

Towards a *Network Marketplace in a Cloud*

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Cisco

“Public” clouds today

- Few providers
- Vertically integrated
- Opaque control of lower layers

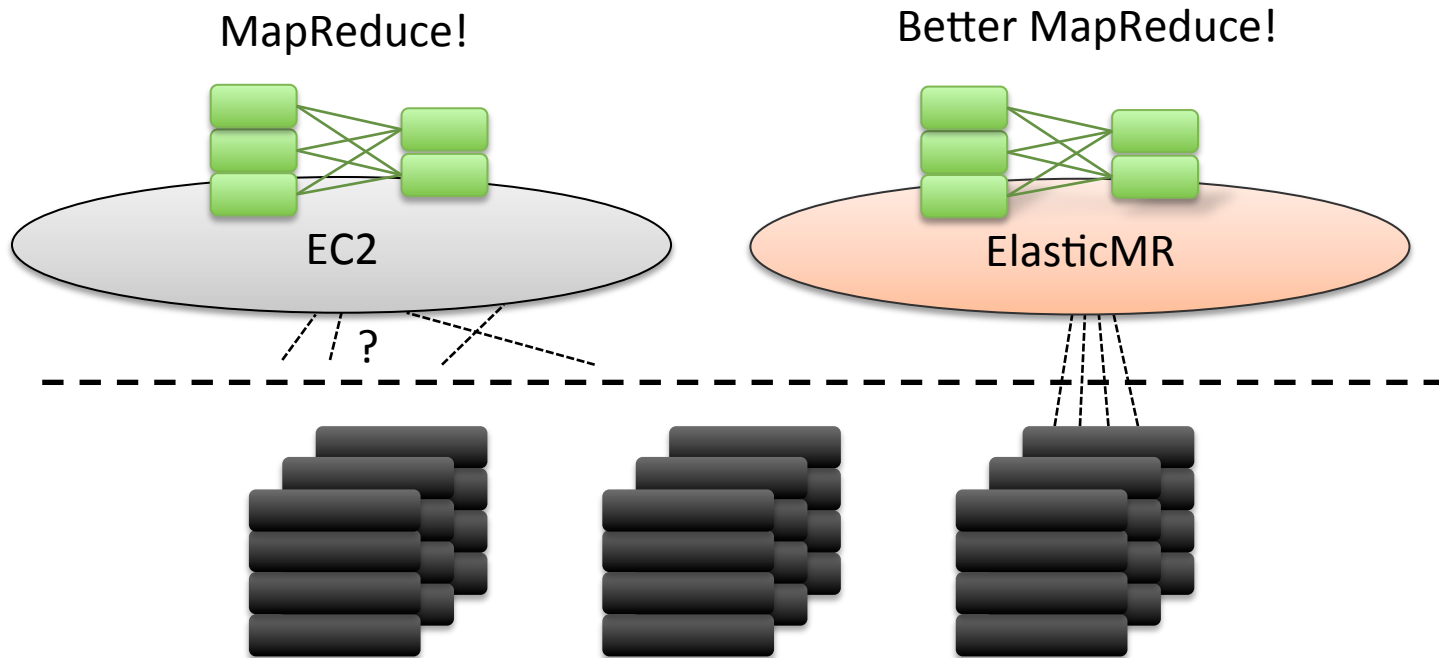


Google Cloud Platform



Microsoft Azure

Example: MapReduce on Amazon



“Public” clouds today

- Few providers
- Vertically integrated
- Opaque control of lower layers
- Vendor lock-in

~~Competition~~

~~Innovation~~



Massachusetts Open Cloud

- Open Cloud Exchange: public and open cloud



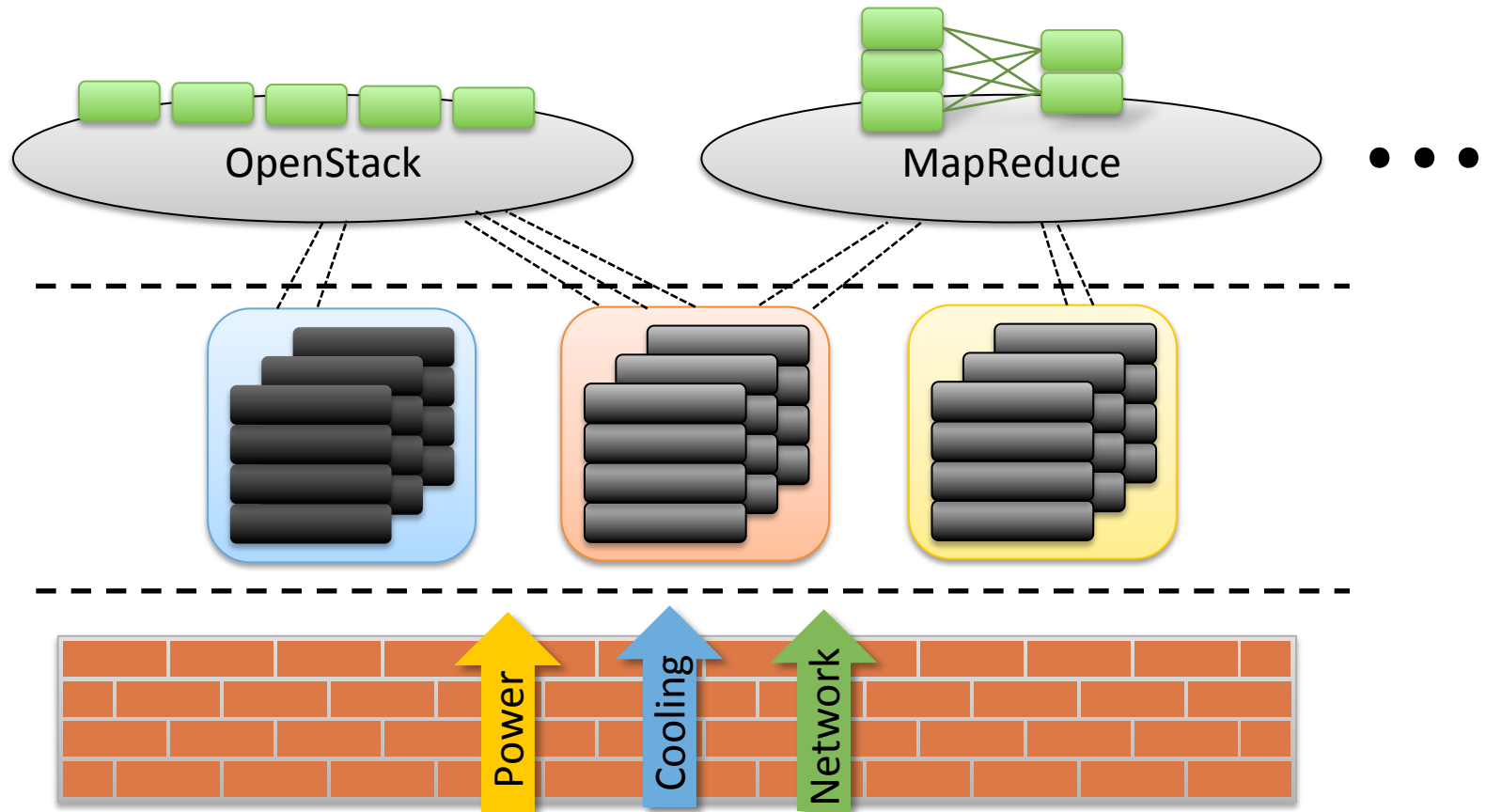
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Source: Christine und Hagen Graf, Flickr

Massachusetts Open Cloud

- **Open Cloud Exchange: public and open cloud**



See <http://info.massopencloud.org/> for more details



Where does Networking fit?



- Our goal: networking should be a first class service, not just basic infrastructure
- Providers should compete, *all the way to the physical level*, to provide networking!



Can we make networking part of the marketplace?

- **Vision:**
 - Alice wants to provision 50 VMs in a compute pool, and 50 VMs in a GPU pool
 - Wants to connect these VMs in a single LAN
 - Gets offered two options to create this network:
 - Standard, best effort network (free)
 - Dedicated 10Gbps network with RDMA (for \$\$)
 - Selects the second option, and her traffic is automatically routed through the right switches, with the right queues configured





Why?



Potential reasons

- **Isolation**
 - Physical (security)
 - Performance (BW/Latency)
- **Control**
 - E.g., DCTCP, PFabric, NetFPGA
- **Special/Niche needs**
 - 100Gbps, Lossless Ethernet (RoCE, RDMA), 60GHz wireless,...

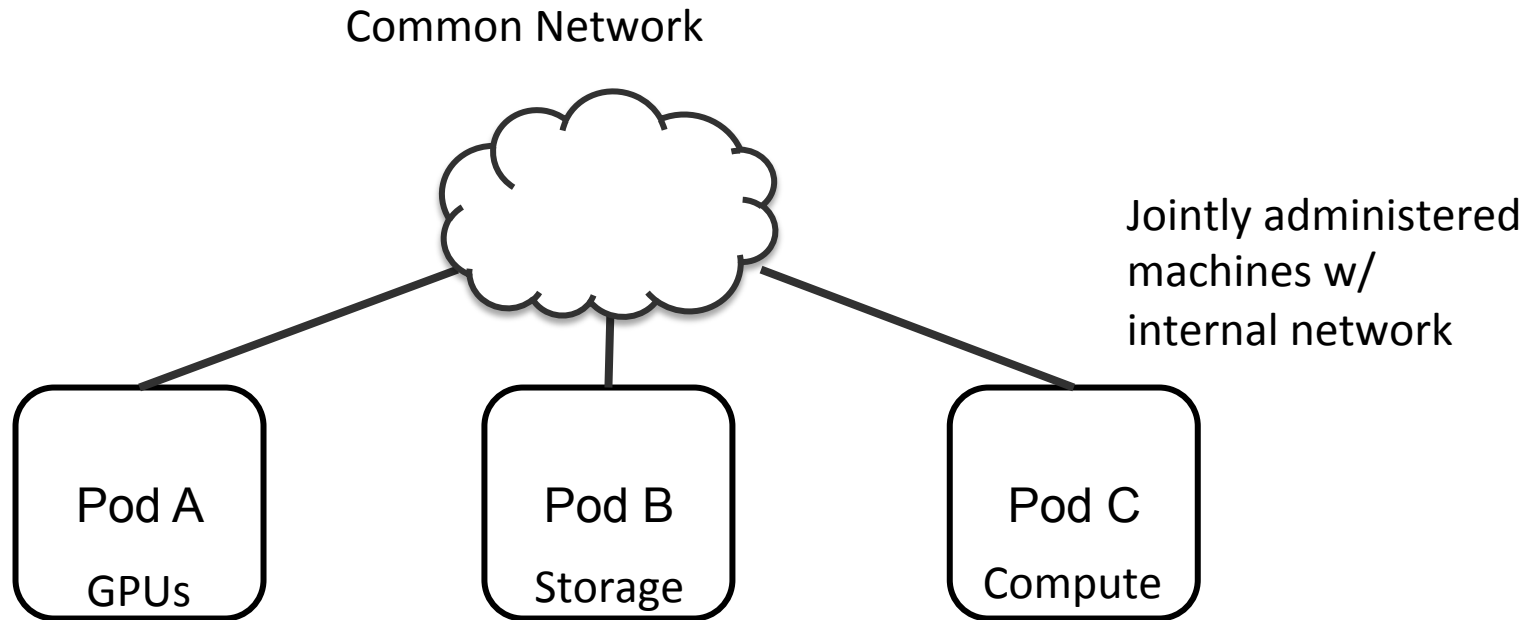
**Enable innovation and market-driven competition for
network services**



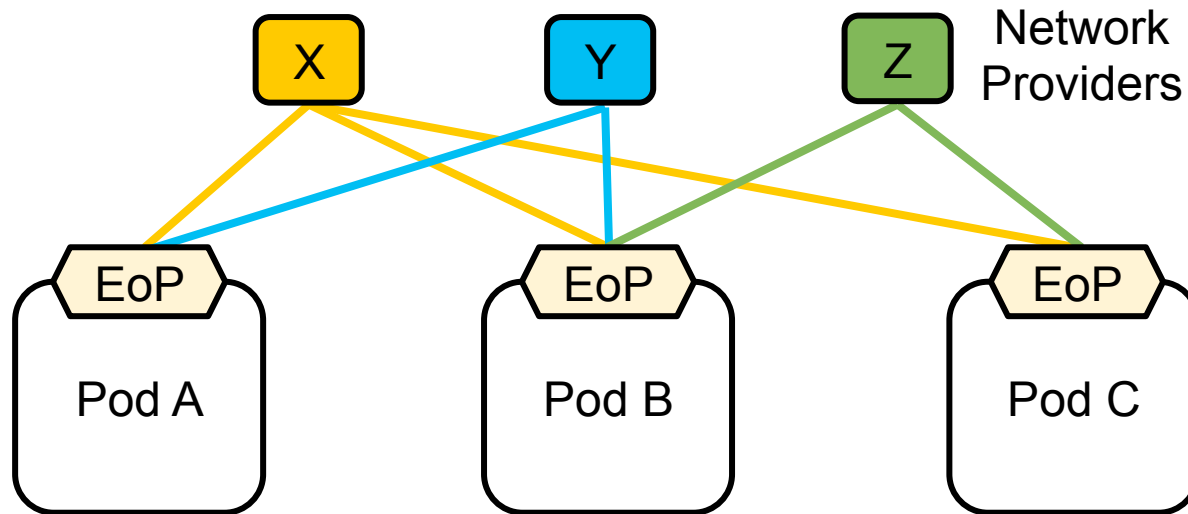
The NetEx Prototype



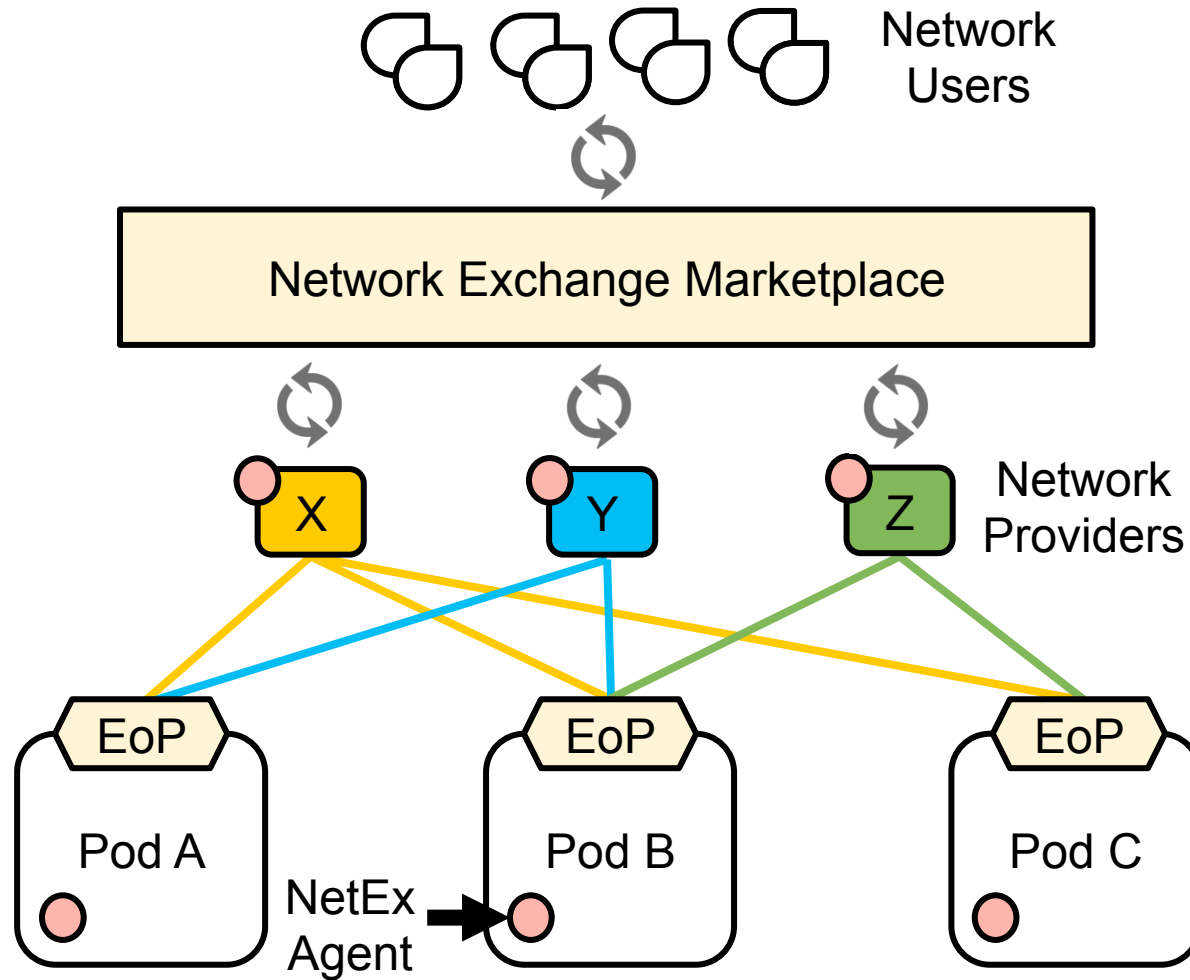
Baseline Architecture



Multi-Provider Inter-Pod Network



Multi-Provider Inter-Pod Network



Configuring a Path

- User requests *path properties* between two or more pods, for specific traffic (*flowspec*)
 - E.g., “I need 10usec latency for my port 445 RPC traffic”
- NetEx forwards request to network providers
- Network providers return bids:
 - <path segment, properties, price>
- User selects path option
- NetEx brokers provisioning...



Configuring a Path

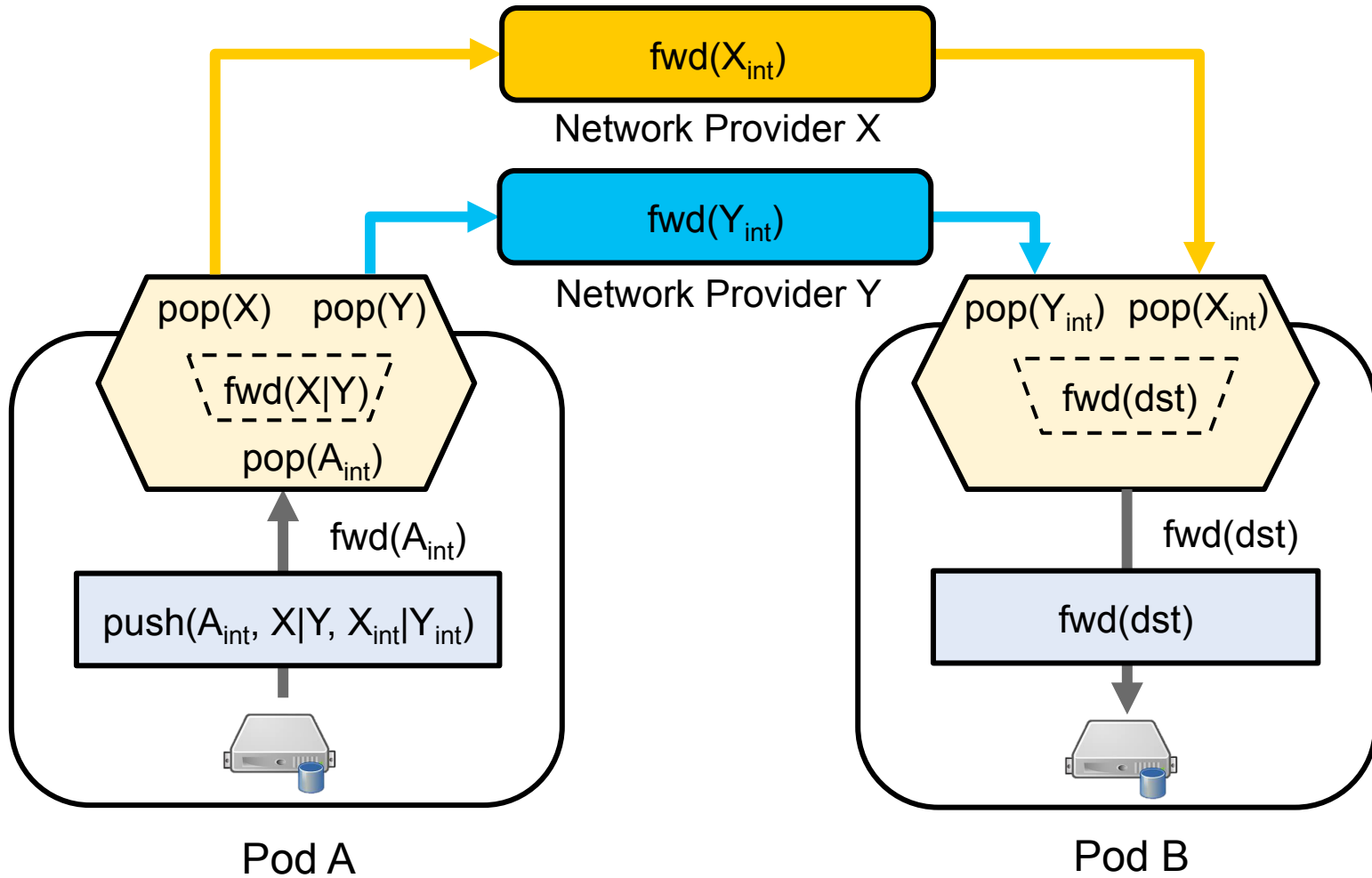
- Selected network provider provisions internal path segment, returns opaque *handle*
- NetEx configures pod switches:
 <flowspec, provider, handle>
- Requirement: packet matching *flowspec* arrives at the egress EoP *provider* port with the label *handle*



Current Pod-level Design

- **Current prototype in Mininet**
 - Uses OpenFlow with nested MPLS labels
- **Divides responsibility between ToR and EoP**
 - EoP directs traffic to providers based on per-provider label
 - ToR matches on flowspec and configures loose source route:
source pod label > provider label > provider internal label > dest





Alternatives

- **Other pod designs possible**
 - E.g., Vswitch does the tagging at the hypervisor (if present)
 - EoP does more of the work
 - Not necessarily MPLS inside the pod
- **Requirement: packet matching *flowspec* arrives at the egress EoP *provider* port with the label *handle***



Next Steps

- **Does this make sense? ☺**
 - Moving to implementation on MOC
 - Our goal is to have an architecture that does not preclude a network marketplace in the cloud
- **Design client APIs, market mechanisms**
- **Design challenges**
 - Accountability, enforcement, (price) transparency
- **Extend to the wide area**



Questions?

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