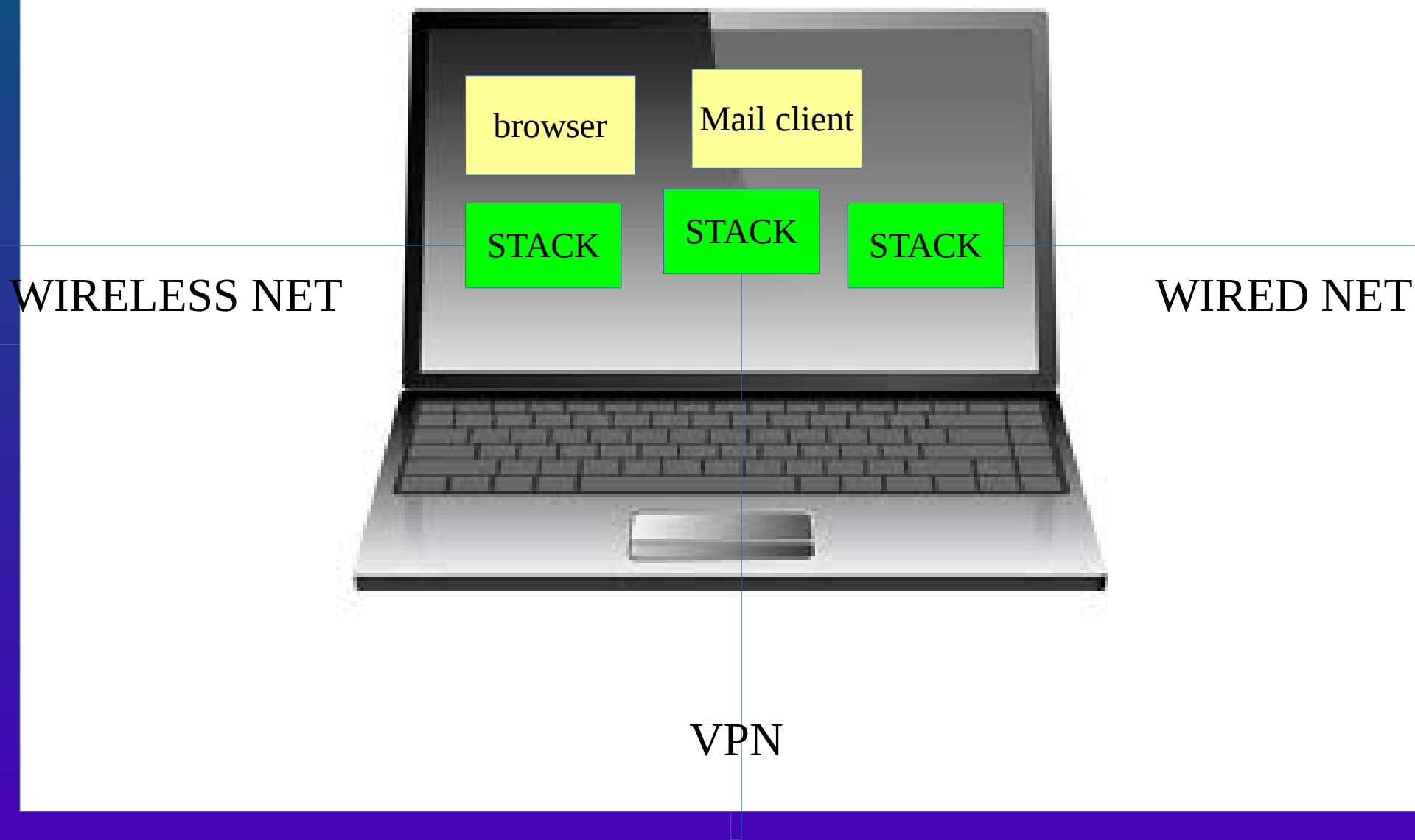
Today



One shared stack?

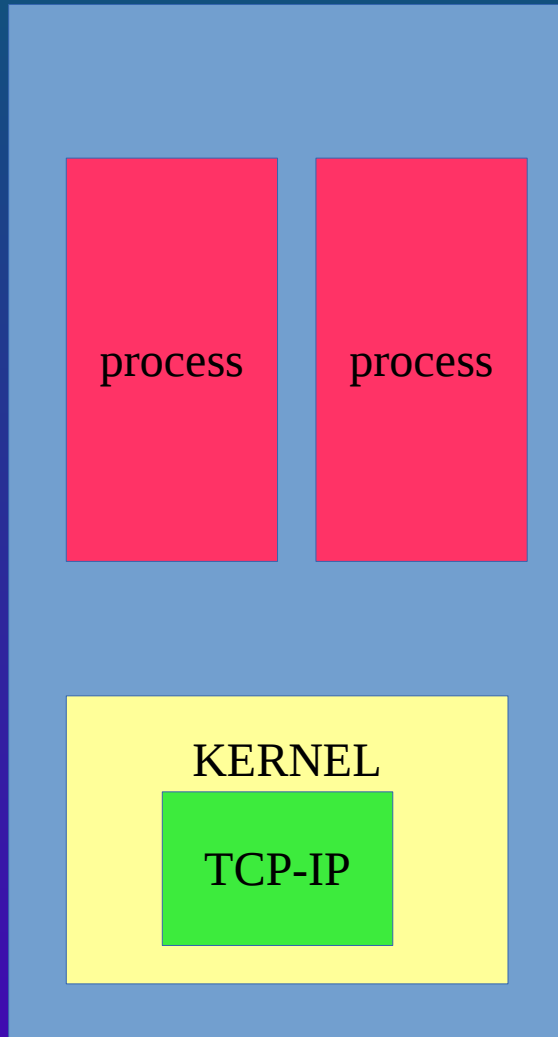


No! Multiple Stacks!

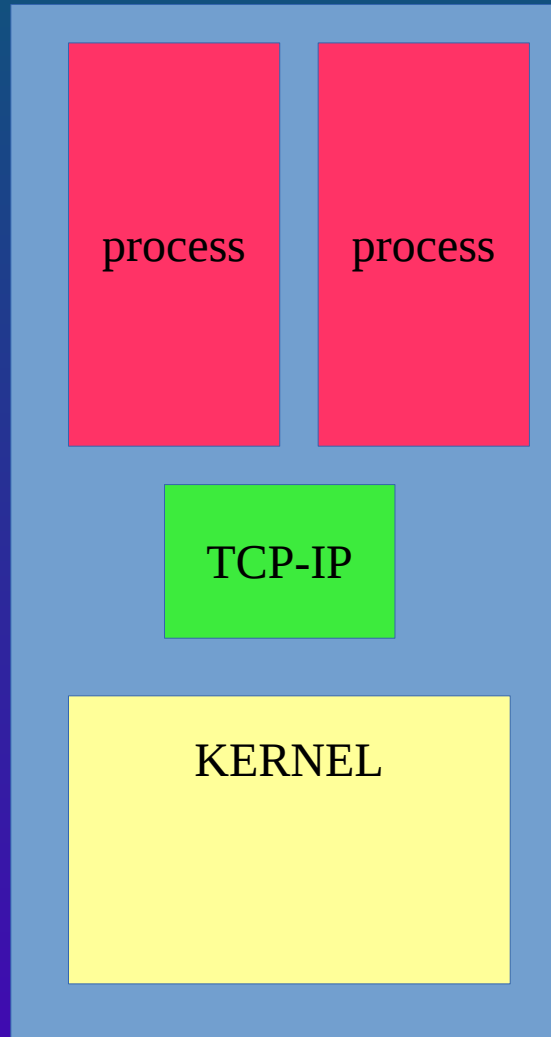


A Stack Implementation is a Library!

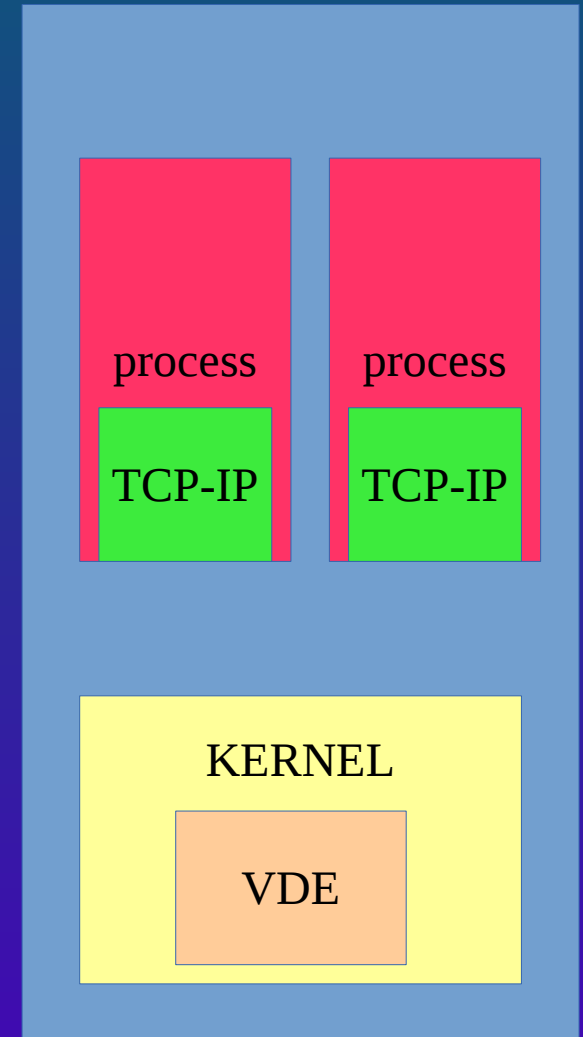
MONOLITHIC KERNEL



MICROKERNEL

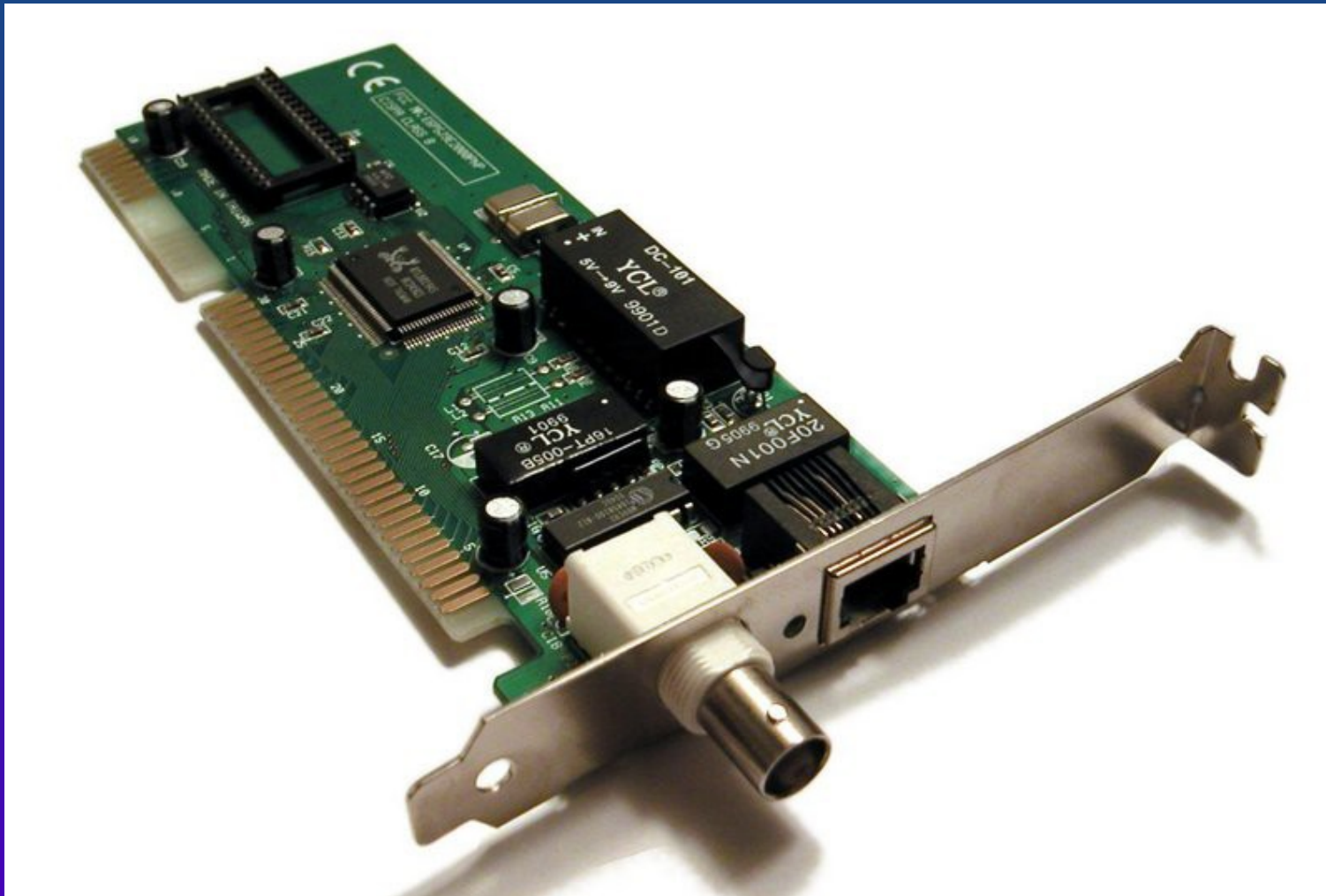


V Networked appliances



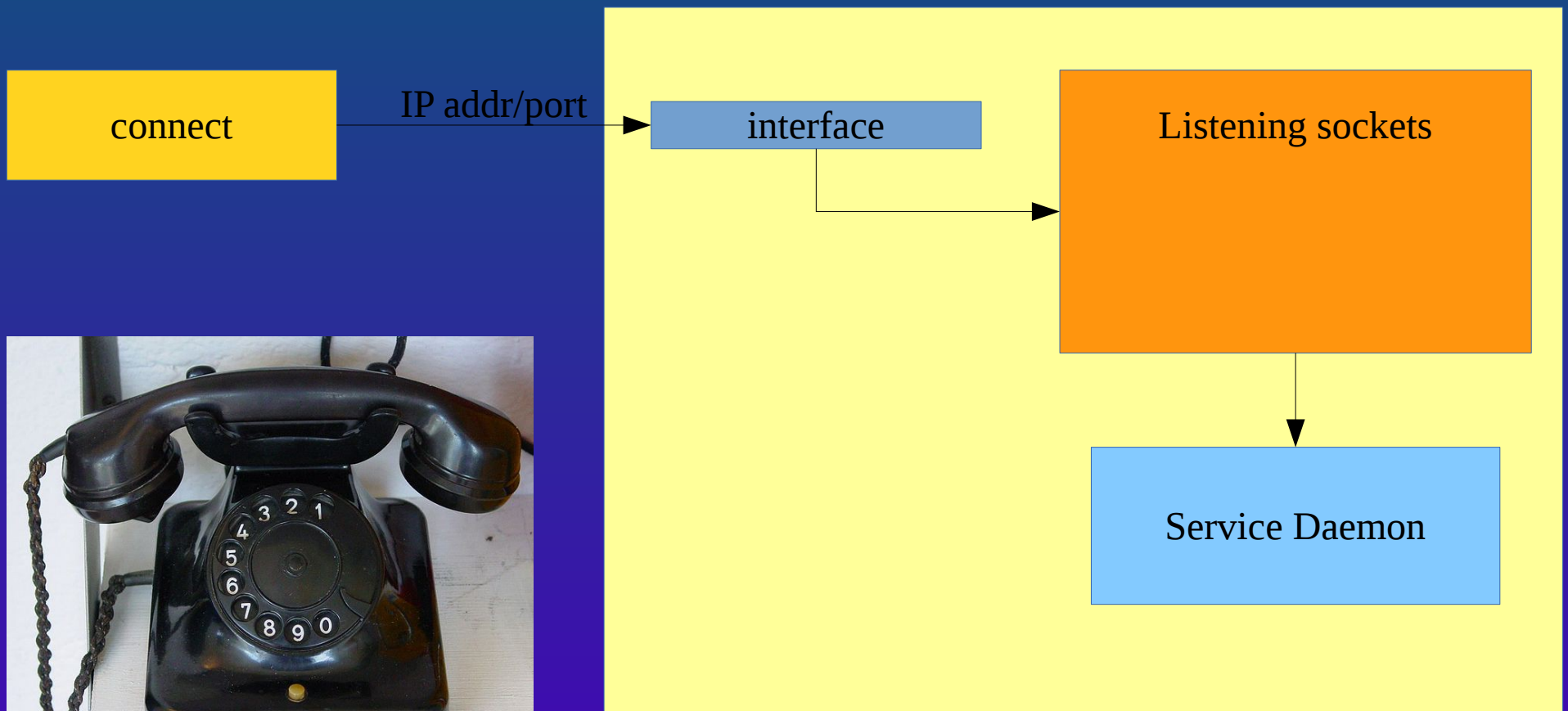
What is an “Internet Node”?

- Network adapters are the “addressable entities” of the Internet.



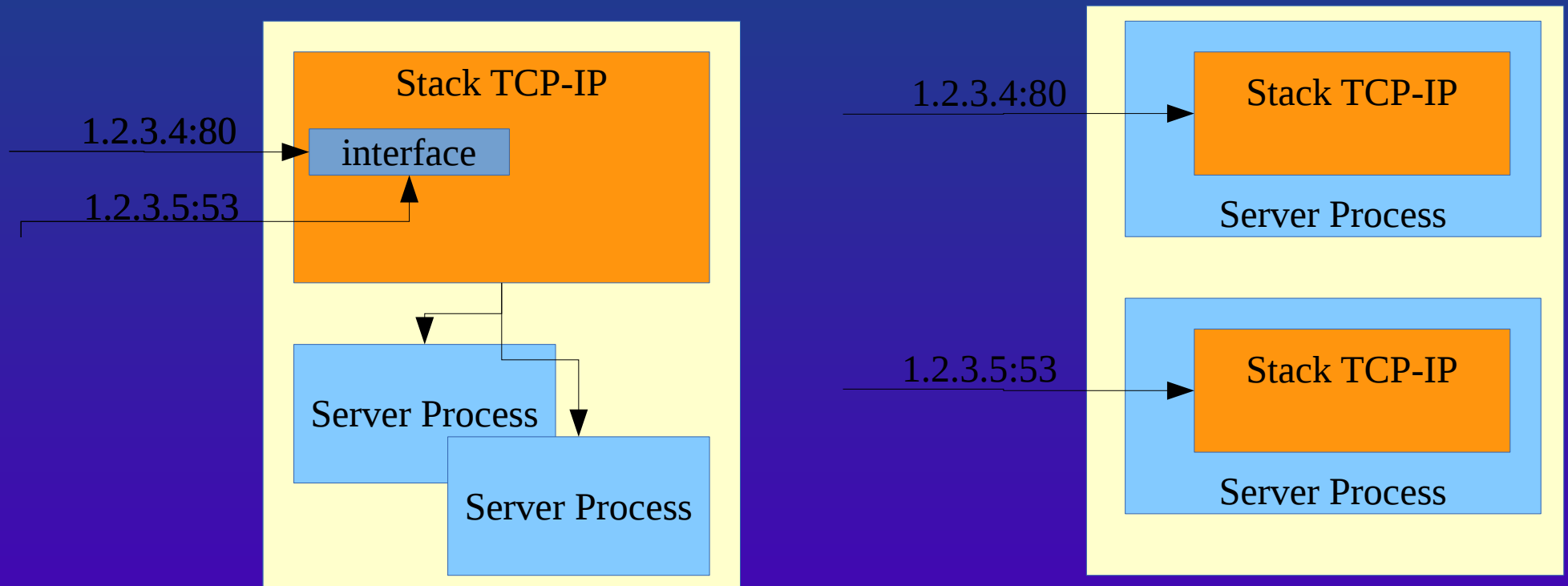
Yesterday: historical view

Internet Server



Internet of Threads (IoTh)

- Processes, Threads can be Internet nodes (too).
- Each process can use all the networking stacks it needs.



Why the IoT? Because some “hard” problems in multitasking multiuser systems become simple.

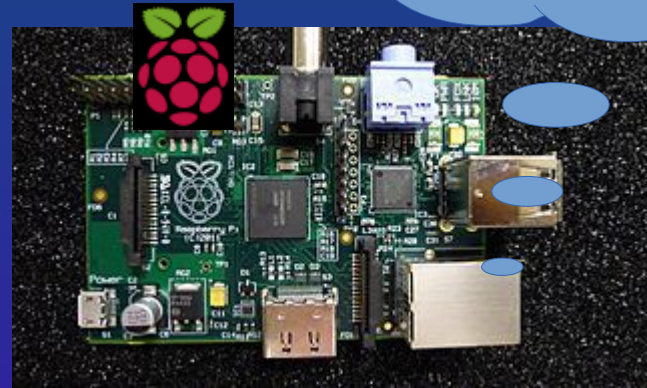
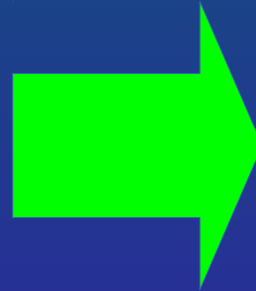
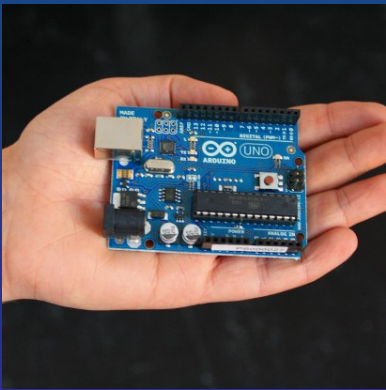
- Provide users working on the same system with user-specific IP addresses
- Provide different QoS/Routing to processes running on the same system
- Run several servers on the same interface+port.
- Use a VPN for some processes and the real network for others.
- Migrate a process to another system while keeping the status of the active connections.

Why the IoT?

- Because we have IPv6!
- We have plenty of addresses
- We must start again from chalk and blackboards and design a new Internet
- IPv4 network concepts are obsolete
- (we must find an excuse to design IPv8, then IPvA, etc.)

Why the IoT?

- It is the software counterpart of the Internet of Things.



Services, services, services

- HW vs SW
- Special Purpose vs. General Purpose
- Consumer Electronics vs. Upgradability

Why the IoT?

- Also Linux Containers (Solaris zones) provide several stacks... but just for sysadm!
- By the IoT networking becomes “ordinary business” for users.
- Network stacks will be chosen as printers using menu items...

Virtual Square does it better!

- Virtual Square has developed a set of tools that permit the implementation of the “Internet of Threads” concept:
 - VDE: virtual distributed ethernet
 - LWIPv6: an entire IPv4/v6 hybrid stack as a library
 - View-OS: view-based operating system.
 - Umview/kmview: View-OS implementations as partial virtual machines running on GNU-Linux.
- This is a usable proof-of-concept test set!

Milestones

- VDE (Tridentcom 2005)
- Msockets (ACM SAC 2012)
- Internet of Threads (ICIW 2013)
- IPv6 Hash-Based Addresses (AFIN 2013)
- and now OTIP One Time IP (ICSNC 2013)

Msocket:

- We propose a clean interface to support multiple stacks:

```
int msocket (char *stack, int domain, int type,  
            int protocol);
```

- Stack is the pathname of a special file (or the path of an object).
- View-OS module named umnetlwipv6 provides a proof of concept implementation of this msocket support.

Client side IoT

VDE Slirpv6

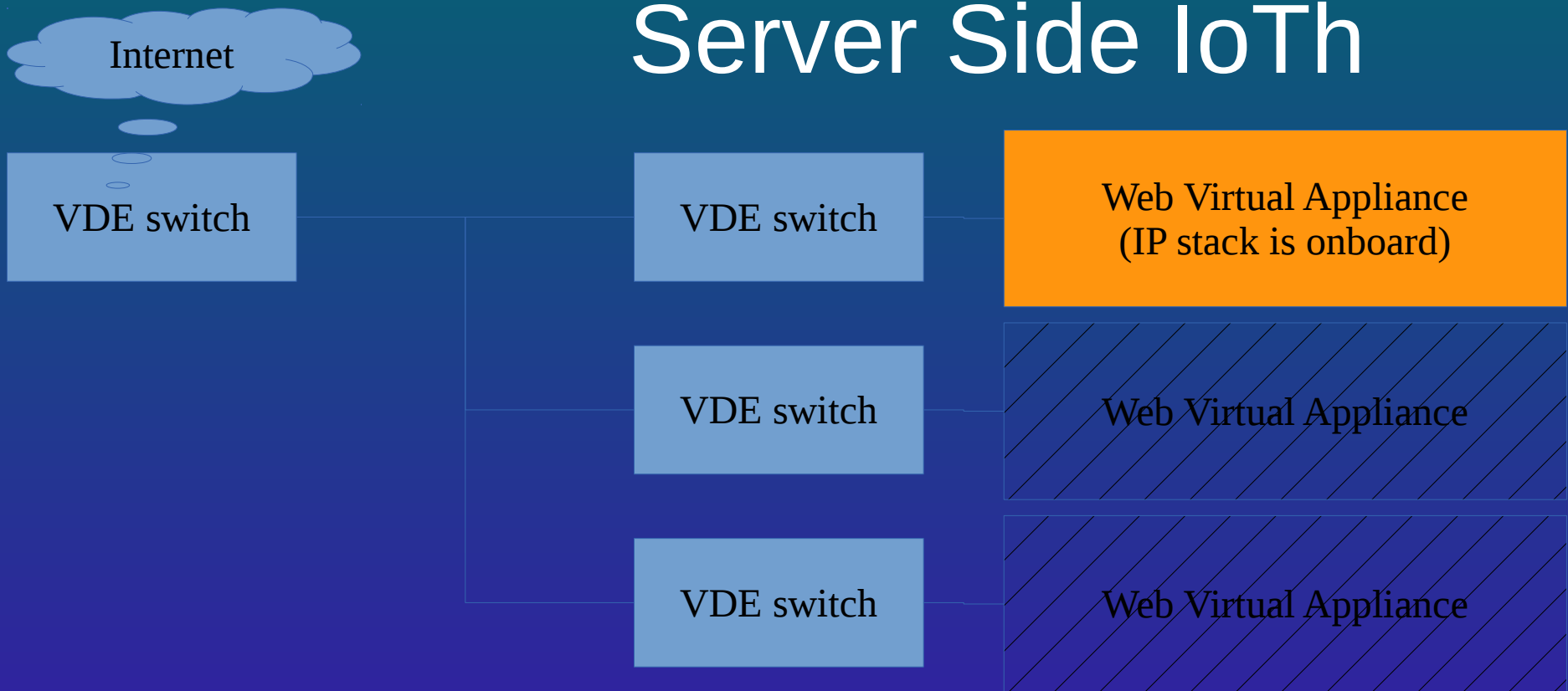
VDE switch

Umview + Lwipv6

- This browser “lives” in its own view of networking.
- It runs on a hidden (masqueraded) network
- It can change continent just by reloading the page (if we “migrate” the slirp process at the other end)

Browser

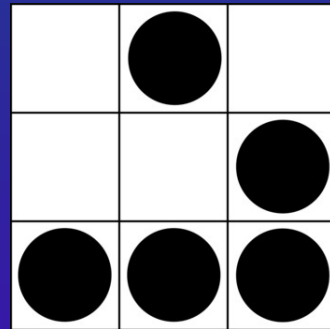
Server Side IoT



- The virtual web appliance has its net stack onboard.
- From the Internet it is (appears as) a web server.
- It can migrate throughout the VDE

We are still creating art and beauty on a
computer:

the art and beauty of revolutionary ideas
translated into (libre) code...



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