RED HAT SUMMIT

Ansible-Powered Red Hat Storage One

A hands-on experience

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Storage Solution Architecture
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About This Workshop

- Hybrid Presentation Format
  - Slides
  - Audience-Driven Demos
  - Hands-On Opportunity
  - Attempts at Humor

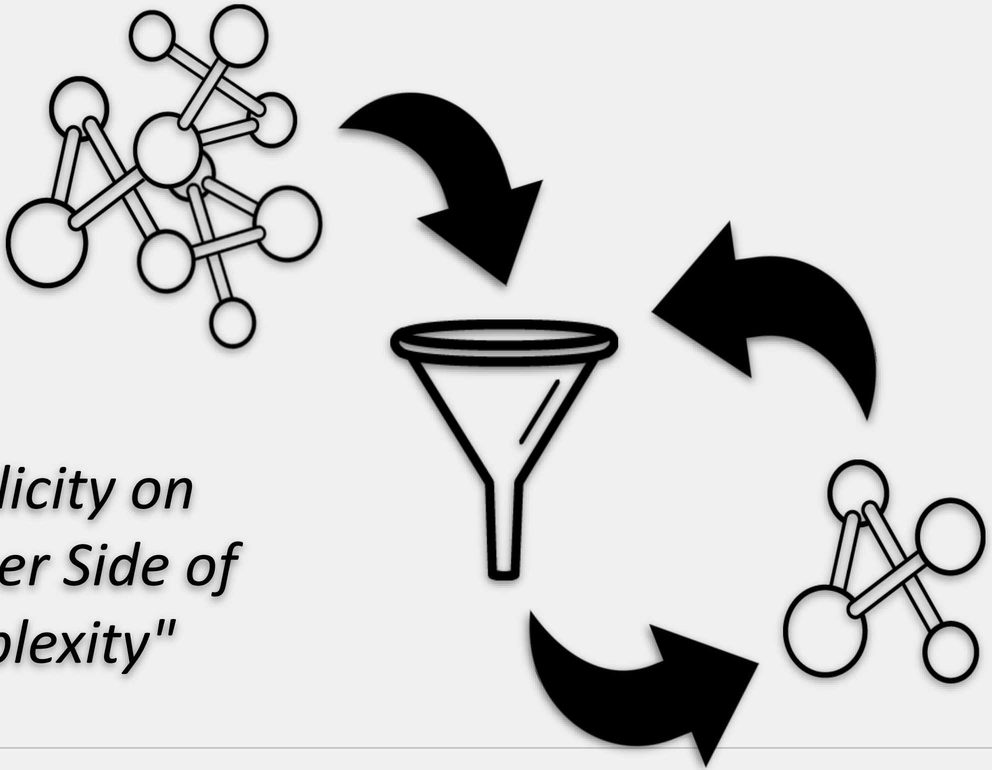
Please jump in with questions at any time

DEVELOPMENT MODEL	APPLICATION ARCHITECTURE	DEPLOYMENT AND PACKAGING	APPLICATION INFRASTRUCTURE	STORAGE
Waterfall	Monolithic	Bare Metal	Data Center	Scale Up
Agile	N-Tier	Virtual Services	Hosted	Scale Out
DEVOPS	MICROSERVICES	CONTAINERS	HYBRID CLOUD	SOFTWARE-DEFINED STORAGE

1929 Buescher Truetone

Add_1929 Buescher Truetone

The Storage Architecture Team



"Simplicity on the Other Side of Complexity"

DIY Software-Defined Storage

Evaluate storage software

Evaluate storage servers

Optimize for target workload

Conduct proof of concept

Procure and license at scale

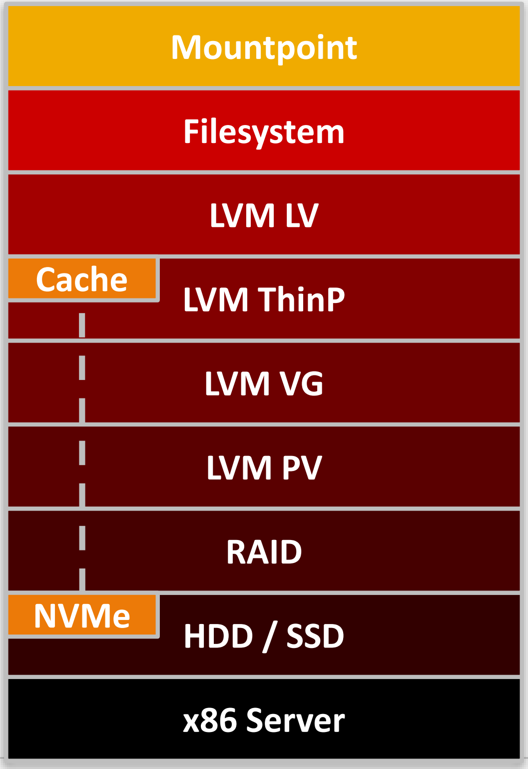
Install

Manually deploy

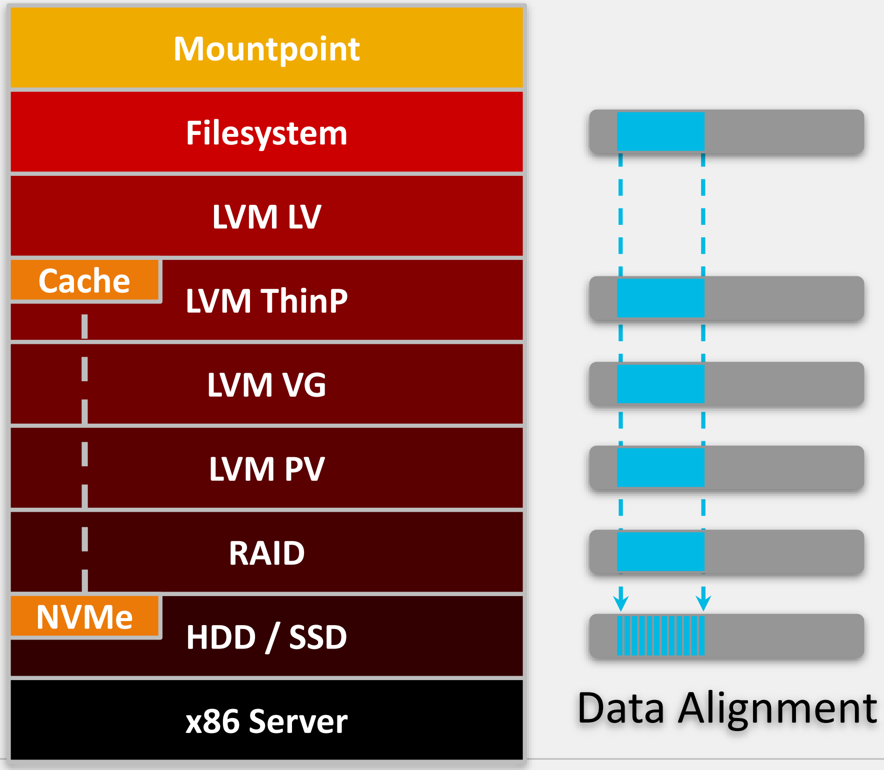
Multiple support contracts

DEMO 1 - MANUAL DEPLOYMENT

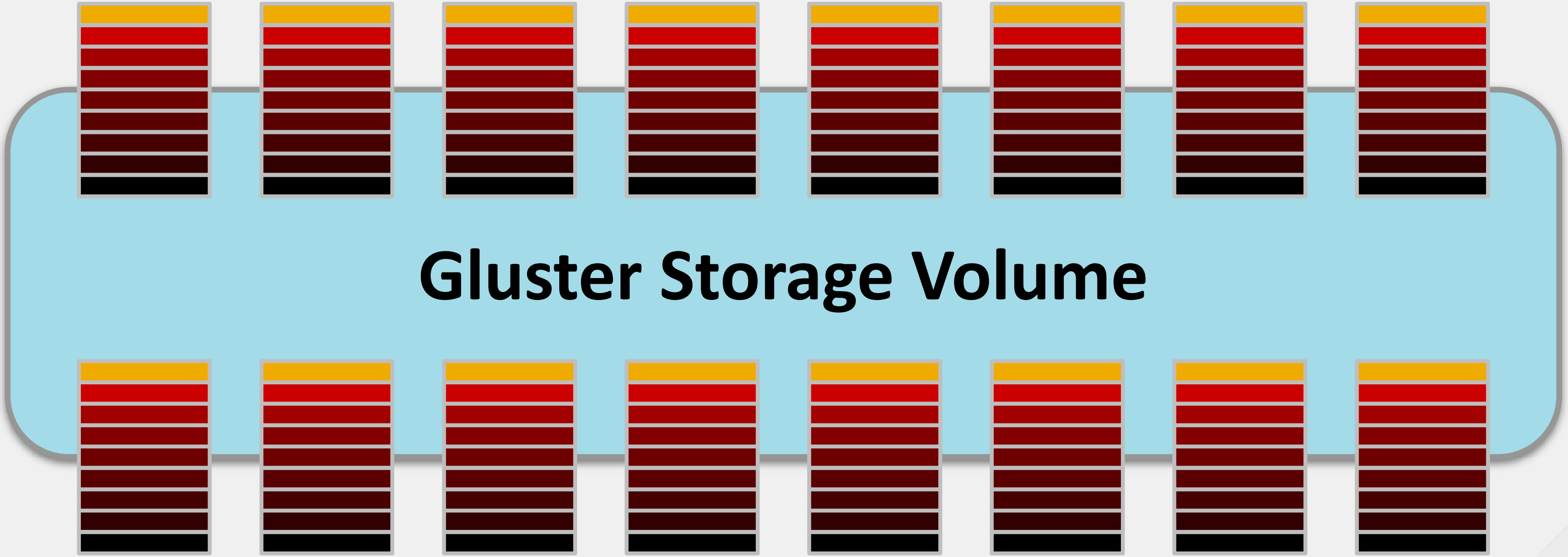
Foundational Storage Stack



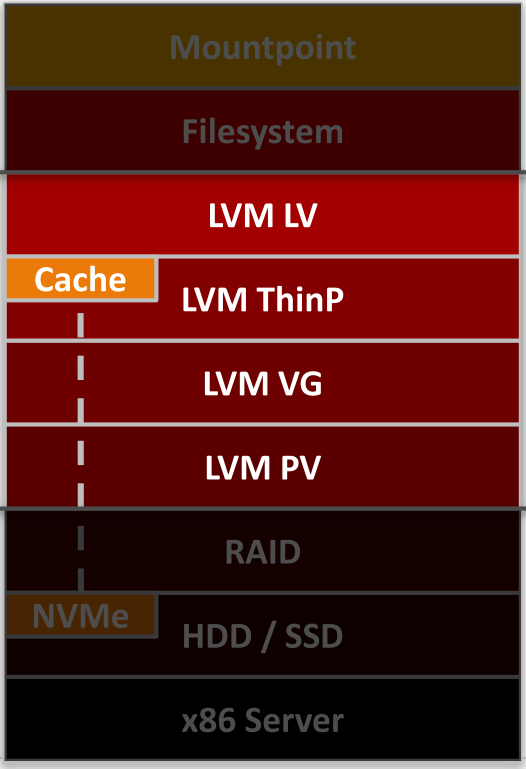
Foundational Storage Stack



Multiplying the Complexity



Foundational Storage Stack

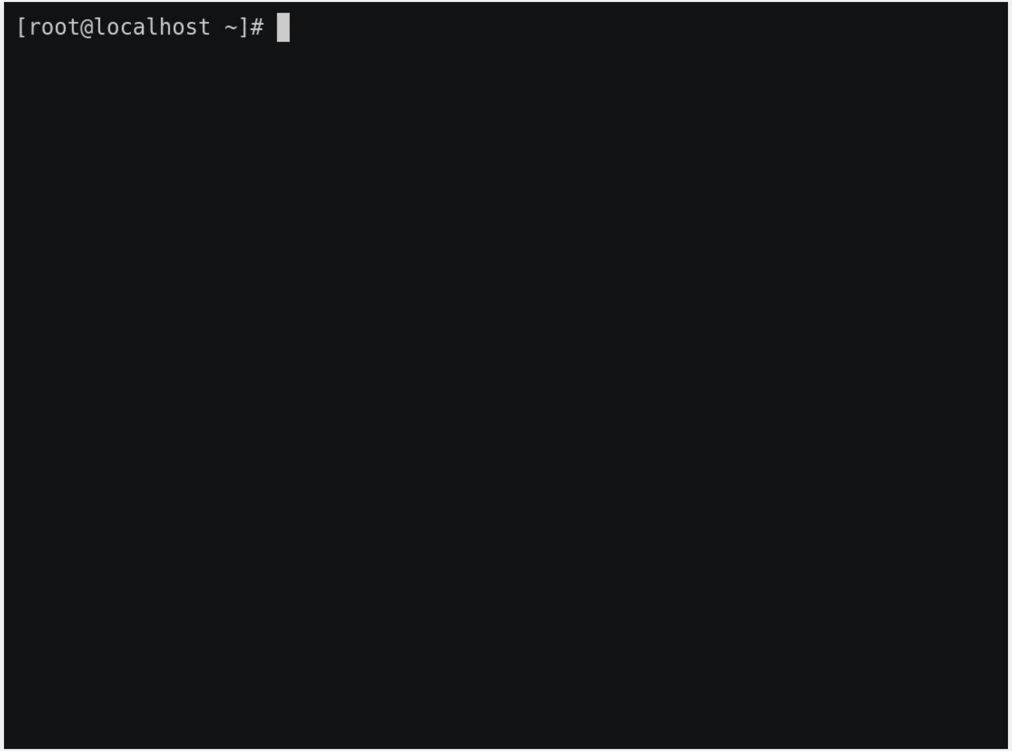


Let's Focus Here

A volunteer from the audience for LVM configuration?

Demonstration

Manual LVM setup



Desired configuration:

- A separate LVM stack with a thin-pool for every backing-device
- Proper data alignment to a 256 KB RAID stripe at all layers
- Fast device configured as LVMcache in writethrough mode
- XFS filesystem with proper data alignment
- Filesystem mounted with appropriate parameters
- **Repeat for 24 nodes and 288 backing devices!**

Demonstration

Manual LVM setup

Thin Provisioning:

- Physical extents are assigned from the PV to the thin pool instead of to the LV directly
- LVs are created instead with logical extents and arbitrary sizes
- Logical extents are mapped to physical extents only as writes occur
- This enables near-instantaneous copy-on-write snapshots and over-provisioning

Demonstration

Manual LVM setup

LVMcache

- A "fast" device is configured as a LVM cache pool
- The cache pool is then associated with a thick LV or with a thin pool
- LVM then intelligently buffers writes and keeps hot blocks in the cache for reads
- High-transaction workloads can be greatly improved
- Both writethrough and writeback modes are supported

Demonstration

Manual LVM setup

Data Alignment

- At the lowest block level, bytes are written in chunks of a particular size (generally 512 bytes for HDDs)
- RAID typically has a larger fundamental block size that is a multiple of the disks' block size
- Aligning the LVM and filesystem layers above to the RAID stripe size ensures transactions at the file level effeciently propogate to the disks, reducing latency

A Good LVM Structure is Non-Trivial

```
# lsblk /dev/sda -o NAME,SIZE,TYPE
NAME                             SIZE TYPE
sda                                5G disk
├─DATA-cpool_cdata                 5G lvm
│ └─DATA-data_thinpool_tdata      29G lvm
│   └─DATA-data_thinpool-tpool    29G lvm
│     ├─DATA-data_thinpool        29G lvm
│     └─DATA-data_thinvolume      20G lvm
└─DATA-cpool_cmeta                 8M lvm
  └─DATA-data_thinpool_tdata      29G lvm
    └─DATA-data_thinpool-tpool    29G lvm
      ├─DATA-data_thinpool        29G lvm
      └─DATA-data_thinvolume      20G lvm
```

```
# lsblk /dev/vda -o NAME,SIZE,TYPE
NAME                                  SIZE TYPE
vda                                    30G disk
├─DATA-data_thinpool_tmeta            512M lvm
│ └─DATA-data_thinpool-tpool           29G lvm
│   ├─DATA-data_thinpool               29G lvm
│   └─DATA-data_thinvolume             20G lvm
└─DATA-data_thinpool_tdata_corig       29G lvm
  └─DATA-data_thinpool_tdata           29G lvm
    └─DATA-data_thinpool-tpool         29G lvm
      ├─DATA-data_thinpool             29G lvm
      └─DATA-data_thinvolume           20G lvm
```

DEMO 2 - AUTOMATION WITH ANSIBLE

Ansible

Python Modules

```
#!/usr/bin/python

from __future__ import
absolute_import, division,
print_function
__metaclass__ = type


ANSIBLE_METADATA =
{'metadata_version': '1.1',
                    'status':
```

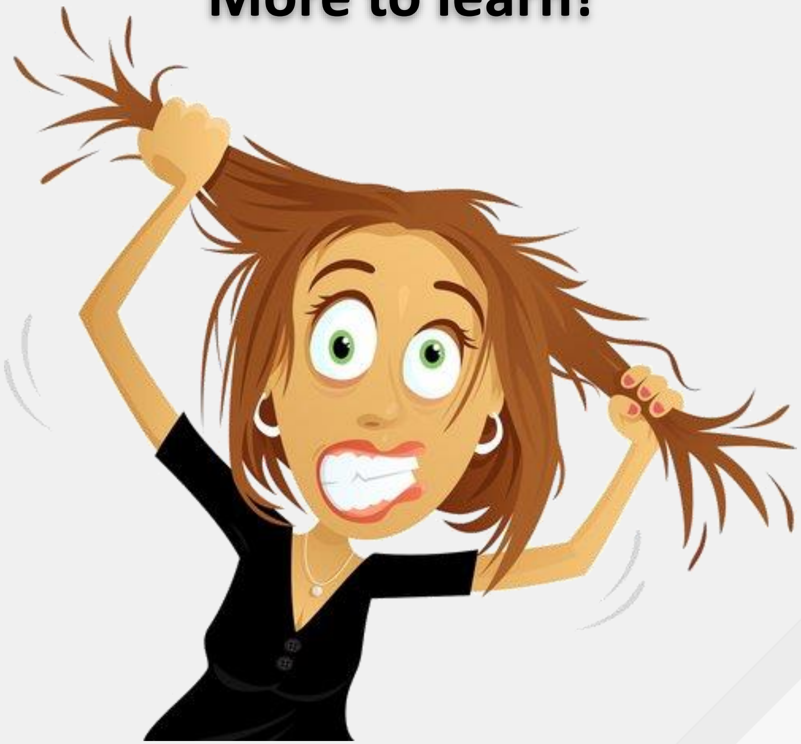
YAML Playbooks

```
- hosts: gluster_nodes
  become: yes

  tasks:
    - name: Create Gluster vol
      volume:
        action: create
        volume: "{{ volname }}"
        bricks: "{{ bricks }}"
        hosts: "{{ play_hosts }}"
```

Automation!

More to learn!



Ansible

- Repetitive tasks are formulated and executed in parallel
- Agentless architecture means any system is a potential Ansible target
- Complicated actions fueled by simple YAML playbooks
- Modules do the heavy lifting and are (generally) designed for idempotence
- **Does not** limit your need to be an expert in whatever you are automating
    - And you need to know Ansible, too!

Your tasks are simpler, not easier!

Demonstration

Ansible deployment for the LVM setup

```
[root@localhost ~]#
```

Desired configuration:

- Automate the LVM stack and filesystem configuration from the first demo
- Add arbiter brick filesystems carved from the fast devices
- Use the remaining fast device space for LVMcache
- Set the tuned profiles
- **Is your playbook idempotent?**

Demonstration

Ansible deployment for the LVM setup

YAML

- YAML Ain't Markup Language
- Human-friendly data serialization
- Whitespace indentation used for structure denotation
- Lists and arrays easily interpreted between languages like python
- Ansible plays are relatively easy to construct and understand

Demonstration

Ansible deployment for the LVM setup

Arbiter Bricks

- Even replica geometries risk split-brain problems
- Adding an odd replica to prevent problems can be prohibitively expensive
- Gluster I/O operations are tracked in metadata with the files
- Arbiter bricks serve as metadata-only stores, providing a lightweight investment for split-brain protection
- Can be separate nodes or chained

Demonstration

Ansible deployment for the LVM setup

"Tune-D" profiles

- Linux has always had a lot of knobs to turn for tuning
- Left on your own, tuning can be daunting if not near impossible
- With tuned, workload-based engineering knowledge has been codified
- Applying a pre-defined tuned profile can make dozens of on-the-fly adjustments

Anatomy of an Ansible Playbook

```yaml
- hosts: gluster_nodes
  become: yes
  any_errors_fatal: True

  tasks:
    - name: Create data volume group
      vg:
        action: create
        disks: "/dev/vda"
        vgname: "DATA"
        diskcount: 10
        disktype: RAID
        stripesize: "256"
        dalign: "256"

   - name: Create data thin pools
     lvol:
          vg: "DATA"
          lv: "data_thinpool"
          size: "100%FREE"
          opts: "--thin --chunksize 256k --poolmetadatasize 1G"
```

Hosts to act on

Tasks to perform on hosts

Task module

Module parameters

Play

Playbook

Plays are ordered, and each play runs in parallel on all hosts

DEMO 3 - AUTOMATION WITH GDEPLOY

Gdeploy

- Ansible-backed
- Gluster-specific modules
- Order-less configuration file
- The power of Ansible with the context of Gluster
- No need for Ansible expertise
- With simplicity comes limited flexibility

Ansible vs. Gdeploy

Ansible YAML

```
- hosts: gluster_nodes
  become: yes
  tasks:
    - lvg:
        vg: DATA
        pvs: /dev/vda

    - lvol:
        vg: DATA
        thinpool: data_thinpool
        size: 29g

    - lvol:
        vg: DATA
        lv: data_lv
...
```

Gdeploy config

```
[hosts]
192.168.122.19

[vg1]
action=create
vgname=DATA
pvname=vda

[lv1]
action=create
vgname=DATA
poolname=data_thinpool
lvtype=thinpool
size=29GB

...
```

Demonstration

Using gdeploy frontend for Ansible

```
[root@localhost ~]#
```

Desired configuration:

- Automate everything from demo 2
- Create a 4-node Gluster trusted storage pool
- Create a Gluster distribute-replicate volume with chained arbiter bricks
- Configure NFS-Ganesha with high-availability
- **Are your arbiter bricks on the correct nodes?**

Demonstration

Using gdeploy frontend for Ansible

Trusted Storage Pools

- Gluster nodes have a "peering" system to establish and modify pools of storage servers
- Peers must be established before volumes can be created
- Peers share status via TCP protocols
- Peers maintain on-disk "volfile" definitions of the translator stacks making up volumes

Demonstration

Using gdeploy frontend for Ansible

Chained Arbiters

- Instead of a dedicated arbiter node, we can use arbiter chaining for better efficiency
- In a 2x replica volume with more than 2 nodes, an arbiter brick for each subvolume is placed on a node that is not part of the replica set
- The arbiter brick should be as fast as your fastest device (including cache)

Demonstration

Using gdeploy frontend for Ansible

PCS High-Availability

- Pacemaker/Corosync Configuration System
- Used to enable VIP migration and session failover for NFS-Ganesha
- Configuration is non-trivial, but aided by built-in Gluster tooling
- High availability and load balancing are not the same thing

All of That Just to Get a Good Volume Config

```
# gluster vol info

Volume Name: myvol
Type: Distributed-Replicate
Volume ID: cc1b8e90-26c6-46c0-9302-58801b608263
Status: Started
Snapshot Count: 0
Number of Bricks: 2 x (2 + 1) = 6
Transport-type: tcp
Bricks:
Brick1: 192.168.122.19:/gluster/brick1/brick1
Brick2: 192.168.122.20:/gluster/brick1/brick1
Brick3: 192.168.122.21:/gluster/arbiter-brick1/arbiter-brick1 (arbiter)
Brick4: 192.168.122.21:/gluster/brick1/brick1
Brick5: 192.168.122.22:/gluster/brick1/brick1
Brick6: 192.168.122.20:/gluster/arbiter-brick1/arbiter-brick1 (arbiter)
Options Reconfigured:
transport.address-family: inet
nfs.disable: on
```

INTRODUCING

RED HAT
STORAGE ONE

WHAT IS RED HAT STORAGE ONE?

A hardware/software/support offering pre-configured for a target workload

4-24 servers
pre-configured for a workload personality

30 minutes or less
to get up-and-running

Fulfilled by Supermicro
or accredited reseller

Pre-loaded Red Hat® Gluster Storage®
and a workload-specific quick-deploy utility

Shipped and supported (L1/L2)
by Supermicro

SIMPLIFYING SDS DEPLOYMENT

Traditional “DIY” software-defined storage

Evaluate storage software › Evaluate storage servers › Optimize for target workload › Conduct proof of concept

Procure and license at scale › Install › Manually deploy › Multiple support contracts

RED HAT STORAGE ONE

Optimization-tested,
self-configuring,
and ready in minutes

120TB to 1.5PB (usable)
of resilient
Red Hat® Gluster Storage

Single part number
for hardware software and support

CURRENT WORKLOAD IDENTITIES

General NAS and content repositories

General NAS

User directories,
mix of small and large files
in NFS, SMB, GlusterFS-native folders

Content repositories

Photos, rich images,
and videos at large scale

RHS One Intro

- Software-defined storage isn't simple
- Compare responsibilities with traditional storage:

	Traditional Storage	Software-Defined Storage
Setup	Vendor	OS Admins?
Administration	Storage Admins	OS Admins? Storage Admins?
Day-to-Day Operation	Storage Admins	End-user? Customer?

SDS Isn't Simple?

- Optimal setup is tricky
  - A myriad of "compatible" hardware choices
  - LVM stack and data alignment is complicated
  - Multiple Gluster geometries to choose from
  - 311 volume options with Gluster
- Easier to define the expected workload
  - Large files
  - Video streams
  - Small files
  - Databases

RHS One is Built on Experience

- Endless test cycles to refine workload categories and performance characteristics
- Massive amounts of data collected on which to base architectural decisions
- Years of experience in critical enterprise deployments
- Extremely close feedback loop with engineering and support

What's in the Box?

The RHS One Quick-Deploy System is Built On:

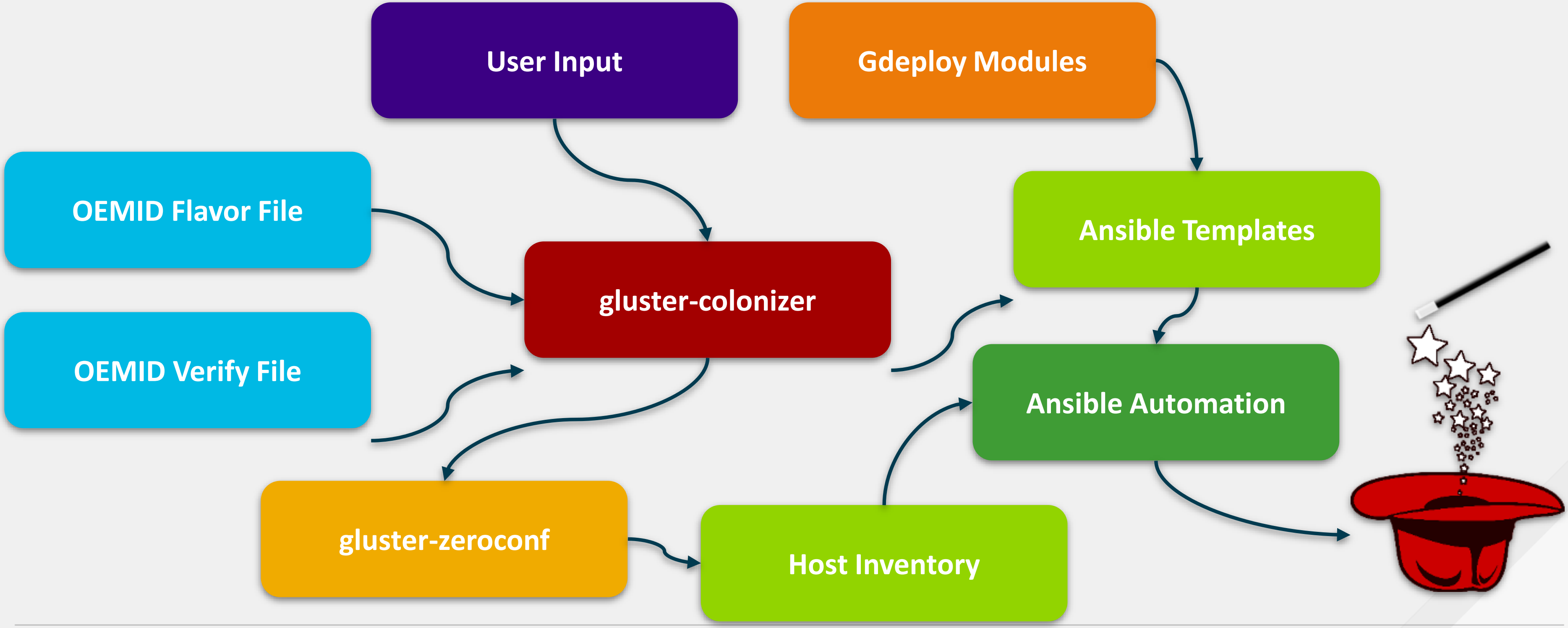
- Ansible
- Gdeploy
- Python
- YAML
- gluster-zeroconf

DEMO 4 - RED HAT STORAGE ONE

Extra Challenges for RHS One

- Networking (bonding, device naming, subnets, hostnames)
- LVM stack with variable disk sizes and backends
- Node discovery
- Calculated arbiter sizes and locations
- Efficient fast device allocation
- Portability among hardware models
- Variable client access method
- Simplified step-by-step UI

The Gluster Colonizer Deployment Model



See the Code Upstream

https://github.com/gluster/gluster-colonizer

- The Gluster Colonizer project is the technical basis for RHS One
- Currently handles:
  - Rep 2 + Chained Arbiter
  - Disperse 4+2 (erasure coding)
- New OEMID file sets can enable more hardware models, deployment types, and workloads

Demonstration

Complete workload-based deployment automation

Desired configuration:

- 4-Node deployment
- Hostnames and IPs configured
- Proper foundational storage stack with data alignment
- Data bricks backed with lvmcache
- Gluster replica deployment with chained arbiter bricks on fast devices
- Key and password updates
- NFS-Ganesha with HA

```
[root@g1-fresh ~]# gluster-colonizer.py -f /usr/share/gluster-colonizer/oemid/g1-id-kvm-nas.yml

    ____  __  _______    ____
   / __ \/ / / / ___/   / __ \____  ___
  / /_/ / /_/ /\__ \   / / / / __ \/ _ \
 / _, _/ __  /___/ /  / /_/ / / / /  __/
/_/ |_/_/ /_//____/   \____/_/ /_/\___/


Welcome to the Red Hat Storage One Gluster deployment tool!

This node will be configured as the deployment master for your
Gluster storage pool. Before proceeding, please ensure that
all RHS One Gluster nodes are connected to the management
network infrastructure and are booted.

Do you wish to continue? [Y/n]
```

HANDS-ON OPPORTUNITY

Hands-On with RHS One

Get the simulation demo in this GitHub private branch:

https://github.com/dustinblack/gluster-colonizer/tree/demo

Requirements:

- python 2.7
- python netaddr
- python pyyaml
- asciinema (in $PATH)

✓ Linux
✓ Mac
✓ Android
? Windows
? IOS

Run from resources/demo/:

```
./gluster-colonizer-demo.py -f g1-demo.yml
```

Demo Inputs:

As this is a simulation, the inputs are arbitrary and up to you. A few selections, such as Client method, have been locked to one option. Validations are active, so entries like hostnames and IP addresses must be in correct formats.

Answering 'no' at most Y/N prompts will abort. Ctrl-c will also abort.

The simulation will not make any system changes.

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THANK YOU

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