2015...

**VIRTUALIZATION**

- Linux bridge
- VLANs
- virtio

**EMERGING**

- SR-IOV
- VEPA
- VM-FEX
- OpenFlow

**OVS**

programmable multi-layer switch using openflow and ovsdb
often used in an overlay
out-of-tree
tc vs ovs
4 YEARS AGO...
YEARS AGO...

OVS IN THE DATACENTER

OpenStack Neutron adoption rates growing
Neutron typically deployed with OVS
OVS typically deployed as overlay (GRE or VXLAN)
Users want security groups
Users want load balancers
Operators want scale
OVS IN THE DATACENTER

4 YEARS AGO...

OVS IN TELCO

OpenStack Neutron adoption rates growing
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Operators want scale

Virtualizing the telco network
PNF -> VNF
performance is paramount
DPDK
service chaining
YEARS AGO...

OVS IN THE DATACENTER

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OVS IN TELCO

OVS PLUS HARDWARE OFFLOAD

hardware VTEP
SR-IOV
dedicated ASIC
NPU
OVS FUTURE THOUGHTS...

Complexity slows adoption

- Extensibility
- Forks
- Governance
- tc, eBPF, and P4
- L3 and up
- Overlays
- Edge
- ovn
Complexity slows adoption
Extensibility
Forks
Governance
tc, eBPF, and P4
L3 and up
Overlays
Edge
ovn

Complexity *still* slows adoption
Extensibility *still critical*
Forks *still bad*
Governance *still important*
tc, eBPF, and P4
L3 and up
Overlays
Telco Edge/5G
OVN!
DEVELOPMENTS

JANUARY 2017
Decided: OpenStack will pursue OVN as a networking backend.

DECEMBER 2017
OVN released as Tech Preview in OSP 12.

JULY 2018
OVN released as Full Support in OSP 13.

JANUARY 2019
Red Hat OpenStack OVN Engineering team increased.

First production customers adopting OpenStack 13 OVN:
- GE
- Atos
- OneWeb

Half of Red Hat Neutron Engineering team moved to OpenStack OVN Engineering, with the other half maintaining ML2/OVS (default OpenStack Neutron backend used by over 90% of our customers)
FUTURE PLANS

JANUARY 2020
OpenStack 16 to be released; first long-term release to use OVN as default backend.

FALL 2020
Featured parity met for telco use cases (primarily SRIOV/telco-grade testing).

OpenStack 17
Most customers expected to be using OVN.
PORTFOLIO DECISIONS

RED HAT®
OPENSHIFT

RED HAT®
OPENSTACK®
PLATFORM

RED HAT®
ENTERPRISE
VIRTUALIZATION
KEEP EVOLVING

HW

Hybrid cloud

Applications

Operations
LESSONS LEARNED

Fragmentation
Consolidation
Adoption
Meet users where they are
Thank you

Red Hat is the world's leading provider of enterprise open source software solutions. Award-winning support, training, and consulting services make Red Hat a trusted adviser to the Fortune 500.

linkedin.com/company/red-hat
facebook.com/redhatinc
youtube.com/user/RedHatVideos
twitter.com/RedHat
OpenStack Upstream Direction

Neutron upstream is embracing OVN as the default networking backend. Discussed in the last PTG at Shanghai, and the one before that, accepted by the community and supported by former PTL (now with Verizon) and the current PTL (with Red Hat). There’s an ongoing effort to move the networking-ovn code into Neutron tree [0] in the coming weeks, as a precursor step to move the default backend upstream in the next development cycle.

[0] https://review.opendev.org/#/q/topic:bp/neutron-ovn-merge+(status:open+OR+status:merged)

Core OVN Contributors, External Contributions

Until recently, OVN lived in the OpenvSwitch repository. Now, the code has been split and has its own repository [0] and independent packaging.

Red Hat has two new core members (commiters) while the core member team is now composed by people from Red Hat (3), VMWare (3) and eBay (1), who are the top contributors.

In the networking-ovn OpenStack repository we’re finding more contributions from other companies such as Chinamobile, Canonical or stackHPC. We learnt from a person with stackHPC that their main reason to choose OVN is its active community. They’re contributing into kolla/kolla-ansible to add support for OVN based deployments [1].

Canonical, as well, are integrating OVN into OpenStack charm (Canonical’s OpenStack installer) as we can see from Frode Nordahl’s contributions in Gerrit [2] (he’s also contributing to core OVN).
Chris: 4 years ago and said “this” and in those 4 years XYZ has happened -- looking forward, we need to be able to evolve the community to meet XYZ
  ○ Xyz = hw support for accelerating encapsulations associated with network connectivity

How has the context changed?
  ○ The public cloud is a critical part of the picture; we’re not just talking about nw connectivity and data-center centric connectivity; its broader
  ○ [HW]
  ○ With Kube evolving as an orchestrator that spans off and on premise use cases, the need to support containers becomes critical; the ability to connect containers with a higher-level connectivity and security policy is also very important (example: service mesh, competitive to what these guys are doing)
  ○ Useability and de-buggability cannot be substituted with functional completeness
    ■ Just because you have 4 wheels / engine doesn’t mean you have a car; you need additional functionality as well
  ○ No.1 issue -- we need to make it useable (common issue w open source bits)
  ○ Rashid points: product portfolio is leveraging these projects

Redeliver the same slide deck….update it with
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OVS IN TELCO

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OVS PLUS HARDWARE

hardware VTEP
SR-IOV
dedicated ASIC
NPU
VIRTUALIZATION CHANGED
THE DATACENTER

VMs directly connected to the network
  focus on L2 adjacency
  dynamic placement
  live migration
  increase in east-west
  inconsistent policy
  virtual I/O performance
Our Vision

Fully Automatable, Fully Distributed Open Hybrid Cloud (OHC)

Any Workload, Any Footprint, Any Location.
Enterprises with a hybrid strategy grew to 58 percent in 2019 from 51 percent in 2018.

RightScale 2019 State of the Cloud Report
Today’s Network

hardware centric
provisioned for peak capacity
relatively static configuration

Tomorrow’s Network

software centric
elastic provisioning
highly dynamic configuration
Today’s Network

- hardware centric
- provisioned for peak capacity
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Tomorrow’s Network

- software centric
- elastic provisioning
- highly dynamic configuration
5G: The Next Generation Network

IMPERATIVES

- Cloud-Native
- Edge Compute
- Application Lifecycle Management

REQUIREMENTS

- Scale
- Real time data streaming
- Hybrid compute models
- Deployment flexibility
- Efficient UPF redirection
- Modular network design
- Stateless functions

5G PLATFORM

- Load Balancing, Scaling / Elasticity
- Discovery
- Resilience
- Tracing
- Invocation Messaging / IPC
- Container Mgmt.
- Build, Deployment Pipeline
- Monitoring
- Validation
Devices And Data Are Driving 5G Technologies

More and smarter devices drive massive amounts of data...

...More data pushes Compute further out to the network edge...

...Requiring robust, non-centralized data production & processing.
Challenge: Enabling Next-Gen Use Cases And Developers

Allowing IT To Create Business Value with Less Wasted Time and Effort.

**DEVELOPMENT**
- Business value as code

**PLATFORM**
- Any application, anywhere

**MANAGEMENT**
- Operations by policy
An Open Platform Is Critical

Content, Internet of Things (IoT), network services, artificial intelligence (AI), orchestration and delivery

BILLIONS OF ENDPOINTS

WiFi edge

CDN AND CACHING NODE

CITY/AREA DATA CENTERS

REGIONAL DATA CENTERS

Microsoft Azure

Google

Alibaba

AWS

5G EDGE
100,000s of connections

vCO
10,000s of connections

MOBILE EDGE COMPUTE

MIDSIZE DATA CENTER
1,000s of connections

TELCO
100s of connections

SATCOM / VoLTE / 5G

OPTICAL / IP / Metro Ethernet / EPC / SD-WAN

CDN AND CACHING NODE

CITY/AREA DATA CENTERS

REGIONAL DATA CENTERS

CDN AND CACHING NODE

CITY/AREA DATA CENTERS

REGIONAL DATA CENTERS

MOBILE EDGE COMPUTE

MIDSIZE DATA CENTER

TELCO
For Mobile Edge Computing and 5G/C-RAN, a common horizontal infrastructure approach can be autonomously distributed and scaled to hundreds of sites at the edge.
OpenStack Networking Evolution
The Hybrid Cloud Is Being Driven by Mega Trends

The Economics Of Modern Apps

The Changing, Distributed Datacenter
Modern Applications Cause Infrastructure Concerns

The Economics Of Modern Applications

TRADITIONAL COMPANIES
- Manage their own datacenters...
- Struggle to migrate legacy workloads to the cloud.

CLOUD-NATIVE COMPANIES
- Minimal initial capex costs...
- Struggle to manage cost & complexity with scale.
The Concept of a Datacenter Is Changing

More and smarter devices drive massive amounts of data...

...More data pushes Compute further out to the network Edge...

...Requiring robust, non-centralized data production & processing.
Result: Hybrid Cloud Is Becoming Increasingly Distributed
OSS Promotes Industry-Agnostic De Facto Standards

Standards
= Marginally Effective

Open Source
= Best Practices

Developers Define Winning Innovations

Standards intended to minimize custom solutions, but bespoke integrations / interoperability testing dulled benefits.

Rather than “standardizing” all problems / solutions, open source empowers developers to define best-practices, enabling code bases to become de-facto standards.

Community-developed solutions provide opportunity to build from and participate in most successful industry-wide technology movements.
Benefiting Entails Move From Inflexible To The Dynamic

Moving from HW to SW-based promotes open source benefits like flexibility, dependability, and reach.
* **Operators** are Kubernetes controllers applied to applications. The Operator Framework and Kubernetes drive de facto standardization of application on-boarding and lifecycle.
Open Source Software (OSS) Changes The Conversation

COMMODITIZATION → AGILITY → INNOVATION
LEVERAGE RED HAT KNOWLEDGE OF OPEN SOURCE

ECOSYSTEM

SRE

Support

Patching / Automation

Observability

OPS

OPEN HYBRID CLOUD

TECH: OPERATORS
PRODUCTS: INSIGHTS

TECH: CHE
PRODUCTS: CODE READY

CONNECTED

DEVs

MICRO SERVICES

Service Mesh

Serverless

AI / ML

SECURITY
Common Infrastructure Requires Microservices

The Evolutionary Path to 5G

1. MANAGE
   Manage all types of workload under a single CMP/NFVI
   - Infrastructure Modernization

2. CONSOLIDATE
   Harmonize to common platforms
   - Application Modernization

3. TRANSFORM
   Modernize Apps/VNFs to “Cloud Native” Model
   - Elastic Distributed Virtual Architecture built on Microservices

4. OPTIMIZE
   - Level of automation

The Evolutionary Path to 5G

- INTELLIGENT DISTRIBUTION TO EDGES
- COMMON MANAGEMENT
  - PHYSICAL
  - VIRTUAL
  - TELCO CLOUD
  - MULTI-CLOUD
  - ANY INFRASTRUCTURE
Edge Tiers

Centralize where you can, distribute where you must.

* Edge computing == Fog computing
  (there is no real difference other than marketing)
Kubernetes Community Leadership Is Critical...

...To Develop Expertise To Continually Meet Customer Demands

KUBERNETES RELEASES


v1.0 v1.1 v1.2 v1.3 v1.4 v1.5 v1.6 v1.7 v1.8 v1.9 v1.10 v1.11 v1.12 v1.13 v1.14

5 years+ of Community Contributions and Leadership

Containers Microservices AI / ML Distributed Compute

Open Containers Ingress Routing RBAC External Storage Nodes Custom Resources Aggregated APIs

Red Hat
Distributed Systems Are Complex, Requiring Automation to Scale

Maximize Business Value While Managing For Scale

- Management & Automation
- Developer Tools
- Application Platforms
- Software-Defined Storage
- Infrastructure Platforms

= distributed systems

I.T. OPERATIONS
DEVELOPERS
Linux is at the Core of The Hybrid Cloud
We Act As A Catalyst For Communities, Customers, And Partners
The Importance of Expertise in Hybrid Multi-Cloud

SELF-MANAGED

HOSTED SERVICES
Open Hybrid Cloud: Platform Requirements

**LIFECYCLE**
- From 10 changes per hour to 10-year lifecycle

**SECURE BY DEFAULT**
- Trusted Content
- Trusted Updates

Open Hybrid Cloud
OPEN HYBRID CLOUD

- BARE METAL
- VIRTUALIZED DATA CENTER
- PRIVATE CLOUD
- PUBLIC CLOUD (Multi)
- EDGE
LEVERAGE RED HAT KNOWLEDGE OF OPEN SOURCE

- **OPS**
  - Technology: OPERATORS
  - Products: INSIGHTS

- **DEVs**
  - Technology: CHE
  - Products: CODE READY

- **SRE**
  - Support
  - Patching / Automation
  - Observability

- **BARE METAL**
  - Public Cloud
    - Serverless
    - AI / ML
  - Virtualized Data Center
    - Service Mesh

- **PRIVATE CLOUD**
  - (Multi) Edge

- **VIRTUALIZED DATA CENTER**
- **MICRO SERVICES**

- **ECOSYSTEM?**
- **SECURITY**
- **CONNECTED?**
Security Requires A System View
What Is The System We Are Securing?
LINUX KERNEL (NOT INCLUDING USERSPACE)

4,000 Committers
230 Changes a day
6,340 Number of bugs
21.6M Lines of code

Over 2 years, 33% of the code has changed.
Over 3 years and 6 major releases, 97% of the code has changed.

**UPSTREAM DYNAMICS**

**OPENSTACK**

**PROJECT INFLUENCE**

- **13.4M** Lines of code
- **2,600** Committers

**CONSUMPTION CONSIDERATIONS**

- **467** Changes per day
- **3,400+** Number current issues / bugs
MAKING OPEN SOURCE PRODUCTION GRADE

257
BUGS FIXED between Kube 1.9 and OpenShift 3.9

194
BUGS FIXED between OpenShift 3.9 and 3.9.33

Source: Matthew Barnes, OSD 3.9 upgrade summary. internal blog post, Mojo. August 2018.
1. The Hybrid Cloud is a Reality.
   a. Factors driving behind why
2. Open Source drives the Cloud
3. Innovation Question:
4. Open source is driving innovation, specifically hybrid cloud innovation -- consume software
5. Improve developer / operational experience (which is largely what we do)
6. Specific projects + details on those projects

We make big bets at RHT and dont bet on too many things; bet based on applicability of technology

Single, vertically integrated cloud, or an open hybrid cloud

Why? Industry moving along these trends (mega trends)

Then what open source is doing in response of that (perpetual pursuit of excellence)

Take that, and apply it to open hybrid cloud (open / hybrid / cloud)

World is changing (how) - megatrends

Open source communities driving innovation in perpetual pursuit of excellence (implicit is refinement on a bunch of ideas coming from upstream)

-- break into two slides; put the sine wave first (OSS innovation engine); what doing? Perpetual pursuit slide

When you take that concept and apply that to the OHC now we’re talking about Kube, dev experience on Kube improving Istio and KNative, ops improving by using common platform (Kube), insights into code (Operators), generating data and doing analysis to feed back recommendations, and then automating recommendations (closed-loop remediation system)

Product v Project
- Rate of Change: needs refreshing (if we are to use it)

This is not just OCTO

OCTO
OUTLINE

• The Vision
  ○ Red Hat Intro
    ■ Sine Wave: Red Hat creates stable enterprise platforms from numerous upstream communities
    ■ Challenge: enabling developers to create more business value with less wasted time / effort
  ○ Red Hat’s Vision is the expansion of a “Self-driving” (fully automatable) distributed Open Hybrid Cloud to the edge
    ■ Linux as core to cloud
    ■ Open / Hybrid / Cloud
    ■ Open Hybrid Cloud = RHEL & OpenShift
  ○ This requires:
    ■ A similar ease of use to that found in the operating experience of a public cloud
    ■ Superior enablement (automation through data)
    ■ Unrivaled choice (strong ecosystem of partners)
  ○ What’s driving this?
    ■ [megatrends slides]
    ■ Conclusion: The Hybrid Cloud is becoming increasingly distributed; an open solution is critical
  ○ The Office of the CTO works with Red Hat customers and partners to refine and deliver Open Source emerging technology insights
    ■ Pipeline of innovation
    ■ [Introduce OCTO as a refiner of insights, utilizing customer perspectives to clarify business needs)
  ○ OCTO covers many technologies; based on customer feedback, we’ll be presenting on these today:
    ■ [Introduce sectors / speakers]