Putting
IPv6
to work

North American IPv6 Summit

Grand Hyatt, Denver, Colorado
September 23-25, 2014

Rocky Mountain IPv6 Task Force
RMv6TF

IPv6 labs-as-a-service

The easy way to hands-on training

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VMware

Christian Elsen – Who am I?

- Staff Product Integration Architect at VMware
- VMware's "IPv6 enthusiast"
  - Technical Product Management:
    IPv6 Requirements and Use Scenarios
  - Engineering: Helping to test solutions
  - Also covering: Certificate Management
- Background
  - Cisco
    - Corporate Business Development
      (Technology Intelligence)
    - Nexus 1000V EMEA launch team

What's this presentation about…

…and what is it not about?

- Tools VMware uses internally for:
  - Training people on IPv6
  - Provide sophisticated test and training environments
  - What works well for teams within VMware

- Using VMware products with IPv6
  - An interesting topic for another time

Agenda

1	**What's the challenge**
2	Cloud to the rescue?
3	The key to more than hot air
4	Use case example

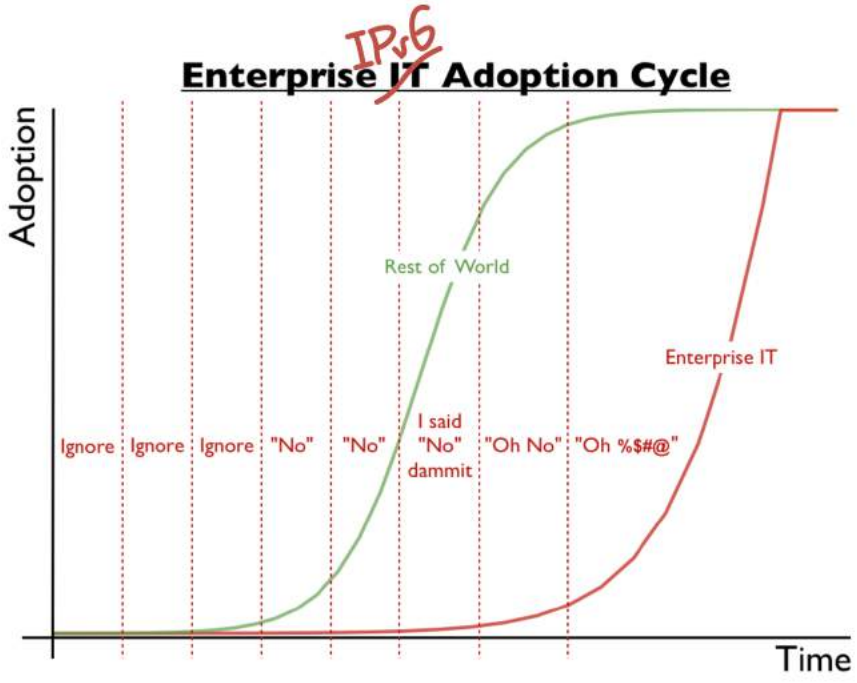
One day even we realized…

- Need to provide solid IPv6 capabilities in our products
- One hot topic: Exposure to IPv6
  - Train people on IPv6, best with hands-on experience
  - Allow architects and engineers to try out features with IPv6
  - Provide test beds in minutes, not hours
- We need:

  IPv6 labs-as-a-service

But then there is IT…

- **Reality:** IPv6 adoption in Enterprises is somewhere between lagging behind to non-existent
- Retrofitting a global enterprise network for thousands of distributed engineers is not easy…
- … and takes time. A lot of time.



- So what we actually really need:

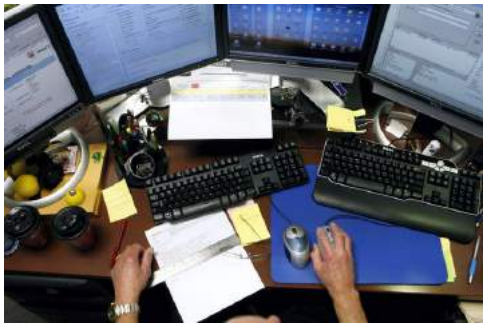
  IPv6 labs-as-a-service without IT having to implemet IPv6

Can we copy others: What are they doing?

- Physical labs
  - Costly to operate
  - Nightmare to maintain
  - Long lead times for equipment

- More computers under your desk
  - Inefficient utilization of resources
  - Didn't we invent virtualization to get rid of this?

Didn't want more of this!



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1	What's the challenge
2	**Cloud to the rescue?**
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What makes a lab in the cloud attractive?

- Abstract resources
  - Focus on your lab needs, not HW specs
- On-Demand provisioning
  - Have a lab available in minutes
- Scalability in minutes
  - Need a bigger lab, have it available in minutes
- Pay per consumption
  - Pay for what you really use
- Efficiency of experts
  - Leverage the skills, knowledge and resources of experts

That's how VMware runs VMWorld labs

Not so fast: Does the cloud actually support IPv6?

No, it doesn't!

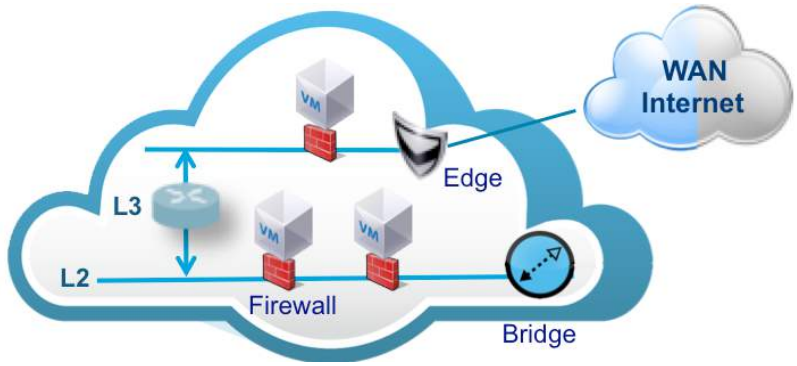
At least not to a level that you could build labs with it.

What now?

Also: Most clouds abstract away infrastructure

- Cloud abstract resources
  - Focus on running applications, not infrastructure components
- Network is usually presented as single L3 network
  - Need L2 for useful IPv6 labs
  - Need multiple L2 segments for advanced IPv6 labs
- We need:

  A cloud that still shows us network resources



vmware
vCloud Air™ Network

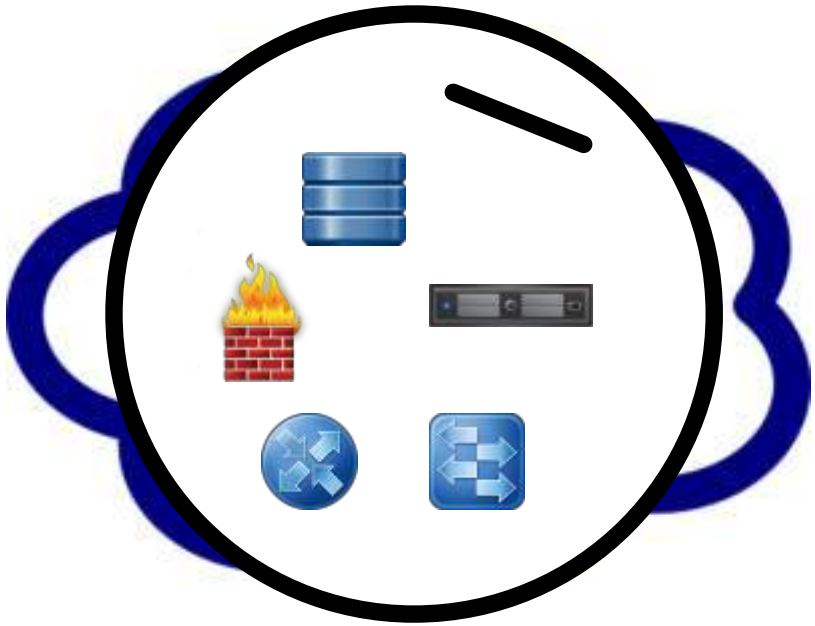
Agenda

1	What's the challenge
2	Cloud to the rescue?
3	**The key to more than hot air**
4	Use case example

The secret sauce: Encapsulate infrastructure inside the cloud

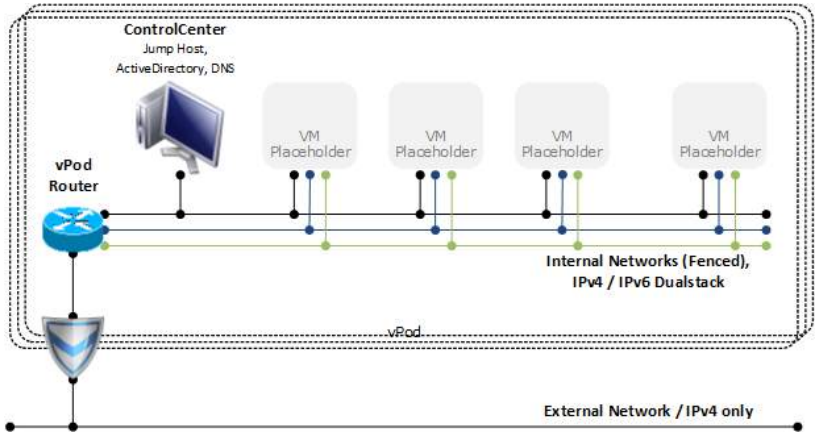
- Capture multiple VMs into a "bubble"
  - Includes L2 network between them
  - Each VM can be an infrastructure component
  - "Bubbles" shielded from each other (Encapsulation)
- Lifecycle around these "bubbles"
  - Create new "bubbles"
  - Store a golden master copy in a library
  - Instantiate multiple independent copies from the golden master
  - Discard a "bubble"
- These "bubbles" are very powerful :

  Called vPod (virtual Pod)



Virtual Testbeds (vPods)
A closer look

- **Goal:**
  - Mimic a customer's data center environment
  - In an isolated and thus replicatable fashion



Included

- Common data center services (Active Directory, DNS, NTP, CA)
- ControlCenter as Jump Host
  - Connect to lab via RDP
  - Have all tools and clients installed here
- Multiple L2 network segments
- Linux-based Router (vPodRouter) for L3 and basic network services
- SLAAC, DHCPv6, NTP, much more if you want to
- Pre-configured placeholders for various items
  - IP address scheme + DNS name

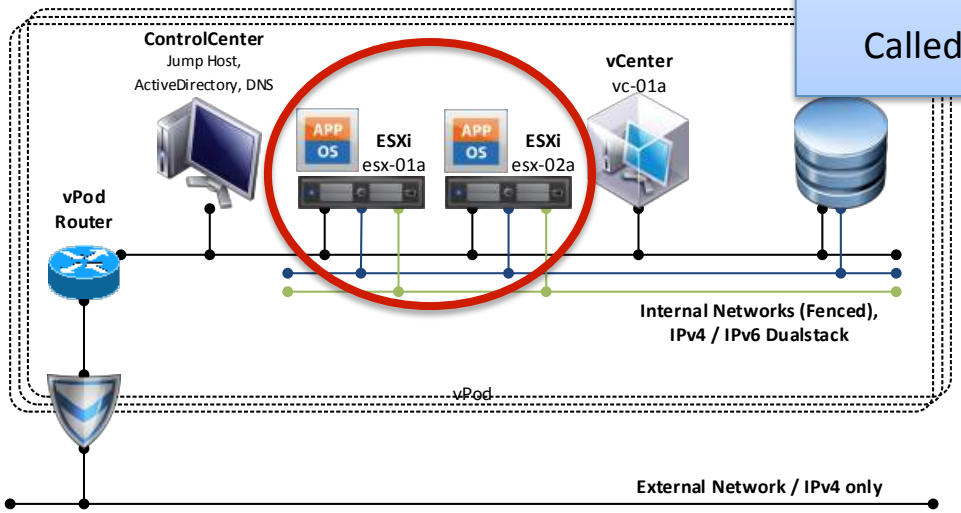
A simple example with VMware vSphere

- Simple vSphere Setup
  - Multiple ESXi hosts + vCenter
  - Network-based storage (NFS/iSCSI)
  - Isolated (non-routed) networks: NFS/iSCSI + VMotion

Even more secret sauce:

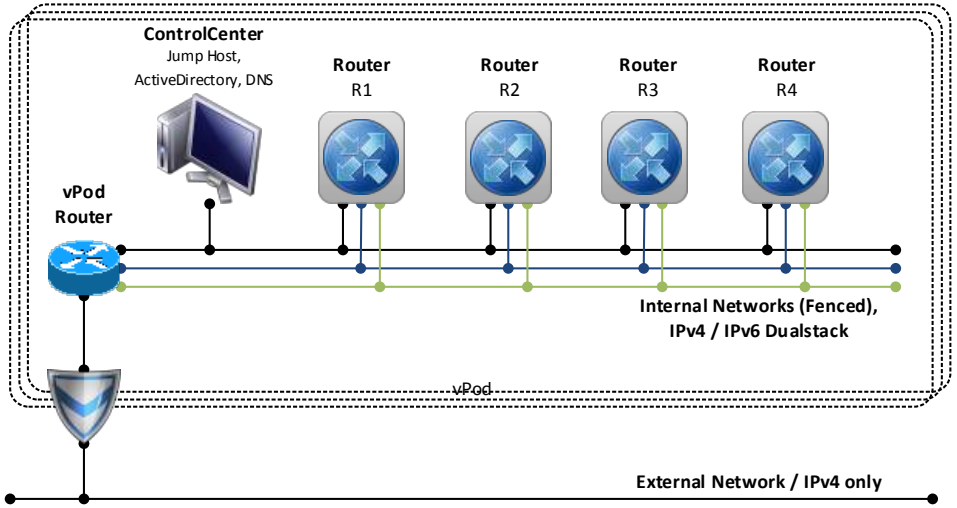
Here: ESXi host run inside a VM on another ESXi host (not visible)

Called: Nested virtualization



A more interesting example for network folks

- Network Equipment Setup
  - VM-based Router / L3 switches / firewalls / load balancer
  - Interconnected via various L2 links
  - Simulate, experiment, learn various complex network scenarios
    - This includes IPv6!



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IPv6 with vSphere: Let's help Emily!

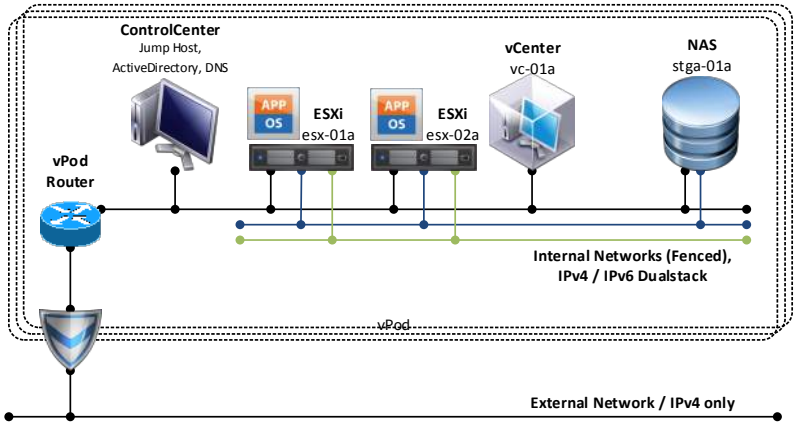
- Emily the engineer
  - Is working on customer support cases
  - Ended up with the short stick:
    Has to deal with all the IPv6 related cases

- Has to find out:
  - Will vSphere work with NFS or iSCSI over IPv6?
  - Can an ESXi work with Stateful DHCPv6?

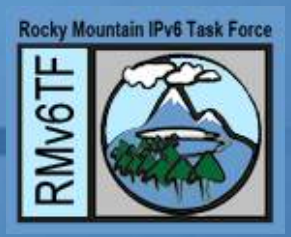
Let's help her via hands-on labs

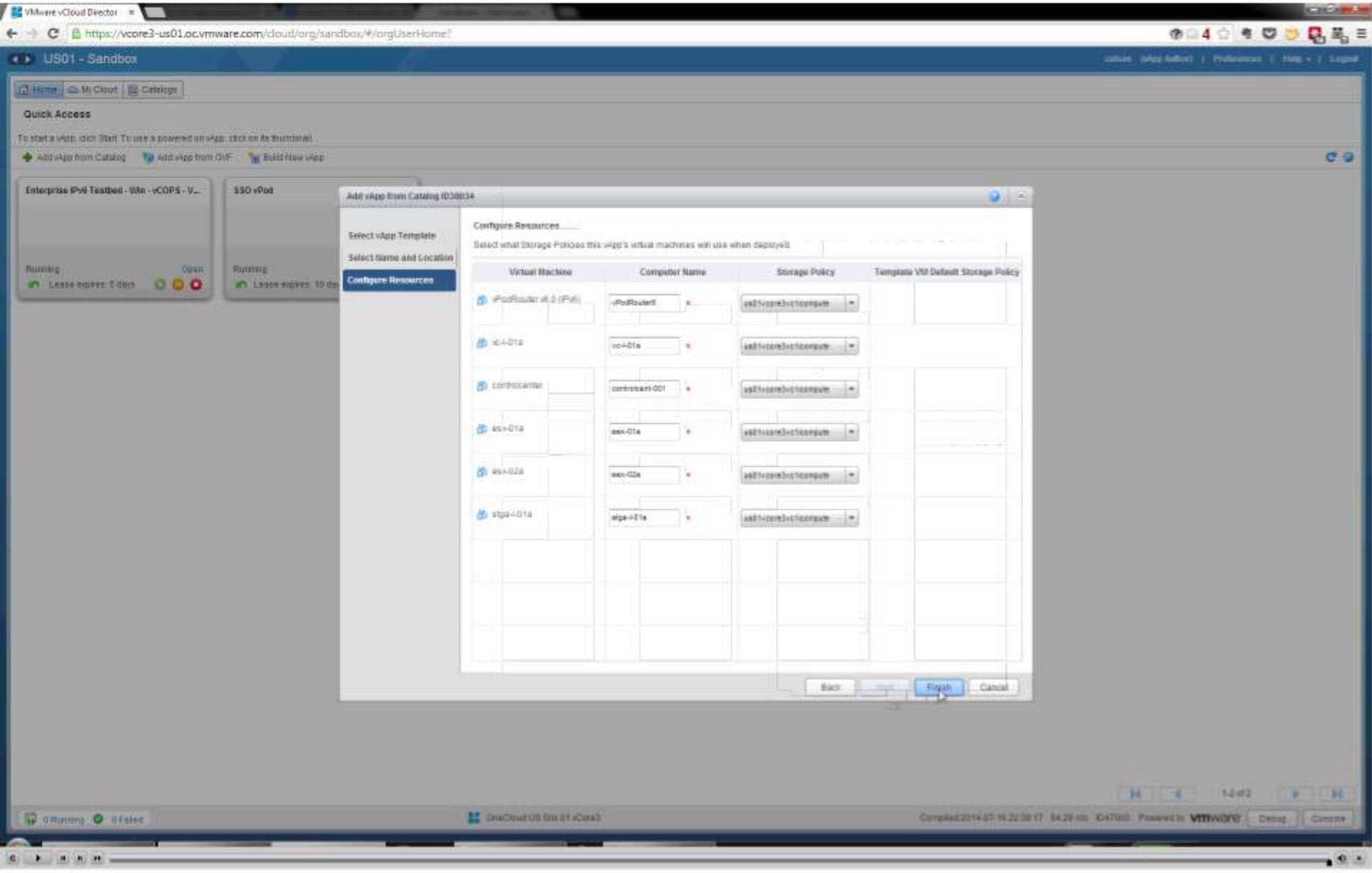
Testbed for use case example

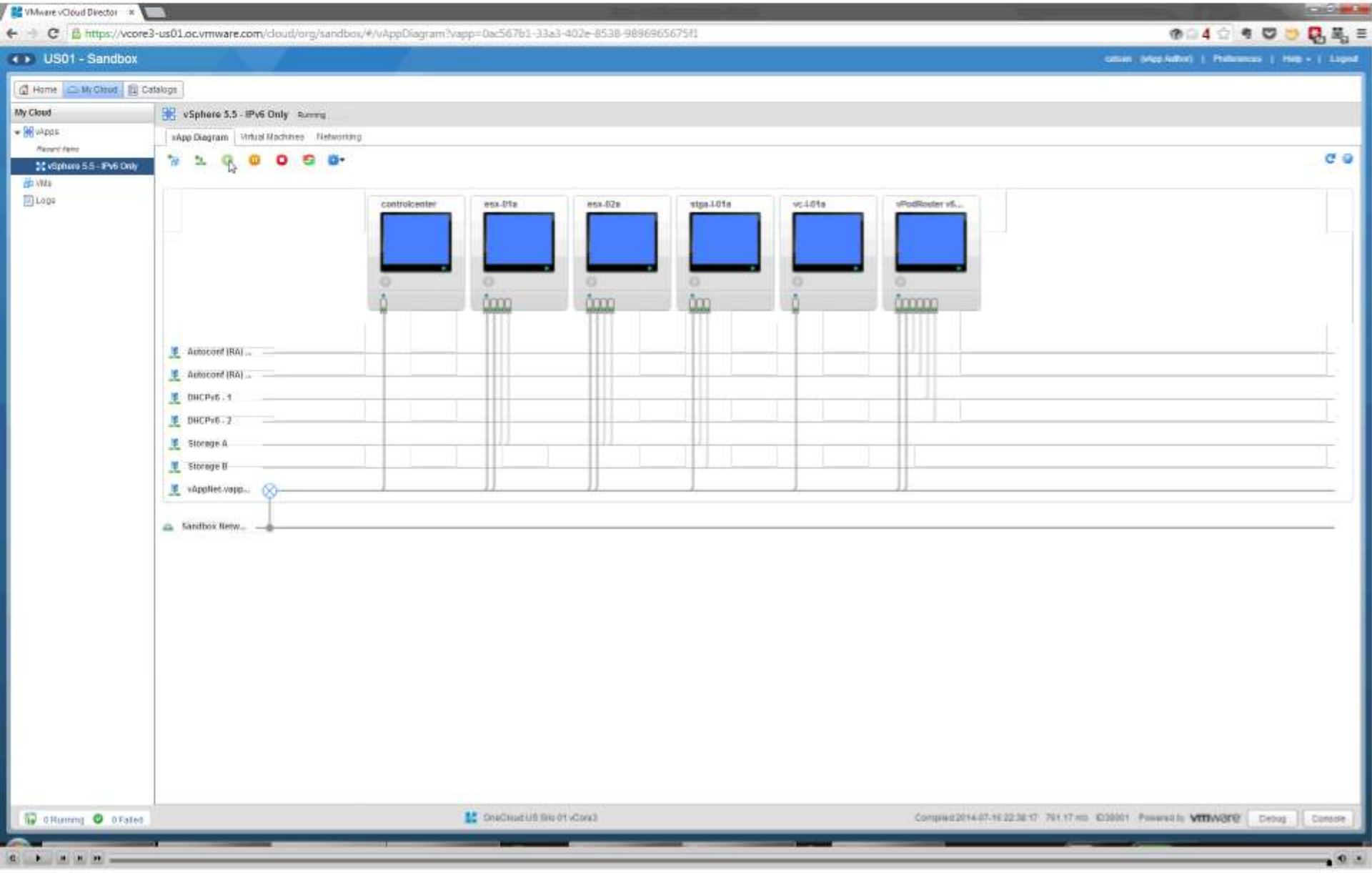
- What to do in each test
  - Test #1: Will vSphere work with NFS or iSCSI over IPv6?
    - NAS configured for IPv6?
    - ESXi configured for IPv6 only?
    - NFS share / iSCSI target mounted via IPv6?
  - Test #2: Can an ESXi work with Stateful DHCPv6?
    - L2 segment configured for Stateful DHCPv6
      - DHCPv6 server + RA (A=0, M=1, O=1)
    - Attach ESXi host to L2 segment
    - See what happens



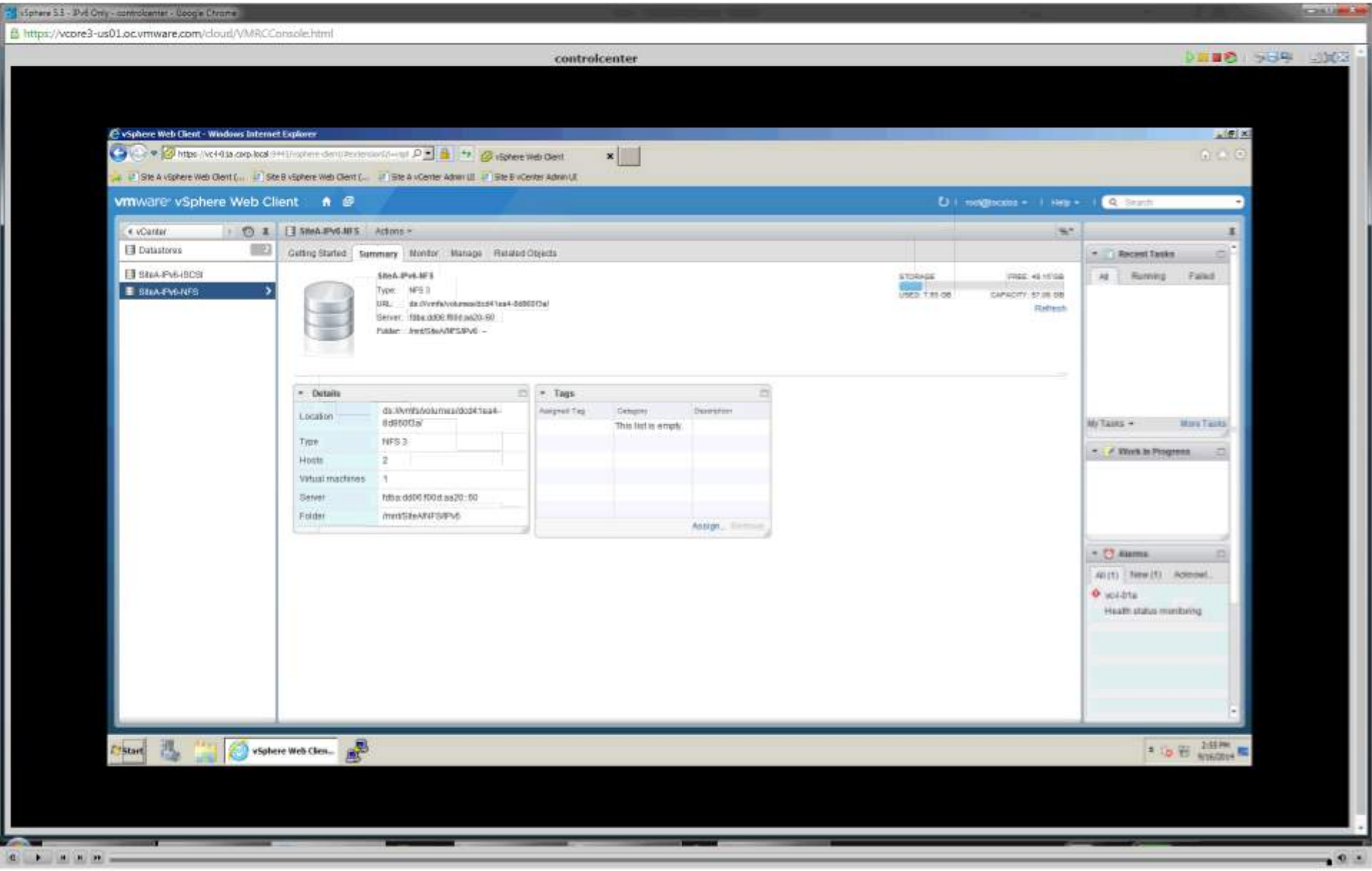
Demo: Deploying the vPod

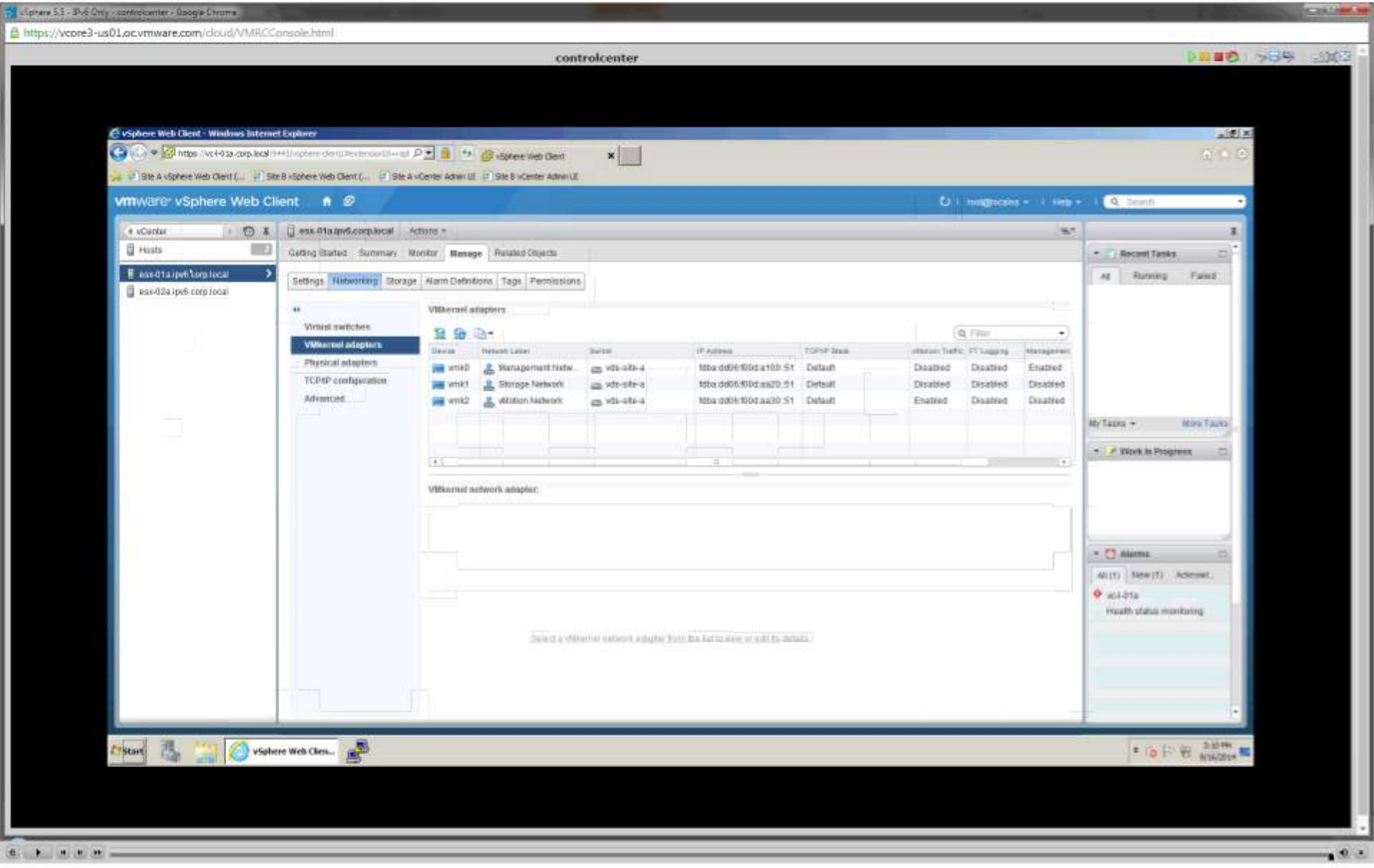



VMware vCloud Director
https://vcore3-us01.oc.vmware.com/cloud/org/sandbox/#/orgUserHome?
US01 - Sandbox
Home
My Cloud
Catalogs
Quick Access
Add vApp from Catalog
Add vApp from OVF
Build New vApp
Enterprise IPv6 Testbed - Win - vCOPS - V...
SSO vPod
Running
Open
Add vApp from Catalog ID38834
Select vApp Template
Select Name and Location
Configure Resources
Configure Resources
Select what Storage Policies this vApp's virtual machines will use when deployed.
Virtual Machine
Computer Name
Storage Policy
Template VM Default Storage Policy
vPodRouter v6.2 (IPv6)
vPodRouterB
vc-l-01a
vc-l-01a
controlcenter
controlcenter-001
esx-01a
esx-01a
esx-02a
esx-02a
vlpa-l-01a
vlpa-l-01a
Back
Next
Finish
Cancel
0 Running
0 Failed
Debug
Console

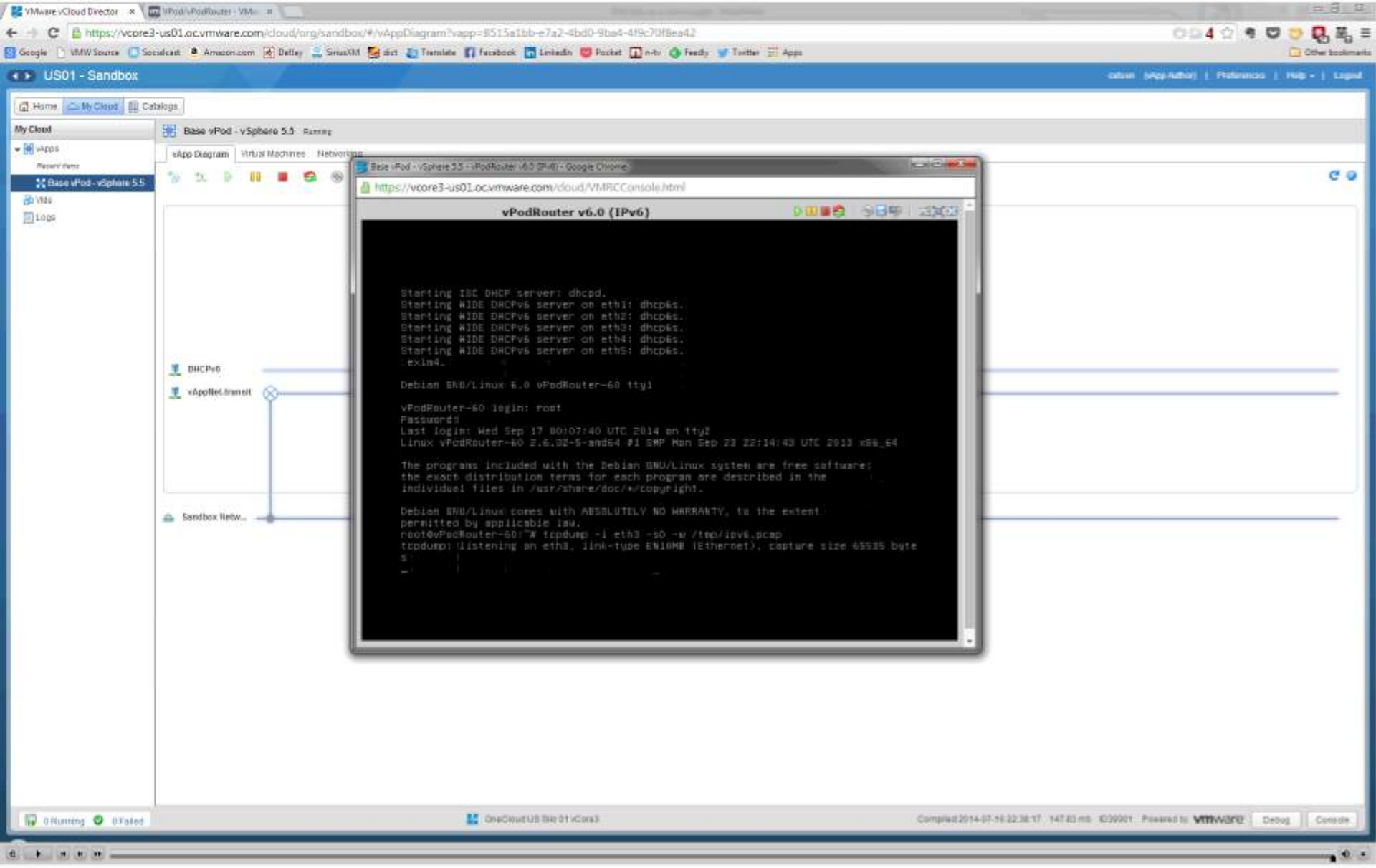

VMware vCloud Director
https://vcore3-us01.oc.vmware.com/cloud/org/sandbox/#/vAppDiagram?vapp=0ac567b1-33a3-402e-8538-989696567511
US01 - Sandbox
Home
My Cloud
Catalogs
My Cloud
vApps
vSphere 5.5 - IPv6 Only
VMs
Logs
vSphere 5.5 - IPv6 Only Running
vApp Diagram
Virtual Machines
Networking
controlcenter
esx-01a
esx-02a
stpa-t-01a
vc-t-01a
vPodRouter v6...
Autoconf (RA) ...
Autoconf (RA) ...
DHCPv6 - 1
DHCPv6 - 2
Storage A
Storage B
vAppNet-vapp...
Sandbox New...
0 Running
0 Failed
Debug
Console

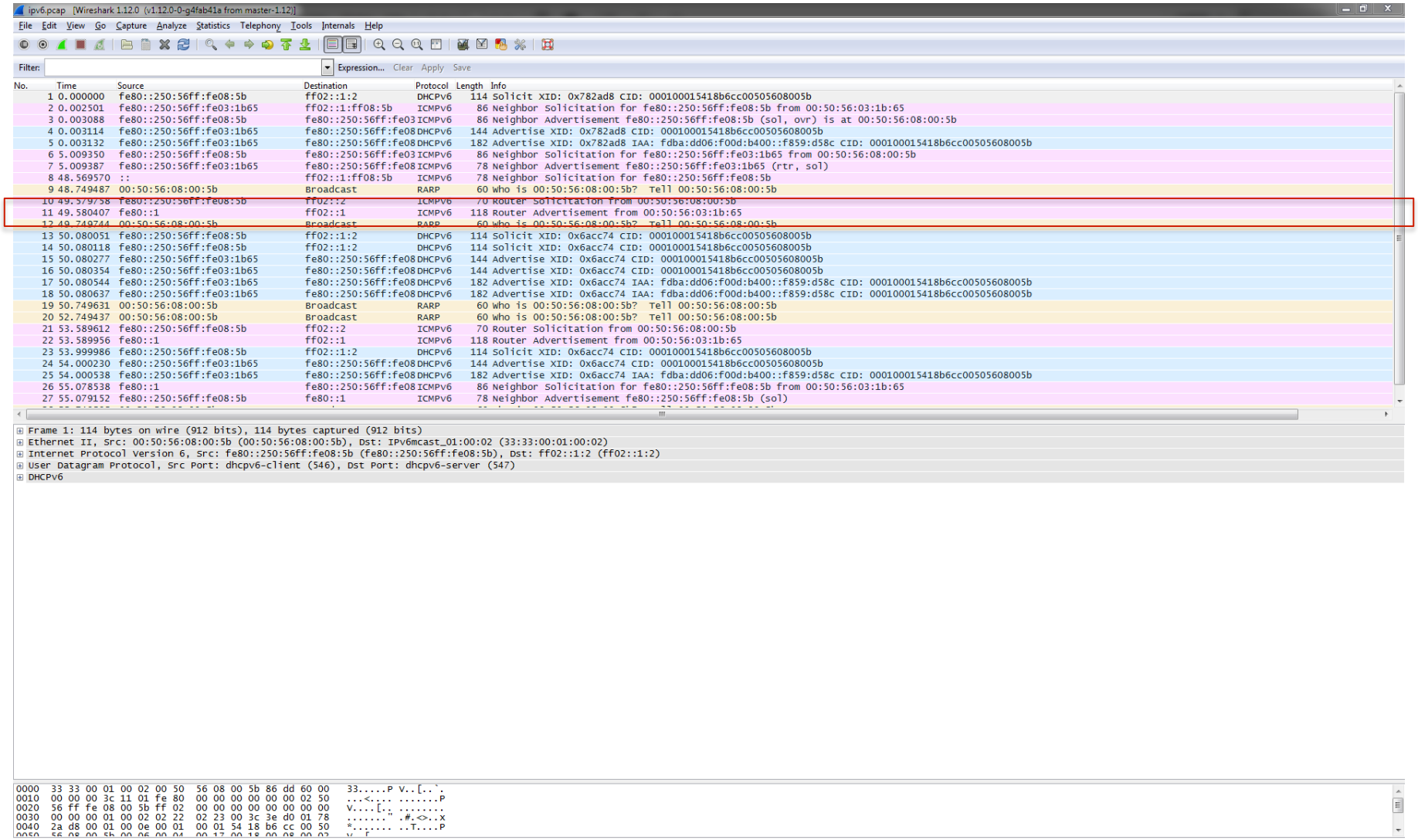
Demo: Will vSphere work with NFS or iSCSI over IPv6?

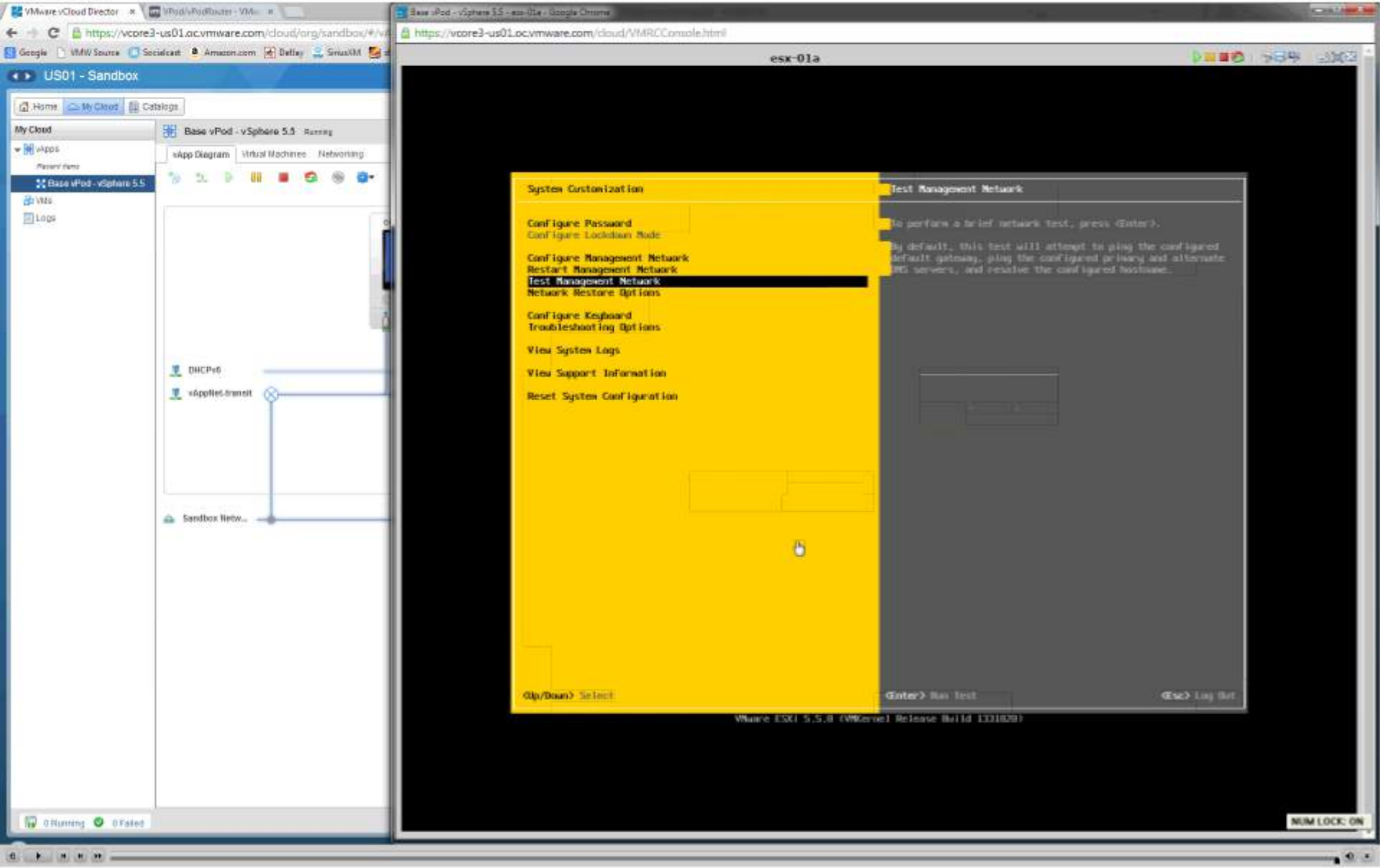

vSphere 5.1 - IPv6 Only - controlcenter - Google Chrome
https://vcore3-us01.oc.vmware.com/cloud/VMRCConsole.html
controlcenter
vSphere Web Client - Windows Internet Explorer
vmware vSphere Web Client
vCenter
Datastores
SiteA-IPv6-iSCSI
SiteA-IPv6-NFS
SiteA-IPv6-NFS
Actions
Getting Started
Summary
Monitor
Manage
Related Objects
Type: NFS 3
Server:
Folder:
Details
Location
Type
NFS 3
Hosts
2
Virtual machines
1
Server
Folder
Tags
This list is empty.
Assign...
Recent Tasks
Work in Progress
Alarms
Health status monitoring
Start
vSphere Web Clien...


https://vcore3-us01.oc.vmware.com/cloud/VMRCConsole.html
controlcenter
vSphere Web Client - Windows Internet Explorer
vmware vSphere Web Client
esx-01a.ipv6.corp.local
esx-02a.ipv6.corp.local
Getting Started
Summary
Monitor
Manage
Related Objects
Settings
Networking
Storage
Alarm Definitions
Tags
Permissions
Virtual switches
VMkernel adapters
Physical adapters
TCP/IP configuration
Advanced
VMkernel adapters
VMkernel network adapter
Recent Tasks
Work In Progress
Alarms
Start
vSphere Web Clien...

Demo: Can an ESXi work with Stateful DHCPv6?


US01 - Sandbox
Base vPod - vSphere 5.5
https://vcore3-us01.oc.vmware.com/cloud/VMRCConsole.html
vPodRouter v6.0 (IPv6)
Starting ISC DHCP server: dhcpd.
Starting WIDE DHCPv6 server on eth1: dhcp6s.
Starting WIDE DHCPv6 server on eth2: dhcp6s.
Starting WIDE DHCPv6 server on eth3: dhcp6s.
Starting WIDE DHCPv6 server on eth4: dhcp6s.
Starting WIDE DHCPv6 server on eth5: dhcp6s.
exim4.
Debian GNU/Linux 6.0 vPodRouter-60 tty1
vPodRouter-60 login: root
Password:
Last login: Wed Sep 17 00:07:40 UTC 2014 on tty2
Linux vPodRouter-60 2.6.32-5-amd64 #1 SMP Mon Sep 23 22:14:43 UTC 2013 x86_64
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@vPodRouter-60:~# tcpdump -i eth3 -s0 -w /tmp/ipv6.pcap
tcpdump: listening on eth3, link-type EN10MB (Ethernet), capture size 65535 byte
s
DHCPv6
vAppNet-transit
Sandbox Netw...

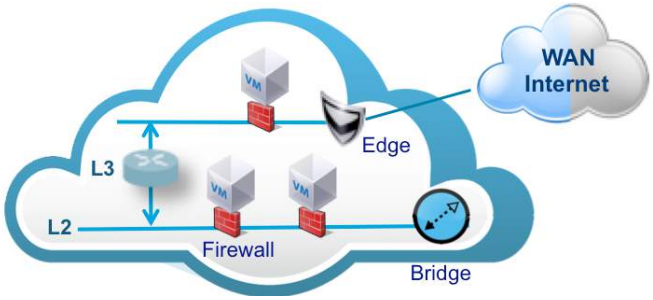

ipv6.pcap [Wireshark 1.12.0 (v1.12.0-0-g4fab41a from master-1.12)]
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help
Filter: Expression... Clear Apply Save
No. Time Source Destination Protocol Length Info
1 0.000000 fe80::250:56ff:fe08:5b ff02::1:2 DHCPv6 114 Solicit XID: 0x782ad8 CID: 000100015418b6cc00505608005b
2 0.002501 fe80::250:56ff:fe03:1b65 ff02::1:ff08:5b ICMPv6 86 Neighbor Solicitation for fe80::250:56ff:fe08:5b from 00:50:56:03:1b:65
3 0.003088 fe80::250:56ff:fe08:5b fe80::250:56ff:fe03 ICMPv6 86 Neighbor Advertisement fe80::250:56ff:fe08:5b (sol, ovr) is at 00:50:56:08:00:5b
4 0.003114 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 144 Advertise XID: 0x782ad8 CID: 000100015418b6cc00505608005b
5 0.003132 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 182 Advertise XID: 0x782ad8 IAA: fdba:dd06:f00d:b400::f859:d58c CID: 000100015418b6cc00505608005b
6 5.009350 fe80::250:56ff:fe08:5b fe80::250:56ff:fe03 ICMPv6 86 Neighbor Solicitation for fe80::250:56ff:fe03:1b65 from 00:50:56:08:00:5b
7 5.009387 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 ICMPv6 78 Neighbor Advertisement fe80::250:56ff:fe03:1b65 (rtr, sol)
8 48.569570 :: ff02::1:ff08:5b ICMPv6 78 Neighbor Solicitation for fe80::250:56ff:fe08:5b
9 48.749487 00:50:56:08:00:5b Broadcast RARP 60 Who is 00:50:56:08:00:5b? Tell 00:50:56:08:00:5b
10 49.579758 fe80::250:56ff:fe08:5b ff02::2 ICMPv6 70 Router Solicitation from 00:50:56:08:00:5b
11 49.580407 fe80::1 ff02::1 ICMPv6 118 Router Advertisement from 00:50:56:03:1b:65
12 49.749744 00:50:56:08:00:5b Broadcast RARP 60 Who is 00:50:56:08:00:5b? Tell 00:50:56:08:00:5b
13 50.080051 fe80::250:56ff:fe08:5b ff02::1:2 DHCPv6 114 Solicit XID: 0x6acc74 CID: 000100015418b6cc00505608005b
14 50.080118 fe80::250:56ff:fe08:5b ff02::1:2 DHCPv6 114 Solicit XID: 0x6acc74 CID: 000100015418b6cc00505608005b
15 50.080277 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 144 Advertise XID: 0x6acc74 CID: 000100015418b6cc00505608005b
16 50.080354 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 144 Advertise XID: 0x6acc74 CID: 000100015418b6cc00505608005b
17 50.080544 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 182 Advertise XID: 0x6acc74 IAA: fdba:dd06:f00d:b400::f859:d58c CID: 000100015418b6cc00505608005b
18 50.080637 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 182 Advertise XID: 0x6acc74 IAA: fdba:dd06:f00d:b400::f859:d58c CID: 000100015418b6cc00505608005b
19 50.749631 00:50:56:08:00:5b Broadcast RARP 60 Who is 00:50:56:08:00:5b? Tell 00:50:56:08:00:5b
20 52.749437 00:50:56:08:00:5b Broadcast RARP 60 Who is 00:50:56:08:00:5b? Tell 00:50:56:08:00:5b
21 53.589612 fe80::250:56ff:fe08:5b ff02::2 ICMPv6 70 Router Solicitation from 00:50:56:08:00:5b
22 53.589956 fe80::1 ff02::1 ICMPv6 118 Router Advertisement from 00:50:56:03:1b:65
23 53.999986 fe80::250:56ff:fe08:5b ff02::1:2 DHCPv6 114 Solicit XID: 0x6acc74 CID: 000100015418b6cc00505608005b
24 54.000230 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 144 Advertise XID: 0x6acc74 CID: 000100015418b6cc00505608005b
25 54.000538 fe80::250:56ff:fe03:1b65 fe80::250:56ff:fe08 DHCPv6 182 Advertise XID: 0x6acc74 IAA: fdba:dd06:f00d:b400::f859:d58c CID: 000100015418b6cc00505608005b
26 55.078538 fe80::1 fe80::250:56ff:fe08 ICMPv6 86 Neighbor Solicitation for fe80::250:56ff:fe08:5b from 00:50:56:03:1b:65
27 55.079152 fe80::250:56ff:fe08:5b fe80::1 ICMPv6 78 Neighbor Advertisement fe80::250:56ff:fe08:5b (sol)
Frame 1: 114 bytes on wire (912 bits), 114 bytes captured (912 bits)
Ethernet II, Src: 00:50:56:08:00:5b (00:50:56:08:00:5b), Dst: IPv6mcast_01:00:02 (33:33:00:01:00:02)
Internet Protocol Version 6, Src: fe80::250:56ff:fe08:5b (fe80::250:56ff:fe08:5b), Dst: ff02::1:2 (ff02::1:2)
User Datagram Protocol, Src Port: dhcpv6-client (546), Dst Port: dhcpv6-server (547)
DHCPv6
0000 33 33 00 01 00 02 00 50 56 08 00 5b 86 dd 60 00 33.....P V..[..`.
0010 00 00 00 3c 11 01 fe 80 00 00 00 00 00 00 02 50 ...<.... ....P
0020 56 ff fe 08 00 5b ff 02 00 00 00 00 00 00 00 00 V....[.. ....
0030 00 00 00 01 00 02 02 22 02 23 00 3c 3e d0 01 78 ....".#.<>..x
0040 2a d8 00 01 00 0e 00 01 00 01 54 18 b6 cc 00 50 *....... ..T....P


VMware vCloud Director
https://vcore3-us01.oc.vmware.com/cloud/org/sandbox/#/v
US01 - Sandbox
Home
My Cloud
Catalogs
My Cloud
vApps
Base vPod - vSphere 5.5
VMs
Logs
Base vPod - vSphere 5.5 Running
vApp Diagram
Virtual Machines
Networking
DHCPv6
vAppNet-transit
Sandbox Netw...
0 Running
0 Failed
https://vcore3-us01.oc.vmware.com/cloud/VMRCConsole.html
esx-01a
System Customization
Configure Password
Configure Lockdown Mode
Configure Management Network
Restart Management Network
Test Management Network
Network Restore Options
Configure Keyboard
Troubleshooting Options
View System Logs
View Support Information
Reset System Configuration
Test Management Network
To perform a brief network test, press <Enter>.
By default, this test will attempt to ping the configured
default gateway, ping the configured primary and alternate
DNS servers, and resolve the configured hostname.
<Up/Down> Select
<Enter> Run test
<Esc> Log Out
VMware ESXi 5.5.0 (VMkernel Release Build 1331820)
NUM LOCK: ON

Summary

- vPods – Excellent for Hands-on-Labs
  - Mimic a customer's data center environment
  - In an isolated and thus replicatable fashion

- vPods and IPv6
  - Leverage full capabilities of IPv6 inside
  - Outside of vPod: No IPv6 necessary
  - About 1 week of work to IPv6-enable the Base vPod
  - All vPods for Hands-on-Lab at VMWorld were IPv6 capable



Thank you

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Web: www.edge-cloud.net

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LinkeIn: http://linkedin.com/in/christianelsen/