

L05 Configuration Management

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History of CM

- 1 History of CM
- 2 CM Languages
- 3 CM Tools
- 4 Meeting
 - Recapitulation
 - Assignments
 - Preview

Learning Outcomes

Students will be able to

- remember differences between CM languages and historical approaches.
- write simple configuration management scripts.

Definition

Configuration Management:

- is a discipline in which configuration (in the broader sense) is administered.
- makes sure computers are assembled from desired parts and the correct applications are installed.
- ensures that the execution environment of installed applications is as required.

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Configuration Management Tools:

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Configuration Management Tools:

- help people involved in configuration management.
- have means to describe the desired configuration of the whole managed system.
- try to converge the actual configuration to the desired one [4].

Challenging tasks in configuration management:

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- inventory list
- installing packages
- monitoring
- add/replace machines
- maintaining files/databases
- ***configuration file manipulation***

Cloning

It all started with:

- clone all files with dd, rdist, rsync or unison (“golden image”)
- then do necessary modifications with scripts or profiles

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- clone all files with dd, rdist, rsync or unison (“golden image”)
- then do necessary modifications with scripts or profiles
 - + works good for many identical stateless machines
 - fails if differences between machines are too big

Scripts

First improvement: have a script to create the “golden image”.

Possible benefits:

- Documentation

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- Documentation
- Customization (using configuration settings)
- **Reproducibility**: Reproduce creation using different operating system versions

Profiles

Profiles are groups of configuration settings between which the user can easily switch.

- by hostname, information EEPROM, manual selection, ...
- can be activated via the profile plugin:

```
1 [application/profile]
2   type := string
3   opt := p
4   opt/long := profile
5   default := current
```

with a config like:

```
1 application/current/key = "current"
2 application/myprofile/key = "myprofile"
3 application/%/key = "default"
```

First four configuration management tools

Cloning, and then NIS/NFS, was state of the art for a long time, until in 1994 when *“the community nearly exploded with four new configuration systems”* [6]:

- lcfg** from Anderson [2]. The development of lcfg started first in 1991 [1, 2]. Nevertheless, its development still continues [3, 9].

- GeNUAdmin** from Harlander [7].

- omniconf** from Hideyo [8].

- config** from Rouillard and Martin [12].

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- **Reusability**

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- Error handling
- Pull/Push
- Reusability
- (Resource) Abstractions

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CM Languages

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See Reading Text

See accompanied reading text for this section.

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CM Tools

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List of CM tools

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- OpsMops (2019)

Key/value access in puppet-libelektra [11]:

```
1 kdbkey {'/slapd/threads/listener':
2     ensure => 'present',
3     value  => '4'
4     check => {
5         'type' => 'short',
6         'range' => '1,2,4,8,16',
7         'default' => '1'
8     }
9 }
```

Key/value access in puppet-libelektra:

```
1 kdbmount { 'system:/sw/samba':
2     ensure => 'present',
3     file   => '/etc/samba/smb.conf',
4     plugins => 'ini'
5 }
6 kdbkey { 'system:/sw/samba/global/workgroup':
7     ensure => 'present',
8     value  => 'MY_WORKGROUP'
9 }
10 kdbkey { 'system:/sw/samba/global/log_level':
11     ensure => 'absent'
12 }
```

Uniqueness of keys is essential. Ideally, applications already mount their configuration at installation.

Key/value specifications in puppet-libelektra:

```
1 kdbkey { 'system:/sw/samba/global/log level':
2     ensure => 'present',
3     value  => 'MY_WORKGROUP',
4     check => {
5         'type' => 'short',
6         'range' => '0-10',
7         'default' => '1',
8         'description' => 'Sets the amount of log/
9             debug messages that are sent to the
10            log file. 0 is none, 3 is consider-
11            able.'
12 }
```


Key/value specifications in puppet-libelektra:

```
1 kdbkey { 'spec:/xfce/pointers/Mouse/RightHanded':  
2     ensure => 'present',  
3     check => {  
4         'namespaces/#0' => 'user',  
5         'namespaces/#1' => 'system',  
6         'visibility' => 'important',  
7         'default' => 'false',  
8         'check/type' => 'boolean'  
9     } }
```

Ideally, applications already specify their settings.

Key/value access in Chef:

```
1 kdbset 'system:/sw/samba/global/workgroup' do
2     value 'MY_WORKGROUP'
3     action :create
4 end
```

Key/value access in Chef:

```
1 kdbset '/slapd/threads/listener' do
2     value '4'
3     action :create
4 end
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Key/value access in Chef:

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Finding

We have CM code representing the settings.

Key/value access in Ansible:

```
1 - name: setup LDAP
2   connection: local
3   hosts: localhost
4   tasks:
5     - name: set listening threads
6       elektra:
7         key: '/slapd/threads/listener'
8         value: '4'
```

Key/value access in Ansible:

```
1 - name: setup samba
2   connection: local
3   hosts: localhost
4   tasks:
5     - name: set workgroup
6       elektra:
7         mountpoint: system:/sw/samba
8         file: /etc/samba/smb.conf
9         plugins: ini
10      elektra:
11        key: 'system:/sw/samba/global/workgroup'
12        value: 'MY_WORKGROUP'
```

Key/Values Revisited

Decide about **changeability** per key:

- Who is responsible (end user, packages, admin manual or CM).

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Changeability

Ownership of every key must be very clear and documented.

Layers of Abstractions

Recursively define useful abstractions (meta-levels):

- Bits in (configuration) files and memory

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- **Global optimization: allocation of nodes and decision regarding topology in the whole network**

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- Bits in (configuration) files and memory
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- CM code to instantiate settings in the whole network
- Global optimization: allocation of nodes and decision regarding topology in the whole network
- **Global goals/specifications of the whole network**

Design Rules [5]

- Factor processes into containers to avoid overlaps in settings.

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Open Topics

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- collaboration
- management (including knowledge)
- centralized vs. distributed

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- complexity in CM vs. complexity in applications' specification

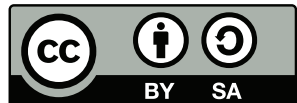
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Meeting

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Question

How can we reuse the same configuration setting for different applications?

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How can we reuse the same configuration setting for different applications?

Answer

- Use CM code to copy the settings to all places as needed.
- Implement support directly in application to fetch setting from central location.
- Override/fallback links in specification.
- Calculate/transform values in specification.

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Task

Break.

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By functional languages and file system (layouts).

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- Which notations for CM exist?

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By functional languages and file system (layouts).
- Which notations for CM exist?
Text, Graphical (UML), Semi-structured, Key-value, Structured

Task

Break.

Today: T1/H1 corrections

Please add slides for talk in private git repo at least one week in advance.

Task for H3?

Which CM language do you want to use for T3?

Outlook

Will be online soon:

- validation techniques

Outlook

Will be online soon:

- validation techniques
- writing plugins

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