Guidelines

- We are a small group
- Interrupt the speaker
- Ask unrelated question
- Help us keep this fluid

- We can re-tool the agenda on-the-fly

Community Development

Topics

- Community Status
  - Why this is Important
  - Open Source Licensing
  - Contributors and Working Groups
  - Source Code
- Becoming a Developer
  - Graph and Rolls
  - Attributes
  - Command Line
- Avoiding becoming a Developer

Community Status

WHY?

Rocks is almost 10 years old!

- Mission accomplished
- Rocks is the *de facto* open-source clustering solution
- Great user community
  - 2000+ on mailing list
  - Amazing signal to noise ratio
- Everything from 2 nodes cluster to top 10 supercomputers

Rocks is almost 10 years old!

- 90% of development is
  - NSF (and other grant) funded
  - Located at UC San Diego
- Need to diversify development
  - More ideas, passion, and focus areas
  - More secure funding

OPEN SOURCE LICENSING

Licensing / Copyrights

http://www.rocksclusters.org/wordpress/?page_id=48

- Rocks is entirely open-source
- BSD Attribution License
  - Standard UNIX open-source
  - Very friendly for derived works
- We have not changed to the more recent non-attribution BSD license
- Copyrights are owned by University of California Regents
- 3rd party code is a mix of licenses and copyrights
  - Most of Rocks bits are 3rd party!

Attribution Clause

This product includes software developed by the Rocks® Cluster Group at the San Diego Supercomputer Center at the University of California, San Diego and its contributors.

Trademark

invent@ucsd.edu

- The Rocks name and logo are registered trademarks.
- For fee licensing is available
  - Standard usage
  - Derivative usage (e.g. “ACME Rocks”)

Summary

- Rocks is open-source and free
- Use it any way you wish
- Make billions of dollars with it without even buying us a single beer

- Give **us attribution**
- License the name for commercial use

- These two things help keep us funded

EARLY COMMUNITY ROLLS

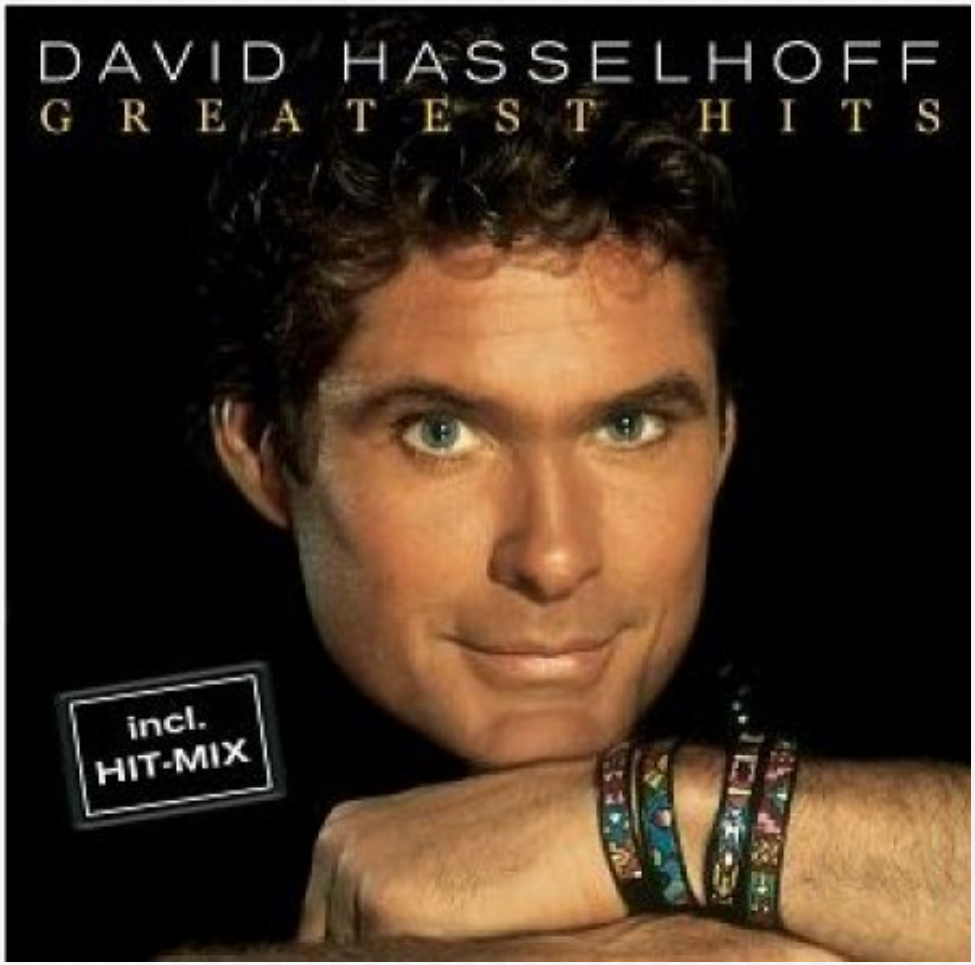
Sun Grid Engine

- Way back in 2004
- Rocks supported PBS
- Scalable Systems added SGE support
  - Laurence Liew, Najib Ninaba
  - 1st external developers for Rocks
  - Based in Singapore
- SGE Roll created from this

Torque Roll

- Way back in 2006
- SGE Roll was the favorite of core team
- Threatened to drop PBS Support
- The Computer Center, University of Tromsø
  - Roy Dragseth
  - 2nd major external developer
  - Based in Norway
- Continues to develop and support Torque Roll

We were “big” overseas



First major attempt for actively recruit developers

WORKING GROUPS

Working Groups

- Purpose
  - Fill gaps from core development team
  - Handle issues off the core road map
  - Make Rocks a more flexible solution
- Success Metrics
  - Number of Rolls produced
  - Amount of new Documentation (Wiki, …)

Software Update WG

https://wiki.rocksclusters.org/wiki/index.php/Software_Update_(SUWG)

- Started early 2008
  - Threads on yum updates increased
  - Core team said “don’t do it”
  - Advocates said “it works for me”
  - WG was recruited to address the issue
- Best practices defined
  - Exclude lists
  - Additional docs on custom restore Rolls

Status

- Community Interest: High
- Documentation: Moderate
- Rolls Produced: None

- Summary: Some real interest but needs leadership.

Thumper Working Group

https://wiki.rocksclusters.org/wiki/index.php/Rocks_on_Thumper

- Began with Rocks Solaris port
  - Sun funded
  - How to Manage ZFS NAS appliances
  - Specifically Sun Thumper
- Core team lead effort
- Used by several groups at UCSD
- Software is released

Status

- Community Interest: Low
- Documentation: Good
- Rolls Produced: Jumpstart

- Summary: Excellent activity with a small UCSD audience. Needs to build a larger user base.

Rolls Working Group

https://wiki.rocksclusters.org/wiki/index.php/Rolls_Working_Group

- Started early 2009
  - Developing free versions of commercial Rolls
  - Organized by Stanford University
- Self-organized group of a 3 individuals
- Good initial offering of Rolls
- Struggled with mailing list support

Status

- Community Interest: High
- Documentation: Average
- Rolls Produced: Good

- Summary: Excellent start, needs help with user support and keeping current with Rocks releases.

Triton Working Group

http://tritonresource.sdsc.edu/

- Started 2009
  - Developing Roll for large production cluster
  - Every piece of SW on system is part of a Roll
  - Includes commercial software
- Amazing set of Rolls (20+) to be released
- Triton group is here at SDSC
- No organized presence on Rocks list

Status

- Community Interest: Good
- Documentation: Good
- Rolls Produced: Excellent

- Summary: Highly productive group, but meets weekly with member(s) of Rocks core team. Phil is also their boss.

Great idea, some good traction, but not what we want

OVERALL GRADE: C-

What can UCSD do better?

- WG phone/video conference
  - WG to Core team
  - WG All hands
- Need to communicate roadmaps between WGs and Core team
  - Ease release tracking
  - No surprises (e.g. Rocks Command Line)
- Where should support issues go?
  - Main list
  - A new WG list

Ideas?

- Docs in dev process
  - Devel guide out of date
  - Mine mailing list for solution
- Developer Cloning Process
  - Jumpstart guide to development
- RESOLVED tag on mailing list
- Bug/Issue searchable database
  - RH is a good example of this
- IRC
- AIM Address Book (non-indexed)

What can you do better

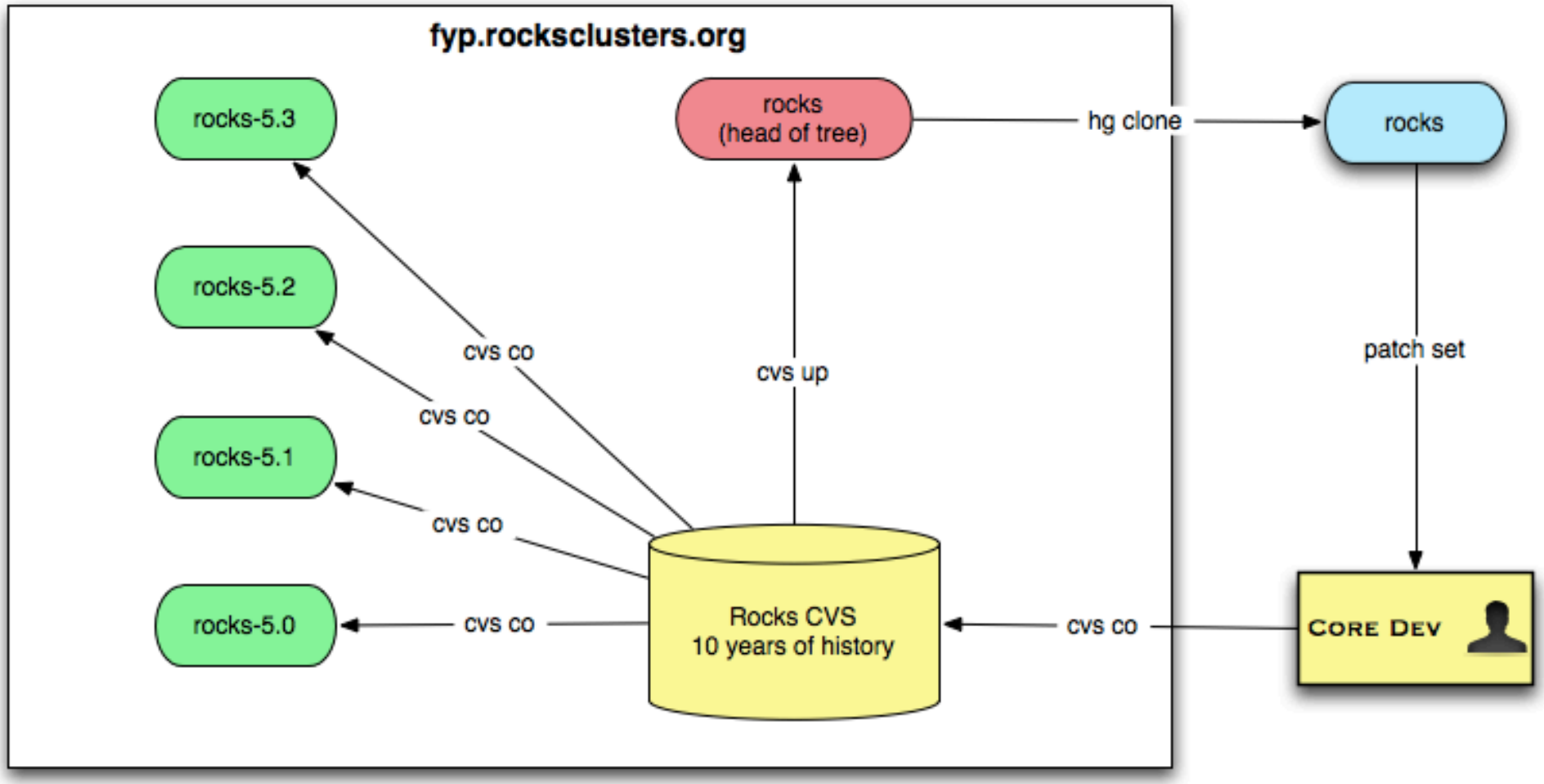
- Tell us what you want
  - Complain
  - A lot
  - But, nicely
- Ask for help to start a new working group
- Join an existing working group
- We are starting this **today**

SOURCE CODE

Version Control

- Core team uses CVS
  - That's what we started with
  - We aren't changing anytime soon
- CVS access available to very few people
  - Too risky
  - Access control is a pain
  - Release management difficult
- We use Mecurial for all non-core development
- Mecurial synced to CVS every 10 minutes!

Workflow



Example

```
$ hg clone http://fyp.rocksclusters.org/hg/rocks-5.3
destination directory: rocks-5.3
real URL is http://fyp.rocksclusters.org/hg/
rocks-5.3/
requesting all changes
adding changesets
adding manifests
adding file changes
added 1 changesets with 2815 changes to 2815 files
2815 files updated, 0 files merged, 0 files removed,
0 files unresolved
```

Issues

- Mecurial is slow
- Transaction based
  - Any aborted operation rolls back
  - Do not stop the clone
- Patch sets can be tedious

Advantages - Freedom

- Publish your own repository
- No need to even commit back to core
- Commit broke code and only hurt yourself

- Core Rocks remains stable
- HG clones innovate

Notes

- For code older than 5.0
  - ftp://ftp.rocksclusters.org/pub/rocks/rocks-src
  - rocks-2.3 to rocks-4.3
- We are not tied to this workflow
- We are not tied to HG

- Other workflow suggestions are solicited

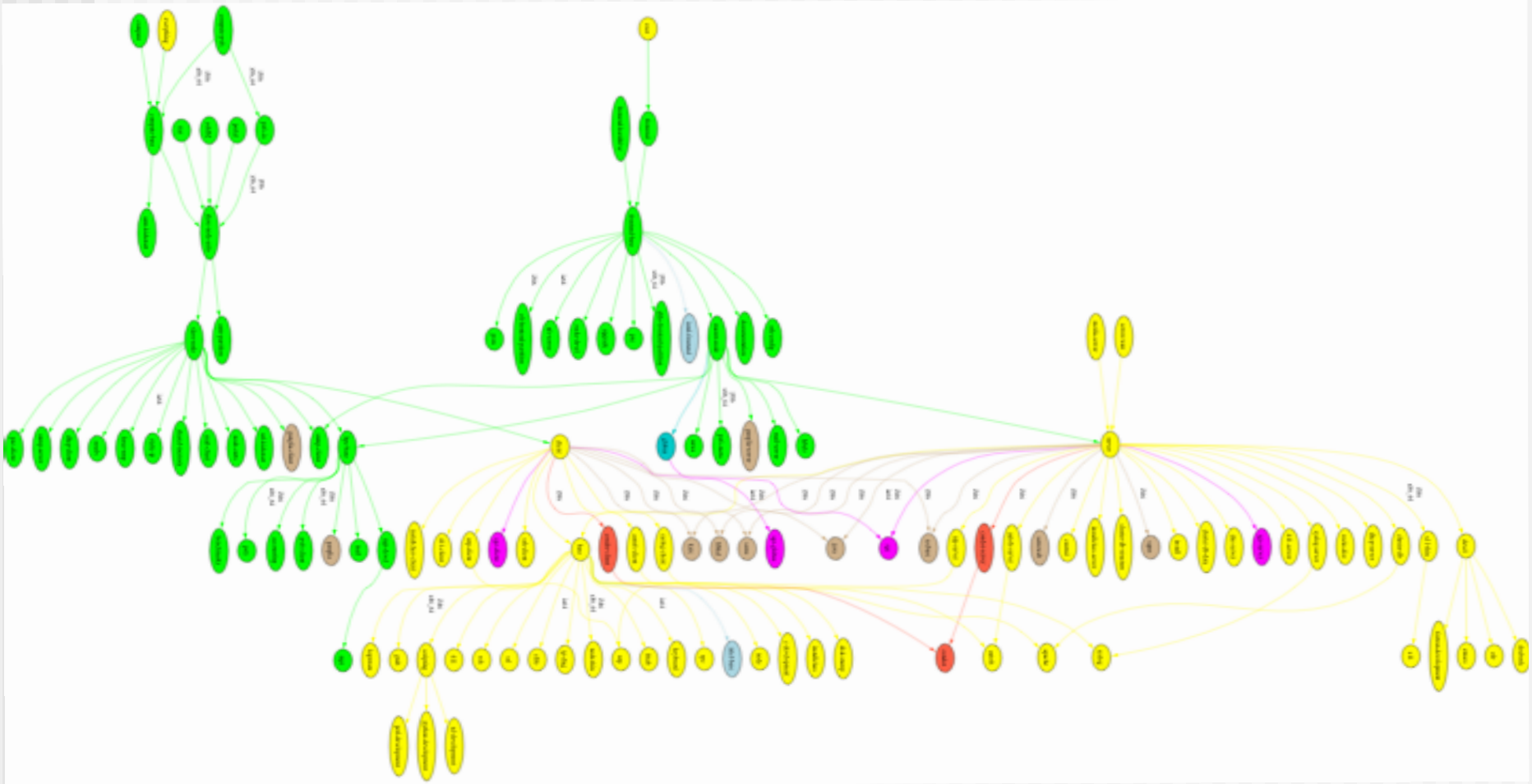
Becoming a Developer

Resume @ 11:20

The Rocks engine

GRAPH AND ROLLS

Rocks Configuration Graph



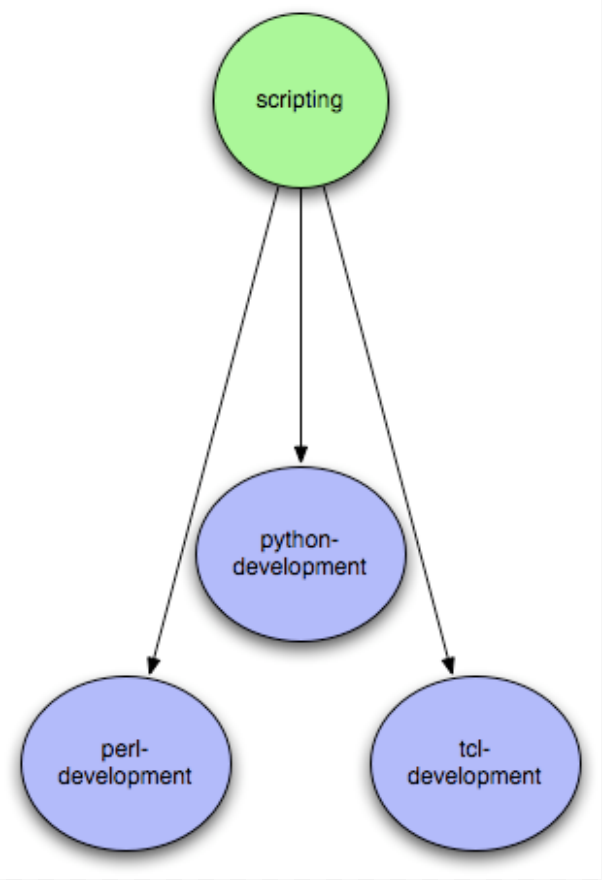
The XML Graph Includes

- Nodes
  - Single purpose modules
  - Kickstart file snippets (XML tags map to kickstart commands)
  - Approximately 200 node files in Rocks
- Graph
  - Defines interconnections for nodes
  - Think OOP or dependencies (class, #include)
  - A single default graph file in Rocks
- Macros
  - SQL Database holds site and node specific state
  - Node files may contain `&state;` entities (attributes)

Composition

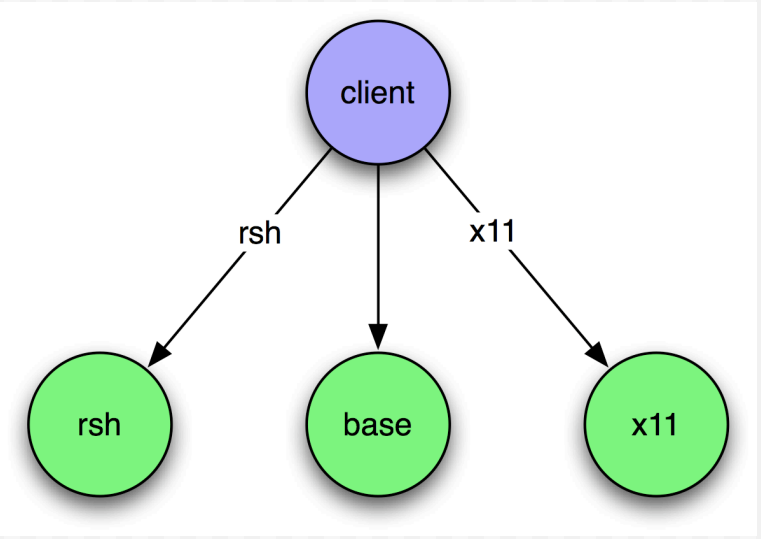
- Aggregate Functionality

- `scripting` IsA
  - `perl-development`
  - `python-development`
  - `tcl-development`

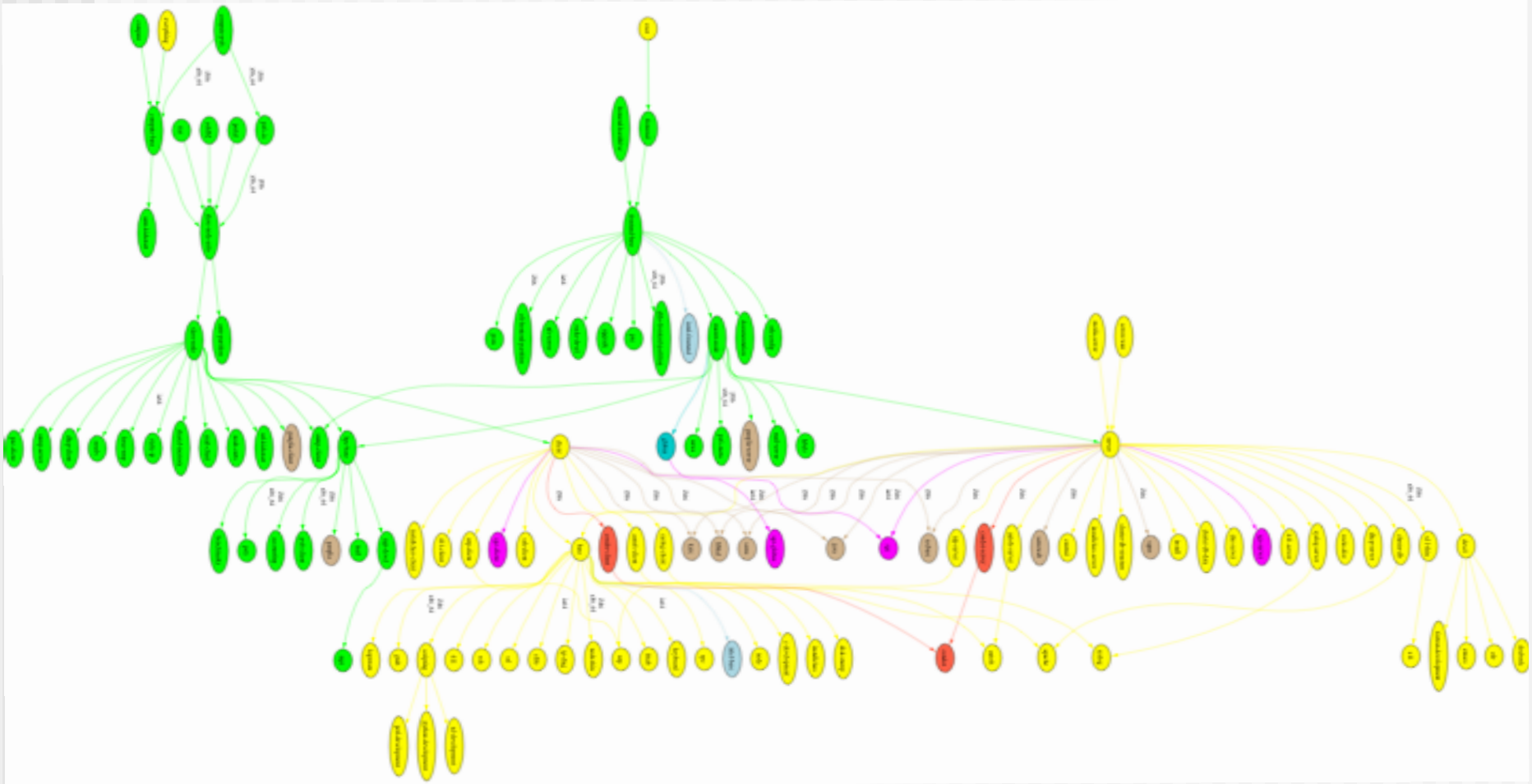


Traverse by Attributes

- if `x11` == TRUE
  - `client` IsA `x11`
- if `rsh` == FALSE
  - `client` IsNotA `rsh`
- **Most important slide in this session**
- RCL allows you to control the graph

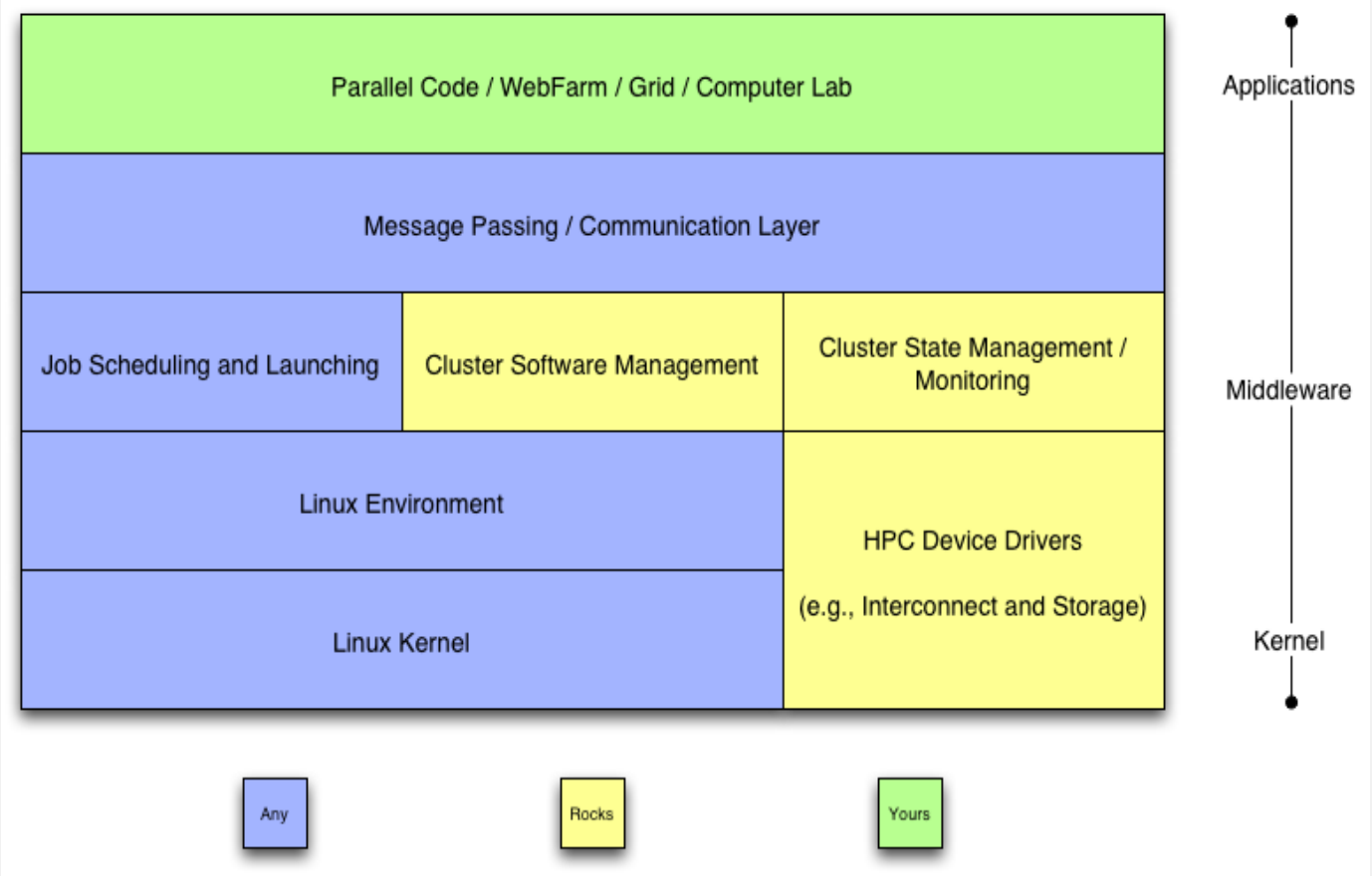


Think of this as Cluster DNA

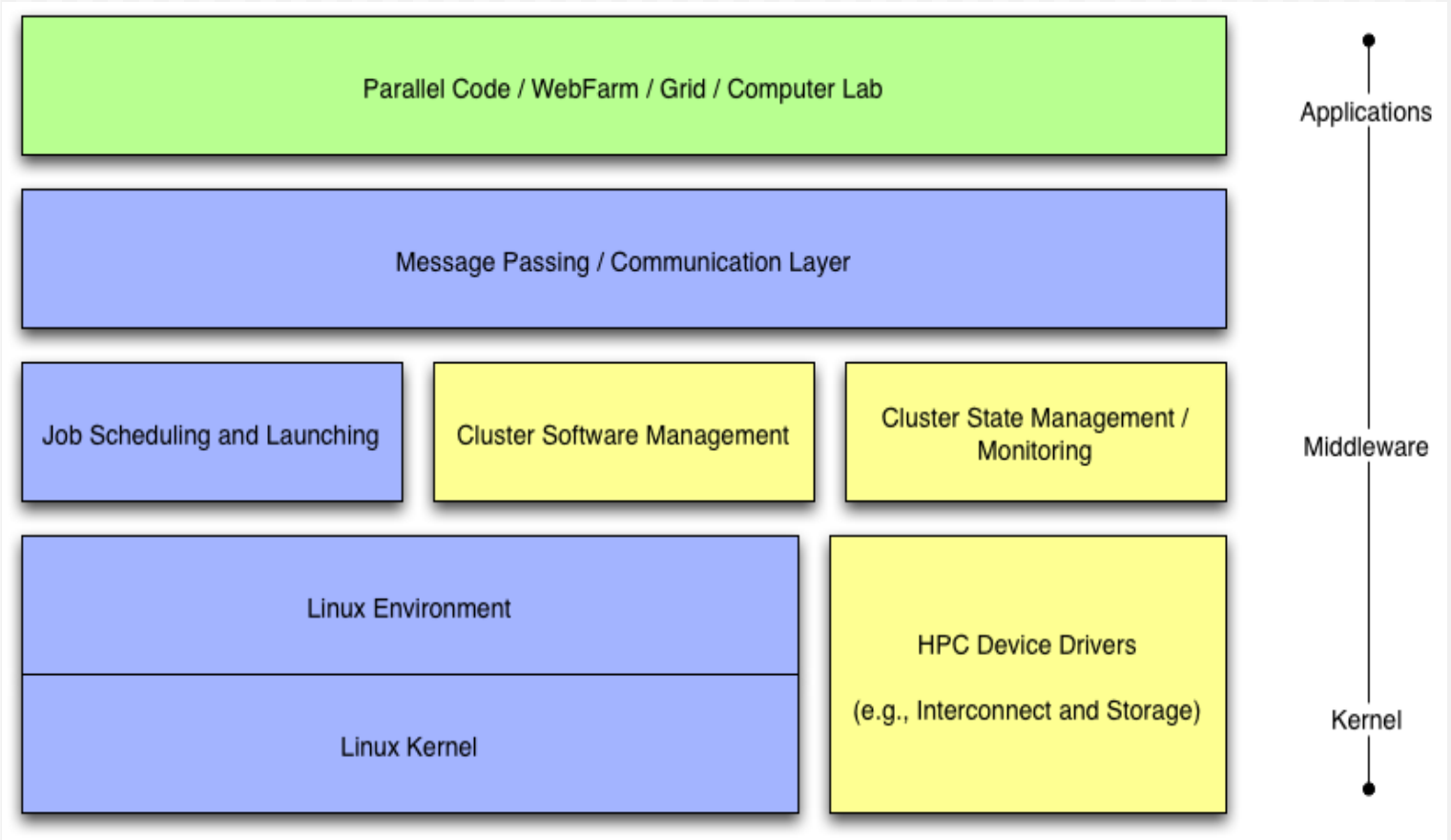


ROLL FUNDAMENTALS

Cluster Software Stack



Rolls Break Apart Rocks

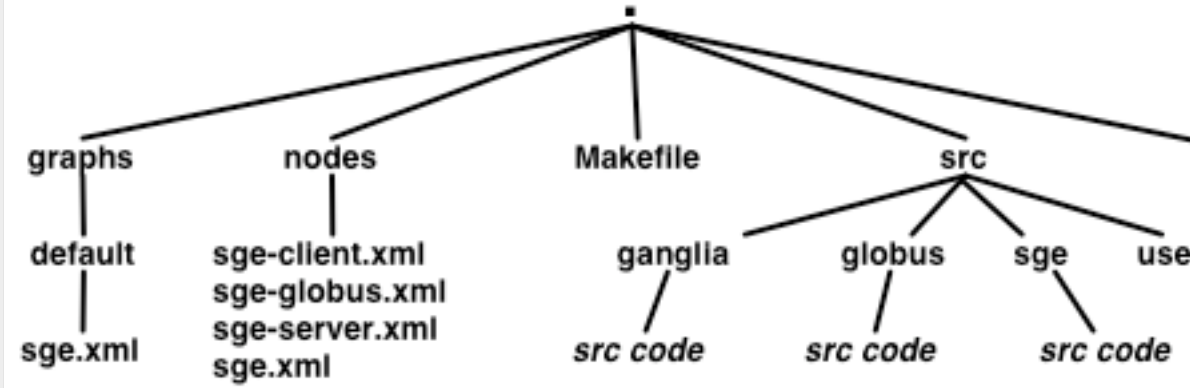


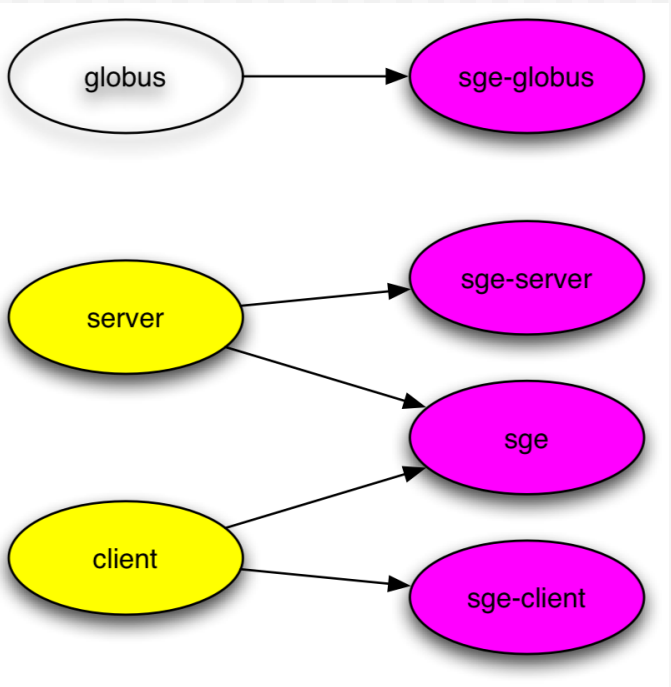
Rolls: Modifying a Standard System Installer to Support User-Customizable Cluster Frontend Appliances. Greg Bruno, Mason J. Katz, Federico D. Sacerdoti, and Phil M. Papadopoulos. *IEEE International Conference on Cluster Computing*, San Diego, California, Sep. 2004.

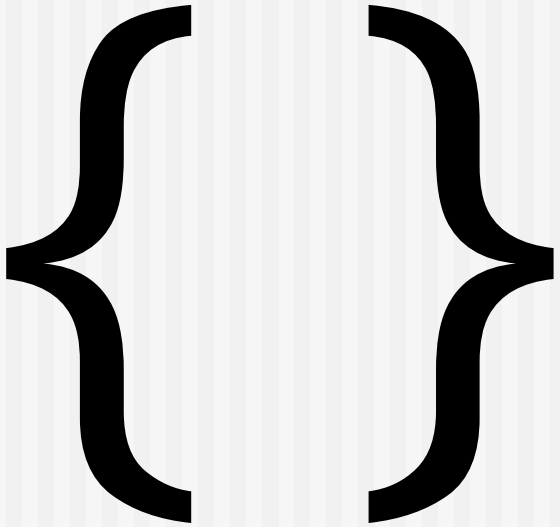
Our Graph Has Colors

Rolls are sub-graphs

- A graph makes it easy to ‘splice’ in new nodes
- Each Roll contains its own nodes and splices them into the system graph file

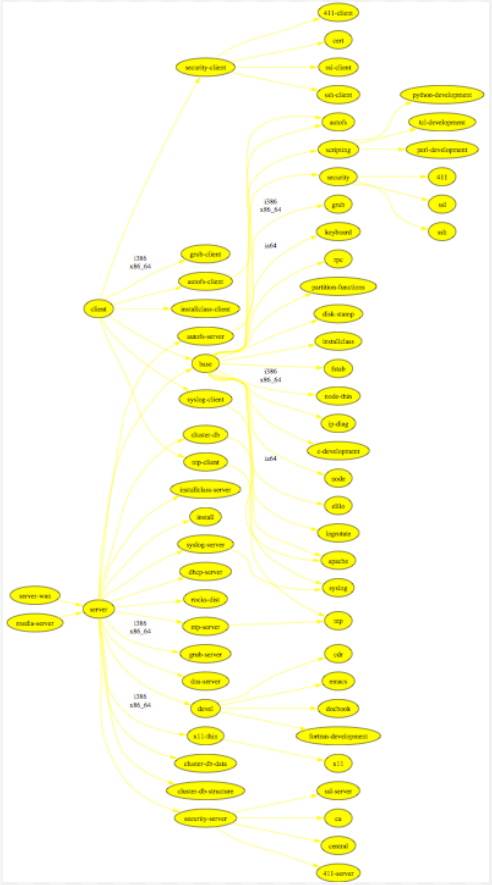




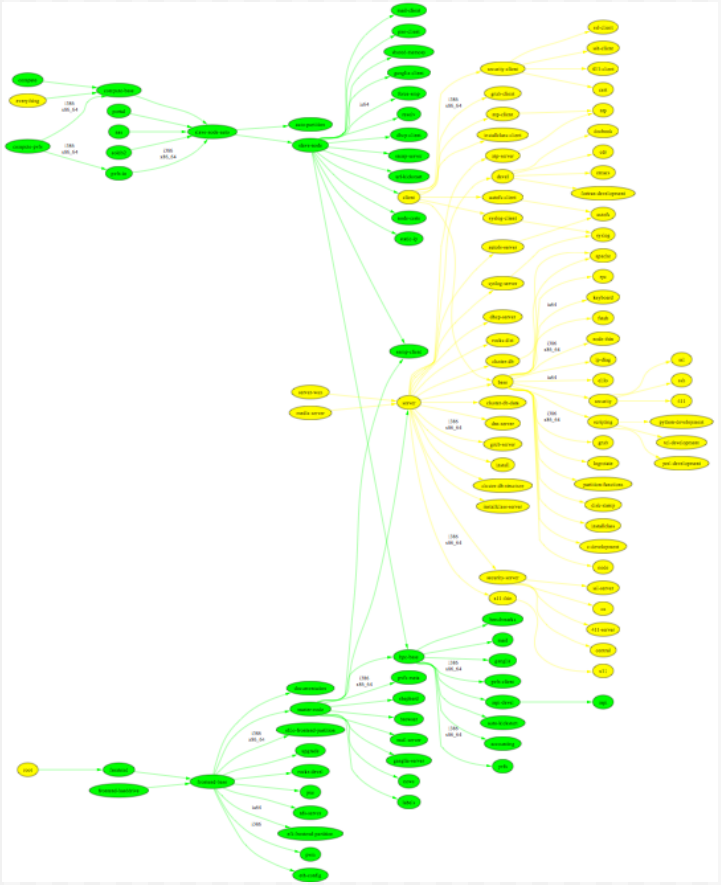


STARTING FROM THE EMPTY SET

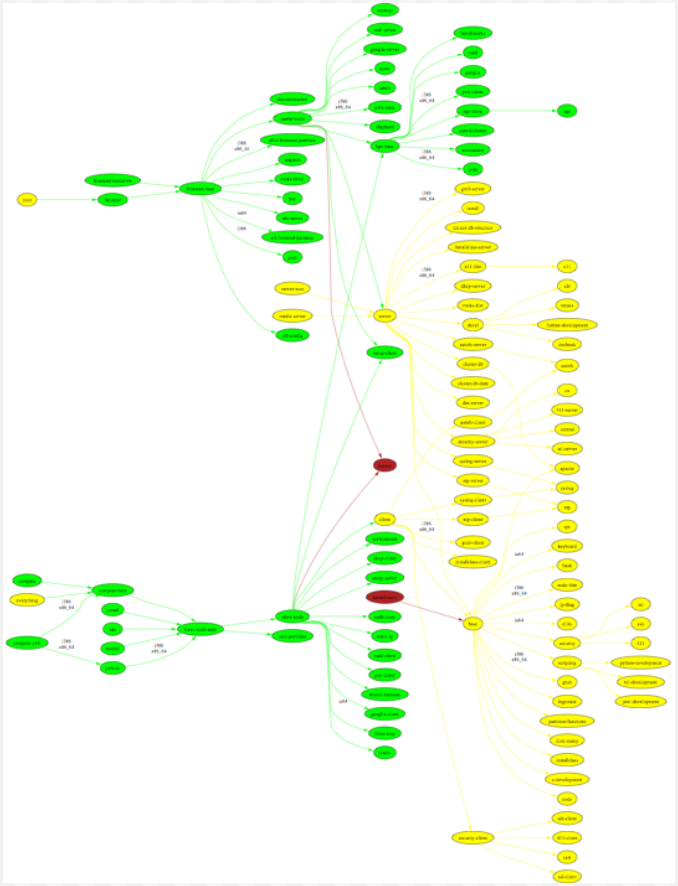
{ base }



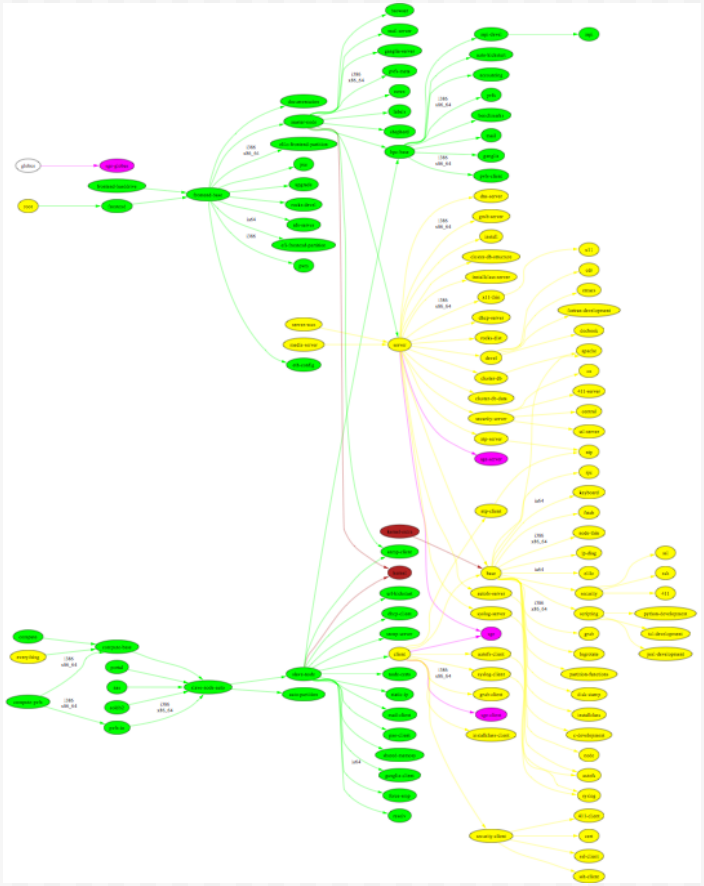
{ base, hpc }



{ base, hpc, kernel }

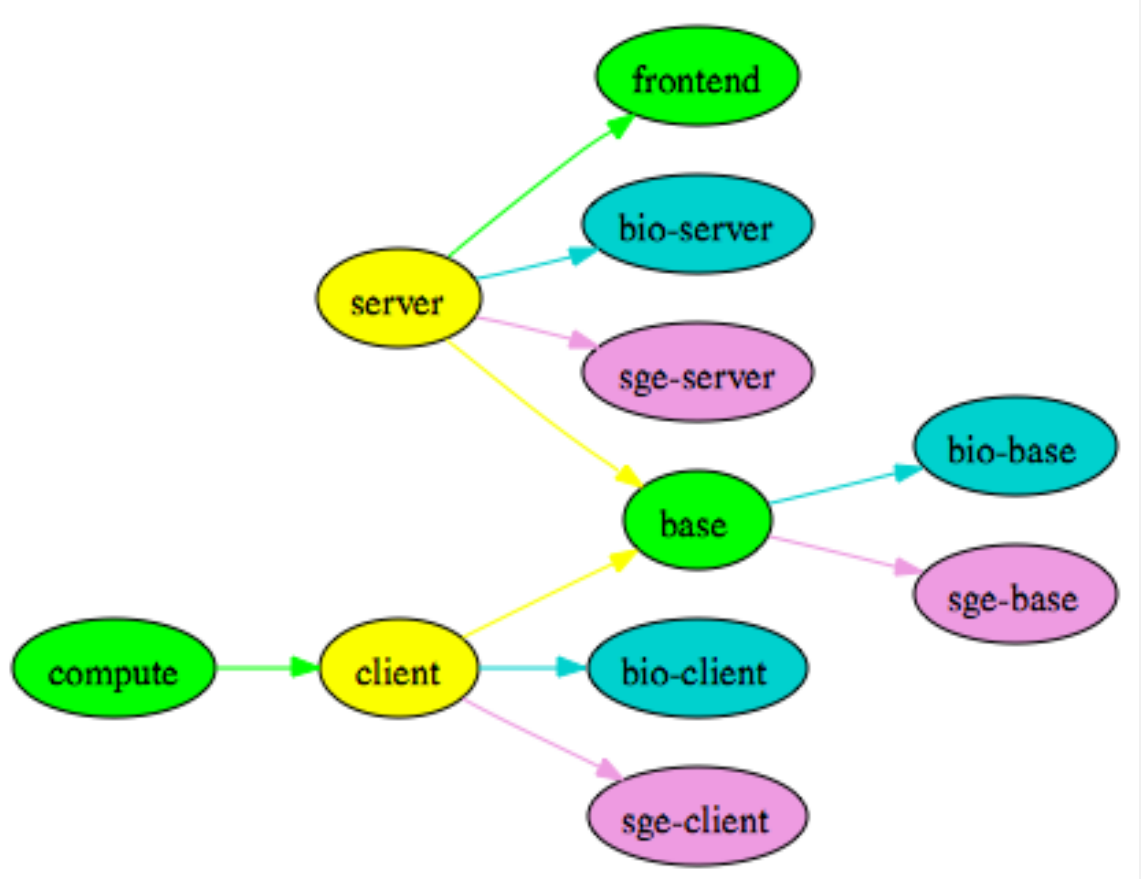


{ base, hpc, kernel, sge }



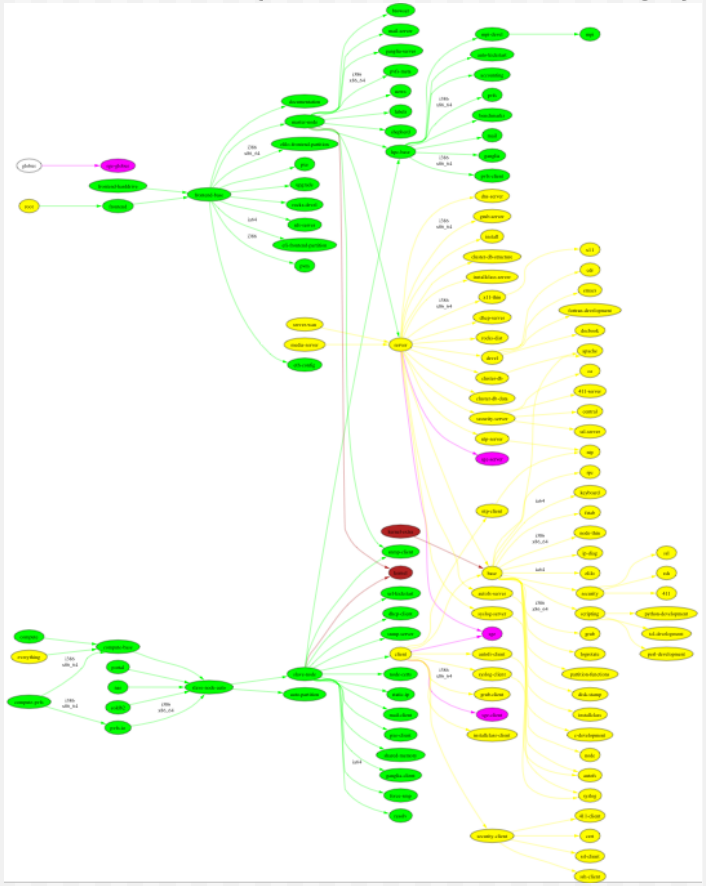
Simplified Example

{base, hpc, sge, bio}

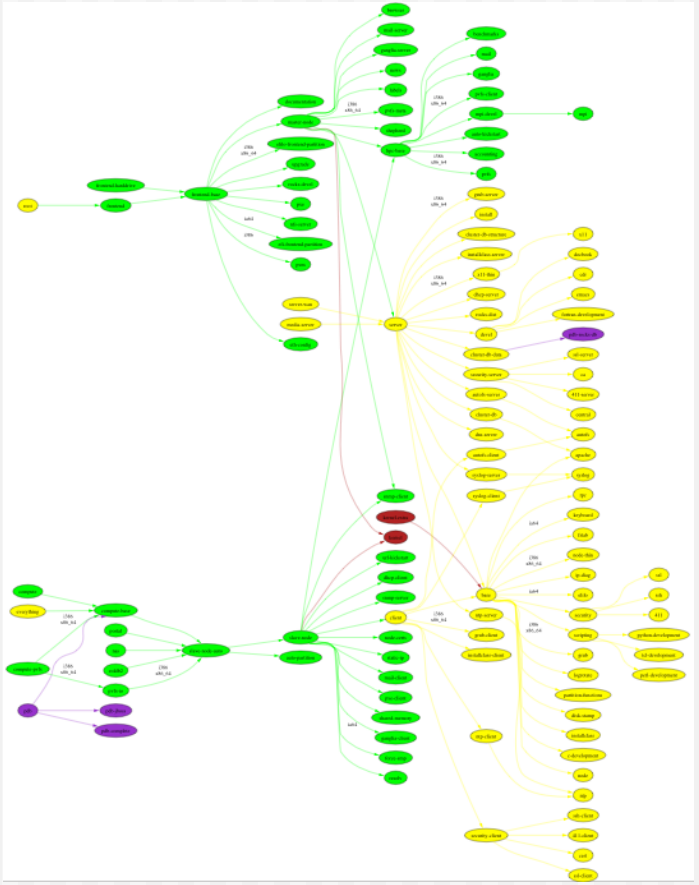


Two different Clusters

MPI Cluster::{base, hpc, kernel, sge}



Protein Databank::{base, hpc, kernel, pdb}



ATTRIBUTES

Attributes

- Attributes can be set at 4 levels:
  - Globally
    - ‘rocks set attr’
  - By appliance type
    - ‘rocks set appliance attr’
  - By OS (linux or sunos)
    - ‘rocks set os attr’
  - By host
    - ‘rocks set host attr’

Attributes

- Example, set the public IP address of a remote frontend that is used during a ‘central’ installation:

```
# rocks set host attr vi-1.rocksclusters.org \
  Kickstart_PublicAddress 137.110.119.118
```

Attributes

```
# rocks list host attr tile-0-0
HOST      ATTR                          VALUE                          SOURCE
tile-0-0: Info_CertificateCountry       US                             G
tile-0-0: Info_CertificateLocality      San Diego                      G
tile-0-0: Info_CertificateOrganization  CalIT2                         G
tile-0-0: Kickstart_DistroDir           /export/rocks                  G
tile-0-0: Kickstart_PrivateAddress      10.1.1.1                       G
tile-0-0: Kickstart_PrivateBroadcast    10.1.255.255                   G
tile-0-0: Kickstart_PrivateDNSDomain    local                          G
tile-0-0: Kickstart_PrivateDNSServers   10.1.1.1                       G
tile-0-0: Kickstart_PrivateGateway      10.1.1.1                       G
tile-0-0: Kickstart_PublicDNSServers    132.239.0.252                  G
tile-0-0: Kickstart_PublicGateway       137.110.119.1                  G
tile-0-0: Kickstart_PublicHostname      vizagra.rocksclusters.org      G
tile-0-0: Kickstart_PublicKickstartHost central.rocksclusters.org      G
tile-0-0: Kickstart_PublicNTPHost       pool.ntp.org                   G
tile-0-0: Kickstart_PublicNetmask       255.255.255.0                  G
tile-0-0: Kickstart_PublicNetmaskCIDR   24                             G
tile-0-0: Kickstart_PublicNetwork       137.110.119.0                  G
tile-0-0: Kickstart_Timezone            America/Los_Angeles            G
tile-0-0: Server_Partitioning           force-default-root-disk-only   G
tile-0-0: arch                          x86_64                         H
tile-0-0: hostname                      tile-0-0                       I
tile-0-0: rack                          0                              I
tile-0-0: rank                          0                              I
tile-0-0: rocks_version                 5.2                            G
tile-0-0: HideBezels                    false                          G
tile-0-0: HttpConf                      /etc/httpd/conf                O
tile-0-0: HttpConfigDirExt              /etc/httpd/conf.d              O
tile-0-0: HttpRoot                      /var/www/html                  O
```

Edge Conditionals

- Use attributes to conditionally traverse edges of the configuration graph

```
<edge from="client" cond="rsh">
      <to>rsh</to>
</edge>
```

- If ‘rsh’ evaluates to ‘true’, then the edge from ‘client’ to ‘rsh’ will be traversed
  - Default value is ‘false’

Edge Conditionals

- To set a conditional attribute:

```
# rocks set attr rsh true
```

- Edge conditionals are attributes
- Can also be set at 4 levels:
  - Globally
  - By appliance type
  - By OS (linux or sunos)
  - By host

COMMAND LINE

Evil Commands

```
Usage: add-extra-nic [-hvv] [-p password] [-u host] [-d database] [--help]
 [--list-rcfiles] [--list-project-info] [--verbose] [--dump] [--del] [--list]
 [--verbose] [--no-update] [--no-modify] [--dryrun] [--rcfile arg] [--host host]
 [--password password] [--db database] [--user host]
 [--if interface (default: eth1)] [--mac mac address]
 [--module linux driver module name] [--ip ip address]
 [--netmask netmask (default /24)] [--gateway ip address of gateway]
 [--name hostname on new interface] [--site client ip] node

Usage: rocks-dist [-hvcpv] [-p password] [-u host] [-d database] [-a arch]
 [-d dirname] [-g path] [-l lang] [-r release] [--help] [--list-rcfiles]
 [--list-project-info] [--verbose] [--copy] [--debug] [--graph-draw-invis-edges]
 [--graph-draw-order] [--graph-draw-edges] [--graph-draw-key] [--graph-draw-all]
 [--graph-draw-landscape] [--install] [--verbose] [--with-rolls-only] [--clean]
 [--notorrent] [--rcfile arg] [--host host] [--password password]
 [--db database] [--user host] [--arch architecture] [--comps path]
 [--dist dirname] [--graph-draw-size arg] [--graph-draw-format arg]
 [--mirror-dir dirname] [--mirror-host hostname] [--root dirname]
 [--cdrom /mnt/cdrom] [--with-roll rollname-rollversion]
 [--path single path item] command
Available commands:
dist dvd makecontrib makesitenodes copycd usb copyroll cdrom paths graph dist2mirror
```

Command Line as API

- Lack of consistency in Rocks commands
  - add-extra-nic (15 flags)
  - 411put
  - rocks-dist
  - dbreport (~ a dozen reports)
- Not extensible to other groups
  - How do I add a flag to an existing command?
  - How do I add a new command?
  - How do I document my command?

Do Over

- Consistent
  - Interface
  - Argument parsing
  - Usage / Help
- Extensible
  - Easy to add commands (3rd party rolls)
  - Easy to modify commands
- Easy to guess the right command
- Purge all –flags from Rocks
- Hide the SQL database (and underlying schema)
- Inspired by Trac

Verb Based

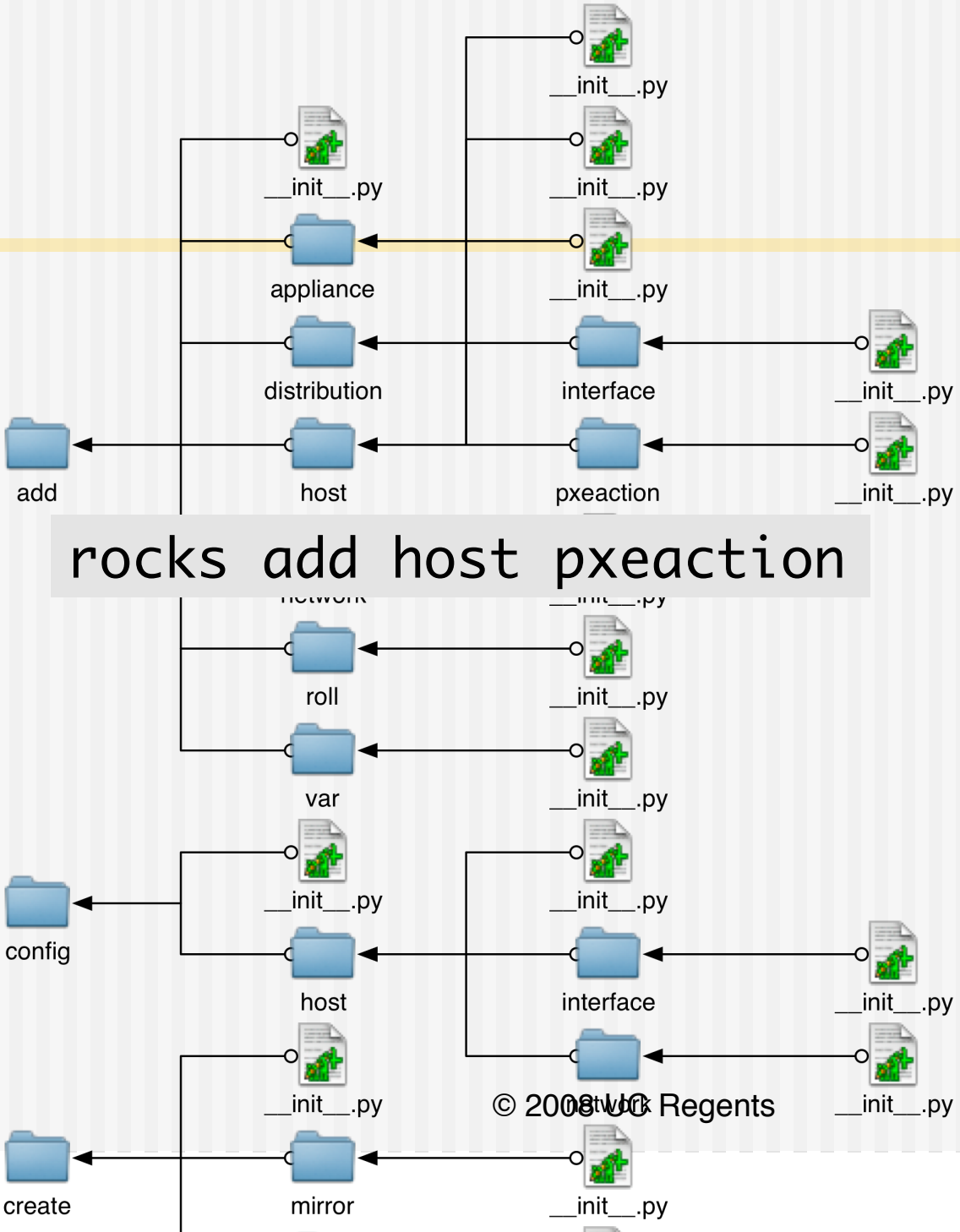
- “add”, “set”, “enable”, …
  - Modify the cluster database
- “list”, “dump”, “report”
  - Inspect the cluster database
- About 20 verbs in the command line so far
- You can even add your own

Grammar

- rocks <verb> <object…> <subject> <params…>
- Object is general to specific
  - “host” “interface”
  - “network” “subnet”
  - “viz” “layout”
- Subject is typed
  - host
  - appliance
  - network

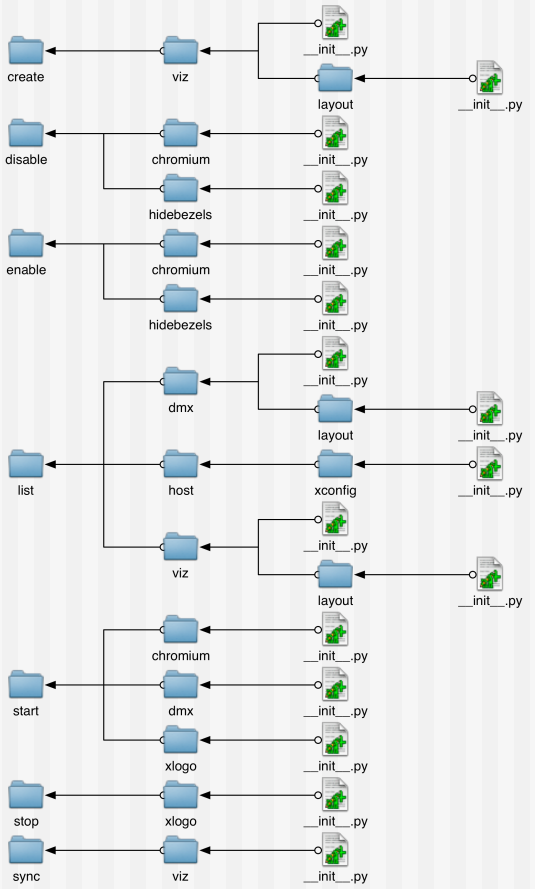
Implementation

- Python
  - Similar to existing dbreport code
  - Very small modules
- Command line is identical to the directory hierarchy
  - Verbs are directories
  - Objects are directories
  - Subjects are __init__.py files
- Commands are added by adding directories



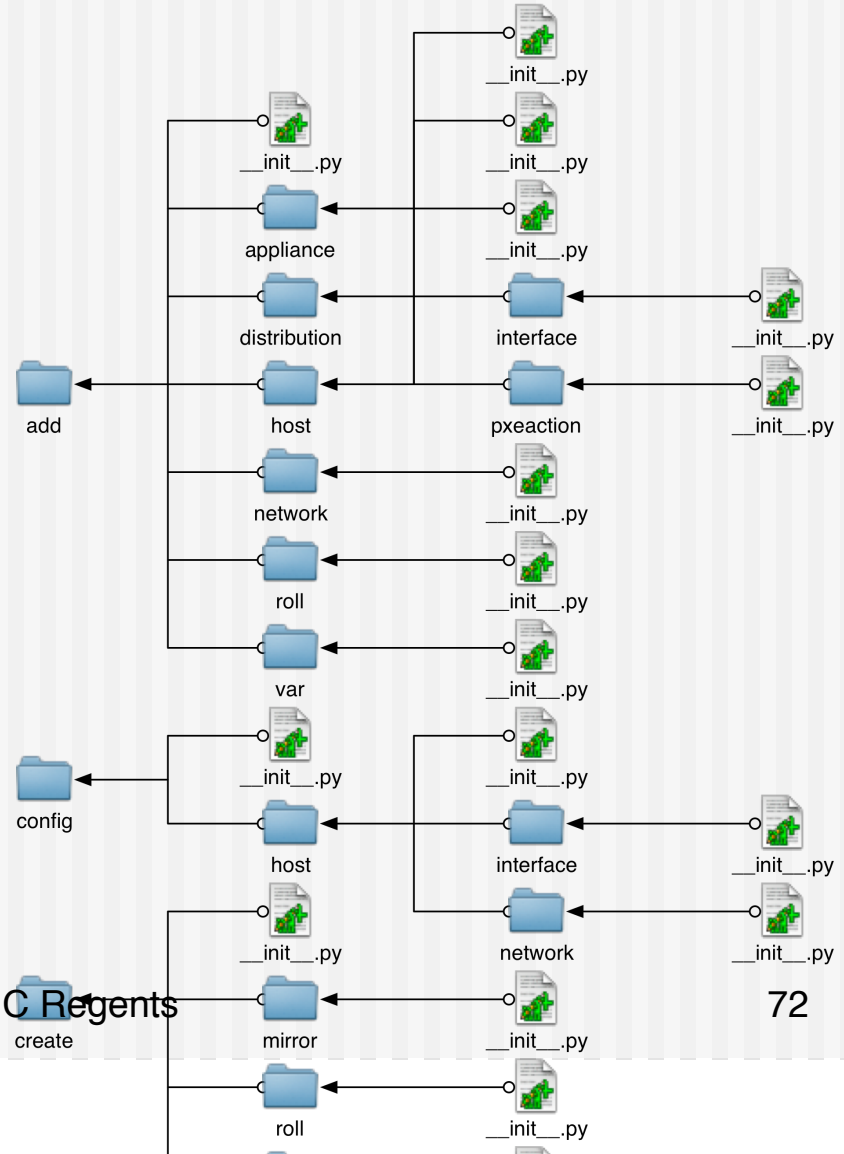
Rolls Can Add Commands

- Similar to the configuration graph
- Rolls can add command line
  - Files : commands
  - Directories : verbs and objects
- Think hard before adding another verb



add

- Creates new entries in the cluster database
- Examples:
  - Hosts
  - Appliances
  - Rolls

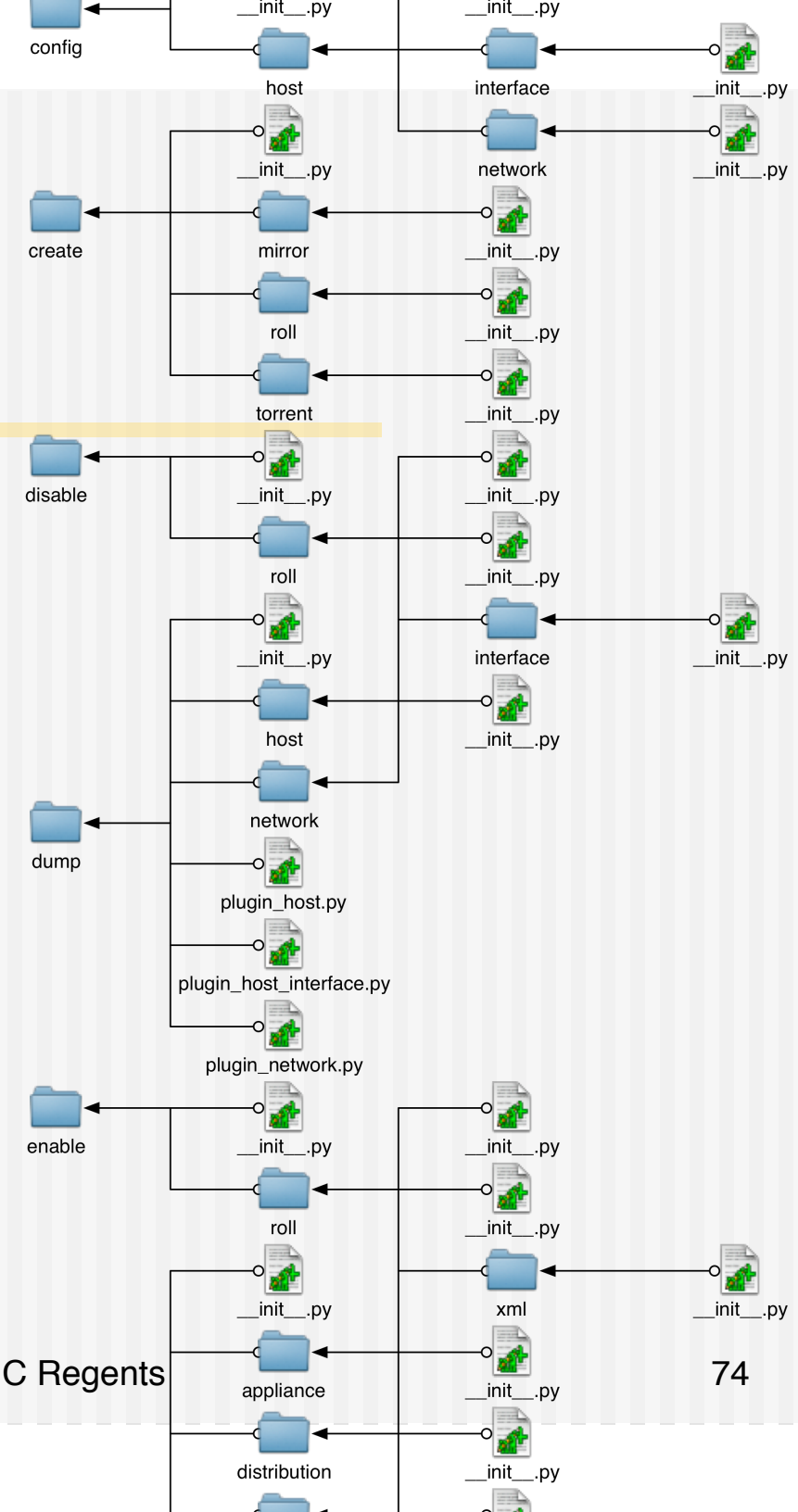


rocks add distribution

```
1: import rocks.commands
2:
3: class Command(rocks.commands.DistributionArgumentProcessor,
4:         rocks.commands.add.command):
5:         """
6:         Add a distribution specification to the database.
7:
8:         <arg type='string' name='distribution'>
9:         Name of the new distribution.
10:        </arg>
11:
12:        <example cmd='add distribution rocks-dist'>
13:        Adds the distribution named "rocks-dist" into the database.
14:        </example>
15:        """
16:
17:        def run(self, params, args):
18:
19:                if len(args) != 1:
20:                        self.abort('must supply one distribution')
21:                dist = args[0]
22:
23:                if dist in self.getDistributionNames():
24:                        self.abort('distribution "%s" exists' % dist)
25:
26:                self.db.execute("""insert into distributions (name) values
27:                        ('%s')""" % dist)
28:
29:
```

dump

- Returns cluster database information in the form of rocks command lines
- Examples:
  - Hosts
  - Network
- Same as –dump flag on insert-ethers

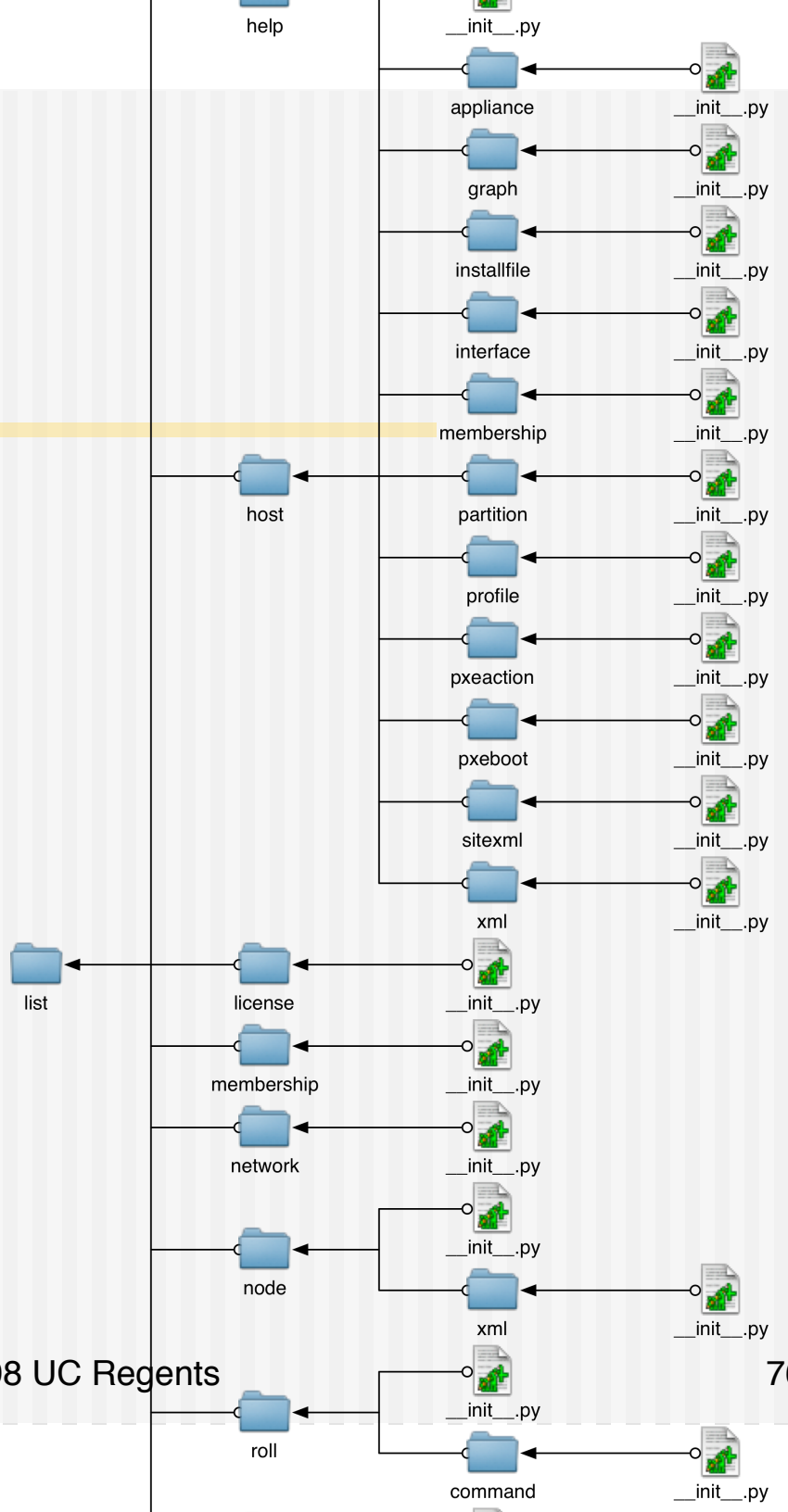


rocks dump host

```
# rocks dump host
/opt/rocks/bin/rocks add host vizagra cpus=1 rack=0 rank=0 membership="Frontend"
/opt/rocks/bin/rocks add host tile-0-1 cpus=2 rack=0 rank=1 membership="Tile"
/opt/rocks/bin/rocks add host tile-0-0 cpus=2 rack=0 rank=0 membership="Tile"
/opt/rocks/bin/rocks add host tile-0-2 cpus=2 rack=0 rank=2 membership="Tile"
/opt/rocks/bin/rocks add host tile-0-3 cpus=2 rack=0 rank=3 membership="Tile"
/opt/rocks/bin/rocks add host tile-1-3 cpus=2 rack=1 rank=3 membership="Tile"
/opt/rocks/bin/rocks add host tile-1-2 cpus=2 rack=1 rank=2 membership="Tile"
/opt/rocks/bin/rocks add host tile-1-1 cpus=2 rack=1 rank=1 membership="Tile"
/opt/rocks/bin/rocks add host tile-1-0 cpus=2 rack=1 rank=0 membership="Tile"
/opt/rocks/bin/rocks add host tile-2-0 cpus=2 rack=2 rank=0 membership="Tile"
/opt/rocks/bin/rocks add host tile-2-1 cpus=2 rack=2 rank=1 membership="Tile"
/opt/rocks/bin/rocks add host tile-2-2 cpus=2 rack=2 rank=2 membership="Tile"
/opt/rocks/bin/rocks add host tile-2-3 cpus=2 rack=2 rank=3 membership="Tile"
/opt/rocks/bin/rocks add host tile-3-0 cpus=2 rack=3 rank=0 membership="Tile"
/opt/rocks/bin/rocks add host tile-3-1 cpus=2 rack=3 rank=1 membership="Tile"
/opt/rocks/bin/rocks add host tile-3-2 cpus=2 rack=3 rank=2 membership="Tile"
/opt/rocks/bin/rocks add host tile-3-3 cpus=2 rack=3 rank=3 membership="Tile"
/opt/rocks/bin/rocks add host tile-4-0 cpus=2 rack=4 rank=0 membership="Tile"
/opt/rocks/bin/rocks add host tile-4-1 cpus=2 rack=4 rank=1 membership="Tile"
/opt/rocks/bin/rocks add host tile-4-2 cpus=2 rack=4 rank=2 membership="Tile"
/opt/rocks/bin/rocks add host tile-4-3 cpus=2 rack=4 rank=3 membership="Tile"
```

list

- Reports information in human readable format
- No side-effects on the database
- Examples:
  - Hosts
  - Appliances
  - Rolls

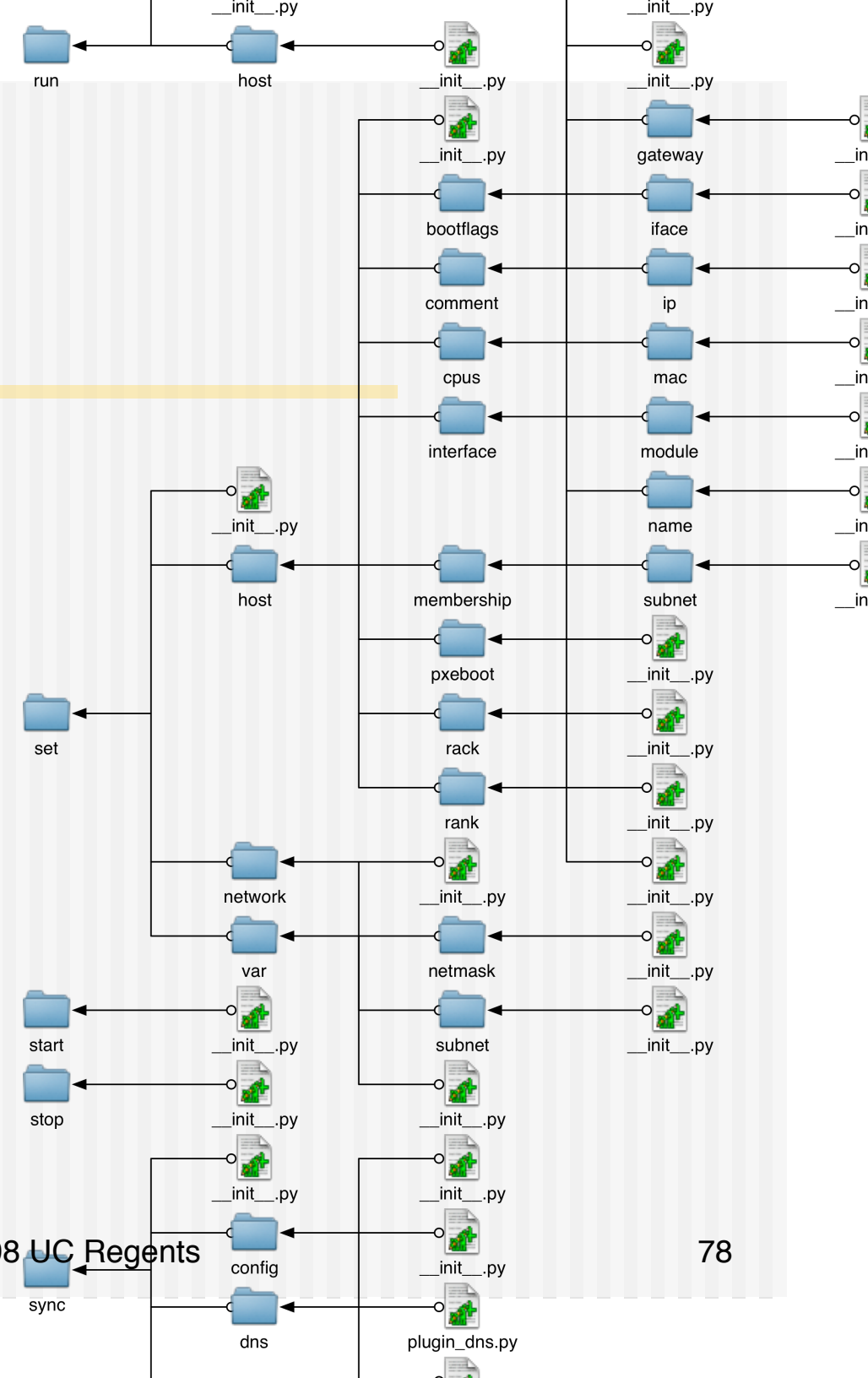


rocks list host

```
# rocks list host
HOST      MEMBERSHIP CPUS RACK RANK COMMENT
vizagra:  Frontend   1    0    0    -------
tile-0-1: Tile       2    0    1    -------
tile-0-0: Tile       2    0    0    -------
tile-0-2: Tile       2    0    2    -------
tile-0-3: Tile       2    0    3    -------
tile-1-3: Tile       2    1    3    -------
tile-1-2: Tile       2    1    2    -------
tile-1-1: Tile       2    1    1    -------
tile-1-0: Tile       2    1    0    -------
tile-2-0: Tile       2    2    0    -------
tile-2-1: Tile       2    2    1    -------
tile-2-2: Tile       2    2    2    -------
tile-2-3: Tile       2    2    3    -------
tile-3-0: Tile       2    3    0    -------
tile-3-1: Tile       2    3    1    -------
tile-3-2: Tile       2    3    2    -------
tile-3-3: Tile       2    3    3    -------
tile-4-0: Tile       2    4    0    -------
tile-4-1: Tile       2    4    1    -------
tile-4-2: Tile       2    4    2    -------
tile-4-3: Tile       2    4    3    -------
```

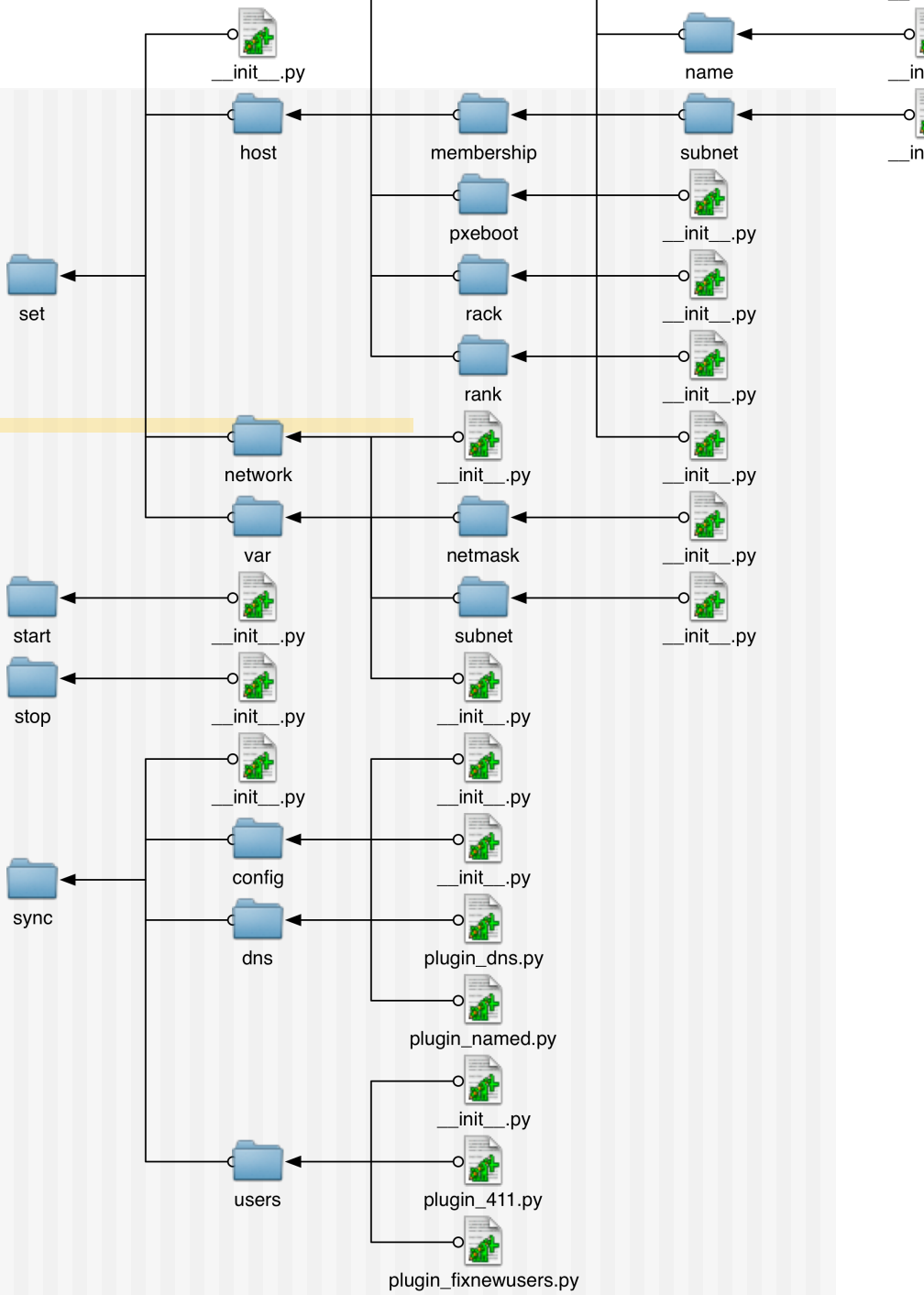
set

- Modifies entries in the cluster database
- Examples:
  - Network Interfaces
  - Appliance Assignment
  - Rack / Rank
- add-extra-nic
  - Rocks add host interface
  - Rocks set host interface



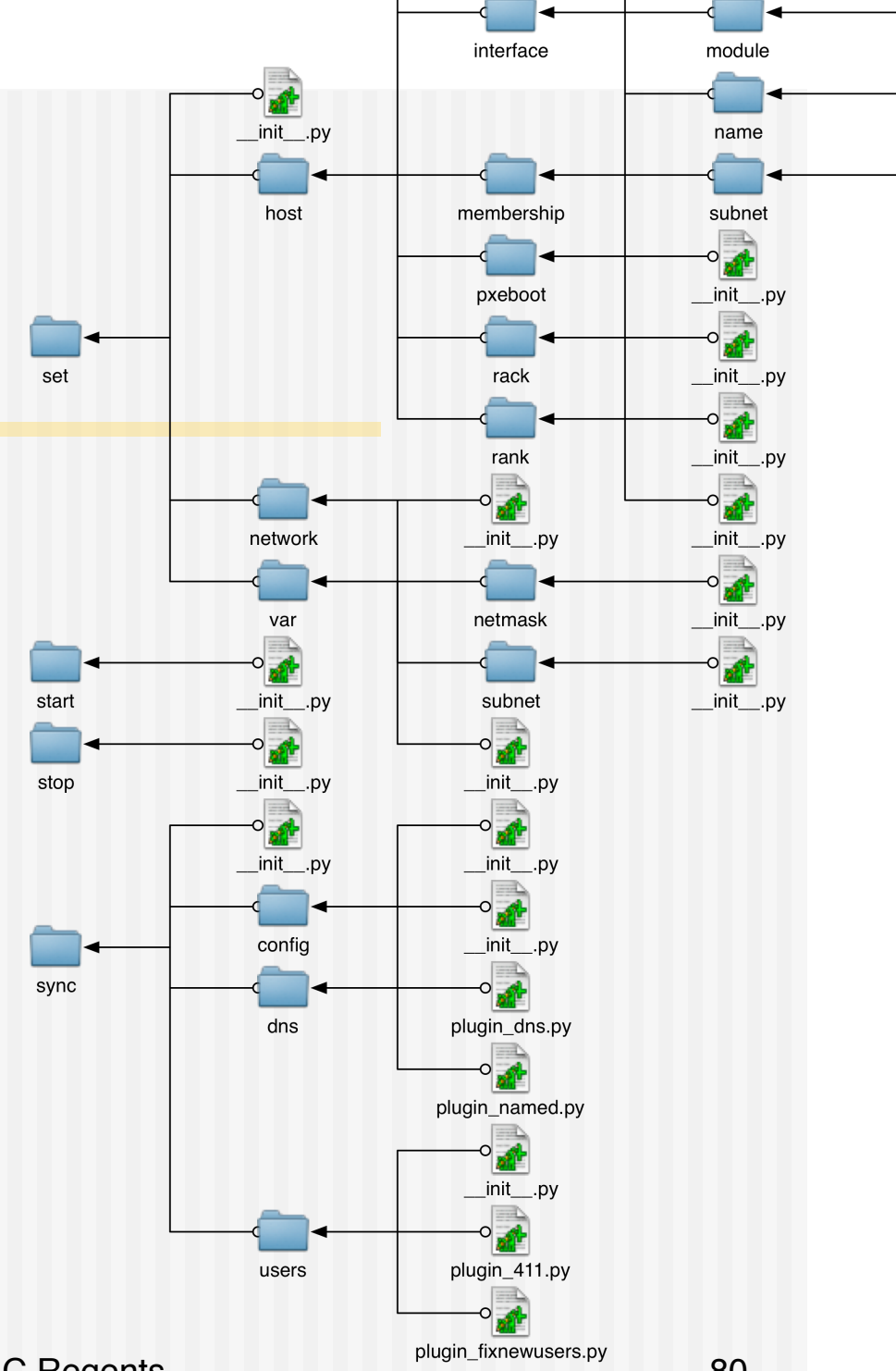
start / stop

- Start and stop something
- NULL commands
- Reserve the verbs for use on other Rolls
- Think “abstract base class”



sync

- Synchronizes the database state to software configuration files
- Similar to the old “insert-ethers – update”

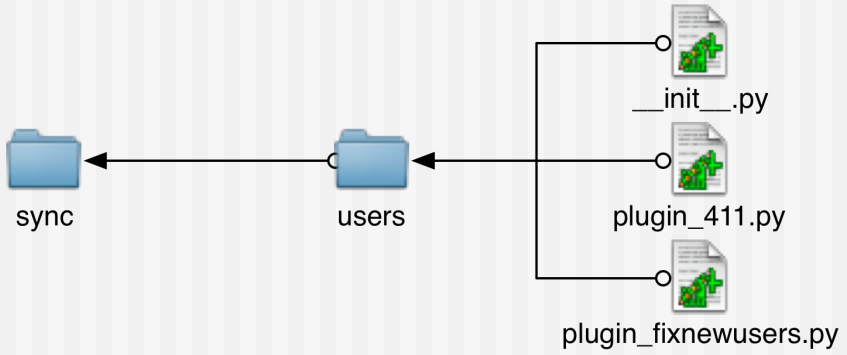


Extensibility

- New commands
  - Add directories
  - Add __init__.py code
- Existing commands
  - Some commands can be extended
  - Plugins

rocks sync users

- Run after useradd
  - Populate auto.home
  - Cleanup password file
  - Send 411 files
- Two plugins
  - Fixnewusers
  - 411
- Partial Ordering
- Other Rolls can add more plugins to this command
- Command must be design for plugins (not default)



__init__.py

```
 1: import rocks.commands
 2:
 3:
 4: class Command(rocks.commands.sync.command):
 5:         """
 6:         Update all user-related files (e.g., /etc/passwd, /etc/shadow, etc.)
 7:         on all known hosts. Also, restart autofs on all known hosts.
 8:
 9:         <example cmd='sync users'>
10:         Send all user info to all known hosts.
11:         </example>
12:         """
13:
14:         def run(self, params, args):
15:                 self.runPlugins()
16:
```

411 plugin

```
1: import os
2: import rocks.commands
3:
4: class Plugin(rocks.commands.Plugin):
5:         """Force a 411 update and re-load autofs on all nodes"""
6:
7:         def provides(self):
8:                 return '411'
9:
10:        def requires(self):
11:                return ['fixnewusers']
12:
13:        def run(self, args):
14:                #
15:                # force the rebuild of all files under 411's control
16:                #
17:                for line in os.popen('make -C /var/411 force').readlines():
18:                        self.owner.addText(line)
19:
20:                #
21:                # restart autofs on all known hosts
22:                #
23:                cmd = '/opt/rocks/bin/tentakel "service autofs reload"'
24:                for line in os.popen(cmd).readlines():
25:                        self.owner.addText(line)
26:
27:
```

auto.home / passwd plugin

```
import os
import string
import rocks.commands

class Plugin(rocks.commands.Plugin):
        """Relocates home directories to /export and fixes autofs.home"""

        def provides(self):
                return 'fixnewusers'

        def run(self, args):
                # scan the password file for any '/export/home' entries
                # this is the default entry as setup by useradd
                new_users = []
                default_dir = '/export/home/'

                file = open('/etc/passwd', 'r')

                for line in file.readlines():
                        l = string.split(line[:-1], ':')

                        if len(l) < 6:
                                continue

                        username = l[0]
                        homedir = l[5]

                        if homedir[:len(default_dir)] == default_dir:
                                new_users.append(username)
                file.close()

                hostname = '%s.%s' % \
                        (self.db.getGlobalVar('Kickstart', 'PrivateHostname'),
                        self.db.getGlobalVar('Kickstart', 'PrivateDNSDomain'))

                for user in new_users:

                        # for each new user, change their default directory to
                        # /home/<username>

                        cmd = '/usr/sbin/usermod -d %s %s' % \
                                (os.path.join('/home', user), user)
                        for line in os.popen(cmd).readlines():
                                self.owner.addText(line)

                        # then update the auto.home file
```

Argument Processing

- rocks <verb> <object…> <subject> <params…>
- Subject is typed by first object
  - host -> one or more hostname
  - roll -> one or more roll names
- Params are in key=value form
- Same as –flag=value but easier to read

Helper classes and functions

- ArgumentProcessors
  - Class to parse the subject in a standard way
  - Exists for hosts, rolls, appliances, …
- Parameters Parsing
  - fillPositionalArgs
  - fillParams

HostArgumentProcessor

- Command must derive from `rocks.commands.HostArgumentProcessor`
- `self.getHostnames(args)`
  - Return a list of hostname as they appear in the cluster database
  - If `args = None` all the host in the cluster are returned
  - `args` can also be a group
    - Rack0, rack1
  - Or an appliance type
    - Compute, Tile, …


```
import rocks.commands

class command(rocks.commands.HostArgumentProcessor,
        rocks.commands.list.command):
        pass

class Command(command):
        """
        List the membership, CPU count, physical position info and comment for
        a list of hosts.

        <arg optional='1' type='string' name='host' repeat='1'>
        Zero, one or more host names. If no host names are supplied, info about
        all the known hosts is listed.
        </arg>

        <example cmd='list host compute-0-0'>
        List info for compute-0-0.
        </example>

        <example cmd='list host'>
        List info for all known hosts.
        </example>
        """

        def run(self, params, args):
                self.beginOutput()

                for host in self.getHostnames(args):
                        self.db.execute("""select m.name, n.cpus,
                                n.rack, n.rank, n.comment from
                                nodes n, memberships m where
                                n.membership=m.id and n.name='%s'""" % host)
                        self.addOutput(host, self.db.fetchone())

                self.endOutput(header=['host', 'membership',
                        'cpus', 'rack', 'rank', 'comment'])
```

args = None

```
# rocks list host
HOST       MEMBERSHIP CPUS RACK RANK COMMENT
vizagra:   Frontend   1    0    0    -------
tile-0-1: Tile        2    0    1    -------
tile-0-0: Tile        2    0    0    -------
tile-0-2: Tile        2    0    2    -------
tile-0-3: Tile        2    0    3    -------
tile-1-3: Tile        2    1    3    -------
tile-1-2: Tile        2    1    2    -------
tile-1-1: Tile        2    1    1    -------
tile-1-0: Tile        2    1    0    -------
tile-2-0: Tile        2    2    0    -------
tile-2-1: Tile        2    2    1    -------
tile-2-2: Tile        2    2    2    -------
tile-2-3: Tile        2    2    3    -------
```

args = list of hosts

```
# rocks list host tile-0-0 10.255.255.253 tile-3-0.local
HOST      MEMBERSHIP CPUS RACK RANK COMMENT
tile-0-0: Tile       2    0    0    -------
tile-0-1: Tile       2    0    1    -------
tile-3-0: Tile       2    3    0    -------
```

args = rack

```
# rocks list host rack2
HOST       MEMBERSHIP CPUS RACK RANK COMMENT
tile-2-0: Tile        2    2    0    -------
tile-2-1: Tile        2    2    1    -------
tile-2-2: Tile        2    2    2    -------
tile-2-3: Tile        2    2    3    -------
```

args = appliance type

```
# rocks list host tile
HOST       MEMBERSHIP CPUS RACK RANK COMMENT
tile-0-0: Tile        2    0    0    --------
tile-0-1: Tile        2    0    1    --------
tile-0-2: Tile        2    0    2    --------
tile-0-3: Tile        2    0    3    --------
tile-1-0: Tile        2    1    0    --------
tile-1-1: Tile        2    1    1    --------
tile-1-2: Tile        2    1    2    --------
tile-1-3: Tile        2    1    3    --------
tile-2-0: Tile        2    2    0    --------
tile-2-1: Tile        2    2    1    --------
```

Any combination is fine

```
# rocks list host tile-2-0 rack1 frontend
HOST       MEMBERSHIP CPUS RACK RANK COMMENT
tile-1-0: Tile        2    1    0    -------
tile-1-1: Tile        2    1    1    -------
tile-1-2: Tile        2    1    2    -------
tile-1-3: Tile        2    1    3    -------
tile-2-0: Tile        2    2    0    -------
vizagra:  Frontend    1    0    0    -------
```

ArgumentProcessors

Class Name	Helper Function
ApplianceArgumentProcessor	getApplianceNames
DistributionArgumentProcessor	getDistributionNames
HostArgumentProcessors	getHostnames
MembershipArgumentProcessor	getMembershipNames
NetworkArgumentProcessor	getNetworkNames
RollArgumentProcessor	getRollNames

RollArgumentProcessor

```
 1: import os
 2: import stat
 3: import time
 4: import sys
 5: import string
 6: import rocks.commands
 7:
 8:
 9: class Command(rocks.commands.RollArgumentProcessor,
10:         rocks.commands.list.command):
11:         """
12:         List the status of available rolls.
13:
14:         <arg optional='1' type='string' name='roll' repeat='1'>
15:         List of rolls. This should be the roll base name (e.g., base, hpc,
16:         kernel). If no rolls are listed, then status for all the rolls are
17:         listed.
18:         </arg>
19:
20:         <example cmd='list roll kernel'>
21:         List the status of the kernel roll
22:         </example>
23:
24:         <example cmd='list roll'>
25:         List the status of all the available rolls
26:         </example>
27:         """
28:
29:         def run(self, params, args):
30:
31:                 self.beginOutput()
32:                 for (roll, version) in self.getRollNames(args, params):
33:                         self.db.execute("""select version, arch, enabled from
34:                                 rolls where name='%s' and version='%s'""" %
35:                                 (roll, version))
36:                         for row in self.db.fetchall():
37:                                 self.addOutput(roll, row)
38:
39:                 self.endOutput(header=['name', 'version', 'arch', 'enabled'],
40:                         trimOwner=0)
41:
```

No Parameter

```
# rocks list roll
NAME         VERSION ARCH ENABLED
viz:         5.0     i386 yes
sge:         5.0     i386 yes
kernel:      5.0     i386 yes
updates:     5.1     i386 yes
java:        4.3.2   i386 yes
xen:         5.0     i386 yes
CentOS:      5.1     i386 yes
ganglia:     5.0     i386 yes
web-server:  5.0     i386 yes
base:        5.0     i386 yes
```

Version Parameter

```
# rocks list roll version=4.3.2
NAME  VERSION ARCH ENABLED
java: 4.3.2   i386 yes
```

Summary

- ArgumentProcessors standardize the handling of command line subjects
- Calling the helper function with an empty list returns all subject in the database
- HostArgumentProcessor knows about more than just host names
- RollArgumentProcessor can filter on versions

fillParams

- Create local variables based on command parameters (key=value)
- Argument a list of (key, default) tuples
- If the parameter is not found on the command line the default value is used

```
33:         </example>
34:         """
35:
36:         def maketorrent(self, filename, data):
37:                 info = {}
38:                 info['length'] =  os.stat(filename)[stat.ST_SIZE]
39:                 info['name'] =  os.path.basename(filename)
40:
41:                 data['info'] = info
42:
43:                 encoded = BitTorrent.bencode.bencode(data)
44:
45:                 file = open('%s.torrent' % (filename), 'w')
46:                 file.write(encoded)
47:                 file.close()
48:
49:
50:         def run(self, params, args):
51:
52:                 if len(args) != 1:
53:                         self.abort('must supply one file')
54:                 filename = args[0]
55:
56:                 (timestamp, ) = self.fillParams([('timestamp', time.time())])
57:                 try:
58:                         creation_date = int(timestamp)
59:                 except:
60:                         creation_date = int(time.time())
61:
62:                 data = {}
63:
64:                 #
65:                 # announce string
66:                 #
67:                 localhost = self.db.getGlobalVar('Kickstart', 'PrivateAddress')
68:                 data['announce'] = 'http://%s:7625/announce' % (localhost)
69:
70:                 data['creation date'] = creation_date
71:
72:                 #
```

rocks create torrent

rocks add host

```
73:                     basename, rack, rank = host.split('-')
74:                     self.db.execute("""select m.name from
75:                             appliances a, memberships m where
76:                             a.name="%s" and m.appliance=a.id""" % basename)
77:                     membership, = self.db.fetchone()
78:                     rack = int(rack)
79:                     rank = int(rank)
80:             except:
81:                     membership = None
82:                     rack = None
83:                     rank = None
84:
85:             # fillParams with the above default values
86:
87:             (membership, numCPUs, rack, rank) = self.fillParams(
88:                     [('membership', membership),
89:                     ('cpus', 1),
90:                     ('rack', rack),
91:                     ('rank', rank)])
92:
93:             if not membership:
94:                     self.abort('membership not specified')
95:             if rack == None:
96:                     self.abort('rack not specified')
97:             if rank == None:
98:                     self.abort('rank not specified')
99:
100:            self.db.execute("""insert into nodes
101:                    (site, name, membership, cpus, rack, rank)
102:                    values
103:                    (0,
104:                    '%s',
105:                    (select id from memberships where name='%s'),
106:                    '%d',
107:                    '%d',
108:                    '%d')""" %
109:                    (host, membership, int(numCPUs), int(rack), int(rank)))
110:
111:
```

fillPositionalArgs

- Allows for parameters to have implied keys (just values on command line)
- This is an optimization for ease of use, not ease of software
- Argument is a list of keys
  - No default value processing, if a key is specified it is required
  - Use this only when a parameter is required
- Example:

```
# rocks set network netmask optiputer netmask=255.255.255.0
# rocks set network netmask optiputer 255.255.0.0
```

```
11:         </arg>
12:
13:         <arg type='string' name='netmask'>
14:         Netmask that named networks should have.
15:         </arg>
16:
17:         <param type='string' name='netmask'>
18:         Can be used in place of netmask argument.
19:         </param>
20:
21:         <example cmd='set network netmask optiputer 255.255.255.0'>
22:         Sets the netmask for the "optiputer" network to a class-c address
23:         space.
24:         </example>
25:
26:         <example cmd='set network netmask optiputer netmask=255.255.255.0'>
27:         Same as above.
28:         </example>
29:
30:         <example cmd='set network netmask optiputer cavewave 255.255.0.0'>
31:         Sets the netmask for the "optiputer" and "cavewave" networks to
32:         a class-b address space.
33:         </example>
34:
35:         <related>add network</related>
36:         <related>set network subnet</related>
37:         """
38:
39:         def run(self, params, args):
40:                 (args, netmask) = self.fillPositionalArgs(('netmask',))
41:
42:                 if not len(args):
43:                         self.abort('must supply network')
44:                 if not netmask:
45:                         self.abort('must supply netmask')
46:
47:                 for network in self.getNetworkNames(args):
48:                         self.db.execute("""update subnets set netmask='%s' where
49:                                 subnets.name='%s'""" % (netmask, network))
50:
```

rocks set network netmask

```
32:         Sets the MAC Address for the eth1 device on host compute-0-0.
33:         </example>
34:
35:         <example cmd='set host interface mac compute-0-0 iface=eth1 mac=00:0e:0c:a7:5d:ff'>
36:         Same as above.
37:         </example>
38:
39:         <example cmd='set host interface mac compute-0-0 iface=eth1 mac=NULL'>
40:         clears the mac address from the database
41:         </example>
42:
43:         <!-- cross refs do not exist yet
44:         <related>set host interface iface</related>
45:         <related>set host interface ip</related>
46:         <related>set host interface gateway</related>
47:         <related>set host interface module</related>
48:         -->
49:         <related>add host</related>
50:         """
51:
52:         def run(self, params, args):
53:
54:                 (args, iface, mac) = self.fillPositionalArgs(('iface', 'mac'))
55:
56:                 hosts = self.getHostnames(args)
57:
58:                 if len(hosts) != 1:
59:                         self.abort('must supply one host')
60:                 if not iface:
61:                         self.abort('must supply iface')
62:                 if not mac:
63:                         self.abort('must supply mac')
64:
65:                 for host in hosts:
66:                         self.db.execute("""update networks, nodes set
67:                                 networks.mac=NULLIF('%s','NULL') where
68:                                 nodes.name='%s' and networks.node=nodes.id and
69:                                 (networks.device='%s' or networks.mac='%s')""" %
70:                                 (mac, host, iface, iface))
71:
```

rocks set host interface

Help and Docstrings

- The command line is the documentation
  - No more out of date man pages
  - Still needs a cookbook document, but reference is part of the code
- We've been looking at this all session
- Class docstring `"""text"""`
- Command line has an XML format


```
# rocks list roll help
rocks list roll [roll]...

Description:

    List the status of available rolls.


Arguments:

    [roll]

    List of rolls. This should be the roll base name (e.g., base, hpc,
    kernel). If no rolls are listed, then status for all the rolls are
    listed.


Examples:

    $ rocks list roll kernel

    List the status of the kernel roll

    $ rocks list roll

    List the status of all the available rolls
```

rocks list roll help

```
import os
import stat
import time
import sys
import string
import rocks.commands

class Command(rocks.commands.RollArgumentProcessor,
        rocks.commands.list.command):
        """
        List the status of available rolls.

        <arg optional='1' type='string' name='roll' repeat='1'>
        List of rolls. This should be the roll base name (e.g., base, hpc,
        kernel). If no rolls are listed, then status for all the rolls are
        listed.
        </arg>

        <example cmd='list roll kernel'>
        List the status of the kernel roll
        </example>

        <example cmd='list roll'>
        List the status of all the available rolls
        </example>
        """

        def run(self, params, args):

                self.beginOutput()
                for (roll, version) in self.getRollNames(args, params):
                        self.db.execute("""select version, arch, enabled from
                                rolls where name='%s' and version='%s'""" %
                                (roll, version))
                        for row in self.db.fetchall():
                                self.addOutput(roll, row)
                self.endOutput(header=['name', 'version', 'arch', 'enabled'],
                        trimOwner=0)

```

<arg>

- Attributes
  - name (required)
  - optional (default = “0”)
  - type (default = “string”)
  - repeat (default = “0”)
- Example:

```
<arg type='string' name='network' repeat='1'>
  One or more named networks that should have the
  defined netmask.
</arg>
```

<param>

- Attributes
  - name (required)
  - optional (default = “1”)
  - type (default = “string”)
  - repeat (default = “0”)
- Example:

```
<param type='string' name='iface'>
  Can be used in place of the iface argument.
</param>
```

<example>

- Attributes
  - cmd(required)
- Example:

```
<example cmd='set host interface mac compute-0-0
  eth1 00:0e:0c:a7:5d:ff'>
  Sets the MAC Address for the eth1 device on host
  compute-0-0.
</example>
```

<related>

- Example

```
<related>set host interface iface</related>
<related>set host interface ip</related>
<related>set host interface gateway</related>
<related>set host interface module</related>
```

Help

- rocks <verb> <object…> <subject> help
  - Loads the command module
  - Parses the XML docstring
  - Format and output help as 80 column text
- Debug syntax with `format=` parameter

help format=raw

```
# rocks list roll help format=raw
1:
2: List the status of available rolls.
3:
4: <arg optional='1' type='string' name='roll' repeat='1'>
5: List of rolls. This should be the roll base name (e.g., base, hpc,
6: kernel). If no rolls are listed, then status for all the rolls are
7: listed.
8: </arg>
9:
10:<example cmd='list roll kernel'>
11:List the status of the kernel roll
12:</example>
13:
14:<example cmd='list roll'>
15:List the status of all the available rolls
16:</example>
```

Help format=parsed

```
# rocks list roll help format=parsed
{'related': [], 'example': [(u'list roll kernel', u'\t\t\n\tList the
   status of the kernel roll\n\t'), (u'list roll', u'\n\tList the status
   of all the available rolls\n\t')], 'description': u'\n\tList the status
   of available rolls.\n\t\n\t', 'param': [], 'arg': [((u'roll',
   u'string', 1, 1), u'\n\tList of rolls. This should be the roll base
   name (e.g., base, hpc,\n\tkernel). If no rolls are listed, then status
   for all the rolls are\n\tlisted.\n\t')]}
```

Docbook

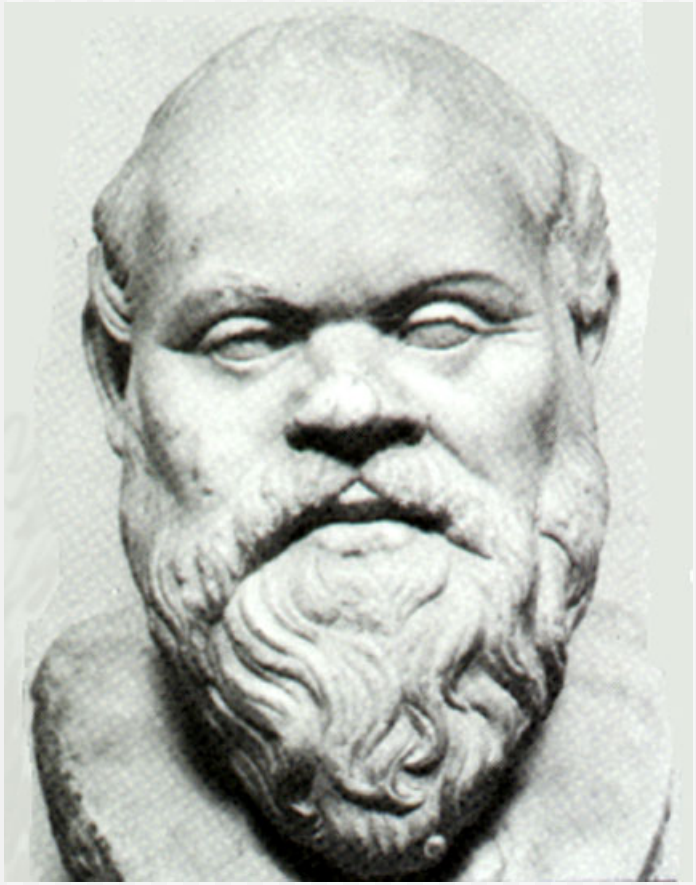
- Roll Usersguide Command Reference is generated automatically

```
# rocks list roll help format=docbook
<section id="rocks-list-roll" xreflabel="list roll">
<title>list roll</title>
<cmdsynopsis>
   <command>rocks list roll</command>
   <arg rep="repeat" choice="opt">roll</arg>
</cmdsynopsis>
<para>

   List the status of available rolls.


</para>
<variablelist><title>arguments</title>
   <varlistentry>
```

AVOIDING BECOMING A DEVELOPER

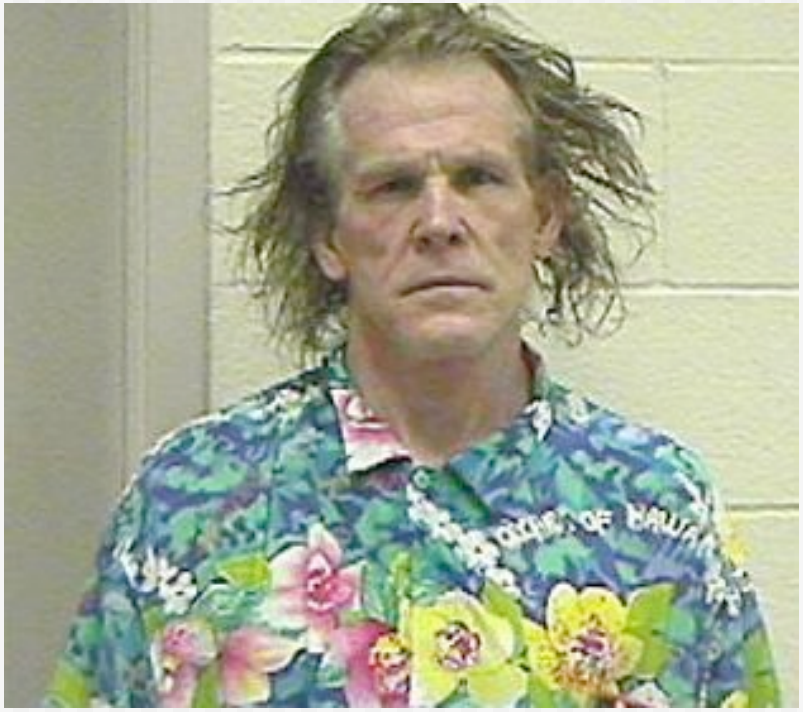
Philosophy

- All software is installed on the local disk
- Does not require NFS or non-scalable diskless technologies
- Use the native OS packager for everything
  - Linux = rpm
  - Solaris = pkg



Violate the Rules

- You just need a few packages added and cannot find or build packages
- You want this only on your cluster and not on several clusters
- You still want to avoid NFS and benefit from Rocks management



Get a Directory Tree

- Build your software from source and install on the frontend
  - configure
  - make
  - install
- Or, just untar a binary bundle

CREATE PACKAGE

```
rocks create package
  <path>
  <package-name>

rocks create package
  /opt/mx
  mx
```

Done

```
# rpm -qip mx-1.0-1.x86_64.rpm
Name        : mx                           Relocations: (not relocatable)
Version     : 1.0                               Vendor: Rocks Clusters
Release     : 1                            Build Date: Tue 12 May 2009 04:40:00 PM
    PDT
Install Date: (not installed)              Build Host: vizagra.rocksclusters.org
Group       : System Environment/Base      Source RPM: mx-1.0-1.src.rpm
Size        : 17588899                        License: University of California
Signature   : (none)
Summary     : A collection of Python software tools.
Description :
The mx extensions for Python are a collection of Python software tools
which enhance Python's usability in many areas.
```

ADDING YOUR PACKAGE TO COMPUTE NODES

Step 1: Contribute the RPM

- Your distribution looks for packages from Rolls and in a contrib area
- Copy your RPMS into contrib

```
cp mx-1.0-1.x86_64.rpm
  /export/rocks/install/contrib/5.2/
  x86_64/RPMS
```

Step 2: Extend XML

```
cd /export/rocks/install/site-
  profiles/5.2/nodes/

cp skeleton.xml
  extend-compute.xml

vi extend-compute.xml
```

Add Package Tag

original

```
<kickstart>

<description>
Skeleton XML Node
</description>

<changelog>
</changelog>

<!-
<package></package>
-->

<post>
</post>

</kickstart>
```

modified (with mx)

```
<kickstart>

<description>
Skeleton XML Node
</description>

<changelog>
</changelog>

<package>mx</package>

<post>
</post>

</kickstart>
```

Step 3: Rebuild Distribution

- RPM package is already contributes
- XML node file is already extended
- Now we need to rebuild the dist

- Must be done in /export/rocks/install

CREATE DISTRO

```
cd /export/rocks/install

rocks create distro
```

Step 4: Re-install
(repeated material 3 slides)

- PXE Boot
  - Network Boot is first in BIOS boot order
  - Set Rocks Boot action to install
  - Reboot the host
- Otherwise use old rocks commands or just hard power cycle the host.

SET HOST BOOT

```
rocks set host boot
  <host>
  action=<boot-action>

rocks set host boot
  compute-0-0
  action=install
```

RUN HOST

```
rocks run host
  <host>
  <command>

rocks run host
  compute-0-0
  /sbin/init 6
```

Should I Build a Roll?

contrib & site-profiles

- Fast and Easy
- Admin Friendly
- Difficult to share
- Difficult to backup/restore
- Frontend is your development host

Roll

- Takes about 1 day
- Developer Friendly
- Easy to share (.iso)
- Easy to backup/restore
- Frontend is your development host

Break Time