Cloud Computing

Perspective from a Networking Company
David Bernstein, VP/GM, Software Group
Cisco Systems, Inc.

Cloud Service Models

Application

- SaaS

Abstract Services

- Services and Platforms for New Applications (via new APIs)


Flexible Infrastructure

- "Virtual Private Datacenter"
- Familiar DC Resources Delivered On-Demand
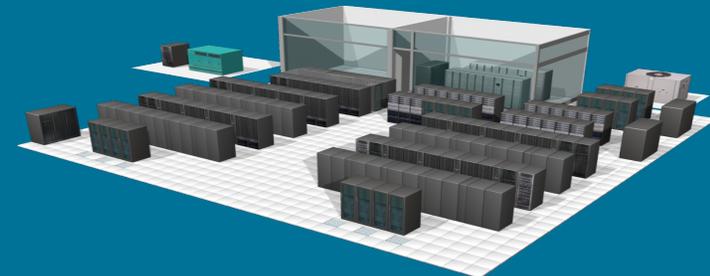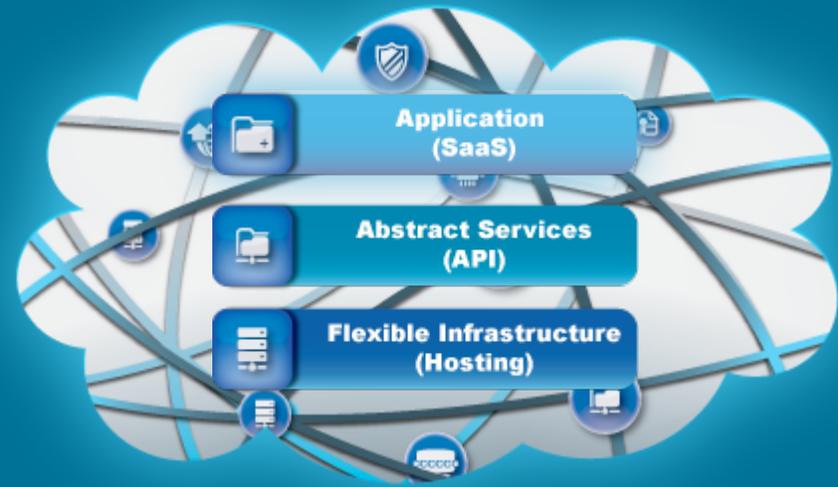
IT Foundation

Next Wave of Application Architecture
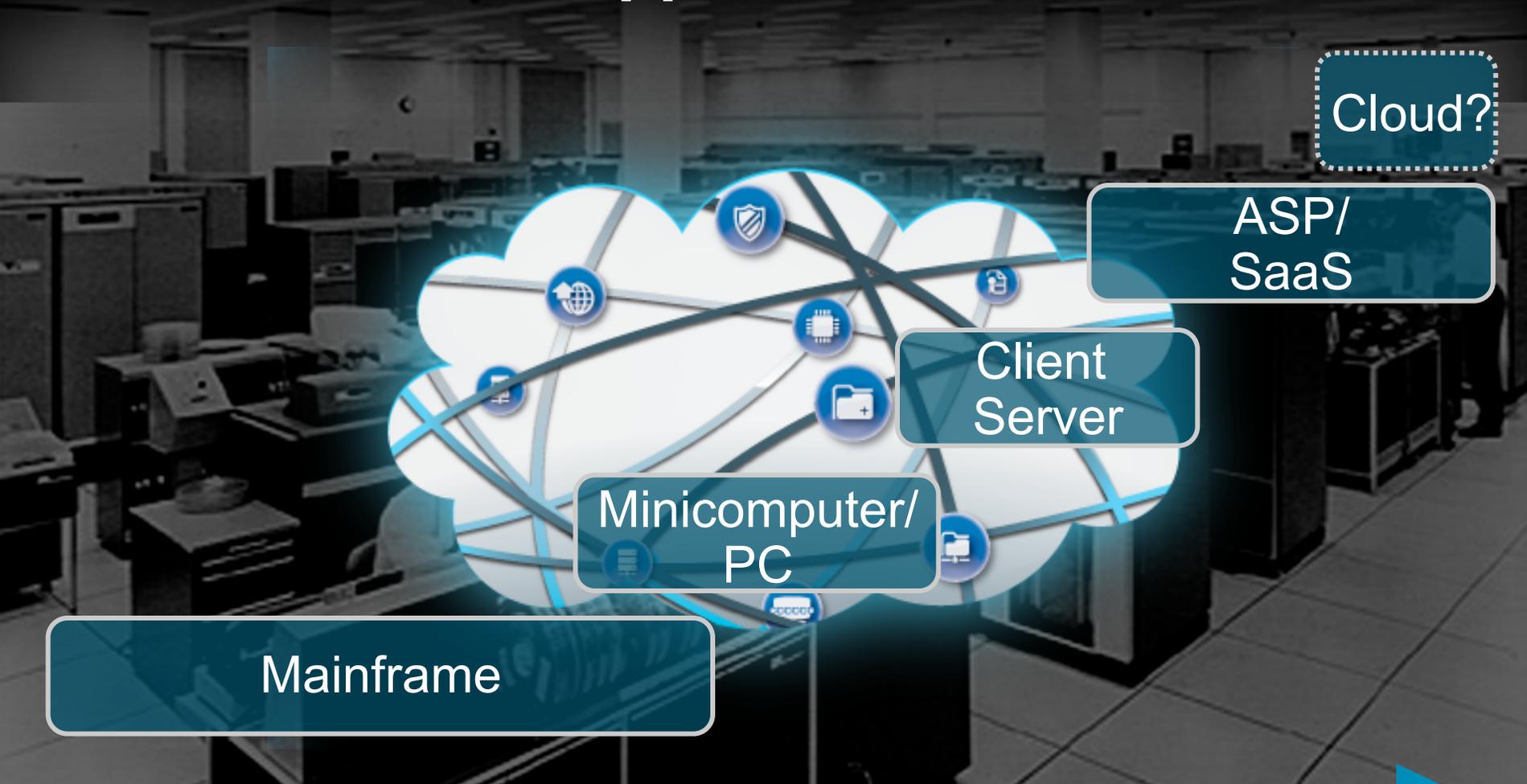
Cloud?

ASP/
SaaS

Client
Server

Minicomputer/
PC

Mainframe

1960   1970   1980   1990   2000

Cloud Adoption Will Be Rapid and Will Occur in Phases

Standalone Clouds

External, Off-Premise

Internal, On-Premise

Hybrid
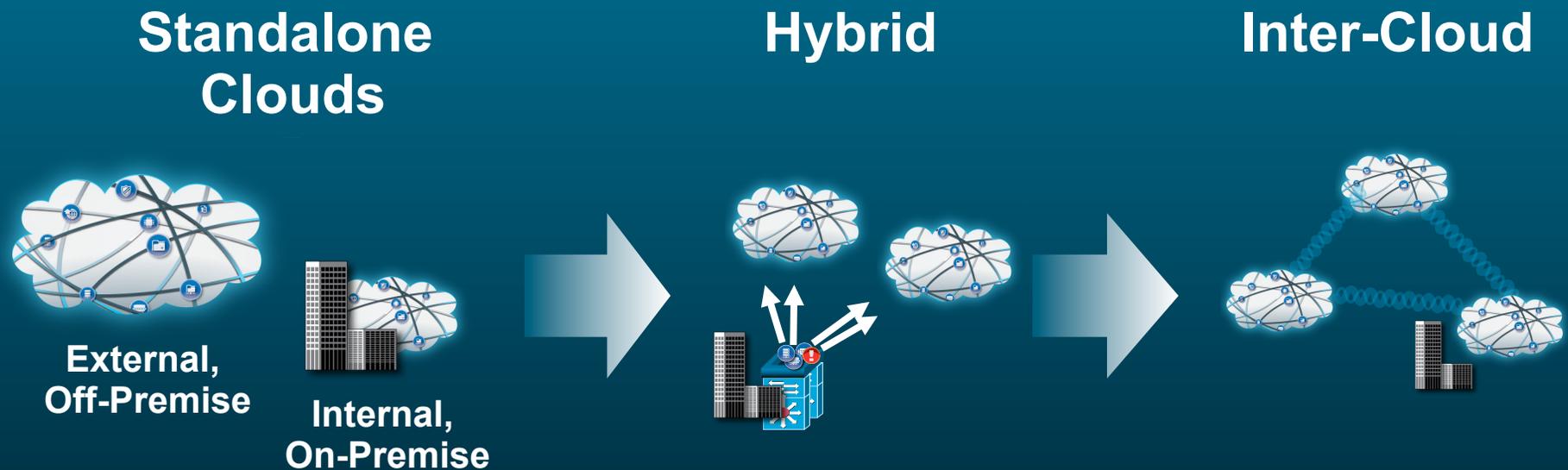
Inter-Cloud

Vision—The Intercloud
Flexible Infrastructure and a New Application Platform

Dynamic Workload Migration

Apps Integrate Services from Multiple Clouds

A Federation of Clouds Based on Open Standards:

- **Naming/Discovery**
- **Trust**
- **Exchange/Peering**

Cloud Infrastructure Challenges

Cost

Flexibility

Security

Complexity

Interoperability

Enterprise

Opportunity for the Network to Help

Profitability

Automation

Enterprise Class

Network-Centric

Service Provider
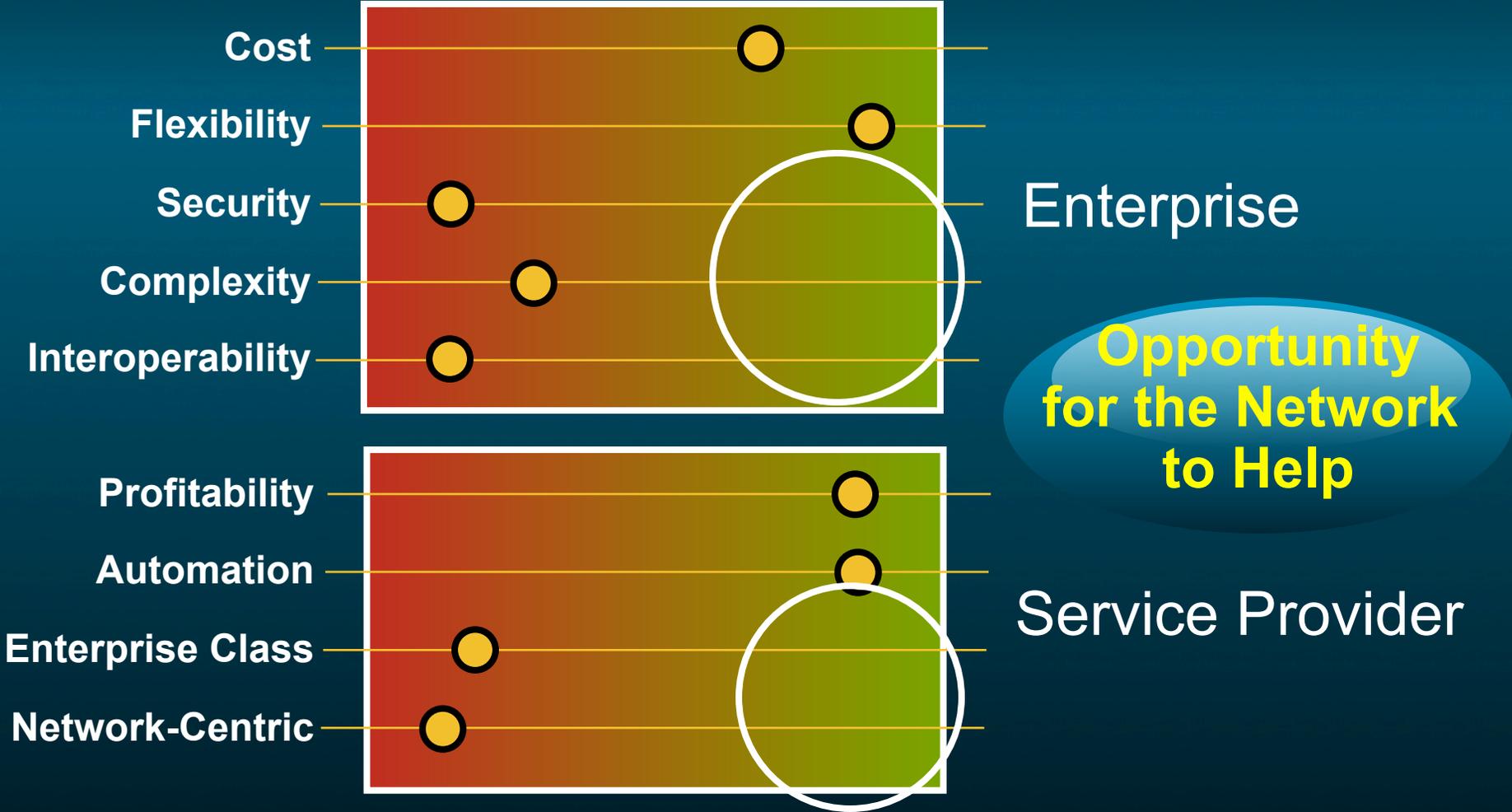
Virtualization is Driving Cloud

But Bandwidth between Components remains behind

1998

2008

2008

- **CPU- 350 Mhz**
- **I/O- 2 Gbps**

Performance Gap   **1GbE**

- **Network- 100Mb**

- **CPU- Quad 3.2 Ghz**
- **I/O- 16 Gbps**

Performance Gap   **10GbE**

- **Network- 1000Mb**

Virtualization

- **Drives I/O Perf.**
- **Scale**
- **Security Concern**
- **VM Transparency**

- **Network Virtualisation**
- **Unified Fabric**
- **Virtual Svces**

Virtualization - Great Benefits
but also New Challenges
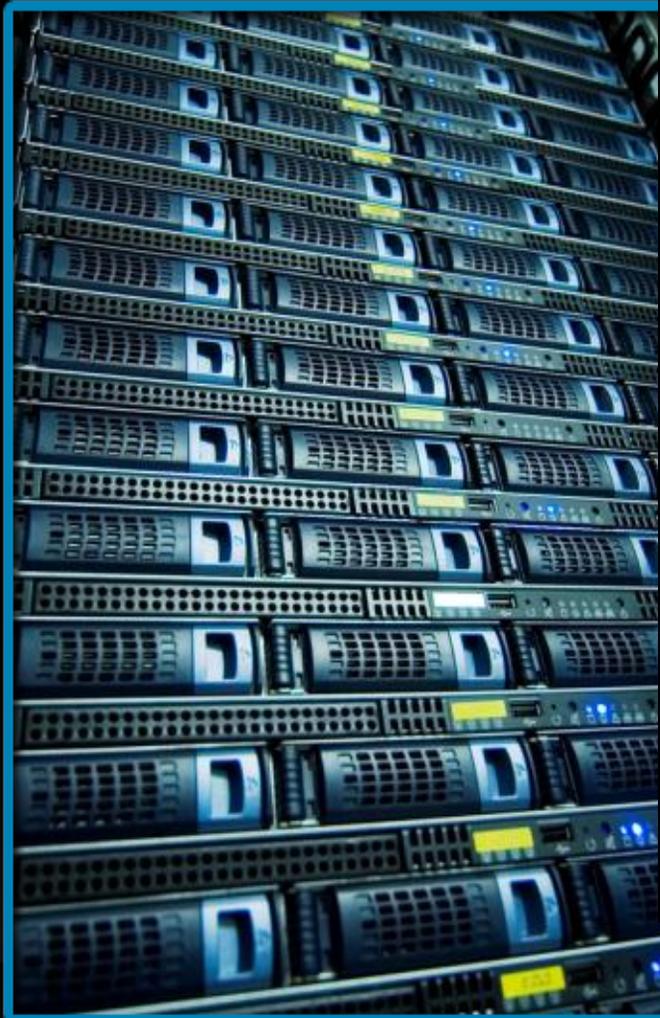
New Paradigm

- Virtual Machine is the New "Atomic Unit"
- Dynamic Movement of VMs / Applications
- New Options: VDI, Clouds, Workload Portability

Infrastructure

- Per-Virtual Machine services required
- Multi-Core CPU's, More I/O Bandwidth
- New emphasis on Security, Trust, QoS

Organization

- Breaks Current Organizational Model
- Reduces Visibility into 'Hidden' Resources
- Requires Continuous Availability/Provisioning

Server Virtualization - Challenges to Scaling

Security and Policy Enforcement

Applied at physical server—not the individual VM

Impossible to enforce policy for VMs in motion

Operations and Management

Lack of VM visibility, accountability, and consistency

Inefficient management model and inability to effectively troubleshoot

Organizational Structure

Blurs ownership as server admin must configure virtual network

Organizational redundancy creates compliance challenges

Storage Networks – Challenges in becoming Virtual Machine-Aware

VMs w/ NPIV

VSAN – Tier 1
VSAN – Tier 2
VSAN – Tier 3

SAN Fabric

Tier 1
Tier 2
Tier 3

FC
FC
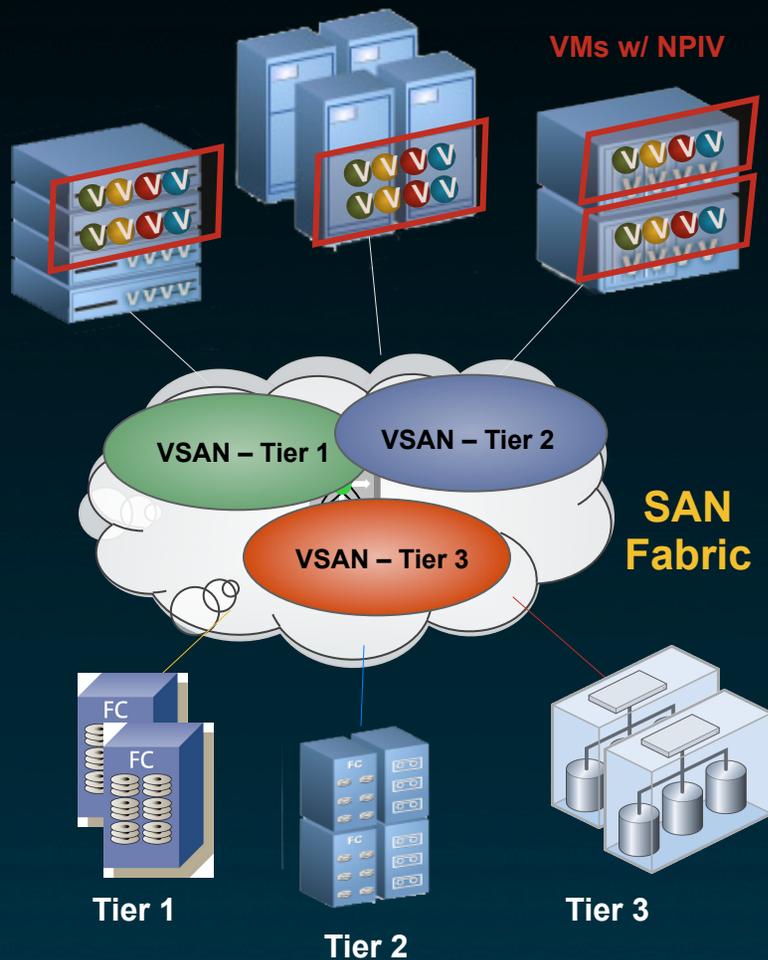
Fabric Scalability and Performance
Resilient, high performance fabric to support large, dense VM environments

Performance Monitoring and Trending
VM-granular management and troubleshooting

Quality of Service (QoS)
VM-granular policy provisioning

VSANs Isolate Fault Domains
Increase availability, simplify troubleshooting, improve security & compliance

Mobility with Security
Wire-speed encryption protects data in transit and VMs during migration

Virtual Interconnect: Unified Fabric
## Reducing complexity, Foundation for VM Mobility
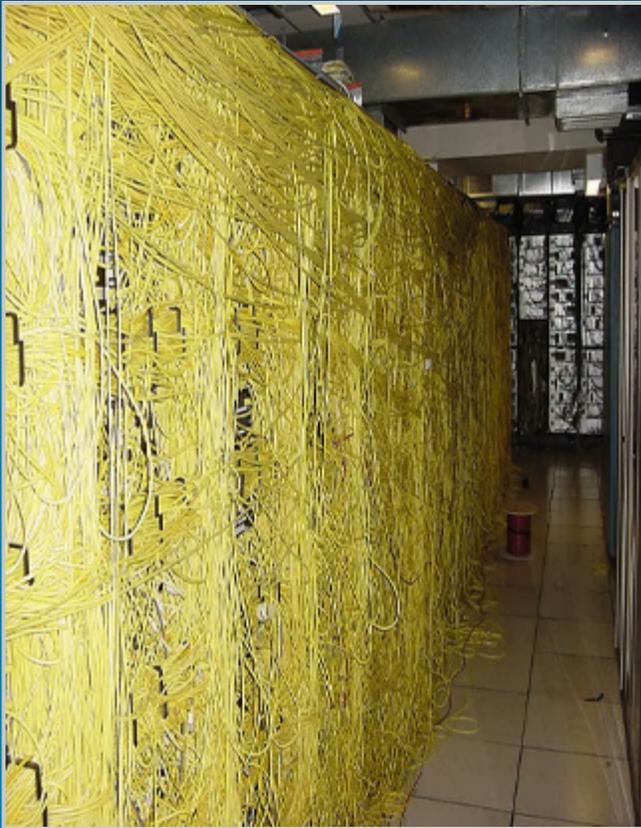
Complexity, Cost, Power

Efficient, Simpler Operations

VN-Link Brings VM Level Granularity

VMotion

vSwitch

vSwitch

vSwitch

VLAN 101
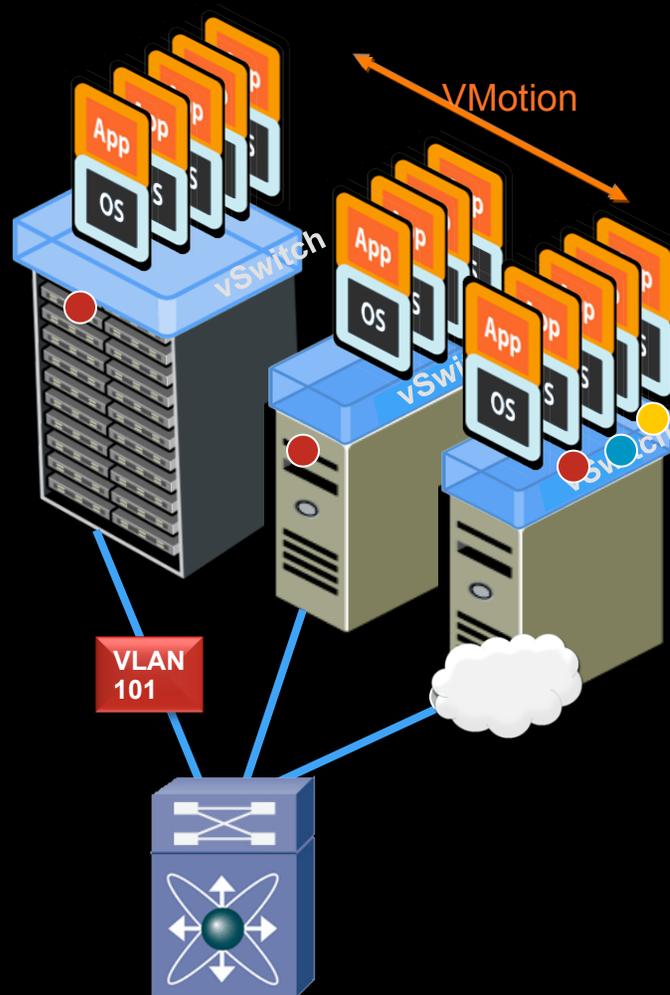
Problems:

- VMotion may move VMs across physical ports—policy must follow

- Impossible to view or apply policy to locally switched traffic

- Cannot correlate traffic on physical links—from multiple VMs

VN-Link:

- Extends network to the VM
- Consistent services
- Coordinated, coherent management

Cloud Scale Virtualization
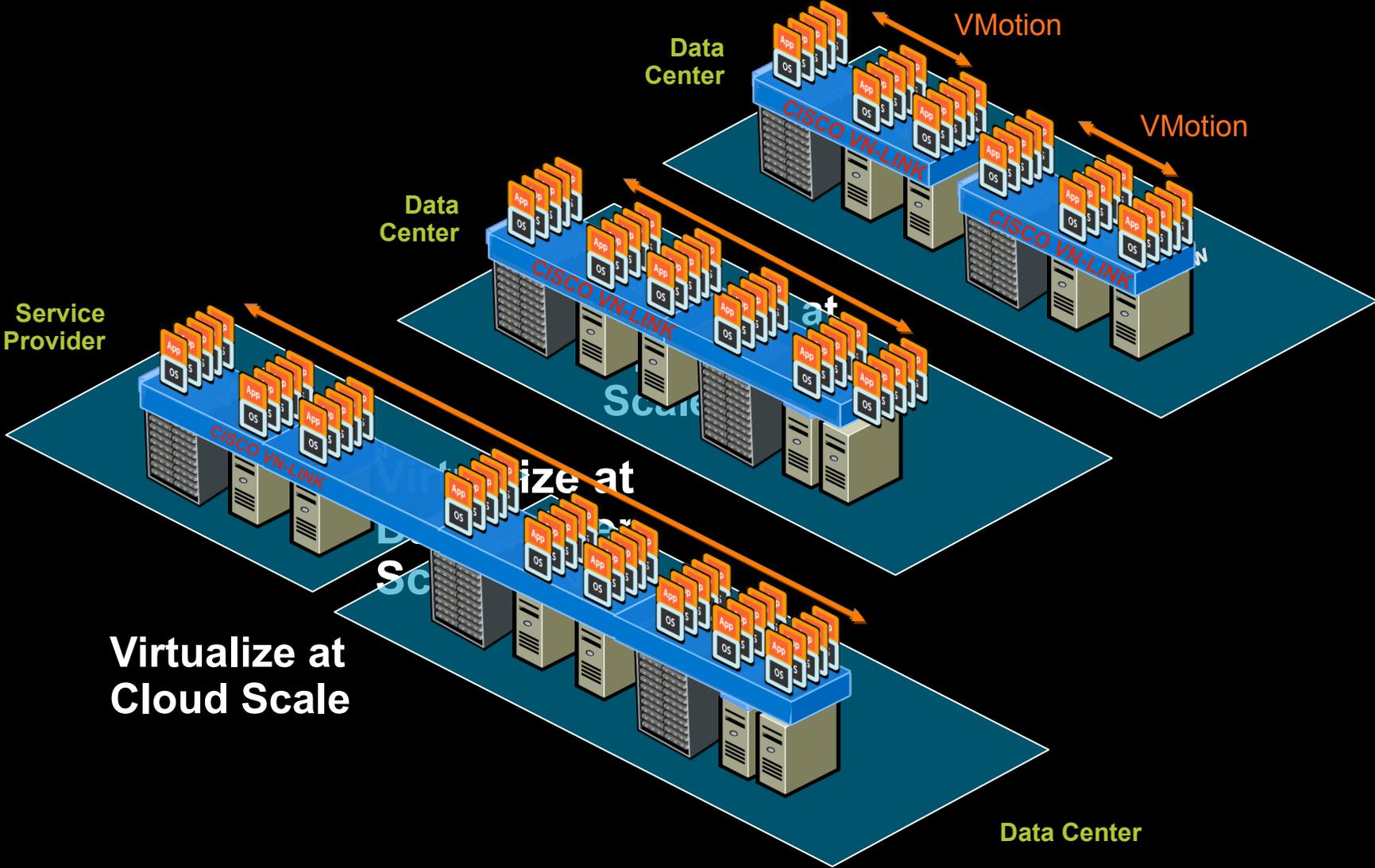
SP and Enterprise Interoperable Cloud Computing

- Standards based virtualization at a network scale
- Transparent interoperability between on-premise and off-premise computing
  - Ex. VDI and DR
- Enterprise and service provider use cases

Service Provider

CISCO VN-LINK

Virtualize at Network Scale

On Premise Data Center
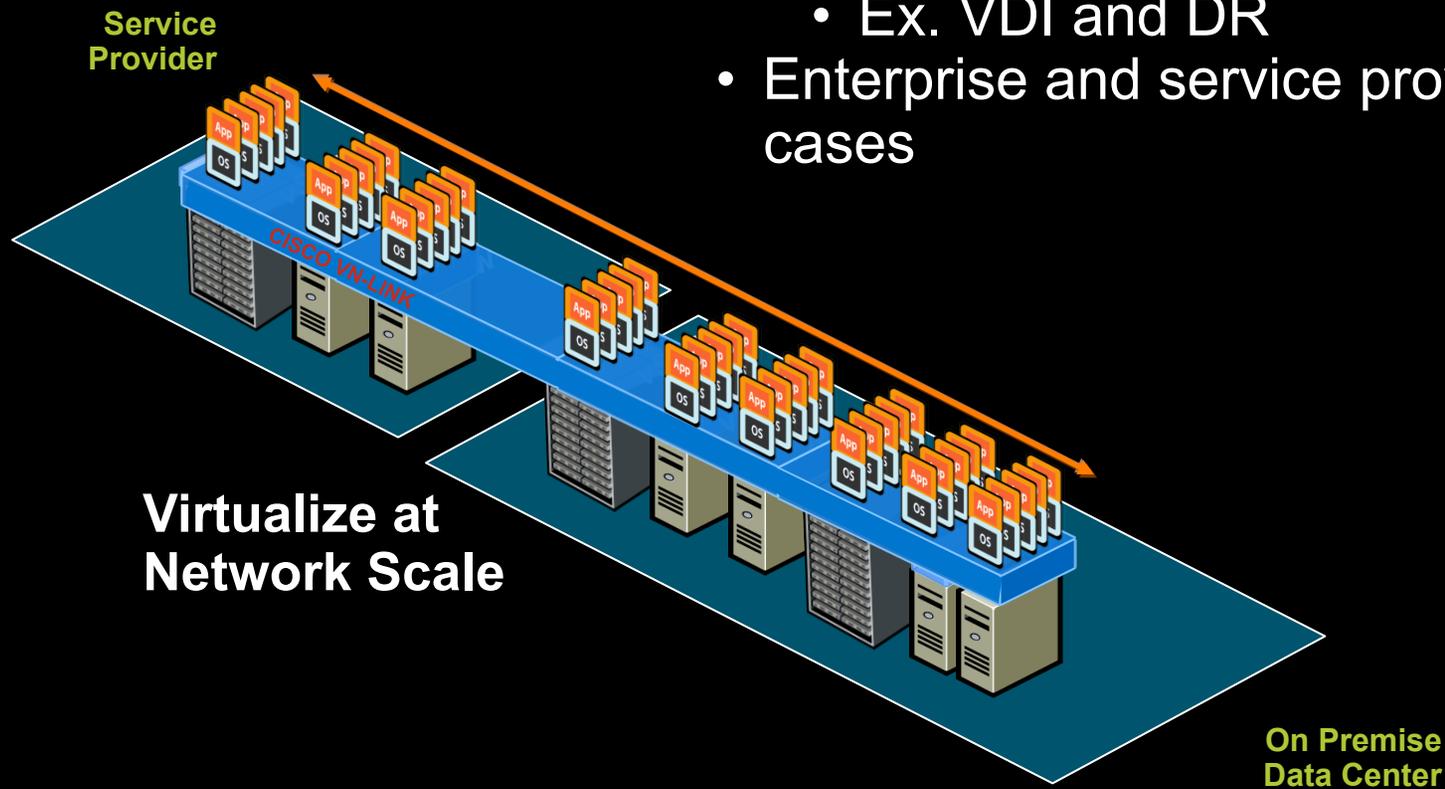
Cisco Strategy

Help Customers Build
"Enterprise-Class" Clouds,
Based on a Network-Derived
Architectural Advantage

Security	Virtualization Aware Networks	Interoperability