IPv6 on OpenStack
Feature Parity is a Tricky Question
Today’s Sequence

• Quick Review of OpenStack
• Is OpenStack IPv6 Ready?
• Case Study: CERN’s use of OpenStack
• Takeaways
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OpenStack Is...

• An open source cloud platform project
  – (Here, “Cloud” == “virtualized computing”)

• Started 2010 by Rackspace & NASA
  – Now well over 100 member companies
  – After 11 releases, maturing but still evolving

• Early focus was compute and storage
  – Networks were just an attribute of a compute node
  – Now networks are treated as “equal citizens”
OpenStack Governance

Technical Committee

Meet the Tech Committee

Software Development & Direction

13 Total Members (elected by active tech contributors)

Determines cross-program issues

Board of Directors

Meet the Board of Directors

Protect, Promote, & Empower

8 Appointed
Platinum appointed by members

8 Elected Gold elected by member class

8 Elected Individual elected by individual members

User Committee

Meet the User Committee

User Advocacy and Feedback

Representing 75+ Global User Groups
OpenStack Cloud Platform
The (Overly) Simple Version
OpenStack: Too Much Detail?

Notes:
- Lots of “projects”
  - KVM, HyperV, etc
- Many hypervisors
- Network just a piece
  - Quantum / Neutron
- Very configurable
- Some network features run as VMs on servers!
  - Firewall
  - Load balancer
## OpenStack releases

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<th>Release</th>
<th>Date</th>
<th>Included Components</th>
<th>(Note: all have Nova + Swift)</th>
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Notable OpenStack Users (point: scale)

- AT&T
- Alcatel-Lucent
- BMW
- Deutsche Telekom
- DreamHost
- eBay
- HP Converged Cloud and HP Public Cloud
- Intel
- Internap
- KT (formerly Korea Telecom)
- NASA
- NSA
- PayPal
- Rackspace Cloud
- Sony
- SUSE Cloud solution
- Wikimedia Labs
- Yahoo!
- Walmart
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IPv6 Considerations with OpenStack

• The Core of OpenStack is IPv4/IPv6/Dual Stack capable
  – with feature parity

• However!
  – Much of the power of OpenStack ecosystem is outside of the core
    • Variety of Hypervisors with varying levels of support depending on features / configuration
      – E.g. “OpenVSwitch” does not support VXLAN tunnels on IPv6
    • Add-on functionality that runs in VMs may have differing support
      – E.g. “Load-Balancer-as-a-Service” or “Firewall-as-a-Service”
  – No “One Size Fits All”
    • If you are using advanced features, like XaaS or VXLAN, you must take more care
Quick look at IPv6 Bugs in OpenStack

• Just to give you a flavor
  – Notes: “Zero” is not credible, Too many signals immaturity

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About CERN

- CERN is the European Organization for Nuclear Research in Geneva
  - Particle accelerators and other infrastructure for high energy physics (HEP) research
  - Worldwide community
    - 21 member states (+ 2 incoming members)
    - Observers: Turkey, Russia, Japan, USA, India
    - About 2300 staff
    - >11’000 users (about 5’000 on-site)
    - Budget (2014) ~1000 MCHF

- Birthplace of the World Wide Web
CERNs drivers for IPv6 and OpenStack

• IPv6 for two main reasons
  – Increased address space for CERN
  – Needed IPv6 connectivity for partners who are IPv6-only!

• “Cloud” is both a driver for IPv6, and an enabler of IPv6
  – The number of workloads means huge need for address space
  – Flexible resources made much easier to test new configurations

• OpenStack was chosen based on the community
  – Several deployments larger than CERN (!!)
  – This means CERN is not constantly solving bleeding edge problems
• Expect to record 400PB/yr by 2023
• 50x compute load expected (budget?)

• Good news / Bad News
  – Budapest online, facility usage growing,
    BUT:
    • Staff fixed, budget decreasing
    • Legacy tools are high maintenance
    • User expectations are for fast self-service

• Innovation Dilemma
  – How to avoid “sustainability trap”
    • Define reqmts that force custom solution?
  – Or can we learn from others and share
  – Are CERN compute needs truly special?
CERN OpenStack Status

• 4 OpenStack clouds at CERN
  – Largest is ~120,000 cores in ~4,000 servers
  – 3 other instances with 45,000 cores total

• Deployment details: Nothing fancy, just huge scale
  – Users can choose for their VMs: IPv4 or Dual Stack (enable v6, but don’t force it)
  – “Flat network”: No NAT, No isolation, every node can reach every other node
  – Just moved to Juno. Still “Linux Bridge” (no OVS); will move to Neutron with Liberty
  – Allows app developers to use Self-service model for rapid app deployment
  – Rapid deployment allowing experimentation in the cloud has helped IPv6 adoption
  – Test environment in cloud, then replicate environment into production

• Collaborating at open design summits (e.g. Paris Nov ‘14, w 4500 attendees)
  – This collaboration is very beneficial for CERN but not required for all users
The Geeky Stuff

- VM OS: 90% Linux (mostly on KVM) / 10% Windows (mostly on HyperV)
  - User Client OS can be whatever Windows/MAC, etc

- Subnet Size
  - Subnet to Top-of-Rack Switch
  - 2000 IP addresses per subnet MAX. Some are smaller (1000, 512)

- Address assignment is not done by RA
  - Only default gateway is handled by RA
  - Provisioning done by in-house system, upgraded to dual stack

- Using Private Unique Local Addresses
  - If IPv4 config is “Private” then allocate IPv6 ULA (remember: No NAT)
Tim Bell’s Recommendations

• Get in touch with your local OpenStack organization
• Get to meet people, go to summit is even better
  • But also: choose the cloud ecosystem that’s right for you
    • Right for you means a community with users similar to you

“Certainly, running v6 on the cloud is straightforward activity. It’s not something to be worried about.”

Note: Tim is a member of the OpenStack user committee, and BoD
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Cultural Transformations

Technology change needs cultural change

• Speed
  – Are we going too fast?

• Budget
  – Cloud quota allocation rather than CHF

• Skills inversion
  – Legacy skills value is reduced

• Hardware ownership
  – No longer a physical box to check
Summary

• CERN has successfully replaced legacy system with open source

• OpenStack scales and supports IPv6, but “your mileage may vary”
  - Every org must evaluate cloud communities from their own context

• Cultural change to Agile requires time and patience but is paying off

• CERN’s computing challenges plus industry/open source collaboration fosters sustainable innovation

• “Cloud” is both a driver for IPv6, and an enabler of IPv6
Q & A
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