

High-Availability Option (HAO) for RHEL on System z and System p

David Boyes
Sine Nomine Associates

Agenda

- Product Positioning
- Technical Description
- Demonstration (if time permits)



SINE NOMINE
ASSOCIATES

What is HAO?

- HAO is a set of software for RHEL on IBM System z and System p hardware that provides:
 - System clustering/failover monitoring
 - Cluster file system software
 - Workload distribution software
- HAO is designed to be plug-compatible with RH Cluster Suite (with minimal differences)



SINE NOMINE
ASSOCIATES

Why Do Customers Need HAO?

- Customers need to deliver continually available services across multiple RHEL systems on non-Intel platforms
- Red Hat does not provide any high-availability management solution on non-Intel platforms
- Support for GFS2 and other cluster filesystems is not available from RH on non-Intel platforms

What Customers Need HAO?

- Customers who need a supported method to deliver continuously available services on RHEL for System z and System p
- Customers who need a supported solution for multiple systems accessing common data
- Customers who need to deploy software-based load balancing to multiple servers

Why is SNA Doing This?

- RH refused to do it
- RH refused to cooperate with SNA to do it
- RH didn't think HA for System z and p was important
 - RH sales teams have decided to tell RH engineering to take a hike and support us anyway
 - Contact: Filipe Miranda (fmiranda@redhat.com)

When Will HAO Be Available?

- Available Today for System z
 - RHEL 6.x
 - RHEL 7
- Available Today for System p
 - RHEL 6.x
 - RHEL 7 (pending hardware access)



SINE NOMINE
ASSOCIATES

Where Can HAO Run? (System z)

- System z:
 - Any supported s390x hardware
 - RHEL 6.x
 - RHEL 7



SINE NOMINE
ASSOCIATES

Where Can HAO Run? (System p)

- System p:
 - Any supported ppc64 hardware
 - RHEL 6.x
 - RHEL 7 (pending hardware access)

How Do Customers Get HAO?

- Complete a trial license agreement
- 120 day test period
 - If customer does not buy, commits to removing software after 120 days
 - Non-production use only during test period
- Install assistance and support access during trial
 - Phone/email support only 9-5 Washington DC time during trial except for sev 1 issues
- Purchase direct from SNA or via partners
- Full implementation support option available (paid)

Pricing

- Pricing by effective capacity in LPARs using HAO
 - Annual subscription
 - Pay only for what you use
 - Same price per proc (GP or IFL)
 - Calculated cost per processor (more procs = cheaper per proc)
 - Proc count can be aggregated across enterprise and platform (all Z and P procs can count)
 - Use worksheet to DIY quote

Support Options

- Support included in subscription price
 - 24x7x365 phone and email
 - New versions/updates released during subscription period
 - z/VM setup-related questions
 - Planning (“what-if”) questions

What Supporting Materials Are Available?

Sales

- Product Brochure
- Support and Pricing
- Trial License Document

Technical

- RHEL Cluster Suite docs
 - www.redhat.com
- System z Tech Notes
 - distributed with package
- White Papers

<http://www.sinenomine.net/products/linux/hao>



SINE NOMINE
ASSOCIATES

TECHNICAL DESCRIPTION



SINE NOMINE
ASSOCIATES

Overview

- Clustering
- High Availability
- Cluster Management
- Failover
- Fencing
- Lock Management
- GFS2
- Configuration
- Failover

Clustering

- Four types
 - Storage
 - **High Availability**
 - High Performance
 - Load Balancing
 - may be incorporated with previous two cluster types

High Availability

- Eliminate Single Points of Failure
- Failover
- Simultaneous Read/Write
- Node failures invisible outside the cluster
- rgmanager is the core software

High Availability

- Major Components
 - Cluster infrastructure — Provides fundamental functions for nodes to work together as a cluster
 - Configuration-file management, membership management, lock management, and fencing
 - High availability Service Management — Provides failover of services from one cluster node to another in case a node becomes inoperative
 - Cluster administration tools — Configuration and management tools for setting up, configuring, and managing the high availability Implementation

High Availability

- Other Components
 - Red Hat GFS2 (Global File System 2)
glustre
Ceph
 - Provides cluster file systems for use with HAO and general-purpose systems. Cluster filesystems allows multiple nodes to share storage at a block level as if the storage were connected locally to each cluster node. Glustre and Ceph provide policy-based storage systems
 - Cluster Logical Volume Manager (CLVM) — Provides volume management of cluster storage
 - Load Balancer — Routing software that provides IP-Load-balancing

Cluster Infrastructure

- Cluster management
- Lock management
- Fencing
- Cluster configuration management

Cluster Management

- CMAN
 - Manages quorum and cluster membership
 - Distributed manager that runs in each node
 - Tracks membership and notifies other nodes

Resource Manager

- The resource manager (rgmanager) manages and provides failover capabilities for collections of cluster resources called services, resource groups, or resource trees
- Allows administrators to define, configure, and monitor cluster services
- In the event of a node failure, rgmanager will relocate the clustered service to another node with minimal service disruption

Failover Management

- **Failover Domains**
 - How the rgmanager failover domain system work
- **Service Policies**
 - rgmanager's service startup and recovery policies
- **Resource Trees**
 - How rgmanager's resource trees work, including start/stop orders and inheritance
- **Service Operational Behaviors**
 - How rgmanager's operations work and what states mean
- **Virtual Machine Behaviors**
 - Special things to remember when running VMs in a rgmanager cluster
- **Resource Actions**
 - The agent actions rgmanager uses and how to customize their behavior from the cluster.conf file.
- **Event Scripting**
 - If rgmanager's failover and recovery policies do not fit in your environment, you can customize your own using this scripting subsystem.

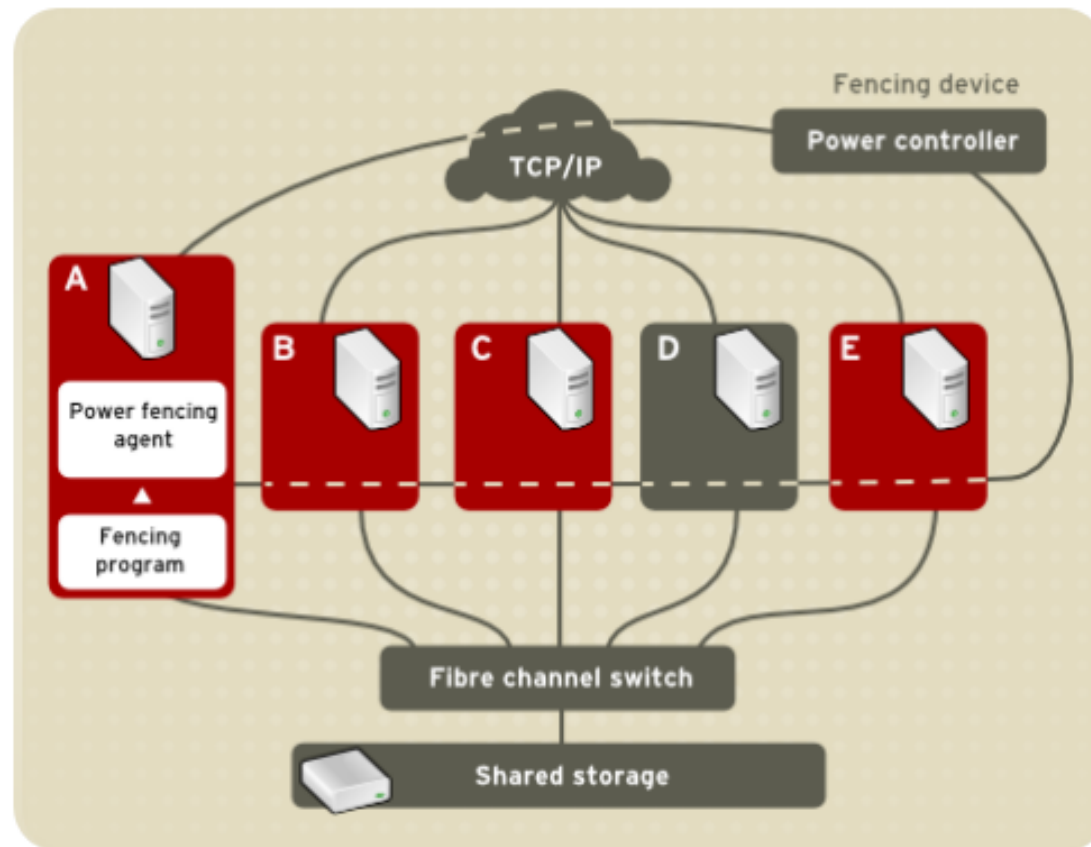
Fencing

- The disconnection of a node from the cluster's shared storage.
- Fencing cuts off I/O from shared storage, thus ensuring data integrity
 - The cluster infrastructure performs fencing through the fence daemon: `fenced`. `cman` determines that a node has failed and communicates to other cluster-infrastructure components that the node has failed
- **fenced**, when notified of the failure, fences the failed node



SINE NOMINE
ASSOCIATES

Power Fencing



z/VM Power Fencing

- Two choices of SMAPI-based fence devices
 - IUCV-based
 - TCP/IP
- Uses image_recycle API to fence a node
- Requires SMAPI configuration update to AUTHLIST:

Column 1	Column 66	Column 131
V	V	V
XXXXXXXX	ALL	IMAGE_OPERATIONS



SINE NOMINE
ASSOCIATES

z/VM Power Fencing

A

SMAPI Srv

B

Node B fails

CP



SINE NOMINE
ASSOCIATES

z/VM Power Fencing

A

SMAPI Srv

B

**Node A
detects node
B is down**

Node B fails

CP



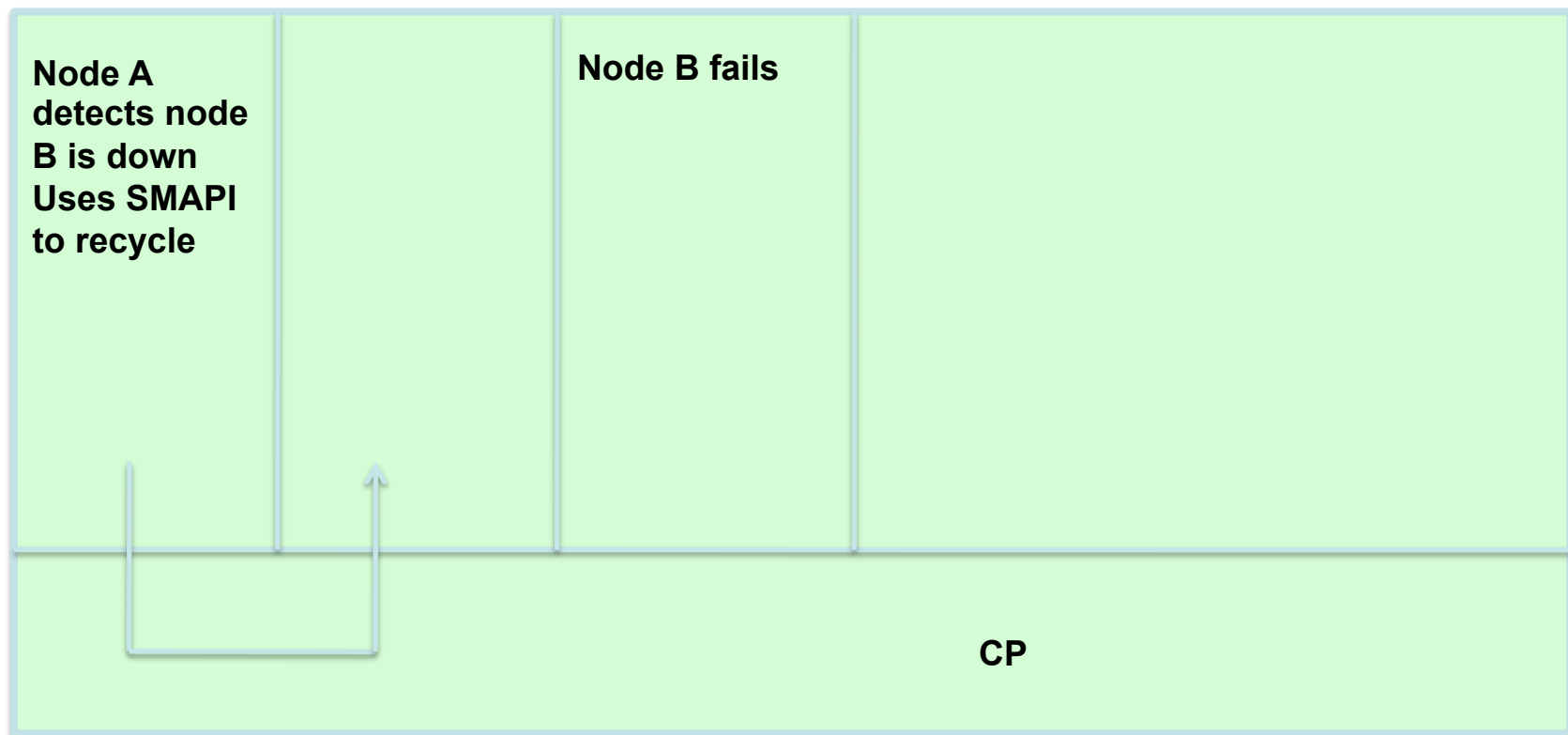
SINE NOMINE
ASSOCIATES

z/VM Power Fencing

A

SMAPI Srv

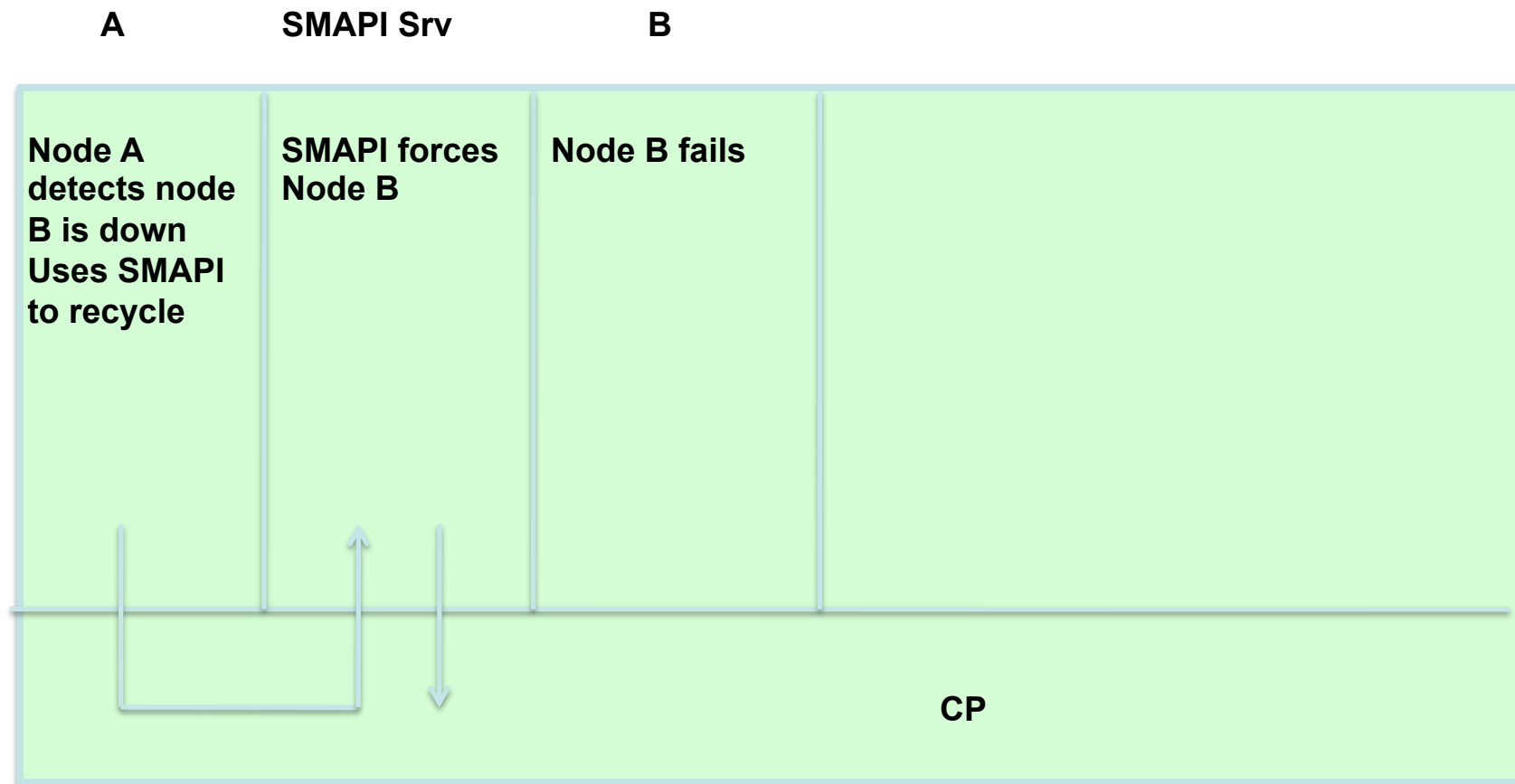
B





SINE NOMINE
ASSOCIATES

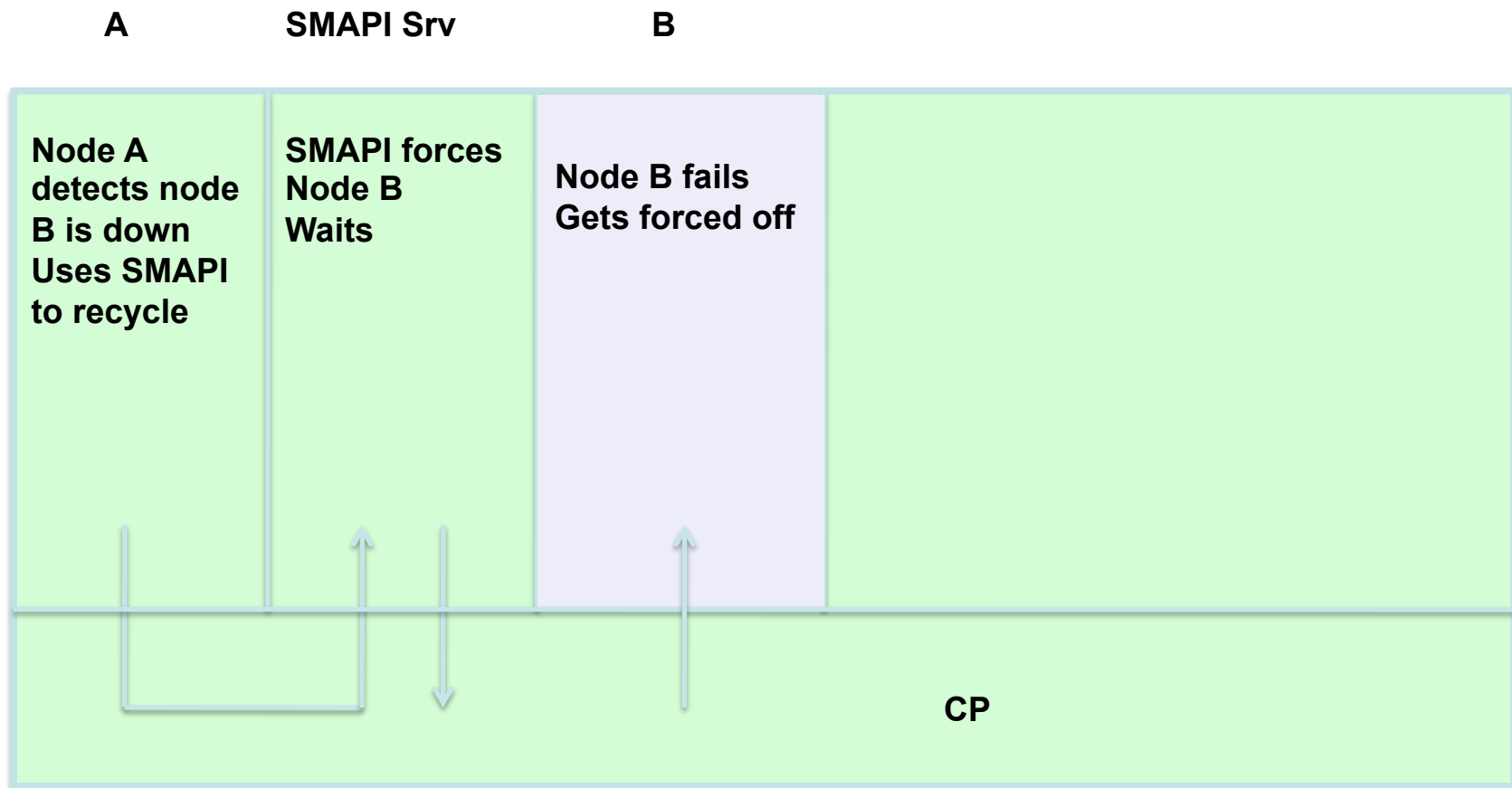
z/VM Power Fencing





SINE NOMINE
ASSOCIATES

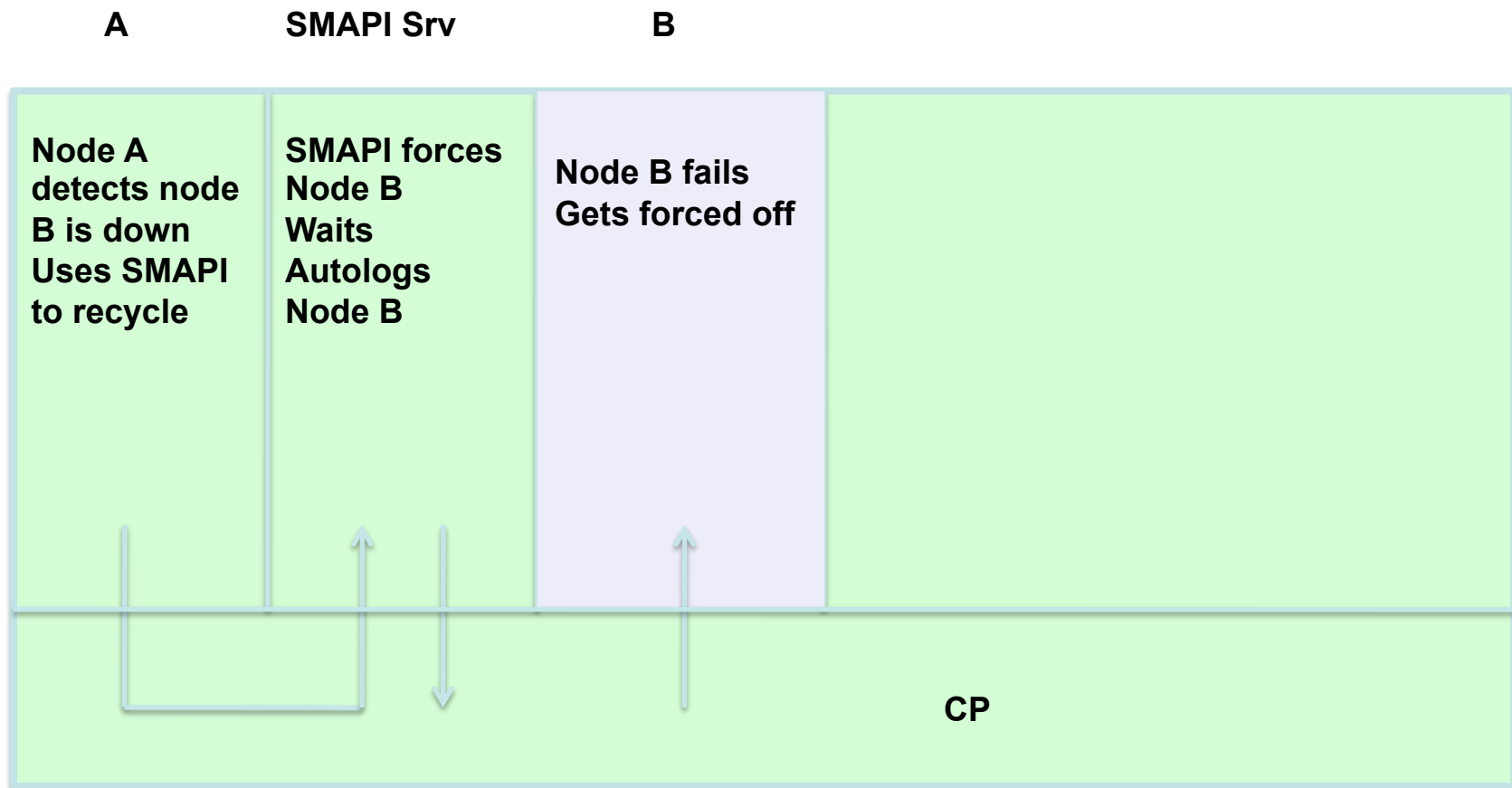
z/VM Power Fencing





SINE NOMINE
ASSOCIATES

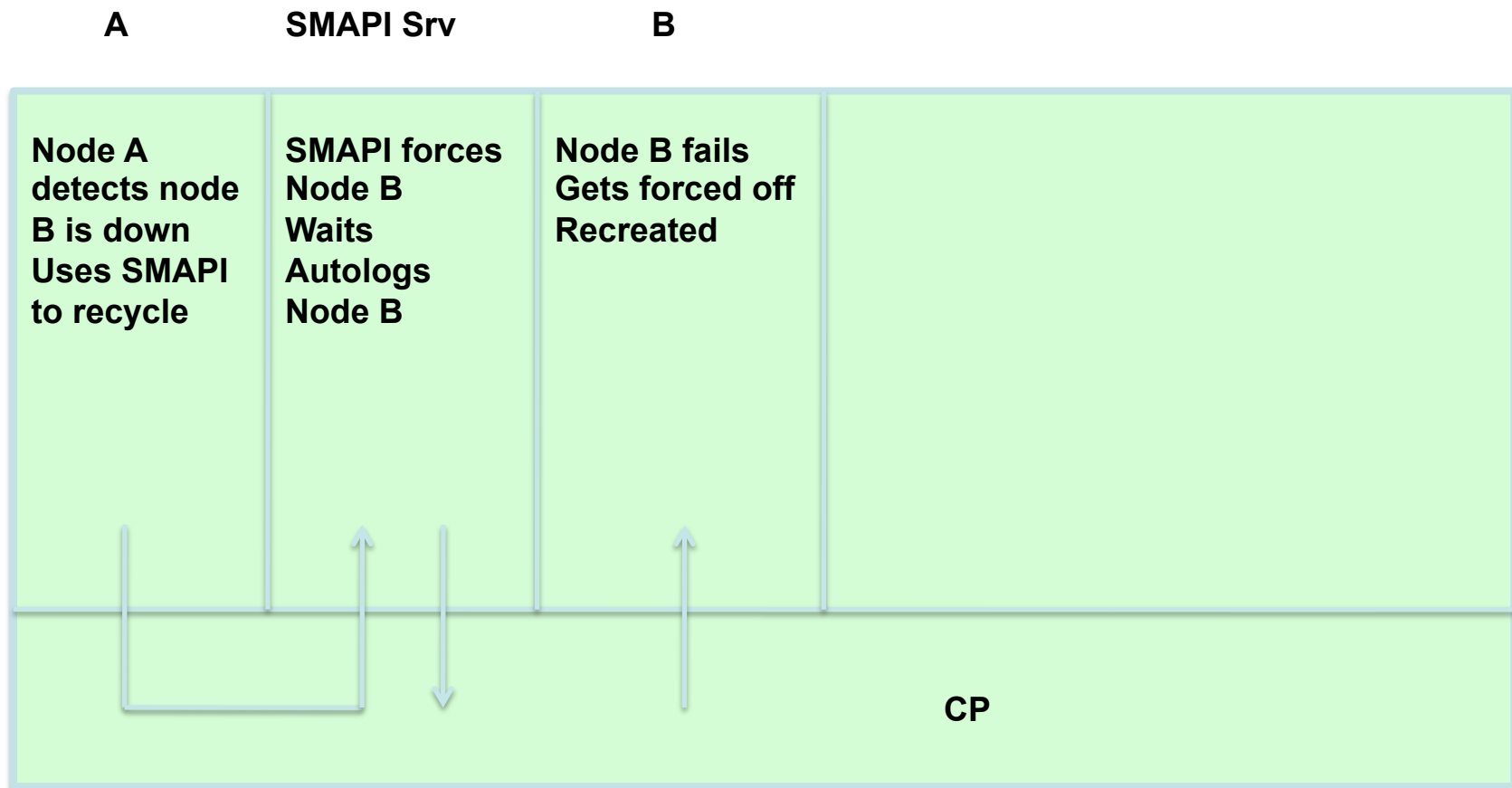
z/VM Power Fencing





SINE NOMINE
ASSOCIATES

z/VM Power Fencing



Lock Management

- Provides a mechanism for other cluster infrastructure components to synchronize their access to shared resources
 - DLM – Distributed Lock Manager used in RHEL systems
- Lock management is distributed across all nodes in the cluster. GFS2 and CLVM use locks from the lock manager
 - GFS2 uses locks from the lock manager to synchronize access to file system metadata (on shared storage)
 - Glustre and Ceph use locks from the lock manager to sync access to filesystem metadata as well.
 - CLVM uses locks from the lock manager to synchronize updates to LVM volumes and volume groups (also on shared storage)
- **rgmanager** uses DLM to synchronize service states.

GFS2

- A shared disk file system for Linux computer clusters
 - GFS2 is a journaling file system
 - GFS2 differs from distributed file systems (such as AFS, Coda, or InterMezzo) because it allows all nodes to have direct concurrent access to the same shared block storage
- GFS2 can also be used as a local filesystem.
 - GFS has no disconnected operating-mode, and no client or server roles: All nodes in a GFS cluster function as peers
- Requires hardware to allow access to the shared storage, and a lock manager to control access to the storage

HAO Release 2.0

- Release 2.0 brings HAO to parity with the RHCS code delivered on Intel systems with RHEL 7
 - Majority of changes involve new service monitoring and instrumentation interfaces
 - Addition of infrastructure to support multiple cluster file systems
 - Support for RHEL 7
 - Removal of RHEL 5 support
 - Application compatibility testing for additional commercial and open source products



SINE NOMINE
ASSOCIATES

HAO 2.0 Core Technology Update

- HAO 2.0 transitions to the pacemaker cluster management stack, providing:
 - Storage Management
 - Cluster Communications
 - Resource Management
 - Cluster Management Applications
- Common converged cluster infrastructure applied to multiple distributions (RHEL, SLES, Debian, etc)
 - Future versions of HAO will extend to managing other distributions

Storage Management

- At the storage layer, HAO 2. now permits:
 - Replicated data instances
 - Distributed data instances at block level
 - Deferral of replication to object storage systems like glustre and Ceph
 - glustre file system support included in HAO 2.0 licensing
 - Ceph support is present in HAO, but some bugs still need to be worked out in Ceph implementation (endianess)

Cluster Communications

- Cluster communications provides reliable messaging, cluster membership and quorum management. HAO 2.0 includes:
 - Improved corosync implementation
 - Implements Totem membership and ordering protocol
 - 20 yrs R&D of guaranteed delivery message passing research
 - UDP multicast, unicast, broadcast
 - Fully supports multiple physically independent interconnects
 - Cluster communications are mutually authenticated and fully encrypted

Cluster Resource Management

- HAO 2.0 delivers:
 - Distributed Cluster Information Base (CIB) replicated automatically, managed by elected coordinator (no master node dependency)
 - Command line and web-based configuration tools
 - Policy engine to validate cluster configuration consistency and status of resources
 - Formal API for easier integration

Resource Agents

- Knowledge of specific aspects of applications or resources is now completely isolated into a resource agent describing the resource and implemented a set of predefined actions
 - More than 70 predefined agents supplied
 - Agents can be written in any convenient language
 - Extended documentation on custom resource development available.



SINE NOMINE
ASSOCIATES

Cluster Management Applications

- Additional updates to luci and the 'crm' interactive shell
 - Adapted to support IUCV and SSI environments
 - Extensions to GUI for additional filesystem semantics inserted by distributed block storage



SINE NOMINE
ASSOCIATES

Application Compatibility Testing

- White papers in progress for more than a dozen commercial and open source applications
 - DB/2, Oracle, MySQL, mariaDB, postgres
 - Websphere App Server, WebLogic
 - Compatible with IBM Wave deployment methodology
 - Etc.
- Requests are welcome



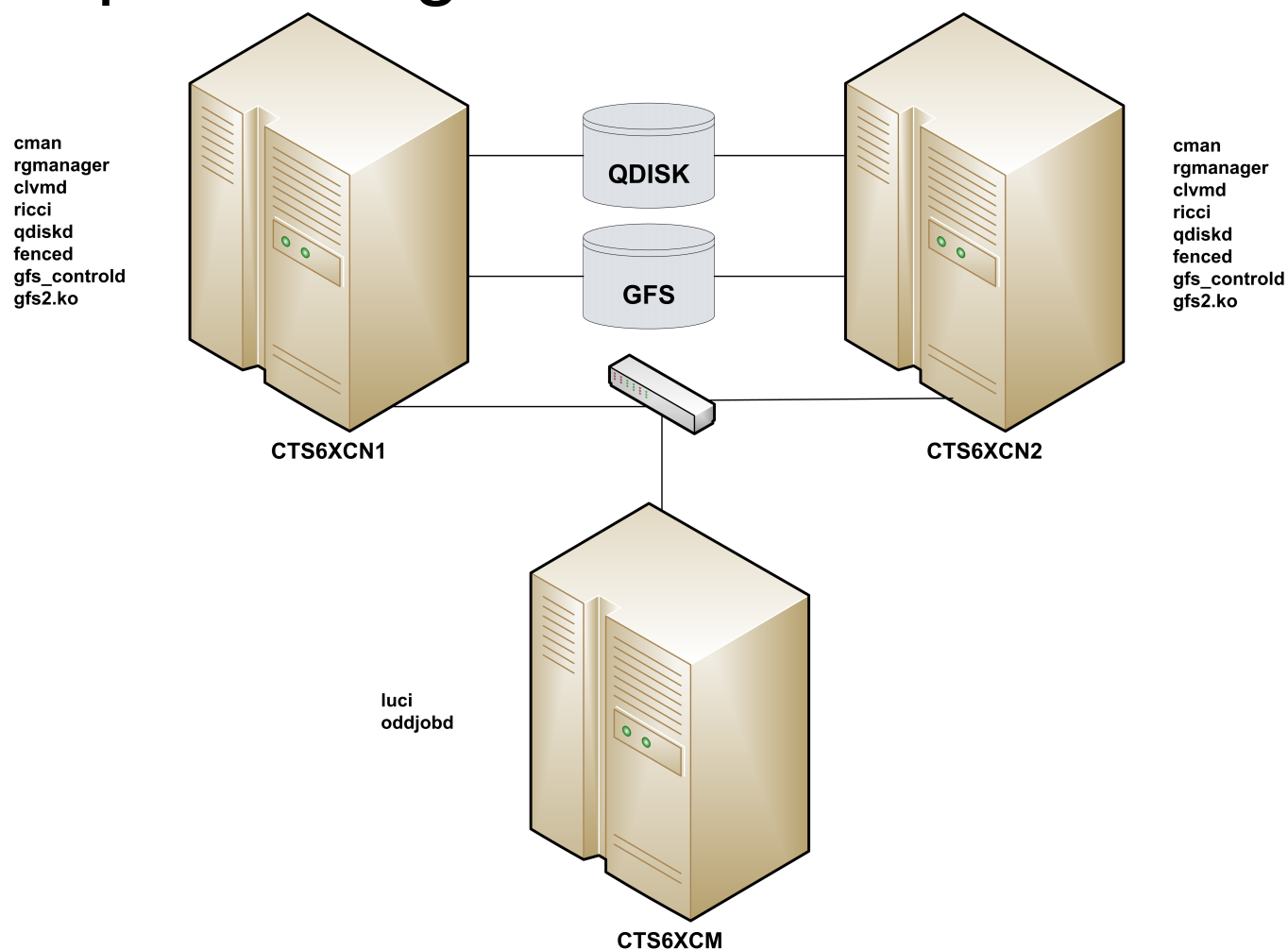
SINE NOMINE
ASSOCIATES

DEMONSTRATION



SINE NOMINE
ASSOCIATES

Sample Configuration





SINE NOMINE
ASSOCIATES

Sample Configuration

```
USER CLUSTER XXXXXXXX 768M 2G G
*FL= N
  ACCOUNT 99999999 GENERAL
  MACHINE ESA
  *AC= 99999999
  COMMAND SET VSWITCH VSWITCH2 GRANT &USERID
  COMMAND COUPLE C600 TO SYSTEM VSWITCH2
  IUCV VSMREQIU
  IPL CMS PARM AUTO CR FILEPOOL USER01
  CONSOLE 0009 3215 T OPERATOR
  SPOOL 00C 2540 READER *
  SPOOL 00D 2540 PUNCH A
  SPOOL 00E 1403 A
  LINK MAINT 190 190 RR
  LINK MAINT 19E 19E RR
  NICDEF C600 TYPE QDIO DEVICES 3
  MDISK 150 3390 3116 3338 CO510C MR
  MDISK 151 3390 6286 3338 CO5109 MR
  MDISK 153 3390 0001 3338 CO520E MW
  MINIOPT NOMDC
  MDISK 200 3390 3007 0020 CO510F MW
  MINIOPT NOMDC
```

```
USER CTS6XCN* XXXXXXXX 768M 2G G 64
*FL= N
  ACCOUNT 99999999 LINUX
  MACHINE ESA
  *AC= 99999999
  COMMAND SET VSWITCH VSWITCH2 GRANT &USERID
  COMMAND COUPLE C600 TO SYSTEM VSWITCH2
  IUCV VSMREQIU
  IPL CMS PARM AUTO CR FILEPOOL USER01
  CONSOLE 0009 3215 T OPERATOR
  SPOOL 00C 2540 READER *
  SPOOL 00D 2540 PUNCH A
  SPOOL 00E 1403 A
  LINK MAINT 190 190 RR
  LINK MAINT 19E 19E RR
  LINK CLUSTER 153 152 MW
  LINK CLUSTER 200 200 MW
  NICDEF C600 TYPE QDIO DEVICES 3
  MDISK 150 3390 0001 3338 CO5204 MR
  MDISK 151 3390 4281 3338 CO5107 MR
```



SINE NOMINE
ASSOCIATES

Sample Configuration...

```
<?xml version="1.0"?>
<cluster config_version="52" name="SNATEST">
  <clusternodes>
    <clusternode name="cts6xcn1.devlab.sinenomine.net" nodeid="1">
      <fence>
        <method name="SMAPITCP">
          <device name="SMAPITCP" target="CTS6XCN1"/>
        </method>
      </fence>
    </clusternode>
    <clusternode name="cts6xcn2.devlab.sinenomine.net" nodeid="2">
      <fence>
        <method name="SMAPITCP">
          <device name="SMAPITCP" target="CTS6XCN2"/>
        </method>
      </fence>
    </clusternode>
  </clusternodes>
  <fencedevices>
    <fencedevice agent="fence_zvm" name="ZVMSMAPI" smapiserver="VSMREQUIU"/>
    <fencedevice agent="fence_zvmip" authpass="c13f0s" authuser="CTS6XCN1" name="SMAPITCP" smapiserver="vm.devlab.sinenomine.net"/>
  </fencedevices>
  <cman expected_votes="3"/>
</cluster>
```

...Sample Configuration

```


<rm>
    <resources>
        <apache config_file="conf/httpd.conf" name="SNA_WebServer" server_root="/etc/httpd" shutdown_wait="0"/>
        <clusterfs device="/dev/mapper/vg_snatest-gfs2" fsid="35269" fstype="gfs2" mountpoint="/var/www/html" name="SNA_GFS2"/>
        <ip address="172.17.16.185/24" sleeptime="3"/>
    </resources>
    <failoverdomains>
        <failoverdomain name="SNA_Failover">
            <failoverdomainnode name="cts6xcn2.devlab.sinenomine.net"/>
        </failoverdomain>
    </failoverdomains>
    <service domain="SNA_Failover" name="GFS2SERVICE" recovery="relocate">
        <clusterfs ref="SNA_GFS2"/>
        <ip ref="172.17.16.185/24"/>
        <apache ref="SNA_WebServer"/>
    </service>
</rm>
<quorumd label="QDISK"/>
<logging>
    <logging_daemon debug="on" logfile="/var/log/cluster/qdiskd.log" logfile_priority="debug" name="qdiskd"/>
</logging>
<fence_daemon post_fail_delay="10"/>
</cluster>

```




SINE NOMINE
ASSOCIATES

Configuration using luci

 **High Availability**
management

About Login

Homebase

Login

Username

Password

Login

...Configuration using luci...

Homebase	CLUSTER SUMMARY		
Manage Clusters	Name	Status	Nodes Joined
	SNATEST	Quorate	2 of 2

...Configuration using luci...

Nodes Fence Devices Failover Domains Resources Service Groups Configure						
+ Add Reboot Join Cluster Leave Cluster Delete						
!	Node Name	Node ID	Votes	Status	Uptime	Hostname
<input type="checkbox"/>	cts6xcn1.devlab.sinenomine.net	1	1	Cluster Member	00:00:59:54	cts6xcn1.devlab.sinenomine.net
<input type="checkbox"/>	cts6xcn2.devlab.sinenomine.net	2	1	Cluster Member	00:23:01:56	cts6xcn2.devlab.sinenomine.net

Select an item to view details



SINE NOMINE
ASSOCIATES

...Configuration using luci...

cts6xcn1.devlab.sinenomine.net

Status Cluster Member

Properties

Number of votes

1

ricci host

cts6xcn1.devlab.siner

ricci port

11111

Update Properties

Services

GFS2SERVICE

Failover Domains

Priority

Fence Devices

Method

SMAPITCP

Name

Type/Values

[SMAPITCP](#)

IBM z/VM – SMAPI using TCP/IP

target : CTS6XCN1

Add Fence Instance

Remove

Add Fence Method

Cluster Daemons

	Status
cman	Running
rgmanager	Running
ricci	Running
modclusterd	Running
clvmd	Running

...Configuration using luci...

Cluster Daemons

	Status
cman	Running
rgmanager	Running
ricci	Running
modclusterd	Running
clvmd	Running

...Configuration using luci...

Nodes			Fence Devices	Failover Domains	Resources	Service Groups	Configure
+ Add			✕ Delete				
Name		Fence Type		Nodes Using			
<input type="checkbox"/>	ZVM SMAPI	IBM z/VM – SSI		0			
<input type="checkbox"/>	SMAPITCP	IBM z/VM – SMAPI using TCP/IP		2			

...Configuration using luci...

SMAPITCP

Type IBM z/VM – SMAPI using TCP/IP

Fence Type

Name

SMAPI Server Virtual Machine Host Name

SMAPI Authorized User Name

SMAPI Authorized User Password

IBM z/VM – SMAPI using TCP/IP

SMAPITCP

vm.devlab.sinenomine.net

CTS6XCN1

Apply

Nodes

! Node Name

Status

cts6xcn1.devlab.sinenomine.net

OK

cts6xcn2.devlab.sinenomine.net

OK

...Configuration using luci...

+ Add
✕ Delete

Name	Prioritized	Restricted
<input type="checkbox"/> SNA_Failover	No	No

SNA_Failover

✕

Update Properties

☐ Prioritized
 Order the nodes to which services failover.

☐ Restricted
 Service can run only on nodes specified.

☐ No Failback
 Do not send service back to 1st priority node when it becomes available again.

Services

GFS2SERVICE

Members

Update Settings

Member	Priority
cts6xcn1.devlab.sinenomine.net	<input type="text"/>
cts6xcn2.devlab.sinenomine.net	<input checked="" type="checkbox"/>

...Configuration using luci...

Nodes	Fence Devices	Failover Domains	Resources	Service Groups	Configure
<div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div></div><div></div></div>					
Name/IP		Type		In Use	
<input type="checkbox"/>	SNA_WebServer	Apache Server		✓	
<input type="checkbox"/>	SNA_GFS2	GFS2		✓	
<input type="checkbox"/>	172.17.16.185/24	IP Address		✓	

...Configuration using luci...

SNA_WebServer

Apache

Name	SNA_WebServer
Server Root	/etc/httpd
Config File	conf/httpd.conf
httpd Options	
Shutdown Wait (seconds)	0

...Configuration using luci...

SNA_GFS2

GFS2

Name

SNA_GFS2

Mount Point

/var/www/html

Device, FS Label, or UUID

/dev/mapper/vg_snatest-gfs2

Filesystem Type

GFS2

Mount Options

Filesystem ID (optional)

35269

Force Unmount

☐

Reboot Host Node if Unmount Fails

☐

...Configuration using luci...

172.17.16.185/24

IP Address

IP Address

172.17.16.185

Netmask Bits (optional)

24

Monitor Link



Disable Updates to Static Routes



Number of Seconds to Sleep After Removing an IP Address

3

...Configuration using luci...

Nodes	Fence Devices	Failover Domains	Resources	Service Groups	Configure
<div>+ Add ▶ Start ↺ Restart ■ Disable ✕ Delete</div>					
!	Name	Status		Autostart	Failover Domain
<input type="checkbox"/>	GFS2SERVICE	Running on cts6xcn1.devlab.sinenomine.net		<input checked="" type="checkbox"/>	SNA_Failover

...Configuration using luci...

[Nodes](#) | [Fence Devices](#) | [Failover Domains](#) | [Resources](#) | [Service Groups](#) | [Configure](#)

[+ Add](#) [▶ Start](#) [↺ Restart](#) [■ Disable](#) [✕ Delete](#)

!	Name	Status	Autostart	Failover Domain
<input type="checkbox"/>	GFS2SERVICE	Running on cts6xcn1.devlab.sinenomine.net	<input checked="" type="checkbox"/>	SNA_Failover

GFS2SERVICE

Status Running on cts6xcn1.devlab.sinenomine.net

[▶](#) [↺](#) [■](#) [✕](#)

...Configuration using luci...

Nodes Fence Devices Failover Domains Resources Service Groups **Configure**

General

Fence Daemon

Network

Redundant Ring

QDisk

Logging

General Properties

Cluster Name

SNATEST

Configuration Version

52

Apply

...Configuration using luci...

General

Fence Daemon

Network

Redundant Ring

QDisk

Logging

Fence Daemon Properties

Post Fail Delay (seconds)	<input type="text" value="10"/>
Post Join Delay (seconds)	<input type="text" value="3"/>

...Configuration using luci...

General

Fence Daemon

Network

Redundant Ring

QDisk

Logging

Network Configuration

Network Transport Type

- ☒ UDP Multicast and Let Cluster Choose the Multicast Address
- ☐ UDP Multicast and Specify the Multicast Address Manually

Multicast Address
- ☐ UDP Unicast (UDPU)

...Configuration using luci...

General	Fence Daemon	Network	Redundant Ring	QDisk	Logging												
<h2>Redundant Ring Protocol Configuration</h2> <table><tr><td>Alternate Ring Multicast Address</td><td><input type="text"/></td></tr><tr><td>Alternate Ring CMAN Port</td><td><input type="text"/></td></tr><tr><td>Alternate Ring Multicast Packet TTL</td><td><input type="text"/></td></tr></table> <h2>Redundant Ring Cluster Node Configuration</h2> <table><tr><td>Cluster Node</td><td>Alternate Name</td></tr><tr><td>cts6xcn1.devlab.sinenomine.net</td><td><input type="text"/></td></tr><tr><td>cts6xcn2.devlab.sinenomine.net</td><td><input type="text"/></td></tr></table>						Alternate Ring Multicast Address	<input type="text"/>	Alternate Ring CMAN Port	<input type="text"/>	Alternate Ring Multicast Packet TTL	<input type="text"/>	Cluster Node	Alternate Name	cts6xcn1.devlab.sinenomine.net	<input type="text"/>	cts6xcn2.devlab.sinenomine.net	<input type="text"/>
Alternate Ring Multicast Address	<input type="text"/>																
Alternate Ring CMAN Port	<input type="text"/>																
Alternate Ring Multicast Packet TTL	<input type="text"/>																
Cluster Node	Alternate Name																
cts6xcn1.devlab.sinenomine.net	<input type="text"/>																
cts6xcn2.devlab.sinenomine.net	<input type="text"/>																

...Configuration using luci...

General

Fence Daemon

Network

Redundant Ring

QDisk

Logging

Quorum Disk Configuration

☐ Do Not Use a Quorum Disk

☒ Use a Quorum Disk

Specify Physical Device

☒ By Device Label

☐ By Filesystem Path to Device (deprecated)

Heuristics

Path to Program	Interval	Score	TKO
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Minimum Total Score

...Configuration using luci...

General

Fence Daemon

Network

Redundant Ring

QDisk

Logging

Logging Configuration

Global Settings

Log Debugging Messages☐

Syslog

Log Messages to Syslog☒

Syslog Message Facility

daemon

Syslog Message Priority

info

Log File

Log Messages to Log File☒

Log File Path

Log File Message Priority

info

...Configuration using luci

Daemon-specific Logging Overrides

▼ rgmanager

Log rgmanager Debugging Messages ☐

Syslog

Log rgmanager Messages to Syslog ☒

rgmanager Syslog Message Facility

rgmanager Syslog Message Priority

Log File

Log rgmanager Messages to Log File ☒

rgmanager Log File Path

rgmanager Log File Message Priority

▶ qdiskd

Failover...

```
Aug 07 15:26:02 rgmanager [apache] Checking Existence Of File /var/run/cluster/apache/
apache:SNA_WebServer.pid [apache:SNA_WebServer] > Failed
Aug 07 15:26:05 rgmanager [apache] Monitoring Service apache:SNA_WebServer > Service Is Not
Running
Aug 07 15:26:05 rgmanager status on apache "SNA_WebServer" returned 7 (unspecified)
Aug 07 15:26:05 rgmanager Stopping service service:GFS2SERVICE
Aug 07 15:26:08 rgmanager [apache] Verifying Configuration Of apache:SNA_WebServer
Aug 07 15:26:11 rgmanager [apache] Checking Syntax Of The File /etc/httpd/conf/httpd.conf
Aug 07 15:26:14 rgmanager [apache] Checking Syntax Of The File /etc/httpd/conf/httpd.conf >
Succeed
Aug 07 15:26:17 rgmanager [apache] Stopping Service apache:SNA_WebServer
Aug 07 15:26:21 rgmanager [apache] Checking Existence Of File /var/run/cluster/apache/
apache:SNA_WebServer.pid [apache:SNA_WebServer] > Failed - File DoAug 07 15:26:23 rgmanager
[apache] Stopping Service apache:SNA_WebServer > Succeed
Aug 07 15:26:27 rgmanager [ip] Removing IPv4 address 172.17.16.154/24 from eth0
Aug 07 15:26:32 rgmanager [clusterfs] Not umounting /dev/dm-3 (clustered file system)
Aug 07 15:26:32 rgmanager Service service:GFS2SERVICE is recovering
Aug 07 15:28:20 rgmanager Service service:GFS2SERVICE is now running on member 1
```

Failover...

```
Aug 07 15:26:33 rgmanager Recovering failed service service:GFS2SERVICE
Aug 07 15:26:41 rgmanager [clusterfs] mounting /dev/dm-6 on /var/www/html
Aug 07 15:26:44 rgmanager [clusterfs] mount -t gfs2 /dev/dm-6 /var/www/html
Aug 07 15:26:59 rgmanager [ip] Link for eth0: Detected
Aug 07 15:27:03 rgmanager [ip] Adding IPv4 address 172.17.16.185/24 to eth0
Aug 07 15:27:06 rgmanager [ip] Pinging addr 172.17.16.185 from dev eth0
Aug 07 15:27:11 rgmanager [ip] Sending gratuitous ARP: 172.17.16.185 02:00:00:00:00:15 brd
ff:ff:ff:ff:ff:ff
Aug 07 15:27:18 rgmanager [apache] Verifying Configuration Of apache:SNA_WebServer
:
Aug 07 15:27:37 rgmanager [apache] Starting Service apache:SNA_WebServer
Aug 07 15:27:40 rgmanager [apache] Looking For IP Addresses
Aug 07 15:27:45 rgmanager [apache] 1 IP addresses found for GFS2SERVICE/SNA_WebServer
Aug 07 15:27:49 rgmanager [apache] Looking For IP Addresses > Succeed - IP Addresses Found
Aug 07 15:27:54 rgmanager [apache] Checking: SHA1 checksum of config file /etc/cluster/apache/
apache:SNA_WebServer/httpd.conf
Aug 07 15:27:59 rgmanager [apache] Checking: SHA1 checksum > succeed
Aug 07 15:28:04 rgmanager [apache] Generating New Config File /etc/cluster/apache/
apache:SNA_WebServer/httpd.conf From /etc/httpd/conf/httpd.conf
Aug 07 15:28:12 rgmanager [apache] Generating New Config File /etc/cluster/apache/
apache:SNA_WebServer/httpd.conf From /etc/httpd/conf/httpd.conf > SuccAug 07 15:28:18 rgmanager
[apache] Starting Service apache:SNA_WebServer > Succeed
Aug 07 15:28:20 rgmanager Service service:GFS2SERVICE started
```

This slide intentionally left blank

For More Information

- **David Boyes**

Sine Nomine Associates
43596 Blacksmith Square
Ashburn, VA 20147

+1 703 723 6673 office

dboyes (at) sinenomine.net

[http://www.sinenomine.net/
contact-us](http://www.sinenomine.net/contact-us)

- **About Sine Nomine Associates**

- R&D leader in System z and System p ideas since 1999
- Supporter of most common VM system tools used with Linux (SWAPGEN, LXFMT, etc)
- Provider of open source and commercial support solutions on legacy and up-to-the-second tech.
- “Research to Reality”

For More Information

Len Santalucia

CTO & Business Development Manager

Vicom Infinity, Inc.
One Penn Plaza – Suite 2010
New York, NY 10119

+1 212-799-9375 office
+1 917-856-4493 mobile

[lsantalucia \(at\) vicominfinity.com](mailto:lsantalucia@vicominfinity.com)

About Vicom Infinity

- IBM Premier Business Partner
- Reseller of IBM Hardware, Software, and Maintenance
- Vendor Source for the Last 4 Generations of Mainframes/IBM Storage
- Professional and IT Architectural Services
- Vicom Family of Companies Also Offer Leasing & Financing, Computer Services, and IT Staffing & IT Project Management