

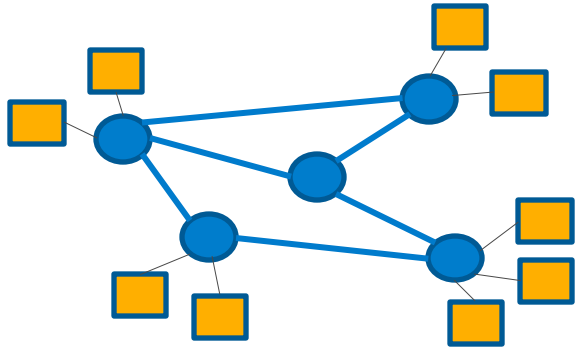
# Programmability and Composability for an e2e networking evolution

OPI Programmable Infrastructure Event

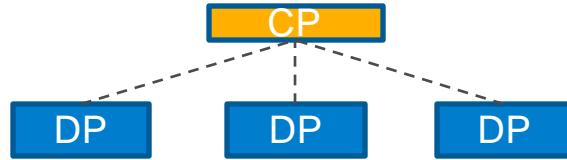
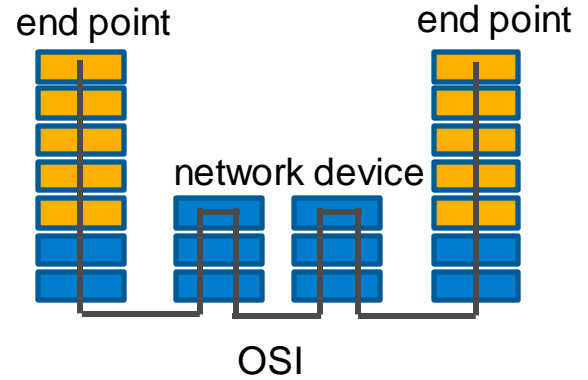
March 15, 2022

Ben Pfaff  
Pere Monclus  
VMware

# What is Networking?



End point / Network



Data Plane / Control Plane separation

Network has always been 'programmed'

# In the DP, why programmability?

- 1) Complex or “slow” functionality
- 2) Feature not mature or well defined
- 3) Innovation



Cost of Programmability decreasing!!!

# In the DP, why not programmability?

- 1) Performance / Power / Cost
- 2) Latency



Cost of ASICs increasing!!!

# What to do without programmability?

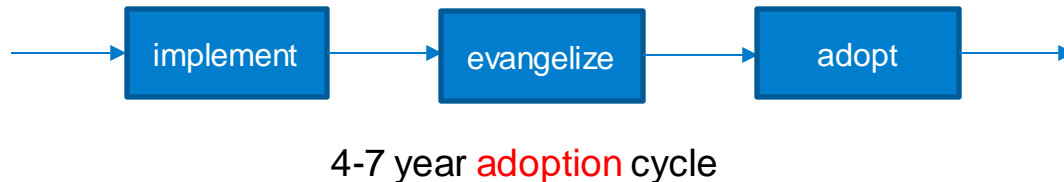
- Force everybody too agree before implementing



**VERY LIMITED INNOVATION**  
and only few can do it  
(clear roadmap)

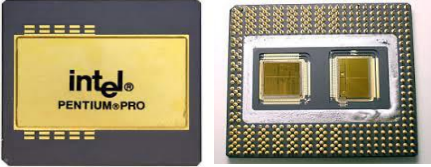
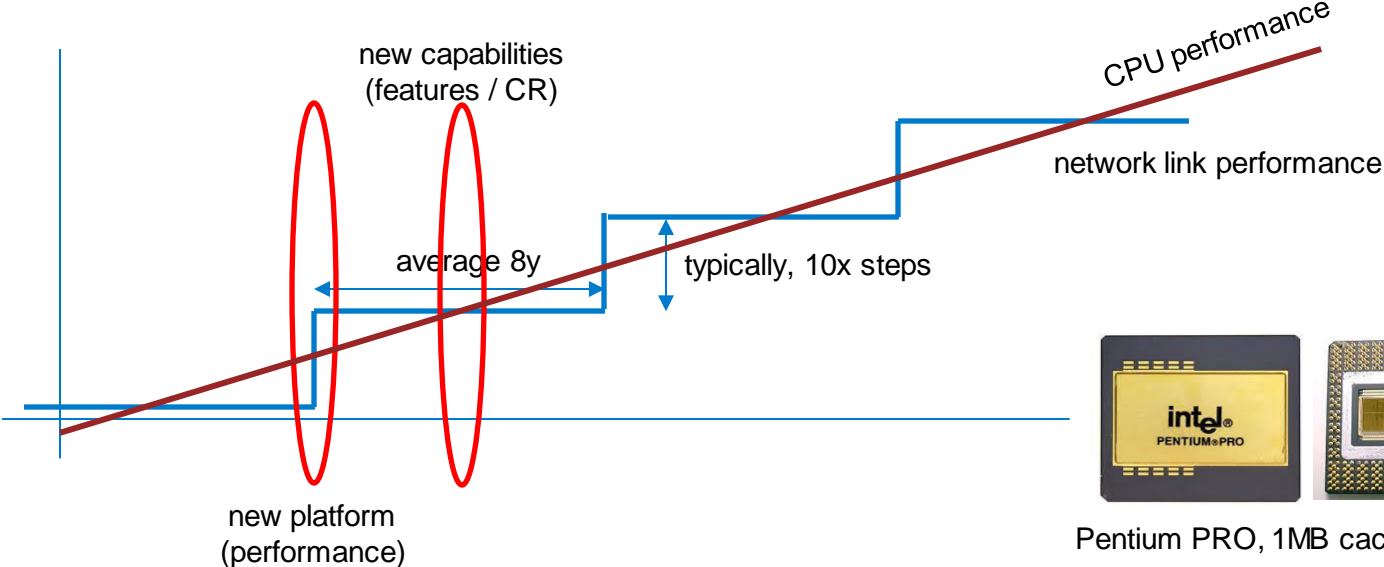
# What to do with programmability?

- Innovate and evangelize



**EXPLOSION IN INNOVATION**  
and everybody can do it  
(market confusion)

# Programmability and technology



Pentium PRO, 1MB cache, year 1995

Networking is memory, more than compute

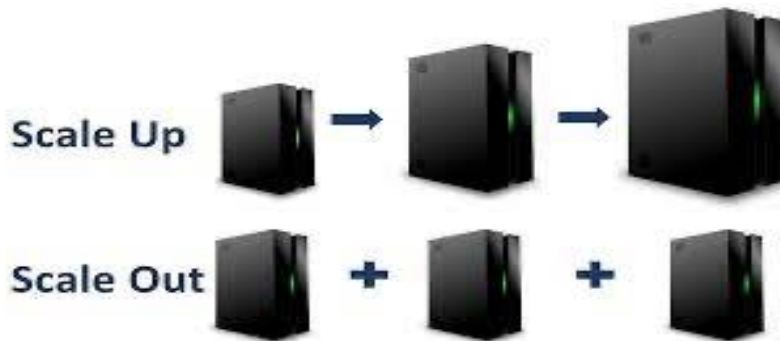
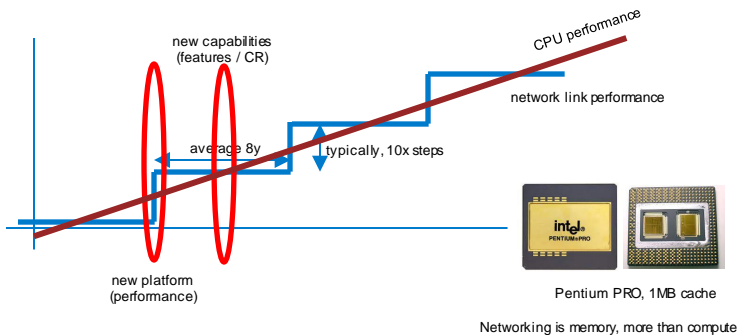
# But... what happens when we aggregate?



VS



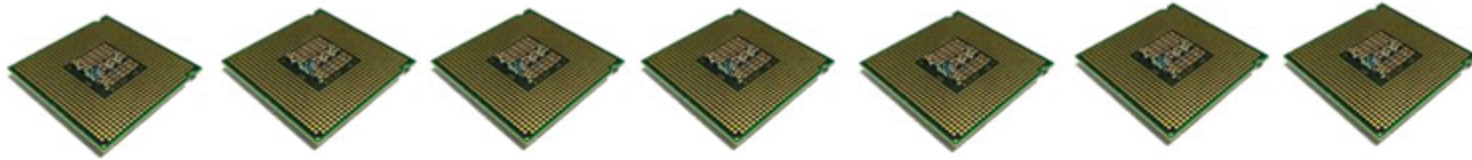
# Solving the performance problem



# Solving the Aggregation problem



in the network



at the edge



# Programmability? Who? How?

End point  
Networking  
Experts

Core  
Networking  
Experts



... many others



Compilers, abstractions, tools

CPUs

FPGAs

NPU's

Multicore

Programmable  
Switch

Smart NIC  
/ DPU

Lot of work and maturity still needed...

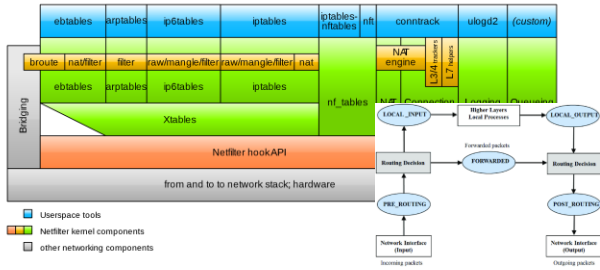
# But... Programming can mean many things



# Composability and Standard Interfaces lead to ecosystems

## Netfilter components

Jan Engelhardt, last updated 2014-02-28 (initial: 2008-06-17)



## Netfilter, Linux Kernel, 1998

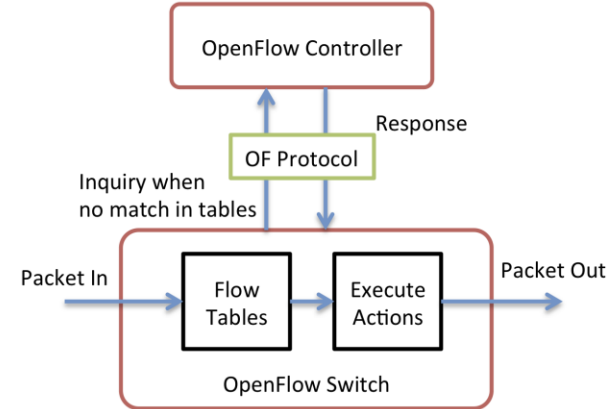


## Cisco networking icons



Fig. 8. An IP router configuration.

## Click Modular Router, MIT, 1999



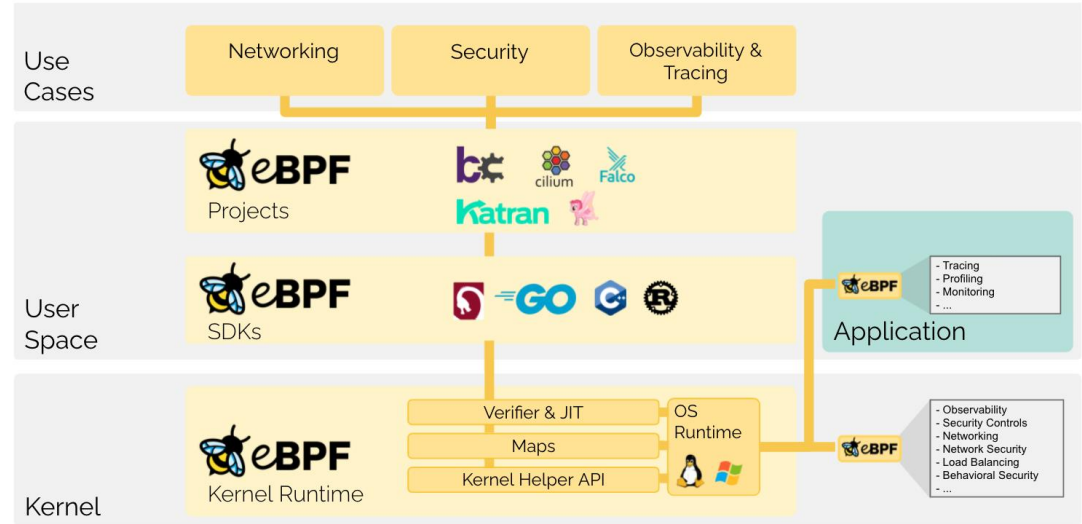
## OVS, 2009

# Aspects of successful networking communities

- Fill a niche.
- Multipurpose.
- Make things that were difficult easy.
- Useful for academia and industry.
- Responsive core maintainers.
- Assemble over time.

# EBPF community

- Fill a niche.
- Multipurpose.
- Make things that were difficult easy.
- Useful for academia and industry.
- Responsive core maintainers.
- Assemble over time.



# Open vSwitch community

- Fill a niche.
- Multipurpose.
- Make things that were difficult easy.
- Useful for academia and industry.
- Responsive core maintainers.
- Assemble over time.

