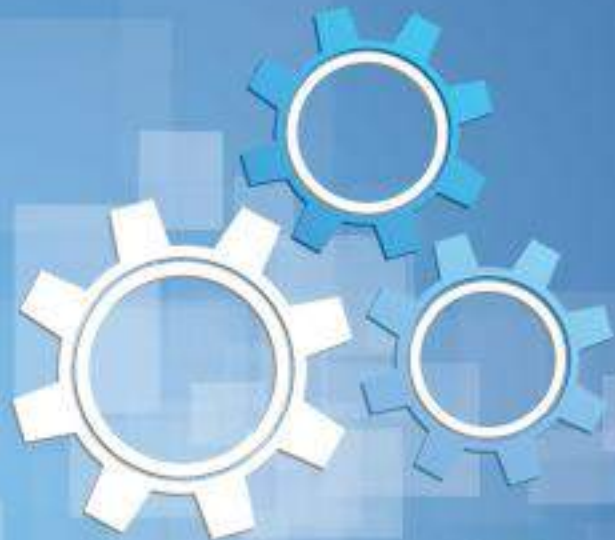


Putting **IPv6** to work



North American IPv6 Summit
Plaza Tower One Conference Facilities
Greenwood Village, CO
April 22-23, 2015

Rocky Mountain IPv6 Task Force





IPv6 Enablement of OpenStack





Becoming production ready

Ciprian Popoviciu
Shixiong Shang



Agenda



-  The IPv6 and Cloud Story
-  IPv6 and OpenStack Overview
-  IPv6 and OpenStack Case Study
-  Conclusion



A Little Bit About Us (Nephos (νέφος) = Cloud, 6 = IPv6)



IPv6

Cloud

Education



Consulting



Product



The IPv6 and Cloud Story

“The promise of Cloud cannot be delivered without IPv6”

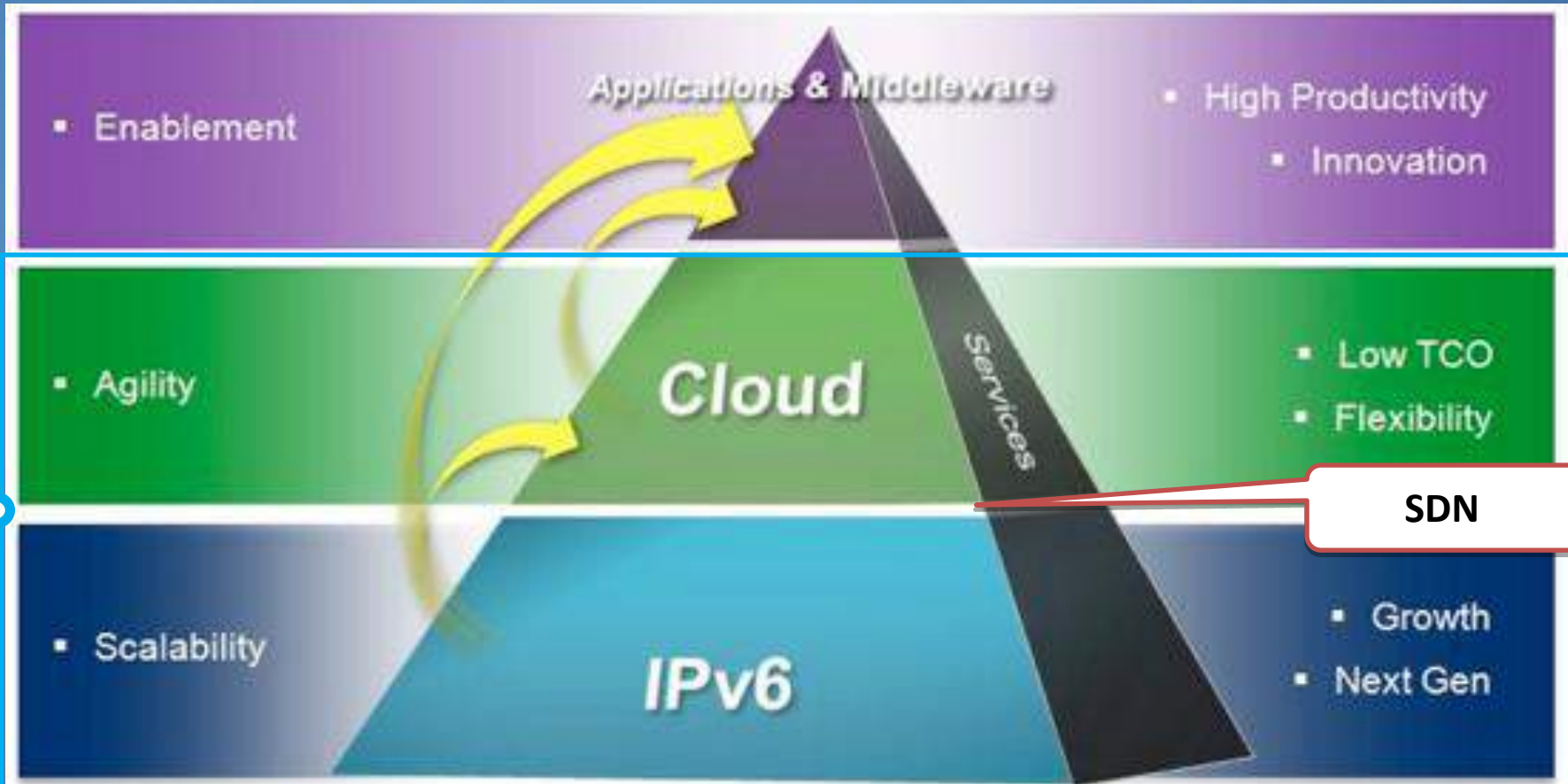


Three Four Major Inflection Points



Driver

Business Results



The inflection points are complex, simultaneous, interdependent and touch every aspect of IT

Benefits of IPv6 Based Clouds



▪ Addressing, addressing, addressing

- Direct access to Cloud resources
- Sufficient address space
- Easier management



Do not trivialize the power of plentiful IP address space

▪ Protocol Specific Considerations

- SLAAC as a provisioning option
- NDP which is better than ARP
- New architectural models, such as VXLAN, MAP



Great opportunities for innovation



Adoption and Trends



- **Public Cloud:** Full IPv6 support has a way to go. New entrants offer IPv6 early on and do it very well.

With mobile traffic going mostly over IPv6, how can a public cloud provider not offer native IPv6 access?

- **Private Cloud:** Demand for IPv6 enabled OpenStack is accelerating however OpenStack is not ready despite claims it is.

With more proof that IPv6 based data centers can be more efficiently managed, how would enterprises not ask for IPv6 enabled OpenStack?

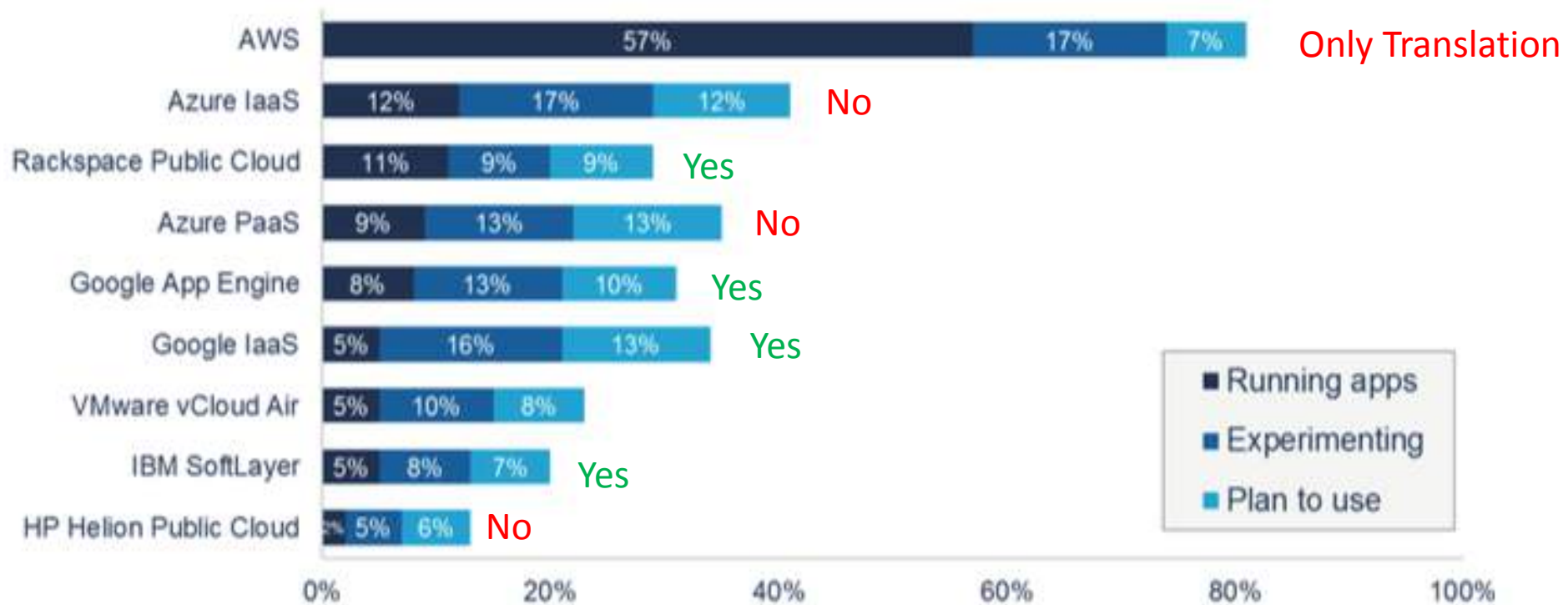


Adoption and Trends



Public Cloud Usage

% of Respondents Running Applications



Source: RightScale 2015 State of the Cloud Report

A User Perspective



- We developed a SaaS based service assurance tool called v6Sonar that monitors Cloud services over IPv4 and IPv6
<http://www.v6sonar.com>
- v6Sonar offers IPv4/IPv6 monitoring agents around the World using new, innovative IPv6 ready IaaS providers such as:
 - Digital Ocean
 - Vultr
 - RamNode
- The backend is in Amazon because of ease of operations for a SaaS based product however, lack of IPv6 native is a major annoyance and one of the reasons we are weighing hosting options.



IPv6 and OpenStack Overview

“OpenStack is the top open-source IaaS platform but not ready for IPv6 primetime”



OpenStack & IPv6 Demand



OpenStack is the foundation of many large public clouds and private clouds of all sizes (top open-source IaaS platform in 2014)

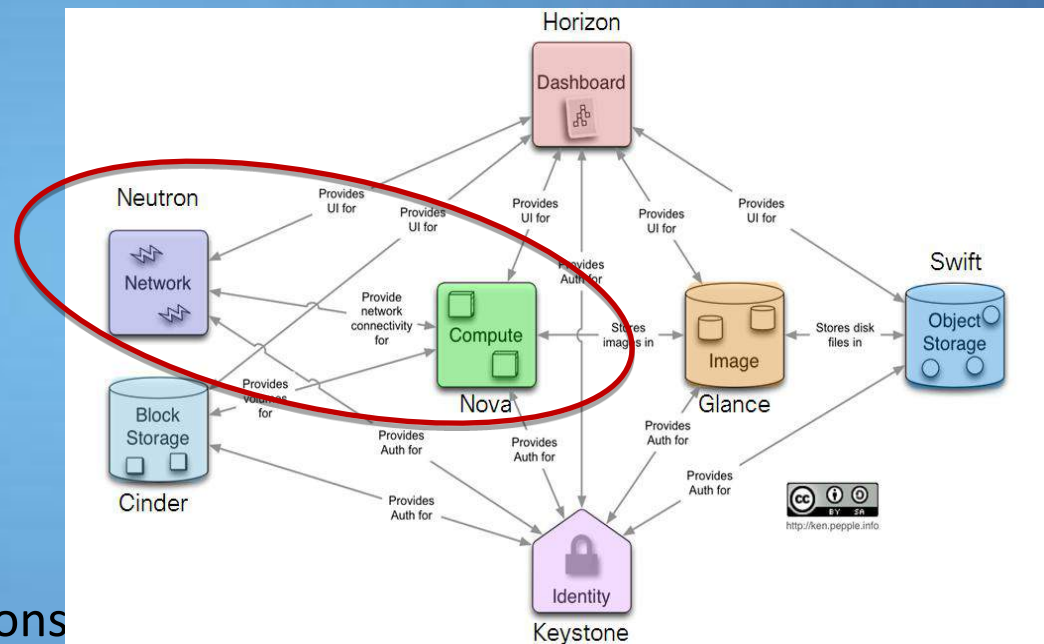
- Large OpenStack cloud providers such as Cisco, Comcast, ATT, DT are experiencing the scaling constraints imposed by IPv4 and customers demanding IPv6 enabled Virtual Private Cloud
- Some organization rightfully align their IPv6 and cloud plans
- Greenfield OpenStack deployments are facing IPv6 compliance requirements
- New cloud provider market entrants see IPv6 as a differentiator
- More than 50% of mobile traffic is over IPv6 and most of the apps are SaaS based hence likely to operate on OpenStack
- IOT drives Cloud but IPv6 makes true IOT possible and cloud integration is critical



OpenStack & IPv6 Overview



- The initial IPv6 enablement work focuses on Neutron but touches Horizon as well
- Have to overcome many IPv4 centric assumptions
 - Address architecture
 - Provisioning options
 - Control plane implementation
 - Security considerations
- IPv6 provides new design options
- Must keep in mind dual-stack operation considerations. In Icehouse, configuring IPv6 on a non-enabled OpenStack infrastructure had major negative impact



OpenStack & IPv6 Challenges



- There are many claims of support however, all of them unsubstantiated through production grade deployments:
 - **Challenge – Take Juno or most commercial release package and deploy with it an IPv6 enabled OpenStack cloud. Good luck!**
- Architectural/Design challenges:
 - To make it work, we are undoing the IPv4 centric view in Neutron
 - We have yet to start being innovative based on IPv6
 - IPv6 security implementation



IPv6 & DevOps with Cloud



- DevOps challenges:
 - There are no IPv6 related test cases in Tempest (public repository) or Rally (test scenarios)
 - There are no monitoring tools
- No one really knows how to do it well
 - Lack of IPv6 knowledge and experience
 - Lack of experience operating IPv6 and just starting to learn about operating OpenStack



OpenStack & IPv6 Roadmap



Claim: IPv6 Supported
Reality: Nothing really works, IPv6 enablement negatively impacts deployments

Claim: Full support of IPv6
Reality:
 -True support depends on deployment scenario
 -It is buggy
 -Entire scenarios not tested
 -No scale and performance numbers
 -Security left out

Industry State of Art

Grizzly

Havana

Icehouse

Juno

Kilo

OpenStack Releases

Patched OpenStack to support IPv6

First IPv6 Only Prod Deploymnt

Patched RHEL/OSP 5 to support IPv6

Dev of IPv6 ready tests of IPv6 enabled OpenStack

First POC showing the operation of IPv6 enabled OpenStack

-Supporting EU election services in Germany
 -5% of traffic IPv6

Extensive Testing
 Unit test
 Functional test
 API test
 Negative test
 Scale/Performance test

IPv6 security hardening for operational readiness
Scale testing in preparation for large scale production deployment

Developed Pv6 blueprints for Neutron

Nephos6 Work (development is aligned up to Kilo release)

IPv6 and OpenStack Case Study

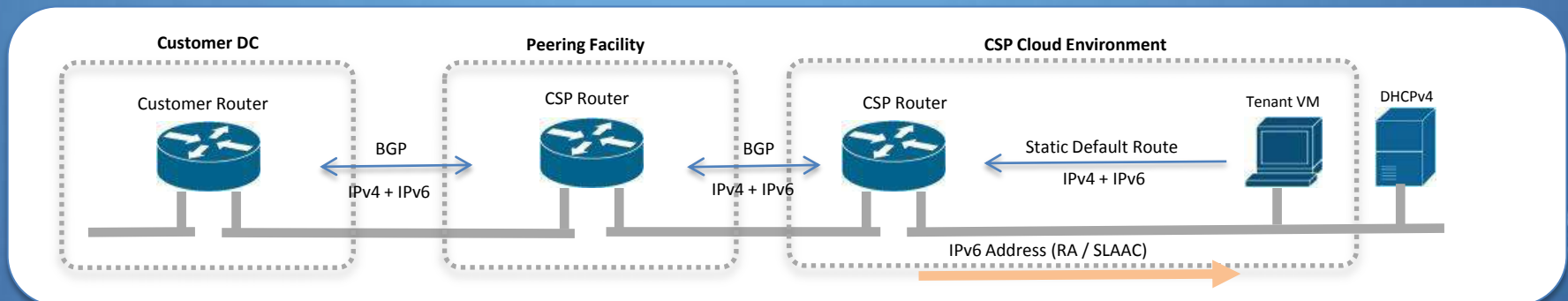
“Todo, it is not markitecture anymore!”



An Implementation Story



- Environment:
 - Large Cloud Service Provider
 - RHEL7/OSP5 based deployment
- Driver: Customer clear request for IPv6 support in order to deliver services from their VPC (Virtual Private Cloud) over IPv6
- Approach: Take a provider model for service delivery where customer VMs are provisioned using SLAAC and Stateless DHCPv6



Implementation



- Aligned with the Neutron IPv6 subcommittee blueprints using the two new attributes

| Attribute | Description | Possible Values |
|-------------------|---|---|
| ipv6_ra_mode | Determine who sends RA and which AMO bits are set. | dhcpv6-stateful dhcpv6-stateless slaac attr_not_specified (i.e. blank) |
| ipv6_address_mode | Determine how VM obtains IPv6 address, default gateway, and/or optional information | dhcpv6-stateful dhcpv6-stateless slaac attr_not_specified (i.e. blank) |

- Added several features to harden functionality and address IPv6 idiosyncrasies
- IPv6 security review and implementation
- Developed test methodology and test scripts for release process



Lessons Learned



- OpenStack community only provides the reference architecture. Any cloud provider, must tailor it for its own needs. Out of box solutions are just a pipe dream.
- During customization, a cloud provider needs to take several key factors into the consideration, like security, scalability and operations, which are completely ignored by the community
- A good DevOps process provides the much needed quality assurance. This is what OpenStack community lacks the most.
- **Off the shelf OpenStack not ready for IPv6 enablement in production**



Lessons Learned (cont.)



- We built code aligned with the community to avoid lock-in
- As we moved our code from earlier small deployments to this environment, we focused more on operational considerations:
 - Support for an IPv6 enabled environment
 - Making it easy to upgrade to future OpenStack releases
 - Monitoring and metering
- We developed multiple test scripts for Tempest and Rally (there was no support for IPv6 enabled OpenStack)
- We did a security analysis and mitigated risk through code & process



Conclusions

“Waiting for others to do it is a losing game”



Conclusions



- Address both inflection points, IPv6 and Cloud within a common, comprehensive, corporate wide strategy
- An IPv6 perspective will change your Cloud architecture for the better and vice versa
- For your **public cloud** needs, you likely use Amazon – push them to support IPv6, at least on par with IPv4
- For your **private cloud** needs, you likely use OpenStack – push your vendor and the community to support IPv6
- Trust IPv6 support claims but make sure you **verify**
- Remember, it is more than just a quick demo of functionality: test, scale, secure, deploy, monitor your IPv6 enabled Cloud.





**“The Promise of Cloud
Cannot Be Fully Met
Without IPv6”**

The Cloud and IPv6 Company



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