OpenFlow/SDN for IaaS Providers

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The Public Cloud

Our Definition

- Shared infrastructure operated by a service provider where no single client uses a significant percentage of the available capacity.
- Provides many infrastructure services: compute, storage, etc
- Metered billing and elastic consumption

Used by

- SMBs for test/dev and production workloads
- Few enterprise users today
- Very little integration with on-premise networks
  - Some VPN stuff happening – ie Azure VPN and Amazon VPN

Public Cloud Networks Need

Infrastructure

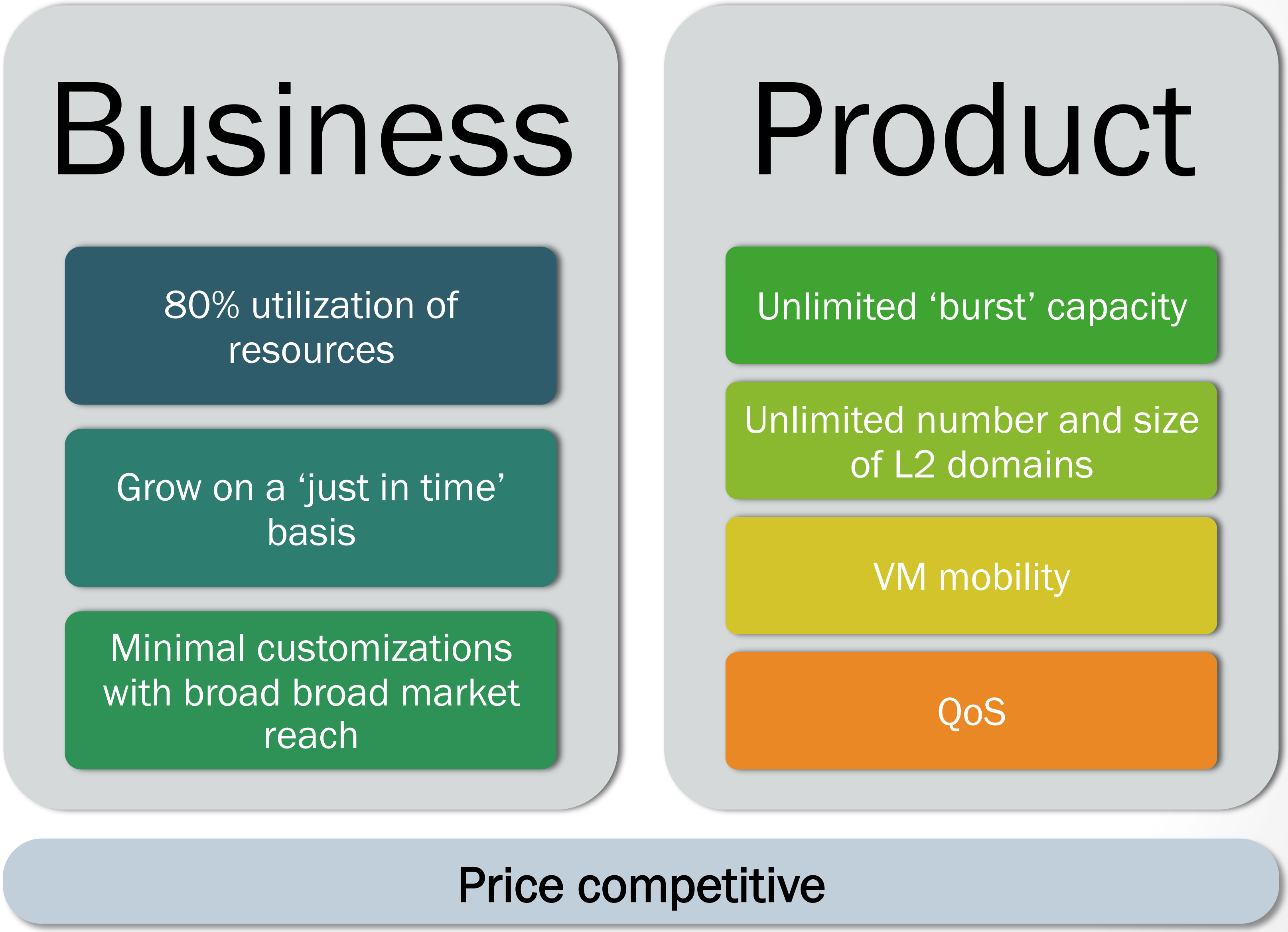
- Large-scale Datacenters ~10k hosts, ~1M VMs
- API provisioning + high rate of change
- Add new capacity with minimal operation overhead
- Mix of “soft” and “hard” devices

Connectivity

- Any-to-any connectivity between arbitrary VMs
- L2 isolation between very large number of domains
- Identity-based routing instead of IP-based routing
- “Fair” or guaranteed resource distribution
- High cross-sectional bandwidth

Cost-effective

Public Cloud Networks Need



Business

80% utilization of resources

Grow on a ‘just in time’ basis

Minimal customizations with broad broad market reach

Product

Unlimited ‘burst’ capacity

Unlimited number and size of L2 domains

VM mobility

QoS

Price competitive

Limitations of traditional networks

- Distributed model is broken
  - Complexity of distributed configuration increases exponentially
  - Current/Legacy protocols have inherent protocol limitations
  - There are limitations in # of routers in OSPF, number of cascaded switches, etc
  - As # of nodes increase, so do convergence times

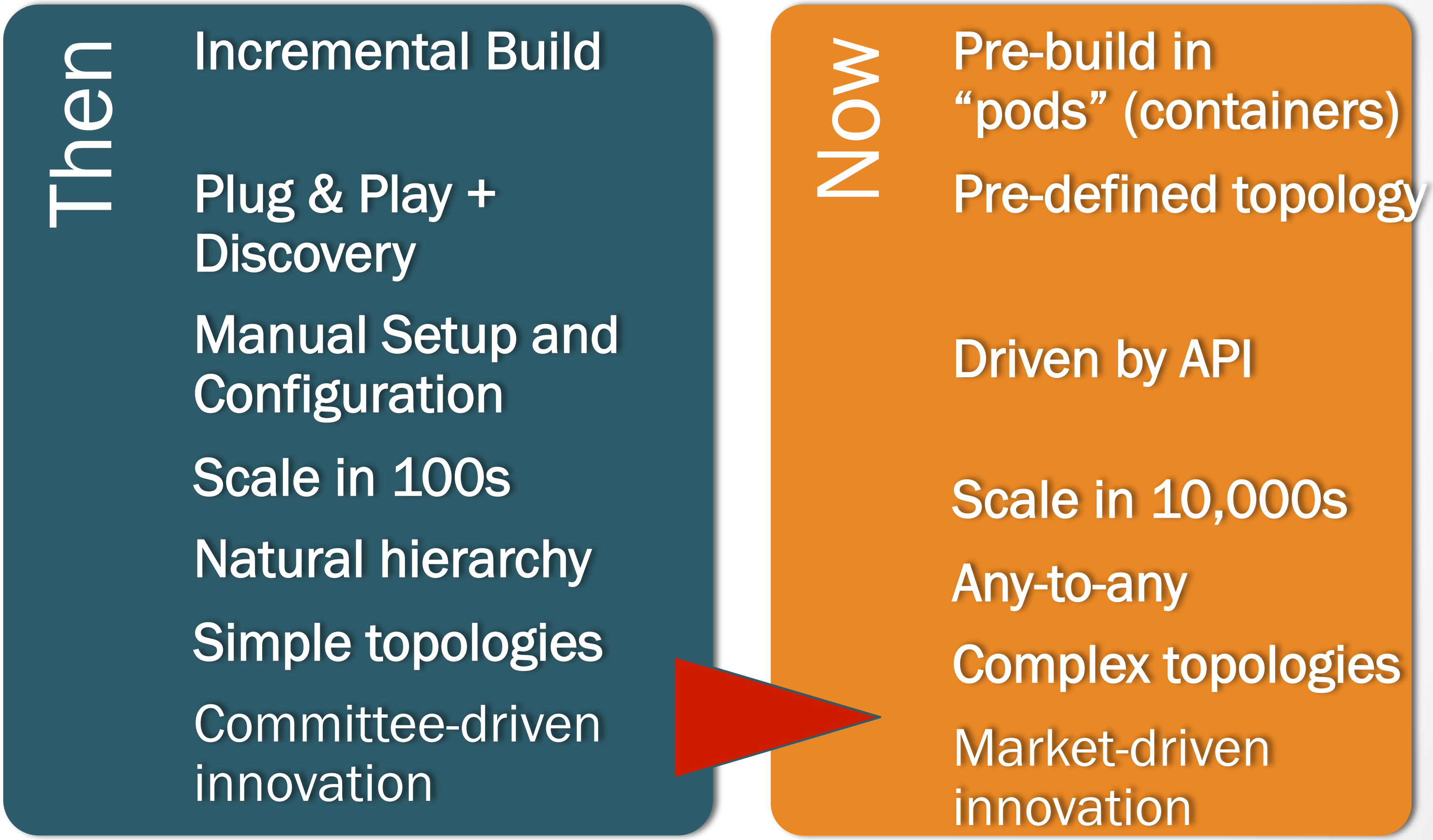
- L2 “pods” are not the solution – need some form of L3 aggregation, but
  - Hardware does not scale well
  - Lack of programmatic access
  - Multi-vendor/platform integration is difficult/impossible
  - Vendor solutions are expensive/proprietary and incomplete

Business needs are not being met

- You end up segmenting your capacity into “pods”
  - And maintaining spare capacity per pod is expensive
- Maintaining one L2 domain per customer is difficult
- Migration of VMs is expensive, sometimes impossible
- Adding more capacity around the DC requires significant planning and we usually get it wrong

- Customers run out of capacity their ‘pod’
- There is really no way to enforce QoS over the entire network

The Paradigm Shift



Then

Incremental Build

Plug & Play + Discovery

Manual Setup and Configuration

Scale in 100s

Natural hierarchy

Simple topologies

Committee-driven innovation

Now

Pre-build in "pods" (containers)

Pre-defined topology

Driven by API

Scale in 10,000s

Any-to-any

Complex topologies

Market-driven innovation

With OpenFlow / SDN

Management and orchestration

- Centralized API to OF controller replaces the CLI of multiple devices
- Implementation of transactional semantics is trivial

Protocol Limitations

- Allows innovative protocols like L2-over-L3 tunneling at scale
- Provides centralized control plane

Vendor-independent abstraction

- Hardware vendors
- Software implementations like OVS

Scalability

- Scaling OF controller is solvable problem
- Reduces complexity of network devices

Key capabilities enabled by SDN

- “Network infrastructure as code”
  - Configuration version control and automatic provisioning
  - Networks portable across public/private clouds

- Disaster Recovery
  - Quickly provision networks without manual configuration
  - VM migration across WANs (private->public, public->public)

- Customers can use arbitrary IP space

- Let customer’s manage their own VLANs, subnets

- End-to-end QoS

Other Technologies to Watch

- Microsoft VL2
- ConteXtream
- Juniper Qfabric

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