BOSTON, MA
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BUILDING OPENSHIFT AND OPENSTACK PLATFORMS WITH RED HAT

Pilar Bravo, Senior Solution Architect, Red Hat
David Manchado, Infrastructure Architect, Produban
Alfredo Moralejo, Senior Domain Architect, Red Hat
Cristian Roldán, Middleware Architect, Produban

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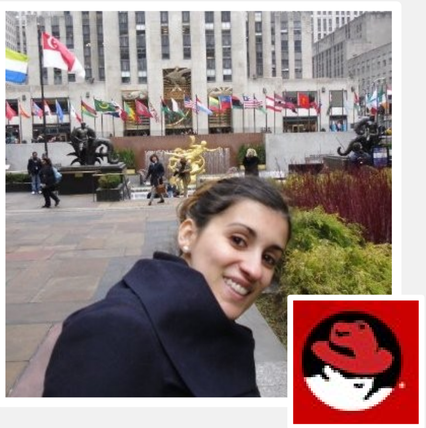
WHO WE ARE

WHO IS WHO

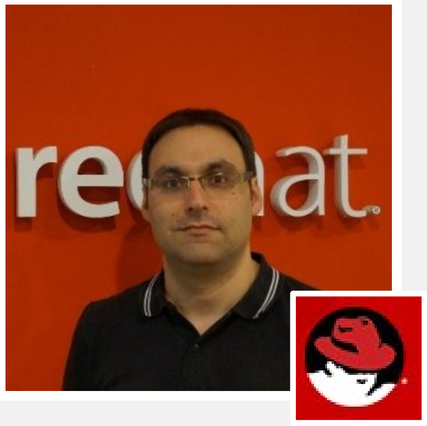


PILAR BRAVO

Senior Solution Architect
JBoss Middleware

CRISTIAN ROLDAN

Middleware Architect



ALFREDO MORALEJO

Senior Cloud Domain Architect

DAVID MANCHADO

Infrastructure Architect

PRODUBAN

+ 5.000 professionals

A Global Company in 9 countries giving services to 120 Santander Group affiliates

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SERVICES PROVIDED...

- 117 million Retail Banking Customers
- 11.6 million Online Banking Customers
- 30 million of credit cards
- 80 million of debit cards
- 30 million Contact Centre calls a month
- 1,258 million of weekly transactions
- 67 million of card transaction during peak days
- 2.4 million weekly batch executions
- 16.7 million of daily payments

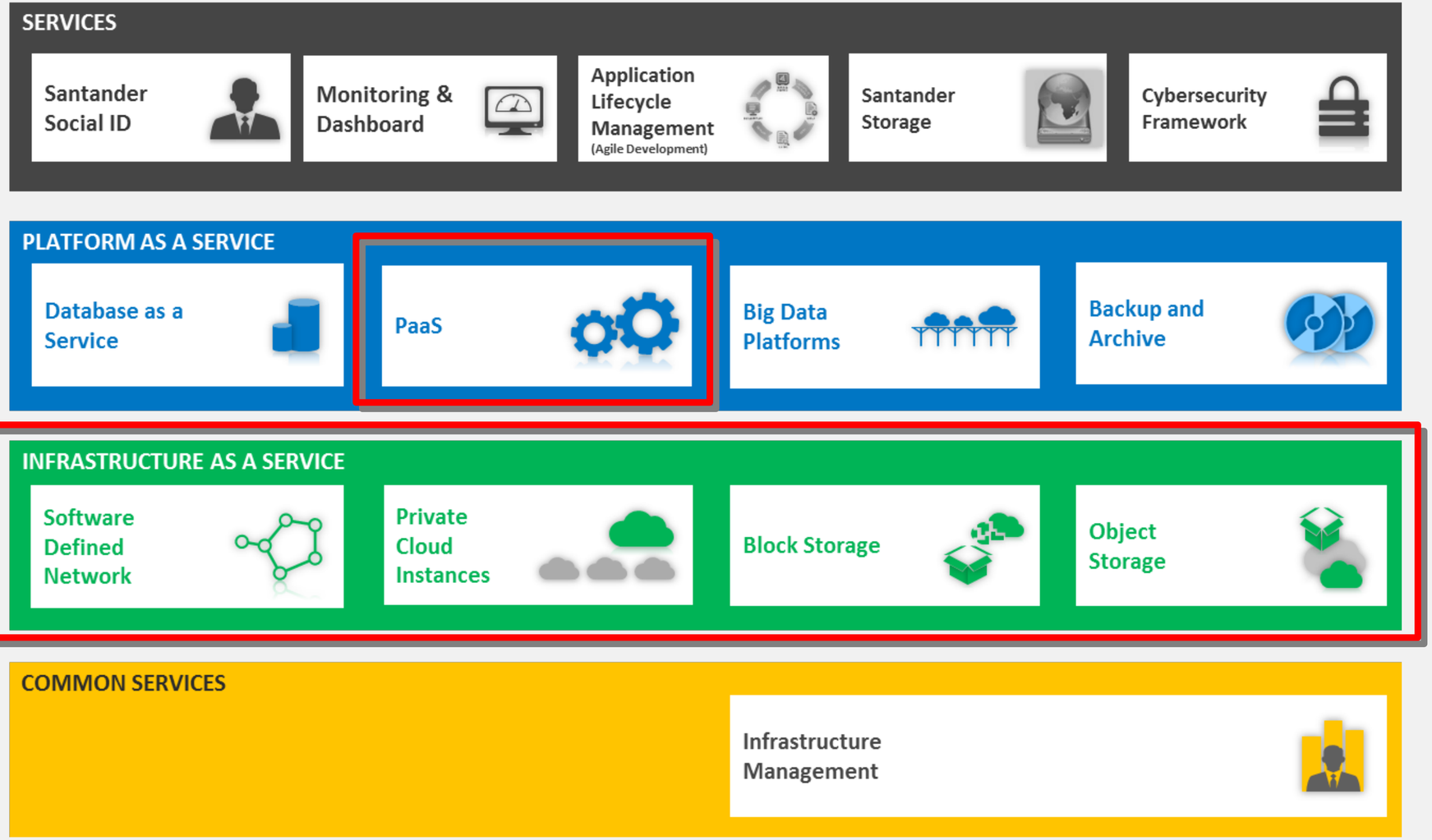
ON TOP OF...

10 Corporate Datacenters
15 Mainframes
+ 28,000 physical servers
+ 64,000 logical servers
+ 22,000 data bases
+ 28,000 web app servers
+ 12,900 branches
+ 253,000 desktops
+ 6 PB/M data btw DC

GLOBAL CLOUD PROJECT

- Aims to provide a full XaaS stack
  - Already existing services
  - IaaS NEW
  - PaaS NEW
- Enable digital transformation (Banking 3.0)
- DevOps
- Mobile Apps

THE WHOLE PICTURE



BUILDING AN OPENSTACK PLATFORM

DESIGN PRINCIPLES

Greenfield approach

General-purpose Cloud

Software Defined Everything

Multilocation

Scale-out

Failure domain contention

Vendor lock-in avoidance

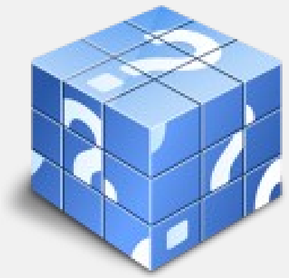
Open Standards

OpenSource First (...but not only!)

DECISSION MAKING PROCESS: OPENSTACK

WHY OPENSTACK

- Openness
- Community
- Interoperability
- Upgrade-in-place (starting from Icehouse)
- Technology meeting point (de-facto standard)



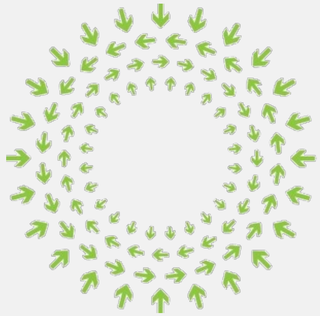
openstack™

WHY RED HAT

- Close relationship since 2010
- Major player in OpenStack
- Professional Service offering
- Support

DECISSION MAKING PROCESS: SERVERS

Openstack Services	Compute Nodes
VMware	KVM
Traditional Standalone Server	OpenCompute
Local disk	Local disk (Ceph)



- Efficiency
- Data Center strategy
- Open

http://www.opencompute.org

DECISSION MAKING PROCESS: STORAGE

Software Defined Storage

Multiple storage needs (image, block & object)

Scale-out

Openstack alignment

Maximum usage of available resources

ceph

OpenSource reference solution for OpenStack

Flexibility

Pay as you grow

Supported by Red Hat

...and it works!

DECISSION MAKING PROCESS: NETWORKING

Software Defined Network

Non-propietary fabric

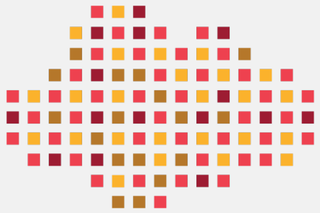
Based on standard routing protocols (OSPF)

Leaf & Spine topology

Scalability

Openstack alignment

Avoid L2 adjacency



nuagenetworks™

Federation Capabilities

Distributed routing

Maturity

Support

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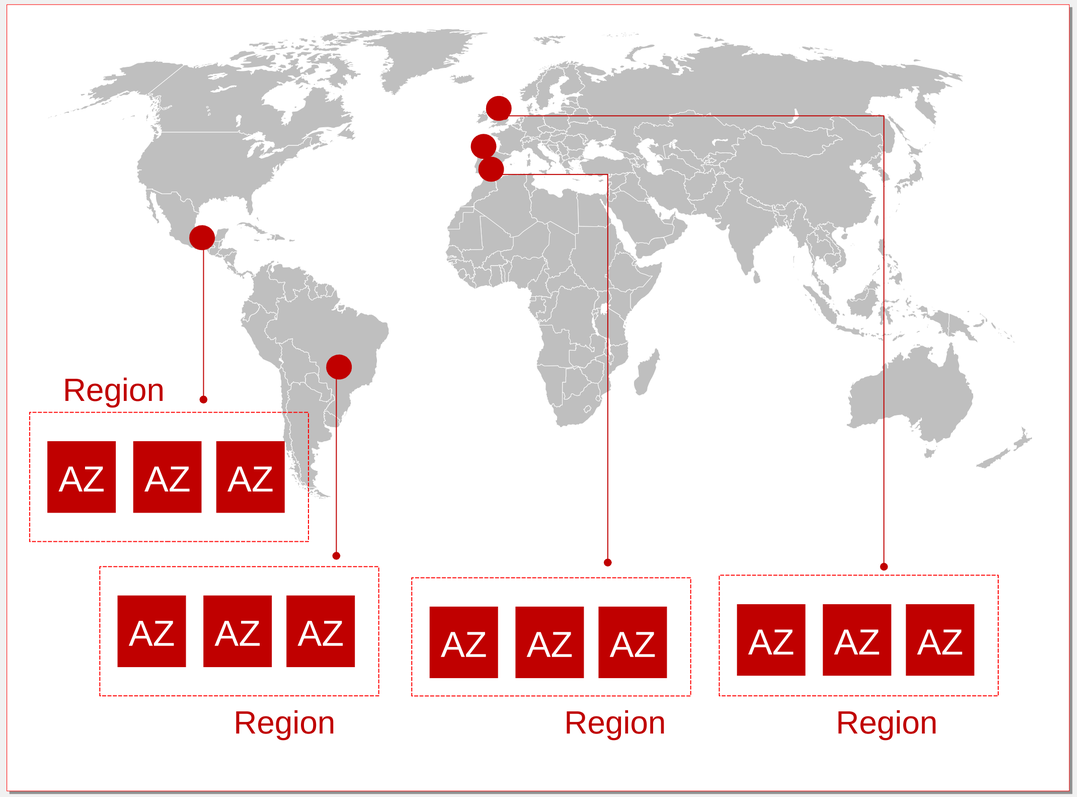
MULTILOCATION DEPLOYMENT



- Located on Corporate DataCenters
- Traditional failure domain approach
    1. Region
    2. Availability Zone (AZ)
- Provide building blocks to define resilient architectures on top

HIGH LEVEL DESIGN

Red Hat CloudForms

CLOUDFORMS by Red Hat Cloud

Public Cloud

Windows Azure

amazon web services

SOFTLAYER

Red Hat Enterprise Linux OpenStack Platform

openstack

Horizon (Dashboard)

CEPH	nuagenetworks	**GLANCE** Images	**NOVA** Compute	**KEYSTONE** ID Management
CINDER Block Store	**SWIFT** Object Store	**NEUTRON** Networks	**HEAT** Orchestration	**CEILOMETER** Metering

SATELLITE 6
(orchestration, automation and patch management)

puppet labs

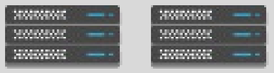
FOREMAN

pulp

KATELLO

Hypervisor KVM

lenovo hp HUAWEI **Hardware**



SIZING

CURRENTLY

```
Biggest region:    88 compute nodes / 44 ceph OSD nodes (440 x 4TB OSDs)
Smallest region:    8 compute nodes /  8 ceph OSD nodes ( 80 x 4TB OSDs)
Total deployed:   160 compute nodes / 12 ceph OSD nodes (120 x 4TB OSDs)
```

MID TERM

14,000
CORES

200TB
RAM

600TB
OSD JOURNAL

16PB
OSD CAPACITY

Think big, start small → plan to grow to ~ 1000 nodes

CLOUD VERSIONING

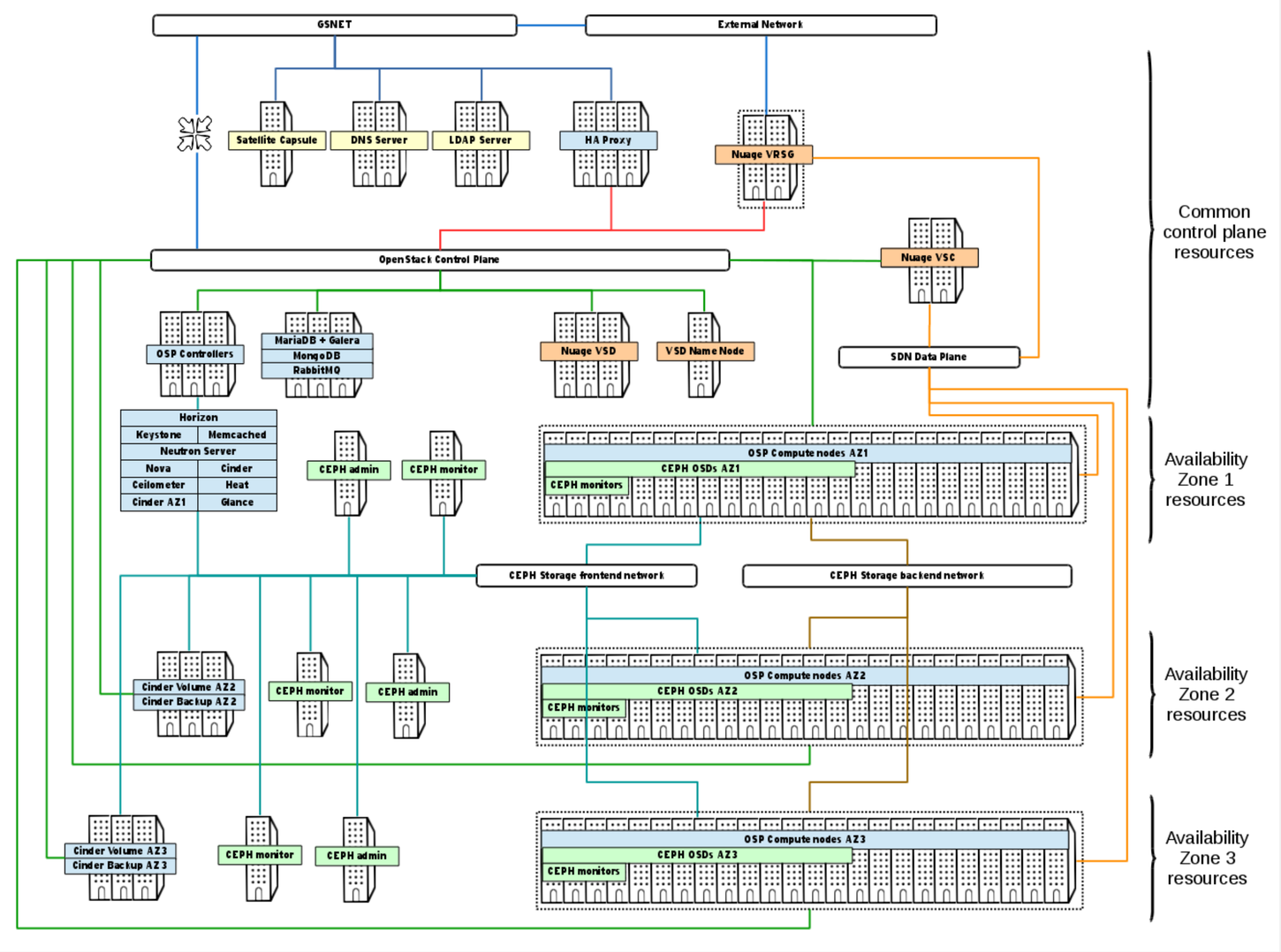
v0	v0.1	v1.0 Beta	v1.0
Private Cloud Instances • RHEL Images (Ceph Volumes) • RHEL Images (Local Disk –Bigdata)	**Private Cloud Instances** • RHEL Images (Ceph Volumes) • RHEL Images (Local Disk –Bigdata)	**Private Cloud Instances** • RHEL Images (Ceph Volumes) • RHEL Images (Local Disk –Bigdata)	**Private Cloud Instances** • RHEL Images (Ceph Volumes) • RHEL Images (Local Disk –Bigdata) • WIN Images (X.Small to X.Large)
Block Storage • Local Disk • Ceph volumes	**Block Storage** • Local Disk • Ceph volumes	**Block Storage** • Local Disk • Ceph volumes	**Block & Object Storage** • Local Disk • Ceph volumes • Object Storage
Software Defined Network • Private networks • External GSNet network (floating IP, shared Subnet) • Service Channing • Network Templates	**Software Defined Network** • Private networks • External GSNet network (floating IP, shared Subnet) • Service Channing • Network Templates • L3 Federation (1)	**Software Defined Network** • Private networks • External GSNet network (floating IP, shared Subnet) • Service Channing • Network Templates • L3 Federation (1)	**Software Defined Network** • Private networks • External GSNet network (floating IP, shared Subnet) • Service Channing • Network Templates • L3 Federation • External Internet Network
RHEL 7.0	RHEL 7.0	RHEL 7.1	RHEL 7.1
Openstack Icehouse	Openstack Icehouse	Openstack Juno	Openstack Juno
Nuage R3.03	Nuage R3.06	Nuage R3.06	Nuage R3.07
CEPH 1.2.2	CEPH 1.2.2	CEPH 1.2.3	CEPH 1.2.3

TECHNICAL CHALLENGES

- Think big, start small
- Maximize resource usage
- Non-cloud native workloads → Big Data
- Availability Zones isolation
- Live Architecture

- Heterogeneous components integration and lifecycle (HW, Openstack, SDS, SDN...)
- Non-openstack ecosystem integration (monitoring, billing, identity provider...)

DEPLOYMENT ARCHITECTURE



- Distribute control plane in following roles:
  - Load Balancers: haproxy
  - Backend: MariaDB, MongoDB, RabbitMQ
  - Controllers: OpenStack services
- Pacemaker as cluster manager
- Galera for MariaDB replication
- RabbitMQ with mirrored queues
- Additional per-AZ cluster with cinder

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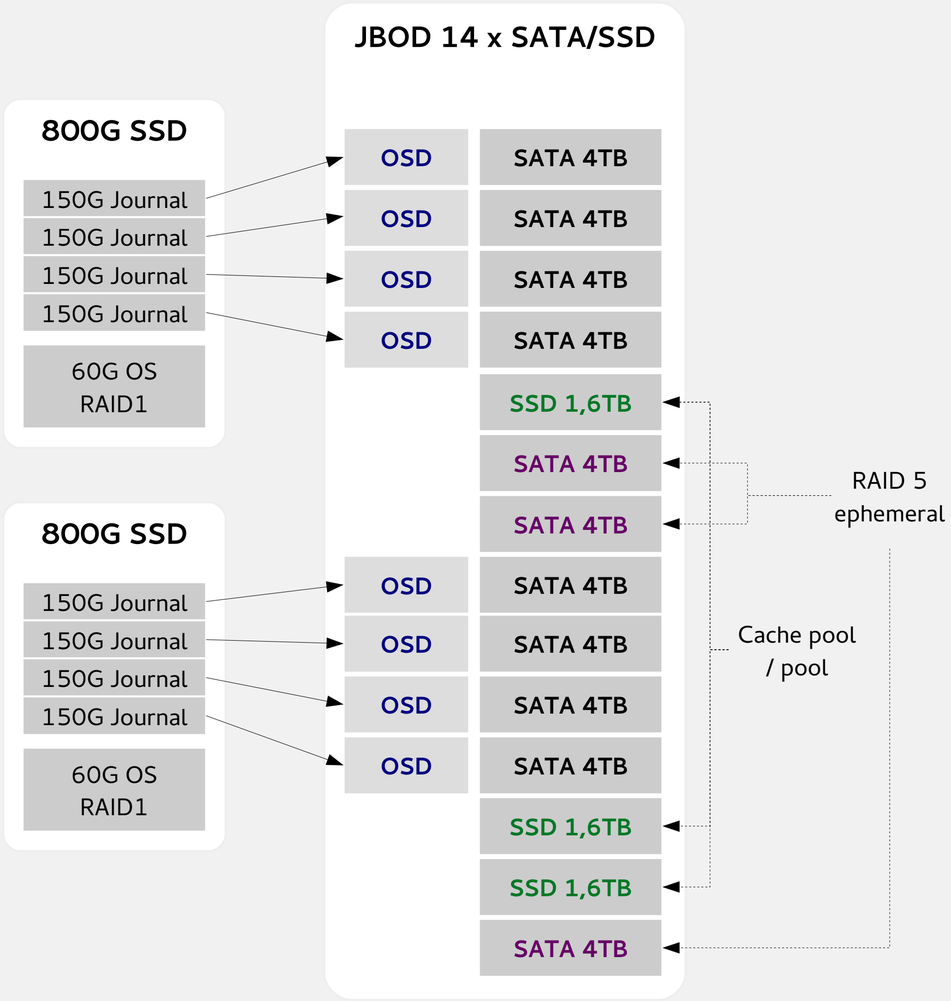
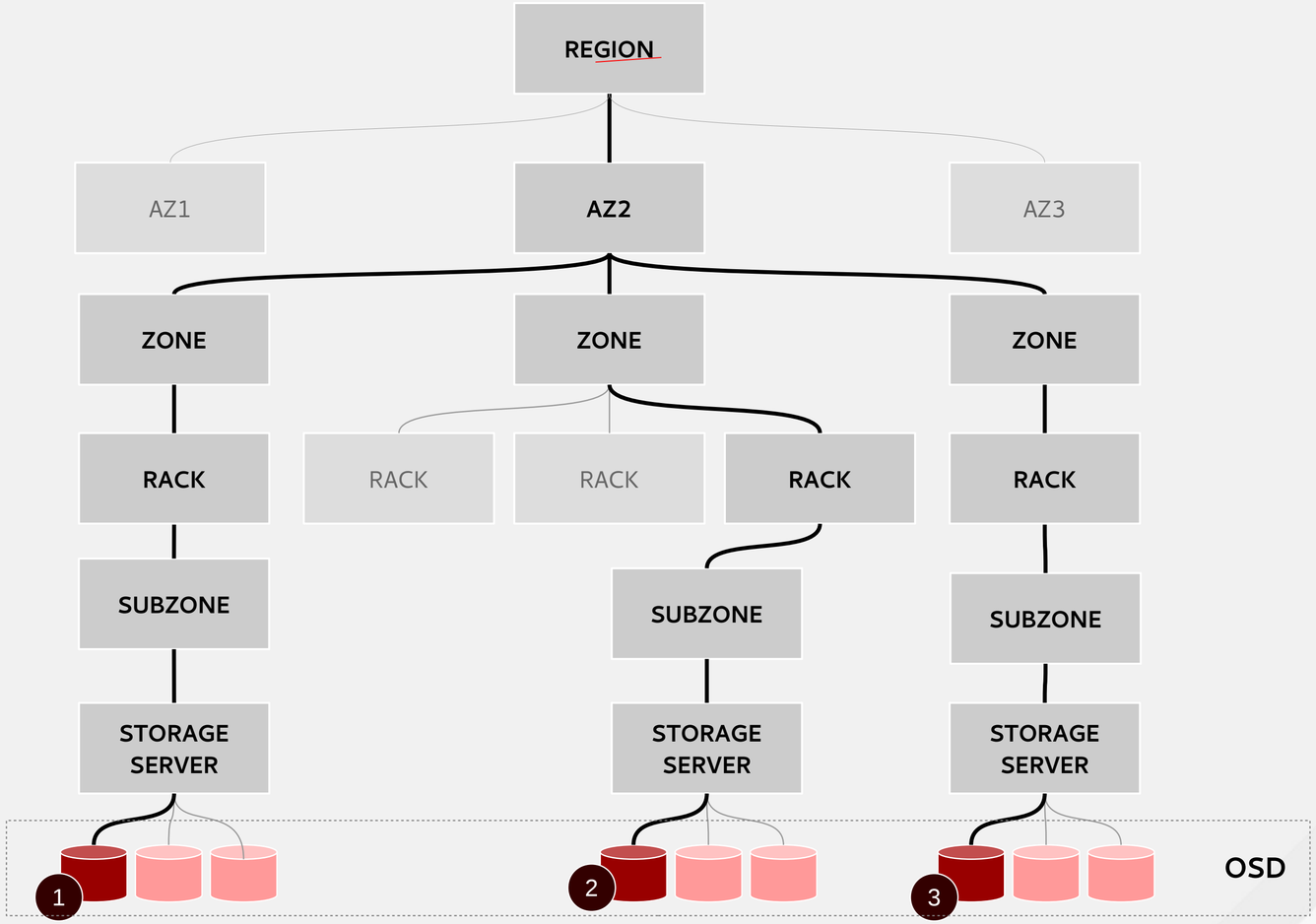
RESOURCE DISTRIBUTION

- Goal: maximize hardware resources usage
- Hyperconvergent mode not recommended by Red Hat.
- Approach: stability over performance
- Limit resources usage (specially memory) for ceph (OSDs) and nova (VMs):
  - cgroups to limit memory used by OSDs (~40GB)
  - Reserved_host_memory_mb to reduce the memory for nova scheduler (~50GB)
  - Use cinder QoS to limit per-volume resources
  - Distribution of available network bandwith for different workflows (QoS)

CEPH DESIGN





3 Copies using a rule placing all copies in different racks and zones inside a given AZ/Region

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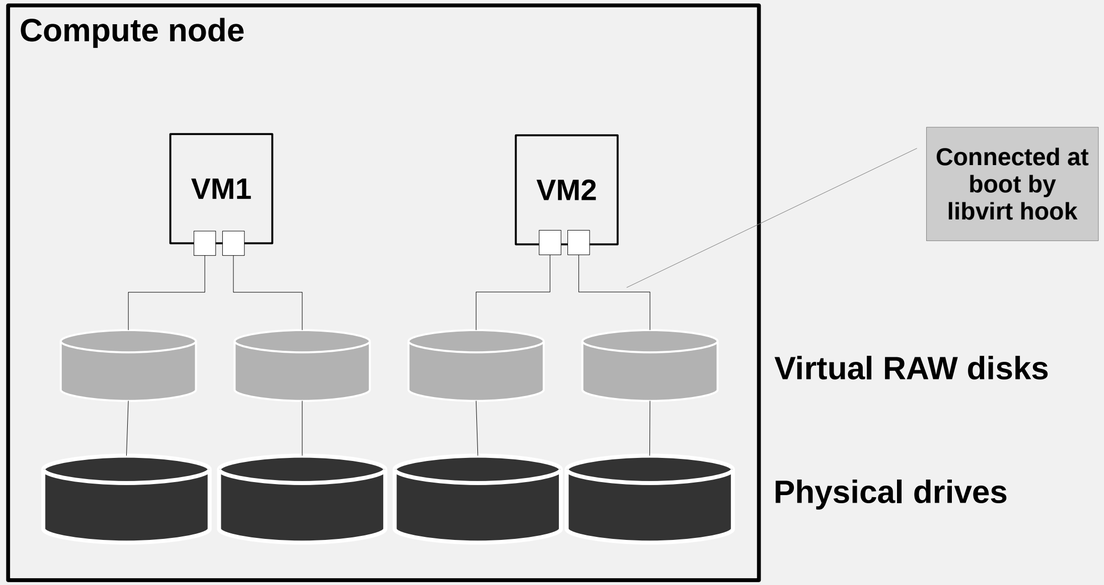
THE DATA ANALYTICS CHALLENGE

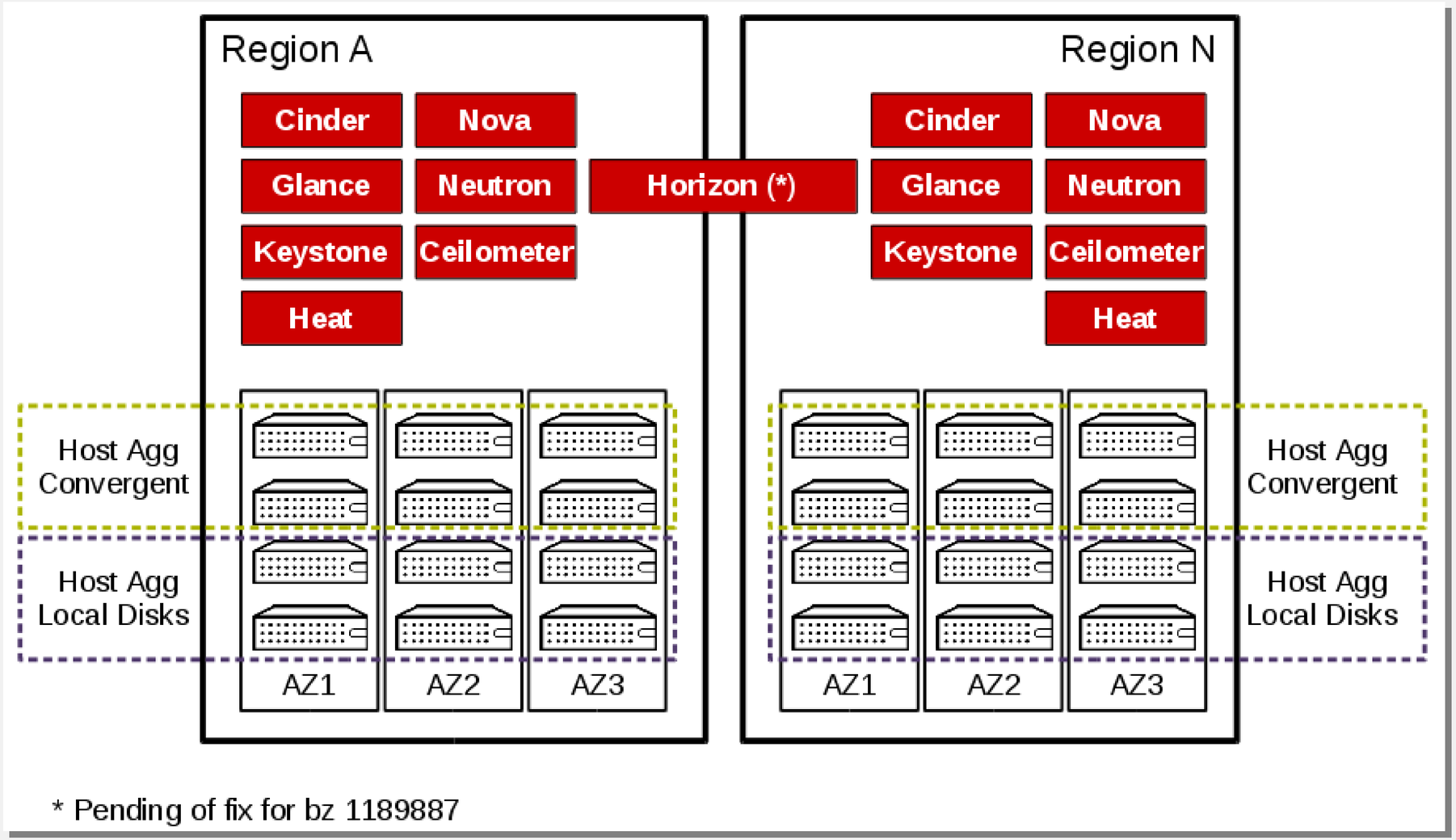
- Critical use case: big data with hadoop and HDFS
  - Designed and conceived for bare metal with local disks
- Created several big flavors for analytics
- Main challenge: I/O access for HDFS

THE DATA ANALYTICS CHALLENGE (II)

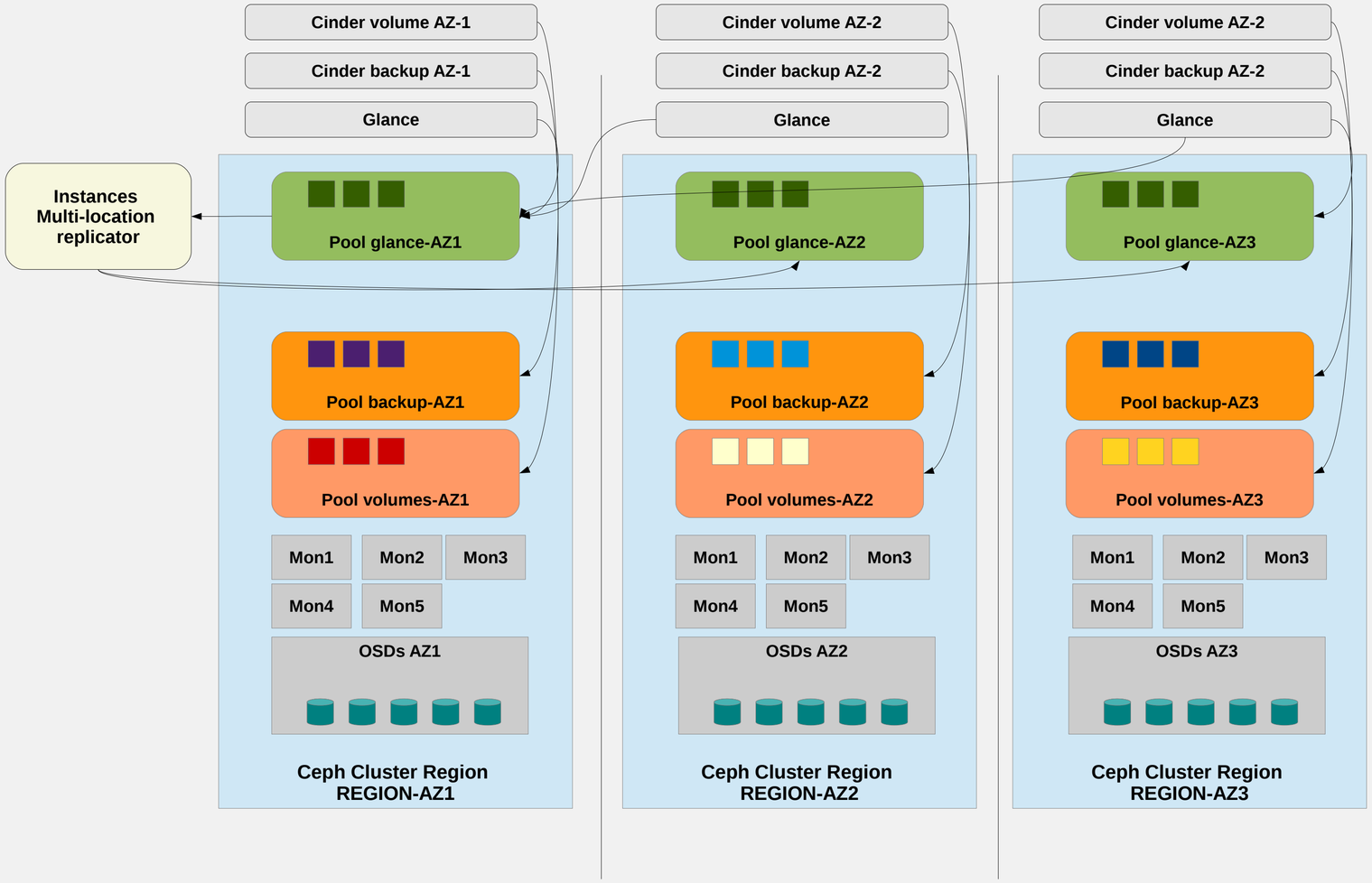
- Defined non-converged nodes with local disks in a Host Aggregate
- Assigned extra_specs to analytics flavors to schedule in non-converged nodes
- At boot time, a libvirt hook attach virtual RAW disks on top of local disks to Vms
- Able to achieve required performance



OPENSTACK SEGREGATION



OPENSTACK SEGREGATION (II)



- Independent CEPH cluster for each AZ for full isolation
- External replication script to clone images between ceph clusters
- Using glance multi-location to register all copies for each image
- Pending on patch in cinder to support CoW with multi-locations
- Next versions of cinder will allow glance to manage multiple RBD stores

NEXT STEPS

New OpenStack projects/features

- –Trove
- –Sahara
- –Ironic
- –Designate
- –Manila
- –LBaaS

Upgrading the whole installed base ¿twice a year/continuous?

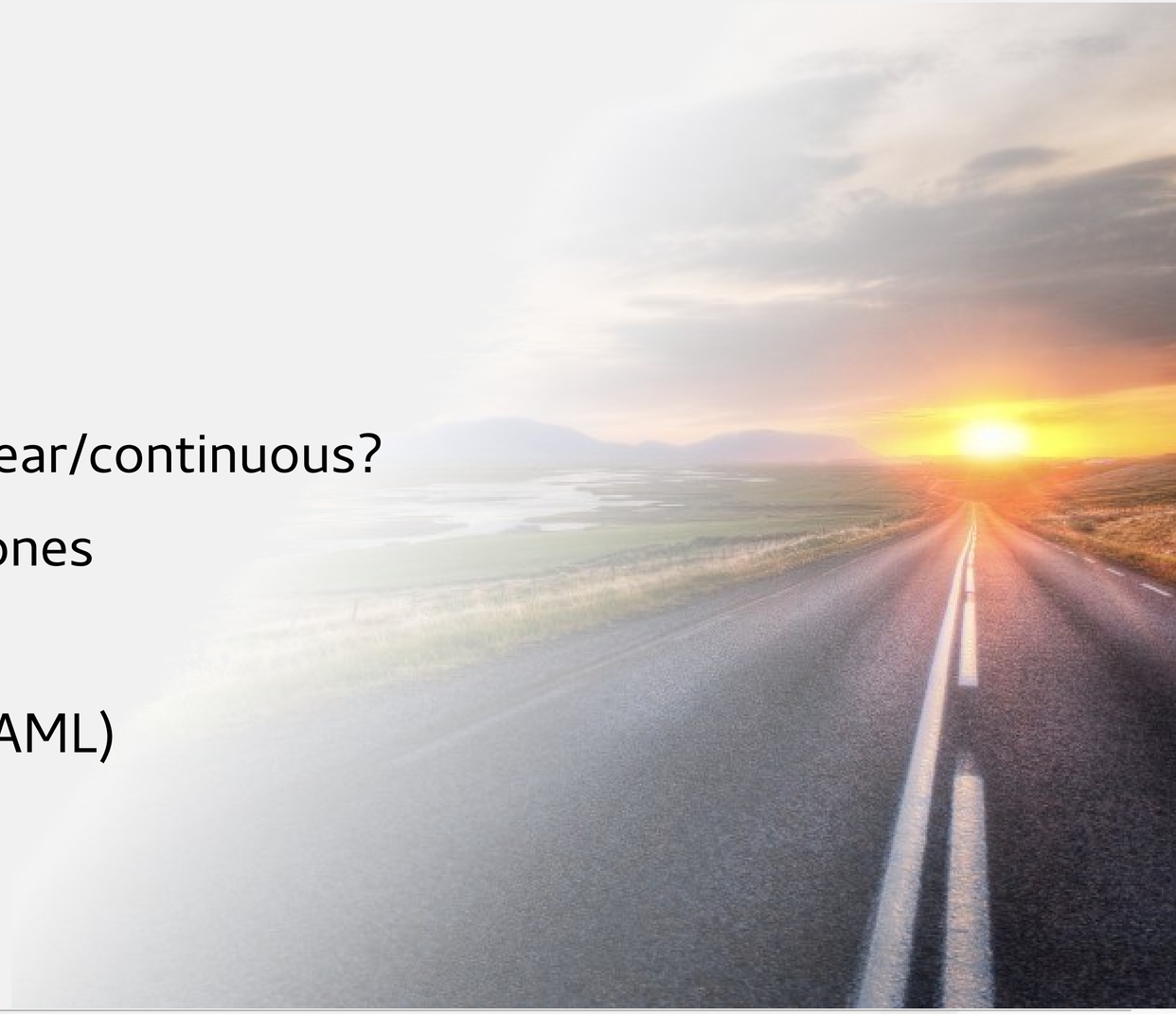
Deploy pending regions / grow in the current ones

Object Storage (Swift-based)

Keystone integration with Identity Provider (SAML)

Cinder & QoS

Evolve architecture and fine tuning



BUILDING AN OPENSHIFT PLATFORM

THE ENVIRONMENT

- Produban provides services to ISBAN
- ISBAN
  - Very focused on Websphere (own framework Banksphere)
  - Started migration of Banksphere to JBoss
  - Interest in:
    - JEE platform
    - Microservices approach
    - Self service for developers
    - ¿PaaS? ... sure!

THE WAY OF PAIN

PRODUBAN VS OPENSHIFT

Produban wanted to:

- Know what they were doing
- Understand the platform
- Be able to adapt the platform to their needs

Red Hat needed

- Defined requisites
- Set expectations and goals
- “Enable” Produban (as a partner)

INITIAL INSTALLATION

- First install was completely manual
- Installation guide became our “Book of knowledge”
- 3 people, 1 keyboard
  - (1 week of less than 2 hours keyboard time for consultant)
  - Required a lot of patience … for all of us

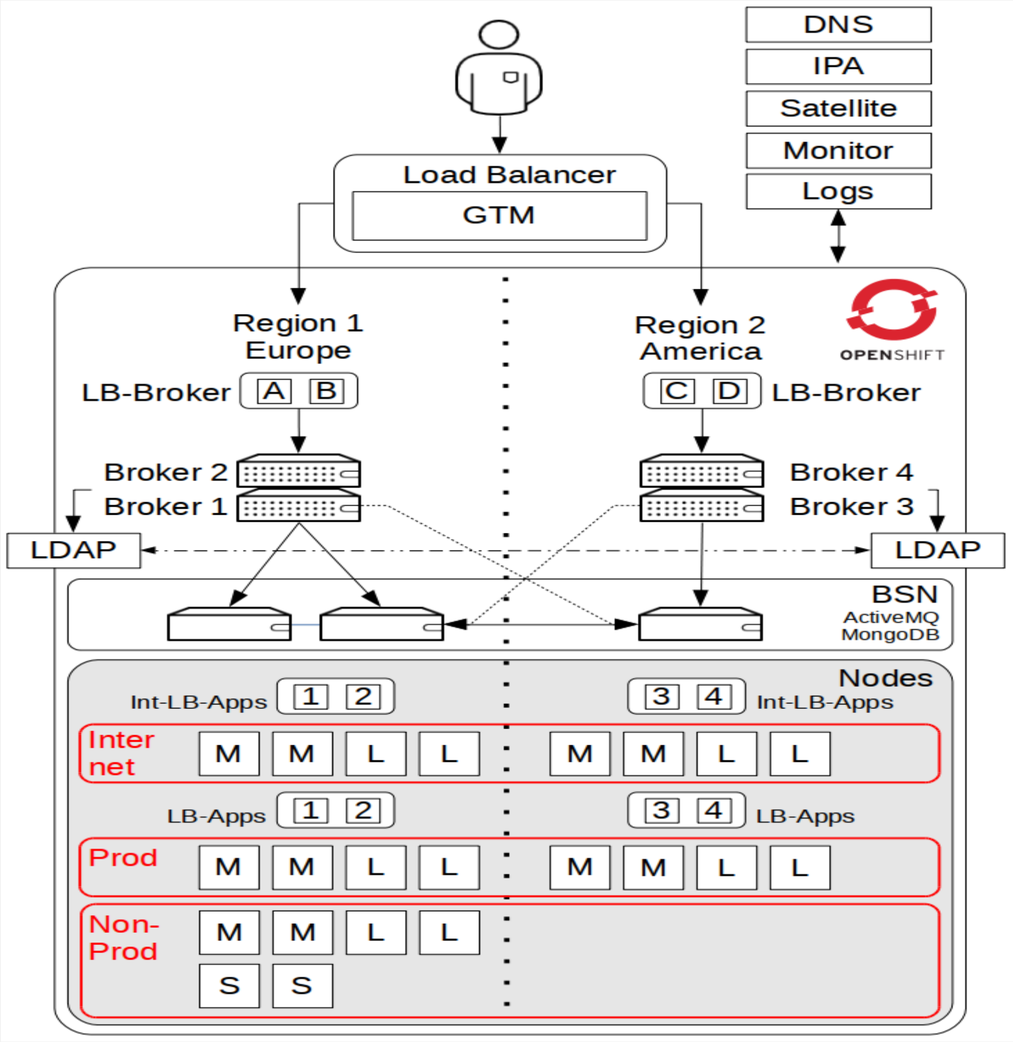
INITIAL INSTALLATION OUTCOME

- Produban felt very comfortable with the product
- We needed a Solution, not a Product
  - Requisites were defined
  - Architecture was needed
  - Project roadmap needed
  - Platform not available

REQUISITES

- 45 infrastructure requisites defined
- 4 priority levels (from “Mandatory” to “Good to Have”)
  - Infrastructure
  - Operational
    - Upgrades were a very important topic
  - Backup
  - Monitoring

ARCHITECTURE DESIGN



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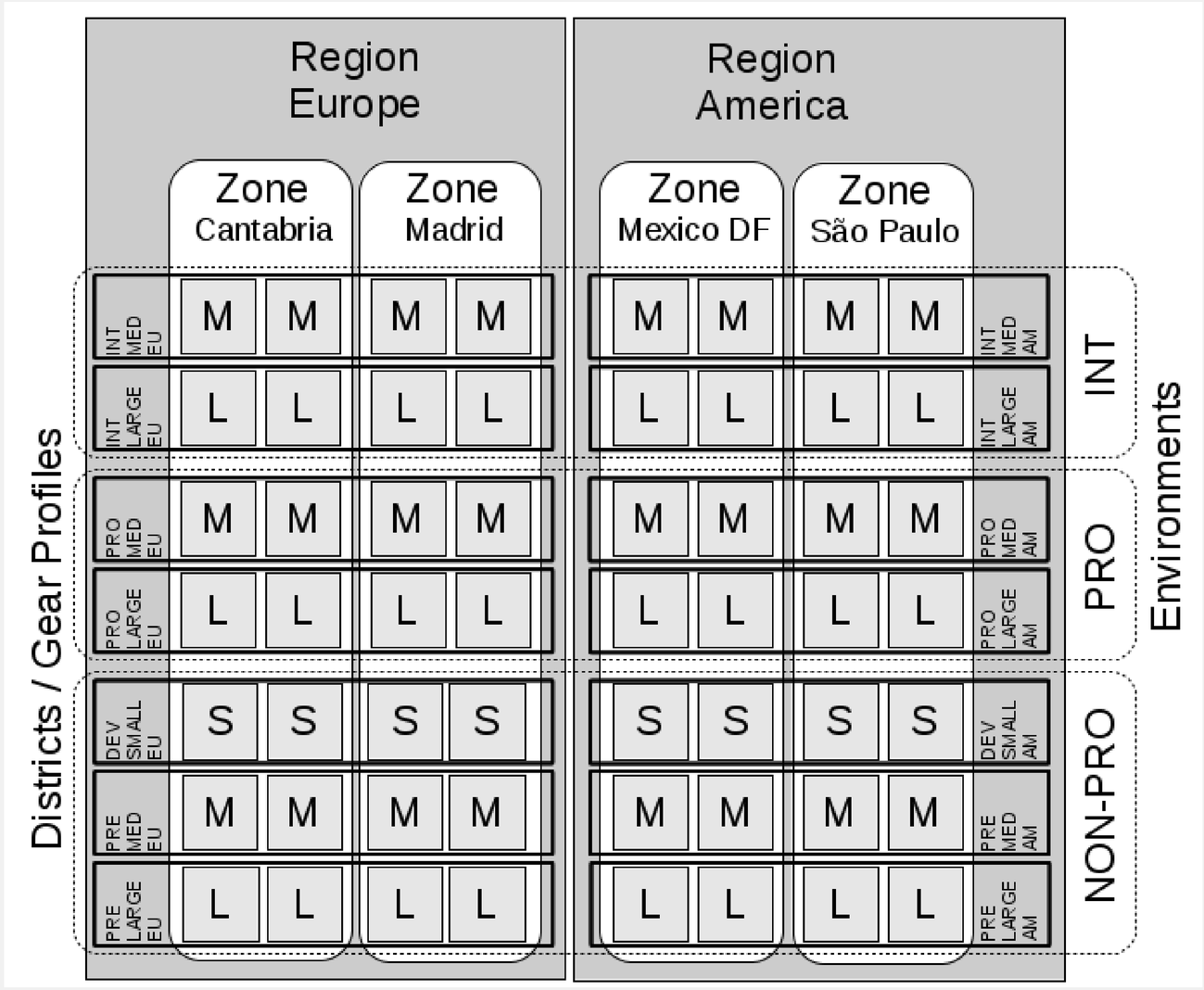
REQUISITES: GEARS

- Zones and Regions appeared with the perfect timing
- Gear sizes were used as Gear profiles permitting:
  - Allocate gears in DEV / PRE / PRO environments
  - Allocate gears in Europe or America region
  - Enable apps in Internet or Intranet
  - ... and of course, assign gear size

ARCHITECTURE: REGIONS, ZONES, DISTRICTS



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SOFTWARE CONFIG AND MANAGEMENT (I)

- Necessary
- Satellite 5 available (Satellite 6 in beta)
  - Used the corporate build to be in line with policies
  - Cloned Software Channels to keep a stable baseline
  - Created Config Channels for each role (Broker, Node, DB+Queue)
  - Created Activation Keys for each role
    - Associated Software Channels
    - Associated Config Channels
  - Support scripts for intermediate tasks

SOFTWARE CONFIG AND MANAGEMENT (II)

- Config channels kept versioned backup of configuration
  - Great to debug issues
  - Macros helpful for machine specific config
  - Customer loved “rhncfg-manager”
- New Nodes / Brokers / DB+Queue easily deployed
- No request for automatic deployment
  - Puppet considered for “phase 2” with Satellite 6

CUSTOM CARTRIDGES

- CA Wily Introscope
  - Created a cartridge to monitor apps:
    - JBoss
    - Tomcat

- Customer wanted to deploy plain Java apps
  - Created initially for Spring Boot applications.
    - **Cartridge won the "Winter of Code"**

https://github.com/Produban/ose_cartridge_javase

LOGGING

- OpenShift's Infrastructure
  - Centralized logging in place
  - Rsyslog for everything
  - Suggested ELK but not accepted (user permissions)

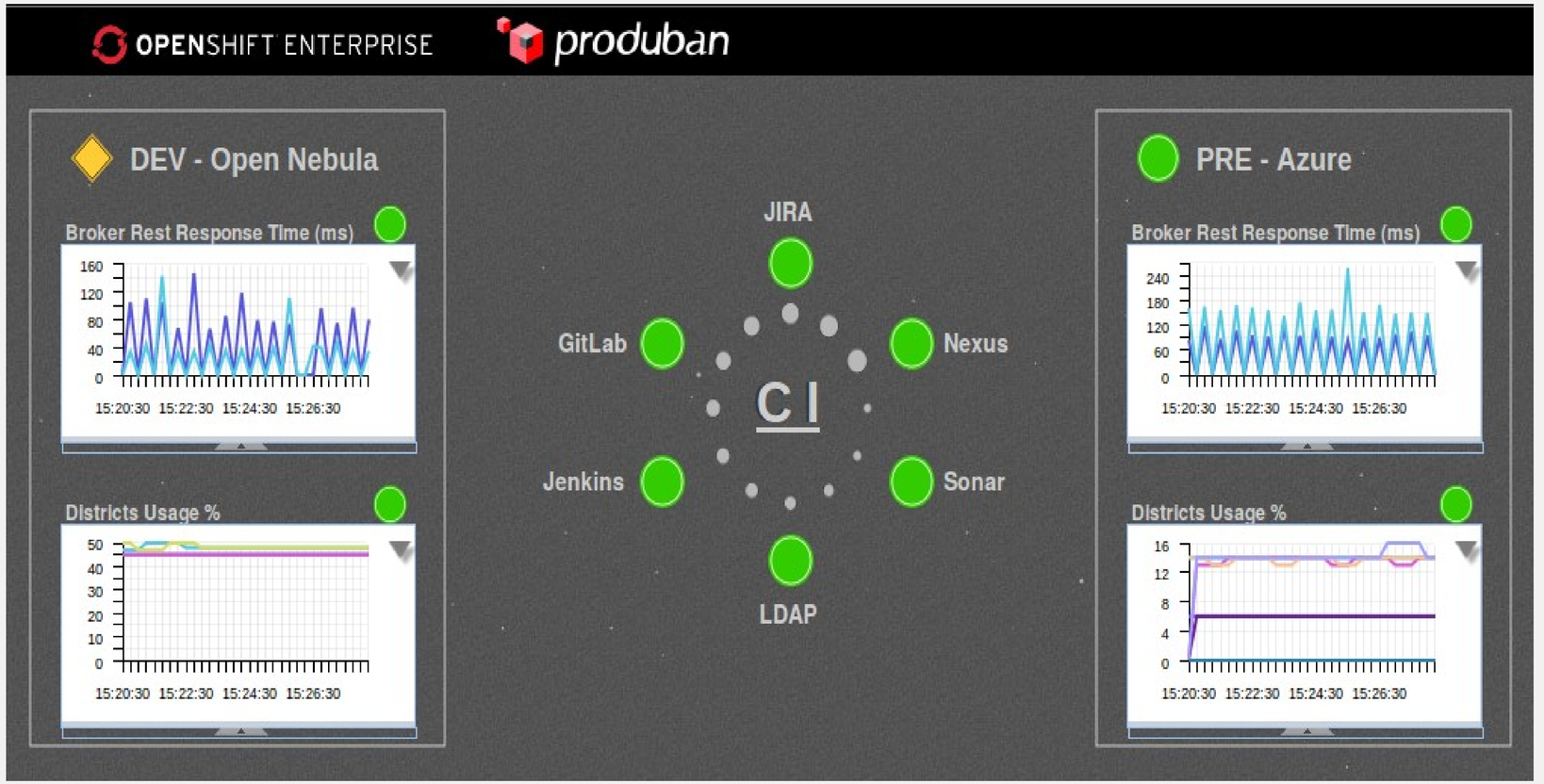
- Applications.
  - OSE's logshifter was tested, but found some performance issues.
  - Appender for Kafka is used.

MONITORING

- Centralized monitoring in place
  - Two levels of monitoring
    - OpenShift's Infrastructure
    - Applications
  - CA Wily Introscope
  - OpenShift Online scripts were used and improved

https://github.com/Produban/OpenShift20_Monitoring

OPENSHIFT INFRASTRUCTURE MONITORING



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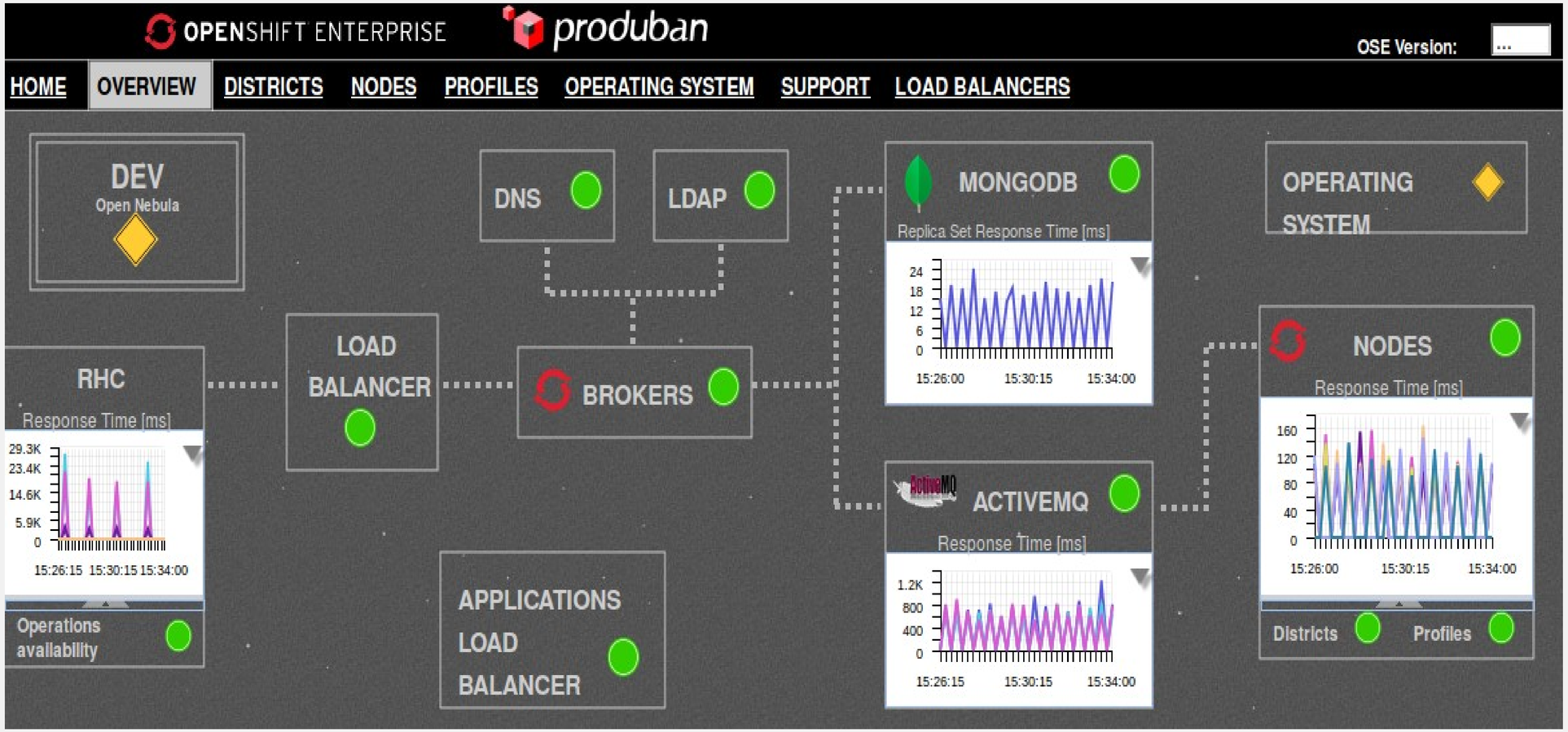
OPENSHIFT OVERVIEW ON OPENNEBULA



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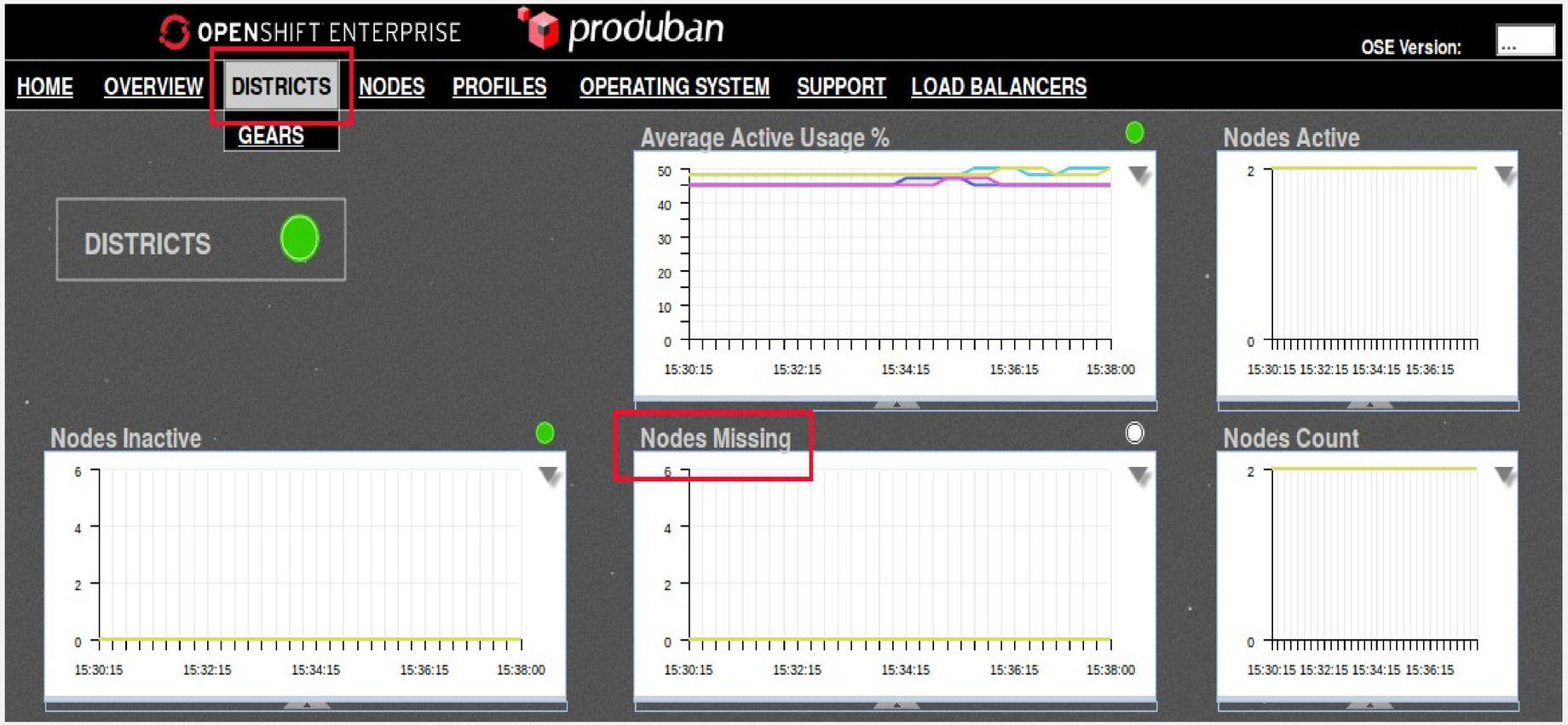
OPENSHIFT'S NODE MONITORING



OSE's metrics are generated by the command `oo-stats --format yaml`

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OPENSHIFT'S GEARS MONITORING

OSE's metrics are generated by the command `oo-stats --format yaml`

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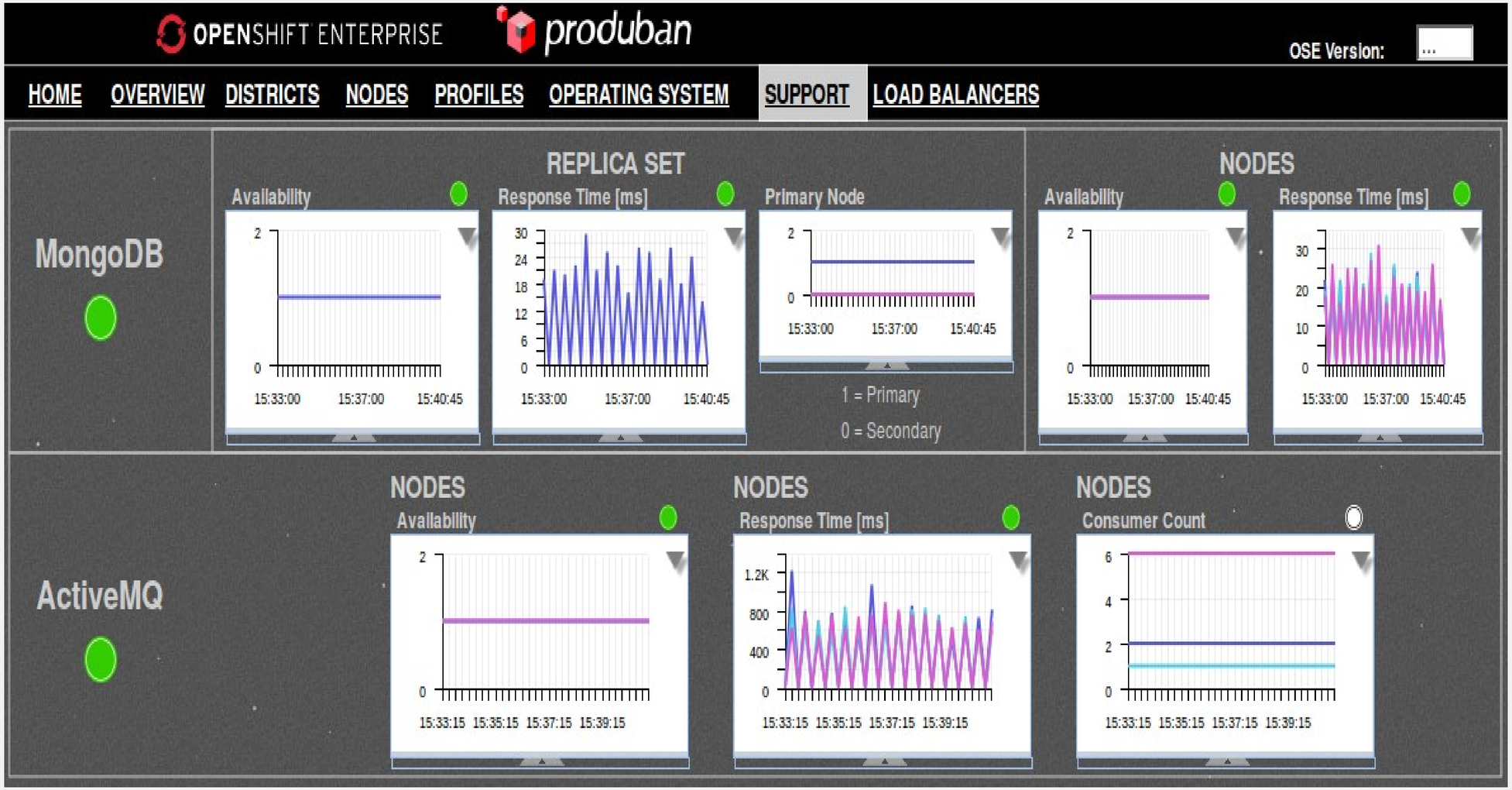
OPENSHIFT'S BSN NODES MONITORING



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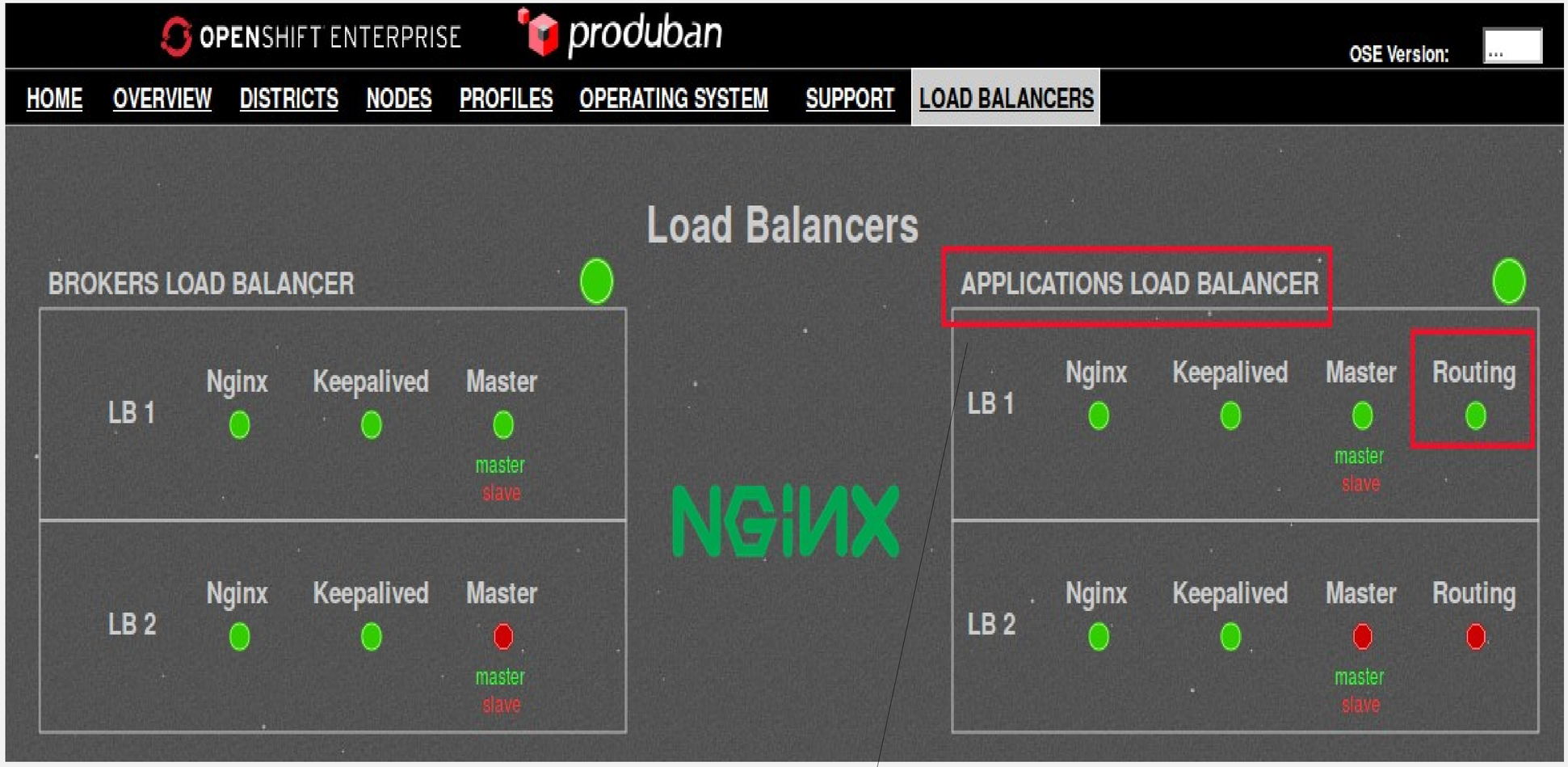
OPENSHIFT CUSTOM LOADBALANCER MONITORING



OSS Project https://github.com/Produban/openshift-origin-app-load-balancer

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CUSTOM LOAD BALANCER

- External load balancer not available
  - Let's make one!
  - Keepalived for floating IP
  - Nginx for redirection
  - Custom listener to manage queues
  - Mcollective for actions

https://github.com/Produban/openshift-origin-app-load-balancer

The custom Load Balancer is not used in Azure, multicast is not supported.

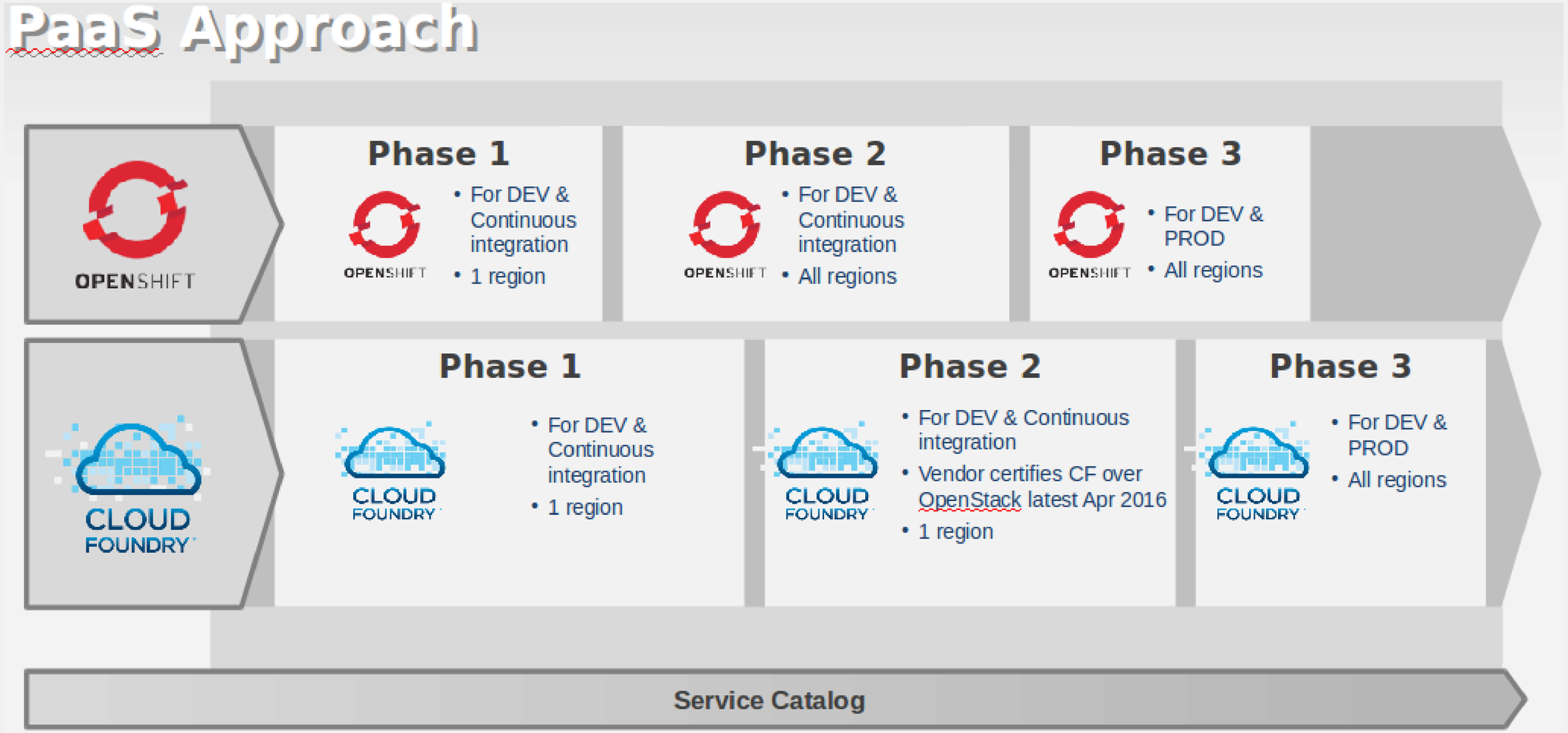
CONCLUSION (I)

- Produban is happy with OpenShift Enterprise 2.x
  - OSE is very flexible and open.
    - We love package oriented solutions instead of black box ....
    - Easy to deploy in any IaaS.
  - We love cartridge specification.... much flexible than other PaaS solutions
  - Is not easy to achieve a stable OSE infrastructure .
  - Infrastructure custom monitoring solution is a MUST.
  - Intuitive and useful OpenShift's eclipse plugins.
  - ssh to GEAR is one of the most useful feature.

CONCLUSION (II)

- We have learned a lot of new things ...
  - Monolithic applications don't fit well in a PaaS environment.
  - PaaS is the perfect environment for Microservices applications.
  - The twelve-factor app, is the core pattern for PaaS applications
    http://12factor.net/build-release-run
  - PaaS administration team, why DevOps skill is a must ?
    - Installation, configuration and integration with external components is complex ...
    - Monitoring, lots of Ruby, Java, bash scripts ...
    - From development perspective PaaS is always the culprit ...
    - CI/CD/Maven/Git/Cartridge is a complex ecosystem for troubleshooting ...

PRODUBAN PAAS STRATEGY



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OPENSHIFT 3 BETA

- We are involved in OpenShift 3 beta
  - Already tested OpenShift Origin Alpha.
  - Docker ecosystem is great!.
  - We have started with Drop 3.
  - Several teams were testing OpenShift V3 beta.
  - We have opened lots of issues in GitHub.

Service Marketplace: We feel very comfortable with Cloud Foundry Marketplace architecture, we would like to see something similar in OpenShift .... why not reuse the CF's Service Broker API ?

http://docs.cloudfoundry.org/services/api.html

THE TEAM

PILAR

CRISTIAN

ALFREDO

DAVID

THE TEAM

PABLO
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DANI
MIGUEL ANGEL
MIGUEL
CRISTIAN
ENRIQUE
ANIA
SERGIO
XAVI
SILVIA
RAQUEL
PEDRO
ANDREA
EDUARDO
CARLOS
DAVID
MARIO
ALFREDO
JONAS
JUAN
MARK
ROBERTO
DAVID
OSCAR
CRISTIAN
JOSE
RODRIGO
RAUL
JORGE
AGUSTIN
JAVIER
LLUIS
DANI
NURIA
CARLOS
CARLOS
ANTONIO
ROBERTO
MANOLO

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ANY
QUESTIONS
?

LEARN. NETWORK.
EXPERIENCE OPEN SOURCE.

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