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# **common-ovf-tool Documentation**

***Release 2.1.0***

**the COT project developers**

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# CHAPTER 1

## Introduction

COT (the Common OVF Tool) is a tool for editing [Open Virtualization Format](#) (.ovf, .ova) virtual appliances, with a focus on virtualized network appliances such as the [Cisco CSR 1000V](#) and [Cisco IOS XRv](#) platforms.

COT's capabilities include:

- Add a disk or other file to an OVF/OVA
- Edit OVF hardware information (CPUs, RAM, NICs, configuration profiles, etc.)
- Edit product description information in an OVF/OVA
- Edit OVF environment properties
- Display a descriptive summary of the contents of an OVA or OVF package
- Embed a bootstrap configuration text file into an OVF/OVA.
- Remove files and disks from an OVF or OVA package
- Deploy an OVF/OVA to an ESXi (VMware vSphere or vCenter) server to provision a new virtual machine (VM).

## 1.1 Examples

Displaying a summary of OVA contents:

```
> cot info --brief csr1000v-universalk9.03.17.01.S.156-1.S1-std.ova
-----
csr1000v-universalk9.03.17.01.S.156-1.S1-std.ova
COT detected platform type: Cisco CSR1000V
-----
Product:  Cisco CSR 1000V Cloud Services Router
Vendor:   Cisco Systems, Inc.
Version:  03.17.01.S.156-1.S1-std

Files and Disks:                File Size  Capacity Device
-----
```

```

csr1000v_harddisk.vmdk          71.5 KiB      8 GiB harddisk @ SCSI 0:0
bdeo.sh                        52.42 KiB
README-OVF.txt                  8.534 KiB
README-BDEO.txt                 6.748 KiB
cot.tgz                         116.8 KiB
csr1000v-universalk9.03.17....  425 MiB      cdrom @ IDE 1:0

Hardware Variants:
System types:                   vmx-08 vmx-09 vmx-10 vmx-11
                                Cisco:Internal:VMcloud-01
SCSI device types:              virtio lsilogic
Ethernet device types:          VMXNET3 virtio

Configuration Profiles:  CPUs      Memory NICs  Serials  Disks/Capacity
-----
1CPU-4GB (default)      1      4 GiB   3        2 1 /      8 GiB
2CPU-4GB                 2      4 GiB   3        2 1 /      8 GiB
4CPU-4GB                 4      4 GiB   3        2 1 /      8 GiB
4CPU-8GB                 4      8 GiB   3        2 1 /      8 GiB

Networks:
GigabitEthernet1 "Data network 1"
GigabitEthernet2 "Data network 2"
GigabitEthernet3 "Data network 3"

Environment:
Transport types: iso

Properties:
<config-version> "1.0"
Router Name      ""
Login Username   ""
Login Password   ""
Management Interface "GigabitEthernet1"
Management VLAN  ""
Management Interface IPv4 Address/Mask ""
Management IPv4 Gateway ""
Management IPv4 Network ""
PNSC IPv4 Address ""
PNSC Agent Local Port ""
PNSC Shared Secret Key ""
Remote Management IPv4 Address (optional, deprecated) ""
Enable SCP Server "false"
Enable SSH Login and Disable Telnet Login "false"
Enable Password  ""
Domain Name      ""
License boot level "ax"
Console          ""
Resource template "default"
Intercloud Mode  ""
Intercloud Mode Management Key ""
Intercloud Control Port ""
Intercloud Tunnel Port ""
Intercloud Tunnel Header Size "148"
Intercloud Tunnel Interface IPv4 Address ""
Intercloud Tunnel Interface Gateway IPv4 Address ""

```

Adding a custom hardware configuration profile to an OVA:

```
> cot edit-hardware csr1000v.ova --output csr1000v_custom.ova \  
    --profile 1CPU-4GB --cpus 1 --memory 4GB
```

Customizing OVF environment properties:

```
> cot edit-properties csr1000v.ova --output csr1000v_custom.ova \  
    --properties mgmt-ipv4-addr=10.1.1.100/24 \  
                mgmt-ipv4-gateway=10.1.1.1
```





- *System requirements*
- *Installing COT using `pip`*
  - *Installing optional features*
- *Installing COT from source*
  - *Downloading COT*
  - *Install the COT libraries and script*
- *Troubleshooting*
  - *"ValueError: Expected version spec"*
- *Installing helper programs*

## 2.1 System requirements

- COT requires either Python 2.7 or Python 3.3 or later.
- COT is tested to work under Mac OS X and Ubuntu Linux and similar distros.
- COT now has limited support for CentOS and related distros as well.

## 2.2 Installing COT using `pip`

Since COT is written in Python, it can be installed like any other Python package using the `pip` tool. For most users this is the recommended installation method.

```
sudo pip install cot
```

or, to install for the current user only (typically installing to `~/ .local/`):

```
pip install --user cot
```

If you have already installed COT and wish to update to the latest available version:

```
sudo pip install --upgrade cot
```

or

```
pip install --user --upgrade cot
```

## 2.2.1 Installing optional features

COT has a number of optional Python package dependencies that enable optional features. If you want to use these features, you can instruct `pip` to install them as part of the COT installation process, or you can install them separately after the fact.

- Tab-completion of COT CLI parameters in `bash`, enabled with the `argcomplete` package.

```
sudo pip install cot[tab-completion]
```

or

```
sudo pip install argcomplete
```

---

**Note:** After installing `argcomplete` by either method, you must configure your `bash` environment to enable it. Refer to the `argcomplete` documentation for the required steps.

---

## 2.3 Installing COT from source

If you wish to install bleeding-edge unreleased code or make code contributions of your own, you can install COT from source as described below.

### 2.3.1 Downloading COT

You can download COT via Git or using HTTP.

```
git clone git://github.com/glenmmatthews/cot
cd cot
```

or

```
wget -O cot.tgz https://github.com/glenmmatthews/cot/archive/master.tar.gz
tar xzf cot.tgz
cd cot-master
```

or

```
curl -o cot.tgz https://github.com/glenmmatthews/cot/archive/master.tar.gz
tar xzf cot.tgz
cd cot-master
```

## 2.3.2 Install the COT libraries and script

```
sudo python setup.py install
```

## 2.4 Troubleshooting

### 2.4.1 "ValueError: Expected version spec"

If you get an error like

```
ValueError: ('Expected version spec in', 'enum34; python_version < "3.4"', 'at', ';_
↳python_version < "3.4"')
```

then you may need to update your version of pip and/or setuptools:

```
sudo pip install --upgrade pip setuptools
```

## 2.5 Installing helper programs

Certain COT features require helper programs - you can install these as part of the COT installation process, or they can be installed as-needed by COT:

- COT uses [qemu-img](#) as a helper program for various operations involving the creation, inspection, and modification of hard disk image files packaged in an OVF.
- The `cot add-disk` command requires either [qemu-img](#) (version 2.1 or later) or [vmdktool](#) as a helper program when adding hard disks to an OVF.
- The `cot inject-config` command requires [mkisofs](#) (or its fork [genisoimage](#)) and/or [xorriso](#) to create ISO (CD-ROM) images for platforms that use ISOs to package the configuration.
- Similarly, for platforms using hard disks for bootstrap configuration, `cot inject-config` requires [fatdisk](#) to format hard disk images.
- The `cot deploy ... esxi` command requires [ovftool](#) to communicate with an ESXi server. If [ovftool](#) is installed, COT's automated unit tests will also make use of [ovftool](#) to perform additional verification that OVFs and OVAs created by COT align with VMware's expectations for these file types.

COT can attempt to install these tools using the appropriate package manager for your platform (i.e., [MacPorts](#) for Mac OS X, and either `apt-get` or `yum` for Linux).

**Warning:** Unfortunately, VMware requires a site login to download [ovftool](#), so if you need this tool, you will have to install it yourself. COT cannot install it for you at present.

To let COT attempt to pre-install all of the above helpers, you can optionally run:

```
cot install-helpers
```

See [here](#) for more details.

If you skip this step, then when you are running COT, and it encounters the need for a helper that has not been installed, COT will prompt you to allow it to install the helper in question.

### 3.1 Getting CLI help

#### 3.1.1 Synopsis

```
cot --help
cot --version
cot help <command>
cot <command> --help
cot <options> <command> <command-options>
```

#### 3.1.2 Description

Common OVF Tool (COT), version 2.1.0+0.gc82395e.dirty

A tool for editing Open Virtualization Format (.ovf, .ova) virtual appliances, with a focus on virtualized network appliances such as the Cisco CSR 1000V and Cisco IOS XRv platforms.

You can always get detailed help for COT by running `cot --help`, `cot <command> --help`, or `cot help <command>`.

#### 3.1.3 Options

<b>-h, --help</b>	show this help message and exit
<b>-V, --version</b>	show program's version number and exit
<b>-f, --force</b>	Perform requested actions without prompting for confirmation
<b>-q, --quiet</b>	Decrease verbosity of the program (repeatable)
<b>-v, --verbose</b>	Increase verbosity of the program (repeatable)

## Commands

**add-disk** Add a disk image to an OVF package and map it as a disk in the guest environment

**add-file** Add a file to an OVF package

**deploy** Create a new VM on the target hypervisor from the given OVF or OVA

**edit-hardware** Edit virtual machine hardware properties of an OVF

**edit-product** Edit product info in an OVF

**edit-properties** Edit or create environment properties of an OVF

**help** Print help for a command

**info** Generate a description of an OVF package

**inject-config** Inject a configuration file into an OVF package

**install-helpers** Install/verify COT manual pages and any third- party helper programs that COT may require

**remove-file** Remove a file from an OVF package

## 3.2 Verifying and installing helper programs with `cot install-helpers`

### 3.2.1 Synopsis

```
cot install-helpers --help
cot <opts> install-helpers --verify-only
cot <opts> install-helpers [--ignore-errors]
```

### 3.2.2 Description

Install or verify the installation of COT manual pages and various required third-party helper programs for COT.

- `qemu-img` (<http://www.qemu.org/>)
- `mkisofs` (<http://cdrecord.org/>)
- `ovftool` (<https://www.vmware.com/support/developer/ovf/>)
- `fatdisk` (<http://github.com/goblinhack/fatdisk>)
- `vmdktool` (<http://www.freshports.org/sysutils/vmdktool/>)

### 3.2.3 Options

- |                            |  |
|----------------------------|--|
| <b>-h, --help</b>          | show this help message and exit                                      |
| <b>--verify-only</b>       | Only verify helpers – do not attempt to install any missing helpers. |
| <b>-i, --ignore-errors</b> | Do not fail even if helper installation fails.                       |

## 3.2.4 Examples

Verify whether COT can find all expected helper programs

```
> cot install-helpers --verify-only
Results:
-----
COT manpages: present in /usr/share/man/man1/
fatdisk:      present at /opt/local/bin/fatdisk
mkisofs:      present at /opt/local/bin/mkisofs
ovftool:      present at /usr/local/bin/ovftool
qemu-img:     present at /opt/local/bin/qemu-img
vmdktool:     NOT FOUND
```

Have COT attempt to install missing helpers for you. Note that most helpers require administrator / `sudo` privileges to install. If any installation fails, COT will exit with an error, unless you pass `--ignore-errors`.

```
> cot install-helpers
(...)
Results:
-----
COT manpages: successfully installed to /usr/share/man
fatdisk:      successfully installed to /usr/local/bin/fatdisk
mkisofs:      present at /usr/bin/mkisofs
ovftool:      INSTALLATION FAILED: No support for automated
              installation of ovftool, as VMware requires a site
              login to download it. See
              https://www.vmware.com/support/developer/ovf/
qemu-img:     present at /usr/bin/qemu-img
vmdktool:     successfully installed to /usr/local/bin/vmdktool

[Errno 1] Unable to install some helpers
```

**Warning:** Unfortunately, VMware requires a site login to download `ovftool`, so if you need this tool, you will have to install it yourself. COT cannot install it for you at present.

## 3.3 Inspecting OVF contents with `cot info`

### 3.3.1 Synopsis

```
cot info --help
cot info [-b | -v] PACKAGE [PACKAGE ...]
```

### 3.3.2 Description

Show a summary of the contents of the given OVF(s) and/or OVA(s).

### 3.3.3 Options

**PACKAGE** [**PACKAGE ...**] OVF descriptor(s) and/or OVA file(s) to describe

<b>-h, --help</b>	show this help message and exit
<b>-b, --brief</b>	Brief output (shorter)
<b>-v, --verbose</b>	Verbose output (longer)

## 3.4 Updating product information with `cot edit-product`

### 3.4.1 Synopsis

```
cot edit-product --help
cot <opts> edit-product PACKAGE [-o OUTPUT] [-c PRODUCT_CLASS]
                                [-p PRODUCT] [-n VENDOR] [-v SHORT_VERSION]
                                [-V FULL_VERSION] [-u PRODUCT_URL ]
                                [-r VENDOR_URL] [-l APPLICATION_URL]
```

### 3.4.2 Description

Edit product information attributes of the given OVF or OVA

### 3.4.3 Options

**PACKAGE** OVF descriptor or OVA file to edit

- |  |  |
|--|--|
| <b>-h, --help</b>  | show this help message and exit  |
| <b>-o OUTPUT, --output OUTPUT</b>                            | Name/path of new OVF/OVA package to create instead of updating the existing OVF                      |
| <b>-c PRODUCT_CLASS, --product-class PRODUCT_CLASS</b>       | Product class, such as "com.cisco.csr1000v"  |
| <b>-p PRODUCT, --product PRODUCT</b>                         | Product name string, such as "Cisco IOS-XE"  |
| <b>-n VENDOR, --vendor VENDOR</b>                            | Vendor string, such as "Cisco Systems, Inc."   |
| <b>-v SHORT_VERSION, --version SHORT_VERSION</b>             | Software short version string, such as "15.3(4)S" or "5.2.0.01I"                                     |
| <b>-V FULL_VERSION, --full-version FULL_VERSION</b>          | Software long version string, such as "Cisco IOS-XE Software, Version 15.3(4)S"                      |
| <b>-u PRODUCT_URL, --product-url PRODUCT_URL</b>             | Product URL, such as " <a href="http://www.cisco.com/go/iosxrv">http://www.cisco.com/go/iosxrv</a> " |
| <b>-r VENDOR_URL, --vendor-url VENDOR_URL</b>                | Vendor URL, such as " <a href="http://www.cisco.com">http://www.cisco.com</a> "                      |
| <b>-l APPLICATION_URL, --application-url APPLICATION_URL</b> | Application URL, such as " <a href="https://router1:530/">https://router1:530/</a> "                 |



## 3.5 Adding disks to an OVF with `cot add-disk`

### 3.5.1 Synopsis

```
cot add-disk --help
cot <opts> add-disk DISK_IMAGE PACKAGE [-o OUTPUT] [-f FILE_ID]
                        [-t {harddisk,cdrom}] [-c {ide,sata,scsi}]
                        [-s SUBTYPE] [-a ADDRESS] [-d DESCRIPTION]
                        [-n DISKNAME]
```

### 3.5.2 Description

Add or replace a disk image in the specified OVF or OVA. If the specified disk image, controller/address, file-id, and/or instance match an existing entry in the OVF, will replace the existing disk with the provided file (prompting for confirmation if `-force` was not set); otherwise, will create a new disk entry.

### 3.5.3 Options

**DISK\_IMAGE** Disk image file to add to the package

**PACKAGE** OVF descriptor or OVA file to edit

#### General options

- h, --help** Show this help message and exit
- o OUTPUT, --output OUTPUT** Name/path of new OVF/OVA package to create instead of updating the existing OVF

#### Disk-related options

- f FILE\_ID, --file-id FILE\_ID** Disk image file ID string within the OVF package (default: use disk image filename)
- t <harddisk,cdrom>, --type <harddisk,cdrom>** Disk drive type (default: files ending in `.vmdk/.raw/.qcow2/.img` will use `harddisk` and files ending in `.iso` will use `cdrom`)

#### Controller-related options

- c <ide,sata,scsi>, --controller <ide,sata,scsi>** Disk controller type (default: determined by disk drive type and platform)
- a ADDRESS, --address ADDRESS** Address of the disk, such as `"1:0"`. Requires that `-controller` be explicitly set. (default: use first unused address on the controller)
- s SUBTYPE, --subtype SUBTYPE** Disk controller subtype such as `"virtio"`, `"lsilogic"`, or `"AHCI"`.

## Descriptive options

- d DESCRIPTION, --description DESCRIPTION** Description of this disk (optional)
- n DISKNAME, --name DISKNAME** Name of this disk (default: "Hard disk #" or "CD-ROM #" as appropriate)

## 3.6 Packaging additional files into an OVF with `cot add-file`

### 3.6.1 Synopsis

```
cot add-file --help
cot <opts> add-file FILE PACKAGE [-o OUTPUT] [-f FILE_ID]
```

### 3.6.2 Description

Add or replace a file in the given OVF. If the specified file and/or file-id match existing package contents, will replace it (prompting for confirmation if `-force` was not set); otherwise, will create a new file entry.

### 3.6.3 Options

**FILE** File to add to the package

**PACKAGE** Package, OVF descriptor or OVA file to edit

- h, --help** show this help message and exit
- o OUTPUT, --output OUTPUT** Name/path of new VM package to create instead of updating the existing package
- f FILE\_ID, --file-id FILE\_ID** File ID string within the package (default: same as filename)

## 3.7 Removing files from an OVF with `cot remove-file`

### 3.7.1 Synopsis

```
cot remove-file --help
cot <opts> remove-file [-f FILE_PATH] [-i FILE_ID] PACKAGE
                        [-o OUTPUT]
```

### 3.7.2 Description

Remove a file from the given OVF. Will prompt for confirmation unless `-force` is set.

### 3.7.3 Options

**PACKAGE** Package, OVF descriptor or OVA file to edit

## General options

- h, --help** Show this help message and exit
- o OUTPUT, --output OUTPUT** Name/path of new OVF/OVA package to create instead of updating the existing OVF

## File selection options

- f FILE\_PATH, --file-path FILE\_PATH** File name or path within the package
- i FILE\_ID, --file-id FILE\_ID** File ID string within the package

# 3.8 Customizing hardware profiles with `cot edit-hardware`

## 3.8.1 Synopsis

```
cot edit-hardware --help
cot <opts> edit-hardware PACKAGE [-o OUTPUT] -v TYPE [TYPE2 ...]
cot <opts> edit-hardware PACKAGE [-o OUTPUT]
                                [-p PROFILE [PROFILE2 ...]
                                [--delete-all-other-profiles]] [-c CPUS]
                                [-m MEMORY] [-n NICS]
                                [--nic-types TYPE [TYPE2 ...]]
                                [-N NETWORK [NETWORK2 ...]]
                                [-M MAC1 [MAC2 ...]]
                                [--nic-names NAME1 [NAME2 ...]]
                                [-s SERIAL_PORTS] [-S URI1 [URI2 ...]]
                                [--scsi-subtypes TYPE [TYPE2 ...]]
                                [--ide-subtypes TYPE [TYPE2 ...]]
```

## 3.8.2 Description

Edit hardware properties of the specified OVF or OVA

## 3.8.3 Options

**PACKAGE** OVF descriptor or OVA file to edit

## General options

- h, --help** Show this help message and exit
- o OUTPUT, --output OUTPUT** Name/path of new OVF/OVA package to create instead of updating the existing OVF
- v <TYPE...>, --virtual-system-type <TYPE...>** Change virtual system type(s) supported by this OVF/OVA package.
- p <PROFILE...>, --profiles <PROFILE...>** Make hardware changes only under the given configuration profile(s). (default: changes apply to all profiles)

**--delete-all-other-profiles** Delete all configuration profiles other than those specified with the `--profiles` option

### Computational hardware options

**-c CPUS, --cpus CPUS** Set the number of CPUs.

**-m MEMORY, --memory MEMORY** Set the amount of RAM. (Examples: "4096M", "4 GiB")

### Network interface options

**-n NICS, --nics NICS** Set the number of NICs.

**--nic-types <TYPE...>** Set the hardware type(s) for all NICs. (default: do not change existing NICs, and new NICs added will match the existing type(s).)

**--nic-names <NAME1...>** Specify a list of one or more NIC names or patterns to apply to NIC devices. See Notes.

**-N <NETWORK...>, --nic-networks <NETWORK...>** Specify a series of one or more network names or patterns to map NICs to. See Notes.

**--network-descriptions <NAME1...>** Specify a list of one or more network descriptions or patterns to apply to the networks. See Notes.

**-M <MAC1...>, --mac-addresses-list <MAC1...>** Specify a list of MAC addresses for the NICs. If N MACs are specified, the first (N-1) NICs will receive the first (N-1) MACs, and all remaining NICs will use the Nth MAC

### Serial port options

**-s SERIAL\_PORTS, --serial-ports SERIAL\_PORTS** Set the number of serial ports.

**-S <URI1...>, --serial-connectivity <URI1...>** Specify a series of connectivity strings (URIs such as "telnet://localhost:9101") to map serial ports to. If fewer URIs than serial ports are specified, the remaining ports will be unmapped.

### Disk and disk controller options

**--scsi-subtypes <TYPE...>** Set resource subtype(s) (such as "lsilogic" or "virtio") for all SCSI controllers. If an empty string is provided, any existing subtype will be removed.

**--ide-subtypes <TYPE...>** Set resource subtype(s) (such as "virtio") for all IDE controllers. If an empty string is provided, any existing subtype will be removed.

## 3.8.4 Notes

The `--nic-names`, `--nic-networks`, and `--network-descriptions` options support the use of a wildcard value to automatically generate a series of consecutively numbered strings. The syntax for the wildcard option is `'{'` followed by a number to start incrementing from, followed by `'}'`. See examples below.

### 3.8.5 Examples

Create a new profile named "1CPU-8GB" with 1 CPU and 8 gigabytes of RAM

```
cot edit-hardware csr1000v.ova --output csr1000v_custom.ova \
--profile 1CPU-4GB --cpus 1 --memory 8GB
```

Wildcard example - without caring about how many NICs are defined in the input OVA, rename all of the NICs in the output OVA as 'Ethernet0/10', 'Ethernet0/11', 'Ethernet0/12', etc., and map them to networks 'Ethernet0\_10', 'Ethernet0\_11', 'Ethernet0\_12', etc., which are described as 'Data network 1', 'Data network 2', etc.

```
cot edit-hardware input.ova -o output.ova \
--nic-names "Ethernet0/{10}" \
--nic-networks "Ethernet0_{10}" \
--network-descriptions "Data network {1}"
```

Combination of fixed and wildcarded names - rename the NICs in the output OVA as 'mgmt', 'eth0', 'eth1', 'eth2'...

```
cot edit-hardware input.ova -o output.ova --nic-names "mgmt" \
"eth{0}"
```

## 3.9 Customizing OVF environment settings with cot edit-properties

### 3.9.1 Synopsis

```
cot edit-properties --help
cot <opts> edit-properties PACKAGE
                        [-p KEY1=VALUE1 [-p KEY2=VALUE2 ...]]
                        [-l LABEL1 [-l LABEL2 ...]]
                        [-d DESC1 [-d DESC2 ...]] [-c CONFIG_FILE]
                        [-u [USER_CONFIGURABLE]]
                        [-t TRANSPORT [TRANSPORT2 ...]]
                        [-o OUTPUT]
cot <opts> edit-properties PACKAGE [-u [USER_CONFIGURABLE]]
                        [-o OUTPUT]
```

### 3.9.2 Description

Configure environment properties of the given OVF or OVA. The user may specify keys and values as command-line arguments or may provide a config-file to read from. If neither `--config-file`, `--properties`, nor `--transport` are given, the program will run interactively.

### 3.9.3 Options

**PACKAGE** OVF descriptor or OVA file to edit

#### General options

**-h, --help** Show this help message and exit

**-o OUTPUT, --output OUTPUT** Name/path of new OVF/OVA package to create instead of updating the existing OVF

### Property setting options

**-u <USER\_CONFIGURABLE>, --user-configurable <USER\_CONFIGURABLE>** Update the 'userConfigurable' flag on all edited properties to True or the given value

**-c CONFIG\_FILE, --config-file CONFIG\_FILE** Read configuration CLI from this text file and generate generic properties for each line of CLI

**-p <KEY1[=VALUE1][+TYPE1]...>, --properties <KEY1[=VALUE1][+TYPE1]...>** Update or create the given property keys. A '=' delimits the optional value to set this key to. A '+' delimits the optional type to enforce for this key. This argument may be repeated as needed to specify multiple properties to edit.

**-l <LABEL1...>, --labels <LABEL1...>** Set the label(s) for the property(s) being edited. If this option is specified, the number of properties and the number of labels *must* be equal.

**-d <DESC1...>, --descriptions <DESC1...>** Set the description(s) for the property(s) being edited. If this option is specified, the number of properties and the number of descriptions *must* be equal.

**-t <TRANSPORT...>, --transports <TRANSPORT...>** Set the transport method(s) for properties. Known values are 'iso', 'vmware', and 'ibm', or an arbitrary URI may be specified.

## 3.9.4 Examples

Add configuration from a text file and mark the resulting properties as non-user-configurable.

```
cot edit-properties input.ovf -c config.txt -u=0
```

Add/update two properties, one a string with no default value and the other a boolean defaulting to true, and mark both properties as user-configurable.

```
cot edit-properties input.ovf -p string-property+string \  
-p bool-property=true+boolean --user-configurable
```

Update the label and description of two existing properties

```
cot edit-properties input.ovf -p hostname -l "Hostname" \  
-d "Hostname of this device" -p enable-ssh -l "Enable \  
remote SSH access" -d "Enable sshd and disable telnetd"
```

## 3.10 Embedding bootstrap configuration with `cot inject-config`

### 3.10.1 Synopsis

```
cot inject-config --help  
cot <opts> inject-config PACKAGE [-o OUTPUT] [-c CONFIG_FILE]  
                                [-s SECONDARY_CONFIG_FILE]  
                                [-e EXTRA_FILE [EXTRA_FILE2 ...]]
```

### 3.10.2 Description

Add one or more "bootstrap" configuration file(s) to the given OVF or OVA. These files will be packaged into a virtual hard disk, or virtual CD-ROM, as appropriate to the target platform. Any specified primary and secondary config files will be renamed if necessary to meet expectations of the target platform, while any files provided with the `--extra-files` option will be included as-is and will not be renamed.

### 3.10.3 Options

**PACKAGE** Package, OVF descriptor or OVA file to edit

- h, --help** show this help message and exit
- o OUTPUT, --output OUTPUT** Name/path of new VM package to create instead of updating the existing package
- c CONFIG\_FILE, --config-file CONFIG\_FILE** Text file to embed as primary configuration
- s SECONDARY\_CONFIG\_FILE, --secondary-config-file SECONDARY\_CONFIG\_FILE** Text file to embed as secondary configuration (currently only used for IOS XR admin config)
- e <EXTRA\_FILE...>, --extra-files <EXTRA\_FILE...>** Additional file(s) to include as-is

## 3.11 Deploying an OVF to create a VM with `cot deploy`

### 3.11.1 Synopsis

```
cot deploy --help
cot <opts> deploy PACKAGE esxi ...
```

### 3.11.2 Description

Deploy an OVF or OVA to create a virtual machine on a specified server.

### 3.11.3 Options

**PACKAGE** OVF descriptor or OVA file

- h, --help** show this help message and exit

#### Hypervisors

**esxi** Deploy to ESXi, vSphere, or vCenter

## 3.12 Creating a VM on VMware vCenter/vSphere with `cot deploy esxi`

### 3.12.1 Synopsis

```
cot deploy PACKAGE esxi --help
cot <opts> deploy PACKAGE esxi LOCATOR [-u USERNAME] [-p PASSWORD]
                                     [-c CONFIGURATION] [-n VM_NAME] [-P]
                                     [-N OVF1=HOST1 [-N OVF2=HOST2 ...]]
                                     [-S KIND1:VAL1[,OPTS1]
                                     [-S KIND2:VAL2[,OPTS2] ...]]
                                     [-d DATASTORE] [-o=OVFTOOL_ARGS]
```

### 3.12.2 Description

Deploy OVF/OVA to ESXi/vCenter/vSphere hypervisor

### 3.12.3 Options

**LOCATOR** vSphere target locator. Examples: "192.0.2.100" (deploy directly to ESXi server), "192.0.2.101/mydatacenter/host/192.0.2.100" (deploy via vCenter server)

- h, --help** show this help message and exit
- u USERNAME, --username USERNAME** Server login username
- p PASSWORD, --password PASSWORD** Server login password
- c CONFIGURATION, --configuration CONFIGURATION** Use the specified configuration profile defined in the OVF. If unspecified and the OVF has multiple profiles, the user will be prompted or the default configuration will be used.
- n VM\_NAME, --vm-name VM\_NAME** Name to use for the VM (if applicable) and any files created. If unspecified, the name of the OVF will be used.
- P, --power-on** Power on the created VM to begin booting immediately.
- N <OVF\_NET1=HOST\_NET1...>, --network-map <OVF\_NET1=HOST\_NET1...>** Map networks named in the OVF to networks (bridges, vSwitches, etc.) in the hypervisor environment. This argument may be repeated as needed to specify multiple mappings.
- S <K1:V1[,O1]...>, --serial-connection <K1:V1[,O1]...>** Set connectivity for a serial port defined in the OVF. This argument may be repeated to specify more port connections. Each entry should be structured as 'kind:value' or 'kind:value,options'.
- d DATASTORE, --datastore DATASTORE** ESXi datastore to use for the new VM
- o OVFTOOL\_ARGS, --ovftool-args OVFTOOL\_ARGS** Quoted string describing additional CLI parameters to pass through to "ovftool". Examples: `-o="--foo"`, `-ovftool-args="--foo --bar"`



### 3.12.4 Examples

Deploy to vSphere/ESXi server 192.0.2.100 with credentials admin/admin, creating a VM named 'test\_vm' from foo.ova.

```
cot deploy foo.ova esxi 192.0.2.100 -u admin -p admin \  
-n test_vm
```

Deploy to vSphere/ESXi server 192.0.2.100, with username admin (prompting the user to input a password at runtime), creating a VM based on profile '1CPU-2.5GB' in foo.ova, and creating the serial port as a telnet server listening on port 10022 of the host

```
cot deploy foo.ova esxi 192.0.2.100 -u admin -c 1CPU-2.5GB \  
-S telnet://:10022,server
```

Deploy to vSphere server 192.0.2.1 which belongs to datacenter 'mydc' on vCenter server 192.0.2.100, and map the two NIC networks to vSwitches. Note that in this case -u specifies the vCenter login username.

```
cot deploy foo.ova esxi "192.0.2.100/mydc/host/192.0.2.1" \  
-u administrator -N "GigabitEthernet1=VM Network" \  
-N "GigabitEthernet2=myvswitch"
```

Deploy with passthrough arguments to ovftool.

```
cot deploy foo.ova esxi 192.0.2.100 -u admin -p password \  
--ovftool-args="--overwrite --acceptAllEulas"
```



**COT** Common *OVF* Tool

**controller**

**hardware controller** A virtual hardware controller for hardware such as a *disk device*. In addition to its primary type (IDE, SCSI, etc.), a controller may also have a subtype, such as `virtio` or `lsilogic`. In an *OVF* package, a controller is represented by an XML `Item` element in the `VirtualHardwareSection` of the *OVF descriptor*. Typically each *disk device* must be associated with a controller.

**disk description**

**disk element**

**disk reference** A description of a virtual disk included in a virtual machine. In an *OVF descriptor*, this is an XML `Disk` element in the `DiskSection`. This disk description may be associated with a *file reference* and/or *disk file*, or it may be a placeholder for a blank disk not yet created. Typically a disk description must be associated with a *disk drive* in order to actually be accessible by the guest OS.

**disk device**

**disk drive**

**disk item** A *hardware item* describing a virtual CD-ROM, DVD-ROM, or hard disk drive. In an *OVF* package, this is an XML `Item` element in the `VirtualHardwareSection` of the *OVF descriptor*. This item may reference a *disk reference* or a *file reference* to map a filesystem to this drive. Typically a disk drive must be associated to a *hardware controller*.

**disk file**

**disk image** A file such as a `.vmdk`, `.iso`, or `.qcow2`. May or may not be associated with a *disk drive*.

**file element**

**file reference** A reference to a file, such as a *disk file* or any other file type, to be included in a virtual machine. In an *OVF descriptor*, this is an XML `File` element in the `References` section.

**hardware element**

**hardware item** Generic term for any discrete piece of virtual machine hardware, including but not limited to the CPU(s), memory, *disk drive*, *hardware controller*, network port, etc.

**OVF** Open Virtualization Format, an open standard.

**OVF descriptor** An XML file, based on the *OVF* specification, which describes a virtual machine.

All notable changes to the COT project will be documented in this file. This project adheres to [Semantic Versioning](#).

### 5.1 2.1.0 - 2018-01-29

#### Fixed

- The `bin/cot` helper script in this repository (not the script installed when installing COT normally) has had some `$PATH` issues fixed.
- `cot add-disk ... --controller` now accepts `sata` as an additional option (#72).

### 5.2 2.0.5 - 2017-11-30

#### Fixed

- Error in previous release due to COT using a user-specified relative file path in `FileReference.create` which implicitly assumed absolute paths.
  - Now correctly fixes up the path before constructing this `FileReference`.
  - To prevent similar errors in the future, if a `FileReference` is constructed with a non-absolute path, COT will log a warning and attempt to fix the path at that point.

### 5.3 2.0.4 - 2017-11-30

#### Fixed

- COT now ensures that cloned Items have a higher `InstanceID` than the Item they were cloned from, avoiding unexpected out-of-order behavior (#70).

- COT now produces valid manifests for OVF 2.x files (which use SHA256 instead of SHA1 as in OVF 0.x and 1.x).

#### Added

- Official support for pypy3. (COT has already been usable under pypy3, but now it's actually part of our tests.)
- COT checks the manifest when loading an OVF/OVA and warns if any checksum mismatches are seen.
- `FileReference` class as superclass of `FileInTAR` and `FileOnDisk`.

#### Changed

- Refactored how man page builds are triggered so that Sphinx is no longer a mandatory pre-requisite for building COT. This helps us to avoid breaking Travis-CI tests when a new version of Sphinx comes out that doesn't support older Python versions like 3.3.
- Replaced `add_disk.guess_drive_type_from_extension` with `DiskRepresentation.predicted_drive_type`.

## 5.4 2.0.3 - 2017-04-03

#### Fixed

- Fixed issue where `UnboundLocalError` would be raised during COT's attempt to clean up after a qemu-img error occurring while trying to convert a disk to VMDK (#67).
- Fixed incorrect invocation of 'sudo mkdir' on Mac OS X.

## 5.5 2.0.2 - 2017-03-20

#### Fixed

- Path normalization of output file resulted in COT failing to detect the case of self-overwriting an OVA, resulting in file corruption (#66). Improved detection of self-overwriting cases including relative vs. absolute paths, symlinks, and hardlinks.

## 5.6 2.0.1 - 2017-03-17

#### Fixed

- One unit test case, `COT.helpers.tests.test_helper.HelperGenericTest.test_download_and_expand_tgz`, was failing after 2.0.0 was released, due to its assumptions about the contents of the master repo on GitHub no longer being valid. Fixed now.

## 5.7 2.0.0 - 2017-03-17

#### Fixed

- Fixed a case that could result in a `RuntimeError` being thrown when using `cot edit-hardware` to simultaneously create NICs and define a new configuration profile (#64).
- Update minimum QEMU version preferred for creation of streamOptimized VMDK files from 2.1.0 to 2.5.1, due to an incompatibility with VMware in VMDKs produced by versions prior to 2.5.1 (#65).

- If `vmtoolsd` is not installed, but QEMU 2.1.0-2.5.0 is, then COT will fall back to using `qemu-img`, but will warn of this potential incompatibility with ESXi.
- When `cot info` is invoked with multiple files as input, an error in loading one file will no longer cause the entire command to abort; COT will now log an error about the offending file and continue to the next.

### Added

- COT commands now check the available disk space in the temporary working directory against the temporary storage space the command estimates it will require, and if there is likely to be a problem, warns the user before continuing. (#63)
- Additionally COT commands that write out an updated OVF/OVA now check the available disk space in the requested output location against the VM's predicted output size, and if there is likely to be a problem, warns the user before continuing.
- Helper classes can now opt to cache their output to avoid repeatedly re-running the same command. Currently enabled for `qemu-img info ...` and `isoinfo ...` commands. (#62)
- New modules and APIs in support of the above:
  - `Command.working_dir_disk_space_required()` instance method, to ask a command to estimate how much temporary storage it will require. This method is now automatically called from Command unit tests to validate its accuracy.
  - `VMDescription.predicted_output_size()` instance method, to ask a VM to estimate how much disk space it will require when written out.
  - `COT.utilities` module with functions `available_bytes_at_path` and `tar_entry_size`.

### Removed

- Discontinued support for Python 2.6 as it has been retired since 2013.
- Removed `cot --debug` alias for `cot --verbose --verbose` as it is no longer correct after increased granularity of logging options, as described below.

### Changed

- With `cot edit-hardware`, the platform hardware validation is no longer a hard limit. Instead, if a value appears to be invalid, the user will be warned about the validation failure and given the option to continue or abort (#61). `cot --force ...`, as usual, can be used to auto-continue without prompting.
- More granular logging levels (thanks to [verboselogs](#); COT now requires version 1.6 of this package) and more self-consistency in message logging.
- Revised format of log messages generated by COT.
- Lots of API changes:
  - All commands ('submodules') are now grouped as a sub-package under `COT.commands`. Most classes in this package have been renamed.
  - Moved `COT.ovf` package to be a sub-package under `COT.vm_description`.
  - Moved UI and CLI classes into a `COT.ui` sub-package.
  - Moved the `to_string` function from `COT.data_validation` to `COT.utilities`.
  - Function `COT.deploy_esxi.get_object_from_connection` is now method `PyVmomiVMReconfigSpec.lookup_object`.
  - Function `COT.cli.formatter` is now class `COT.ui.cli.CLILoggingFormatter`.
  - The functionality of classes `VMContextManager` and `VMFactory` has been rolled into the core `VMDescription` class.

- COT.disks module:
  - \* Function `create_disk` is now split into class methods `DiskRepresentation.for_new_file` (creates the disk file and returns a corresponding `DiskRepresentation` instance) and `DiskRepresentation.create_file` (creates disk file only).
  - \* Function `convert_disk` is now class method `DiskRepresentation.convert_to`
  - \* Function `disk_representation_from_file` is now class method `DiskRepresentation.from_file`
  - \* The `DiskRepresentation` constructor now only takes the path to a file as input - if you want to create a new file, use `DiskRepresentation.for_new_file` instead of calling the constructor directly.
- COT.helpers module:
  - \* Static method `Helper.cp` has been renamed to `Helper.copy_file`.
- COT.ovf module:
  - \* `COT.ovf.ovf.byte_string` has been moved and renamed to `COT.utilities.pretty_bytes`.
  - \* `COT.ovf.ovf.byte_count` has been moved and renamed to `COT.vm_description.ovf.utilities.programmatic_bytes_to_int`.
  - \* `COT.ovf.ovf.factor_bytes` has been moved and renamed to `COT.vm_description.ovf.utilities.int_bytes_to_programmatic_units`.
  - \* `OVF.validate_and_update_file_references` and `OVF.validate_and_update_networks` have been moved to private functions and are no longer part of the public API of the `OVF` class.
  - \* `Hardware.update_existing_item_count_per_profile` has been moved to a private method.
- COT.platforms module:
  - \* Class `GenericPlatform` is now `Platform`.
  - \* Function `platform_from_product_class` is now class method `Platform.for_product_string` and returns an instance of a `Platform` class rather than the class object itself.
  - \* Most `Platform` APIs are now instance methods instead of class methods.
  - \* Function `COT.platforms.is_known_product_class` has been removed.

## 5.8 1.9.1 - 2017-02-21

### Changed

- Removed 32 GiB memory limitation on Cisco IOS XRv 9000 platform.

## 5.9 1.9.0 - 2017-02-13

### Added

- Support for Python 3.6



- Support for *brew* package manager (#55).
- Support for Cisco Nexus 9000v (NX-OSv 9000) platform (#60).

#### Fixed

- Improved messaging when COT is unable to install a helper program (#57).

## 5.10 1.8.2 - 2017-01-18

#### Fixed

- Issue (#58) where various multi-value CLI options for the `edit-hardware` and `inject-config` commands did not append properly.
- Issue in which explicitly specified NIC names were being overwritten by names auto-derived from network names when attempting to set both NIC name and network names in a single `cot edit-hardware` call.
- `cot edit-properties` again accepts property values containing the characters `+` and `=` (#59).

#### Added

- COT can now detect the presence of an `.ovf` file in a TAR archive even if the archive is not named `*.ova*` and even if the `.ovf` file is not the first file in the archive as specified by the OVF specification. This allows (read-only at present) handling of VirtualBox Vagrant `.box` files, which are approximately equivalent to non-standards-compliant OVAs.

## 5.11 1.8.1 - 2016-11-12

#### Fixed

- Under Python versions older than 2.7.9, explicitly require `pyOpenSSL` and `ndg-httpsclient` to avoid issues like `hostname 'people.freebsd.org' doesn't match 'wfe0.ysv.freebsd.org'` when installing `vmtoolsd`.

## 5.12 1.8.0 - 2016-11-08

#### Fixed

- `TypeError` in `find_item` method (#54).
- `cot inject-config` correctly handles OVAs with multiple empty CD-ROM drives to choose amongst (#54 also).
- Cisco CSR1000v platform now supports 8 CPUs as a valid option.

#### Added

- `cot inject-config --extra-files` parameter (#53).
- Helper class for `isoinfo` (a companion to `mkisofs`).
- Added glossary of terms to COT documentation.
- Inline documentation (docstrings) are now validated using the [PyLint docparams](#) extension.

#### Changed

- Refactored the monolithic `COT/platforms.py` file into a proper submodule.
- `create_iso()` now adds Rock Ridge extensions by default.
- Refactored `COT.helpers` into two modules - `COT.helpers` (now just for handling helper programs such as `apt-get` and `mkisofs`) and `COT.disks` (which uses the helpers to handle ISO/VMDK/QCOW2/RAW image files).
- Inline documentation (docstrings) have been converted to "Google style" for better readability in the code. Sphinx rendering of documentation (for [readthedocs.org](http://readthedocs.org), etc) now makes use of the [napoleon](#) extension to handle this style.

#### Removed

- `get_checksum()` is no longer part of the `COT.helpers` API. (It's now the method `file_checksum()` in `COT.data_validation`, where it really belonged from the start).
- `download_and_expand()` is no longer part of the `COT.helpers` public API. (It's now the static method `download_and_expand_tgz()` on class `Helper`.)

## 5.13 1.7.4 - 2016-09-21

Newer versions of Sphinx have dropped support for Python 2.6 and 3.3, so I have updated COT's installation requirements to use older Sphinx versions under these Python versions.

## 5.14 1.7.3 - 2016-09-06

#### Added

- When adding NICs to an OVF, if no `-nic-networks` are specified, `cot edit-hardware` will now try to infer sequential naming of the Network elements and if successful, offer to create additional Networks as appropriate. (#18)

## 5.15 1.7.2 - 2016-08-17

#### Fixed

- Issue #52 - `OVFItemDataError` raised when adding NICs to CSR1000V OVA, or more generally when cloning an `OVFItem` whose `ElementName` references its `Connection`.

## 5.16 1.7.1 - 2016-08-12

#### Fixed

- `cot deploy ... --serial-connection` will create additional serial ports beyond those defined in the OVF, if requested. Previously it would ask the user for confirmation but not actually do anything about it. (#51)

## 5.17 1.7.0 - 2016-08-05

### Added

- Support for Python 3.5
- Enhancements to `cot edit-properties` (#50):
  - Added `--user-configurable` option to set whether created/updated properties are marked as user-configurable in the OVF.
  - Added `--labels` and `--descriptions` options to set/update the labels and descriptions associated with properties.
  - It's now valid to set no default value for a property by omitting the `=value`, as in `-p property-with-no-value`, as well as the existing `-p property-with-empty-value=` syntax to set an empty string as the value.
  - Users can now optionally specify the property type to enforce for each property by using the delimiter `+type`, as in `-p key=1+boolean`.

### Changed

- Switched from statement coverage to branch coverage for better test analysis.
- Moved from [Coveralls](#) to [Codecov](#) for test coverage tracking, since Coveralls does not support branch coverage reporting.

### Fixed

- When `cot edit-hardware` is used to create new NICs in an OVF that previously had none, and the user does not specify any corresponding Network entries, automatically create a 'VM Network' entry, because all NICs must be mapped to Networks for a valid OVF descriptor.

## 5.18 1.6.1 - 2016-07-07

### Fixed

- `ValueMismatchError` exceptions are properly caught by the CLI wrapper so as to result in a graceful exit rather than a stack trace.
- `cot remove-file` now errors if the user specifies both `file-id` and `file-path`, one of which matches a file in the OVF, but the other does not match this or any other file.
- Better handling of exceptions and usage of `sudo` when installing helpers.
- Manual pages are now correctly included in the distribution. Oops!

## 5.19 1.6.0 - 2016-06-30

### Added

- `cot edit-product --product-class` option, to set or change the product class identifier (such as `com.cisco.csr1000v`).
- Enabled additional code quality validation with [Pylint](#), [pep8-naming](#), and [mccabe](#) (#49).

### Changed

- Lots of refactoring to reduce code complexity as measured by [Pylint](#) and [mccabe](#).

#### Fixed

- COT now recognizes `AllocationUnits` values like megabytes.
- COT no longer ignores the `AllocationUnits` value given for RAM.
- `COT.ovf.byte_string()` now properly uses binary units (KiB rather than kB, etc.)

## 5.20 1.5.2 - 2016-06-17

#### Changed

- Development requirement changes: The package [pep8](#) has been renamed to [pycodestyle](#), and [pep257](#) has been renamed to [pydocstyle](#). Updated configuration and documentation to reflect these changes. Also, [flake8-pep257](#) does not presently handle these changes, so replaced it as a dependency with the more up-to-date [flake8-docstrings](#) package.

## 5.21 1.5.1 - 2016-06-07

#### Added

- `cot edit-hardware --network-descriptions` option, to specify the descriptive string(s) associated with each network definition.

#### Fixed

- [#48](#) - NIC type not set when adding NICs to an OVF that had none before.
- When updating NIC network mapping, COT now also updates any Description that references the network mapping.

## 5.22 1.5.0 - 2016-06-06

#### Added

- [#47](#) - Added `cot remove-file` subcommand.
- [#43](#) - add `cot edit-properties --transport` option to set environment transport type(s) - iso, VMWare Tools, etc.
  - `cot info` now has a new "Environment" section that displays the transport type
- [#45](#) - support for multiple values for `--nic-types`, `--ide-subtypes`, and `--scsi-subtypes` in `cot edit-hardware`.
- COT now recognizes the Cisco IOS XRv 9000 platform identifier `com.cisco.ios-xrv9000`.
- [#21](#) - subcommand aliases (Python 3.x only):
  - `cot edit-product` aliases: `cot set-product`, `cot set-version`
  - `cot edit-properties` aliases: `cot set-properties`, `cot edit-environment`, `cot set-environment`
  - `cot info` alias: `cot describe`

- `cot inject-config alias: cot add-bootstrap`
- `cot remove-file alias: cot delete-file`

- Support for tab-completion of CLI parameters using [argcomplete](#).

#### Changed

- `cot edit-hardware` options `--nic-types`, `--ide-subtypes`, and `--scsi-subtypes` are now validated and canonicalized by COT, meaning that:
  - `cot edit-hardware --nic-type virtio-net-pci` is now a valid command and will correctly create an OVF with `ResourceSubType virtio` (not `virtio-net-pci`)
  - `cot edit-hardware --ide-subtype foobar` will now fail with an error
- `cot info` is now more self-consistent in how it displays property keys. They are now always wrapped in `< >`, whereas previously this was only sometimes the case.
- `cot info --verbose` now displays file and disk ID strings under the "Files and Disks" section.

## 5.23 1.4.2 - 2016-05-11

#### Added

- COT now supports `xorriso` as another alternative to `mkisofs` and `genisoimage`

#### Fixed

- [#42](#) - `cot deploy esxi` error handling behavior needed to be updated for [requests](#) release 2.8.
- [#44](#) - test case failure seen when running [pyVmomi](#) 6.0.0.2016.4.

#### Changed

- Installation document now recommends installation via [pip](#) rather than installing from source.
- [#40](#) - Now uses faster Docker-based infrastructure from [Travis CI](#) for CI builds/tests.

## 5.24 1.4.1 - 2015-09-02

#### Fixed

- [#41](#) - symlinks were not dereferenced when writing out to OVA.

## 5.25 1.4.0 - 2015-09-01

#### Added

- [#24](#) - `cot deploy esxi` now creates serial ports after deployment using [pyVmomi](#) library.
  - Serial port connectivity must be specified either via entries in the OVF (which can be defined using `cot edit-hardware ... -S`) or at deployment time using the new `-S / --serial-connection` parameter to `cot deploy`.
  - The syntax for serial port connectivity definition is based on that of QEMU's `--serial` CLI option.
  - Currently only "telnet", "tcp", and "device" connection types are supported.

- [#38](#) - `cot edit-product` can now set product and vendor information.
- `flake8` validation now includes [pep257](#) to validate docstring compliance to [PEP 257](#) as well.
- Added changelog file.
- Added `COT.file_reference` submodule in support of [#39](#).

#### Changed

- Split ESXi-specific logic out of `COT.deploy` module and into new `COT.deploy_esxi` module.
- UT for `COT.deploy_esxi` now requires `mock` (standard library in Python 3.x, install via `pip` on Python 2.x).

#### Fixed

- [#39](#) - avoid unnecessary file copies to save time and disk space.

## 5.26 1.3.3 - 2015-07-02

#### Fixed

- [#10](#) - When changing network mapping, delete no longer needed networks
- [#31](#) - Added `--delete-all-other-profiles` option to `cot edit-hardware`
- [#32](#) - `cot edit-hardware` network names can now use wildcards
- [#34](#) - `cot add-disk` can now be used to replace a CD-ROM drive with a hard disk, or vice versa.

## 5.27 1.3.2 - 2015-04-09

#### Fixed

- Adapt to changes to the Travis-CI testing environment.

## 5.28 1.3.1 - 2015-04-09

#### Fixed

- [#30](#) - `cot install-helpers` can now install `fatdisk` and `vmtool` under Python 3.

## 5.29 1.3.0 - 2015-03-27

#### Added

- Installation of helper programs is now provided by a `cot install-helpers` subcommand rather than a separate script.
- COT now has man pages (`man cot`, `man cot-edit-hardware`, etc.) The man pages are also installed by `cot install-helpers`.
- Improved documentation of the CLI on [readthedocs.org](#) as well.

#### Changed

- Refactored `COT.helper_tools` module into `COT.helpers` subpackage. This package has an API (`COT.helpers.api`) for the rest of COT to access it; the helper-specific logic (qemu-img, fatdisk, etc.) is split into individual helper modules that are abstracted away by the API.
- Similarly, logic from `COT.tests.helper_tools` has been refactored and enhanced under `COT.helpers.tests`.
- Renamed all test code files from "foo.py" to "test\_foo.py" to facilitate test case discovery.
- CLI help strings are dynamically rendered to ReST when docs are built, providing cleaner output for both [readthedocs.org](http://readthedocs.org) and the manpages.

#### Removed

- COT no longer supports Python 3.2.
- `cot_unittest` is no more - use `tox` or `unit2 discover` to run tests.
- As noted above, the installation script `check_and_install_helpers.py` no longer exists - this functionality is now provided by the `COT.install_helpers` module.

## 5.30 1.2.4 - 2015-03-06

#### Fixed

- [#29](#) - `cot edit-properties` interactive mode was broken in v1.2.2

## 5.31 1.2.3 - 2015-02-19

#### Fixed

- Some documentation fixes for <http://cot.readthedocs.org>

## 5.32 1.2.2 - 2015-02-19

#### Added

- Documentation built with Sphinx and available at <http://cot.readthedocs.org>

#### Changed

- CLI adapts more intelligently to terminal width (fixes [#28](#))
- Submodules now use Python properties instead of `get_value/set_value` methods.

## 5.33 1.2.1 - 2015-02-03

#### Added

- Now [PEP 8](#) compliant - passes validation by [flake8](#) code analysis.
- Very preliminary support for OVF 2.x format
- Now uses [tox](#) for easier test execution and [coverage.py](#) for code coverage analysis.
- Code coverage reporting with [Coveralls](#).

#### Changed

- Now uses `colorlog` instead of `coloredlogs` for CLI log colorization, as this fits better with COT's logging model.
- Greatly improved unit test structure and code coverage, including tests for logging.

### 5.34 1.2.0 - 2015-01-16

#### Added

- Greatly improved logging ([#26](#)). COT now defaults to logging level INFO, which provides relatively brief status updates to the user. You can also run with `--quiet` to suppress INFO messages and only log WARNING and ERROR messages, `--verbose` to see VERBOSE messages as well, or `--debug` if you want to really get into the guts of what COT is doing.
- Now integrated with [Travis CI](#) for automated builds and UT under all supported Python versions. This should greatly improve the stability of COT under less-common Python versions. ([#12](#))

#### Changed

- The CLI for `cot deploy` has been revised somewhat based on user feedback.
- A lot of restructuring of the underlying code to make things more modular and easier to test in isolation.

#### Fixed

- Various bugfixes for issues specific to Python 2.6 and 3.x - these environments should now be fully working again.

### 5.35 1.1.6 - 2015-01-05

#### Added

- Added THANKS file recognizing various non-code contributions to COT.

#### Fixed

- Bug fixes for `cot inject-config` and `cot deploy`, including issues [#19](#) and [#20](#) and a warning to users about serial ports and ESXi (issue eventually to be addressed by fixing [#24](#)).
- More graceful handling of Ctrl-C interrupt while COT is running.

### 5.36 1.1.5 - 2014-11-25

#### Fixed

- Fixed issue [#17](#) (`cot edit-hardware` adding NICs makes an OVA that vCenter regards as invalid)
- Removed several spurious WARNING messages

### 5.37 1.1.4 - 2014-11-12

#### Added



- COT can at least be installed and run under CentOS/Python2.6 now, although the automated unit tests will complain about the different XML output that 2.6 produces.

#### Changed

- Vastly improved installation workflow under Linuxes supporting `apt-get` or `yum` - included helper script can automatically install all helper programs except `ovftool`. Fixes #9.

#### Fixed

- Improved `cot deploy` handling of config profiles - fixed #5 and #15

## 5.38 1.1.3 - 2014-10-01

#### Added

- `cot edit-hardware` added `--nic-names` option for assigning names to each NIC
- `cot info` now displays NIC names.

#### Fixed

- Improved installation documentation
- Some improvements to IOS XRv OVA support

## 5.39 1.1.2 - 2014-09-24

#### Added

- Take advantage of QEMU 2.1 finally supporting the `streamOptimized` VMDK sub-format.
- Can now create new hardware items without an existing item of the same type (issue #4)

#### Changed

- Clearer documentation and logging messages (issue #8 and others)
- Now uses `versioneer` for automatic version numbering.

#### Fixed

- Fixed several Python 3 compatibility issues (issue #7 and others)

## 5.40 1.1.1 - 2014-08-19

#### Fixed

- Minor bug fixes to `cot deploy esxi`.

## 5.41 1.1.0 - 2014-07-29

#### Added

- `cot deploy esxi` subcommand by Kevin Keim (@kakeim), which uses `ovftool` to deploy an OVA to an ESXi vCenter server.

**Changed**

- Removed dependencies on `md5` / `md5sum` / `shasum` / `sha1sum` in favor of Python's `hashlib` module.
- Nicer formatting of `cot info` output

**Fixed**

- Miscellaneous fixes and code cleanup.

## **5.42 1.0.0 - 2014-06-27**

Initial public release.

Please do contribute! We only have a few simple requirements for diffs and pull requests.

- *Follow coding guidelines*
- *Add automated unit tests*
- *Update documentation*
- *Add yourself as a contributor*
- *Open a pull request*

## 6.1 Follow coding guidelines

### 6.1.1 Logging level usage

COT uses logging levels (including the additional intermediate logging levels provided by the [verboselogs](#) package) as follows:

Level	Usage guidelines	Examples
ERROR	<p>Something is definitely wrong, but COT is able to proceed, at least for the moment. COT may raise an exception at some later point due to this issue.</p> <p>If continuing is already known to be impossible, you should raise an exception now instead of logging an ERROR message.</p>	<ul style="list-style-type: none"> <li>• OVF descriptor is not following the specification.</li> <li>• User has provided invalid input, but can retry.</li> <li>• Expected data is missing.</li> <li>• Internal logic error in COT that should never be encountered.</li> </ul>
WARNING	<p>Something potentially wrong, or at least risky, happened that the user should be informed of.</p> <p>This includes cases where, due to insufficient information provided by the user, COT had to make an uncertain choice on its own (or was unable to make such a decision but is continuing nonetheless).</p>	<ul style="list-style-type: none"> <li>• COT would have prompted the user to provide input or confirm a risky operation, but has been instructed to run non-interactively.</li> <li>• COT is having to guess whether a given disk drive should be SCSI or IDE as the user didn't specify which when instructing COT to add the drive.</li> <li>• User-provided information was unused, such as providing the device type to set for a device that doesn't exist.</li> <li>• User has instructed COT to configure hardware settings that appear to be outside the supported range for the given platform.</li> </ul>
NOTICE	<p>Something noteworthy happened that is not necessarily a problem, but deserves the user's attention.</p> <p>This is the lowest logging level enabled by default, so messages generated at and above this level should be succinct and meaningful to all users.</p>	<ul style="list-style-type: none"> <li>• COT does not recognize the virtual platform described by a given OVF and so will be treating it generically.</li> <li>• COT is attempting to install a needed helper application.</li> <li>• COT is having to create parts of the OVF descriptor from scratch.</li> <li>• COT is replacing a file or disk that was previously included in this OVF with a new one.</li> </ul>
INFO	Status updates about normal operation of the software.	<ul style="list-style-type: none"> <li>• COT has successfully parsed an OVF or OVA and is ready to operate on it.</li> <li>• COT is beginning to write the updated OVF/OVA to disk.</li> </ul>
VERBOSE	Detailed information of interest to an expert or very curious user.	<ul style="list-style-type: none"> <li>• Individual task steps of editing an OVF.</li> </ul>
40		<p><b>Chapter 6. Contributing to COT</b></p> <p>COT's reasoning for making high-level decisions.</p>
DEBUG	Highly detailed information, probably only useful to a developer familiar with the code.	<ul style="list-style-type: none"> <li>• Information about temporary</li> </ul>

## 6.1.2 Coding style

We try to keep COT's code base compliant with Python coding standards including [PEP 8](#) and [PEP 257](#). We use the [flake8](#) and [Pylint](#) tools and their extension packages to verify this as part of our test automation. To run coding style analysis independently of the other test automation, you can run `tox -e flake8,pylint`, or you can install these tools and run them directly:

```
cot/$ sudo pip install --upgrade flake8
cot/$ sudo pip install --upgrade pydocstyle
cot/$ sudo pip install --upgrade flake8-docstrings
cot/$ sudo pip install --upgrade pep8-naming
cot/$ sudo pip install --upgrade mccabe
cot/$ flake8
./COT/ovf/item.py:229:1: C901 'OVFItem.value_replace_wildcards' is too complex (11)
./COT/ovf/item.py:603:1: C901 'OVFItem.generate_items' is too complex (11)
./COT/ovf/ovf.py:461:1: C901 'OVF.validate_hardware' is too complex (14)
```

```
cot/$ sudo pip install --upgrade pylint
cot/$ pylint COT
***** Module COT.ovf.item
E:331,24: Instance of 'list' has no 'split' member (no-member)
R:334,16: Redefinition of value type from list to tuple (redefined-variable-type)
R:603, 4: Too many branches (13/12) (too-many-branches)
***** Module COT.ovf.ovf
C: 1, 0: Too many lines in module (2646/2600) (too-many-lines)
R:177, 0: Too many public methods (76/74) (too-many-public-methods)
```

Fix any errors and warnings these tools report, and run again until no errors are reported.

## 6.1.3 CLI consistency

When adding or modifying CLI, keep the following guidelines in mind:

- All subcommands *must* support `-h/--help`. Never redefine `-h` to mean something other than "get help".
- All commands that modify files *must* define `-o/--output` to specify a new file to create instead of overwriting any input file. If and only if the command does not modify the input file, you may use `-o` to mean something else (e.g., `cot deploy ...` has `-o/--ovftool-args`).
- Best effort: use consistent argument names and short argument names unless there's an unavoidable conflict. Examples:
  - `cot add-file` and `cot add-disk` abbreviate `--file-id` as `-f`, but `cot remove-file` abbreviates it as `-i` because it uses `-f` to mean `--file-path`. In retrospect, using `-p` for `--file-path` would have allowed COT to be more self-consistent.
  - `cot edit-hardware` uses `-p/--profiles` to specify one or more configuration profiles to operate on. `cot deploy esxi` uses `-c/--configuration` to specify the configuration profile to deploy. In this case, this is somewhat unavoidable as `cot edit-hardware` uses `-c` to mean `--cpus` (no reasonable alternative) and `cot deploy esxi` uses `-p` to mean `--password` (likewise).
- In cases where short argument names unavoidably differ between commands, support the same set of long names if at all possible. For example, `cot edit-hardware` and `cot deploy esxi` should both support both `--profile(s)` and `--configuration(s)` as synonymous long names that can be used interchangeably to specify a configuration profile.

## 6.2 Add automated unit tests

Whether adding new functionality or fixing a bug, **please** add appropriate unit test case(s) under COT/tests/ or COT/<sub-package>/tests/ (as appropriate) to cover your changes. Your changes **must** pass all existing and new automated test cases before your code will be accepted.

You can run the COT automated tests under a single Python version by running `python ./setup.py test`.

For full testing under all supported versions as well as verifying code coverage for your tests, you should install `tox` (pip install tox) and `coverage` (pip install coverage) then run `tox` from the COT directory:

```
cot/$ tox
...
py27 runtests: commands[0] | coverage run --append setup.py test --quiet
...
py33 runtests: commands[0] | coverage run --append setup.py test --quiet
...
py34 runtests: commands[0] | coverage run --append setup.py test --quiet
...
py35 runtests: commands[0] | coverage run --append setup.py test --quiet
...
py36 runtests: commands[0] | coverage run --append setup.py test --quiet
...
pypy runtests: commands[0] | coverage run --append setup.py test --quiet
...
flake8 runtests: commands[0] | flake8
...
pylint runtests: commands[0] | pylint COT
...
docs runtests: commands[0] | sphinx-build -W -b html -d ...
...
stats runtests: commands[0] | coverage combine
stats runtests: commands[1] | coverage report -i
```

Name	Stmts	Miss	Branch	BrPart	Cover
COT/__init__.py	5	0	0	0	100%
COT/add_disk.py	168	3	66	3	97%
COT/add_file.py	45	0	12	0	100%
COT/cli.py	254	15	95	9	93%
COT/data_validation.py	124	2	44	1	98%
COT/deploy.py	154	6	62	6	94%
COT/deploy_esxi.py	196	0	68	1	99%
COT/disks/__init__.py	23	0	10	0	100%
COT/disks/disk.py	56	1	20	1	97%
...					
COT/vm_description.py	166	4	4	0	98%
COT/vm_factory.py	26	0	4	0	100%
COT/xml_file.py	121	3	54	1	98%
...					
TOTAL	5122	114	1908	105	97%

```
stats runtests: commands[2] | coverage html -i
_____ summary _____
  setup: commands succeeded
  py27: commands succeeded
  py33: commands succeeded
  py34: commands succeeded
  py35: commands succeeded
  py36: commands succeeded
```

```
pypy: commands succeeded
flake8: commands succeeded
pylint: commands succeeded
docs: commands succeeded
stats: commands succeeded
congratulations :)
```

After running `tox` you can check the code coverage details by opening `htmlcov/index.html` in a web browser.

## 6.3 Update documentation

If you add or change any COT CLI or APIs, or add or remove any external dependencies, please update the relevant documentation.

## 6.4 Add yourself as a contributor

If you haven't contributed to COT previously, be sure to add yourself as a contributor in the `COPYRIGHT.txt` file.

## 6.5 Open a pull request

COT follows Vincent Driessen's [A successful Git branching model](#). As such, please submit feature enhancement and non-critical bugfix requests to merge into the `develop` branch rather than `master`.





# CHAPTER 7

---

## Credits

---

We would like to thank:

- For evangelization, user feedback and bug reports:
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- Neil McGill, for creating and maintaining `fatdisk`
- Brian Somers, for creating and maintaining `vmdktool`

## COT package reference

The below documents describe in depth the code structure and APIs of COT. These are not generally of interest to the end users of the COT script, but are provided for reference of developers wishing to integrate the COT package directly into their code. Package implementing the Common OVF Tool.

## 8.1 Utility modules

<i>COT.data_validation</i>	Various helpers for data sanity checks.
<i>COT.file_reference</i>	Wrapper classes to abstract away differences between file sources.
<i>COT.utilities</i>	General-purpose utility functions for COT.
<i>COT.xml_file</i>	Reading, editing, and writing XML files.

### 8.1.1 COT.data\_validation module

Various helpers for data sanity checks.

#### Exceptions

<i>InvalidInputError</i>	Miscellaneous error during validation of user input.
<i>ValueMismatchError</i>	Values which were expected to be equal turned out to be not equal.
<i>ValueUnsupportedError</i>	An unsupported value was provided.
<i>ValueTooLowError</i>	A numerical input was less than the lowest supported value.
<i>ValueTooHighError</i>	A numerical input was higher than the highest supported value.

#### Functions

<code>alphanum_split</code>	Split the key into a list of [text, int, text, int, ..., text].
<code>canonicalize_helper</code>	Try to find a mapping of input to output.
<code>canonicalize_ide_subtype</code>	Try to convert the given IDE controller string to a canonical form.
<code>canonicalize_nic_subtype</code>	Try to convert the given NIC subtype string to a canonical form.
<code>canonicalize_scsi_subtype</code>	Try to convert the given SCSI controller string to a canonical form.
<code>check_for_conflict</code>	Make sure the list does not contain references to more than one object.
<code>device_address</code>	Parser helper function for device address arguments.
<code>file_checksum</code>	Get the checksum of the given file.
<code>mac_address</code>	Parser helper function for MAC address arguments.
<code>match_or_die</code>	Make sure "first" and "second" are equal or raise an error.
<code>natural_sort</code>	Sort the given list "naturally" rather than in ASCII order.
<code>no_whitespace</code>	Parser helper function for arguments not allowed to contain whitespace.
<code>non_negative_int</code>	Parser helper function for integer arguments that must be 0 or more.
<code>positive_int</code>	Parser helper function for integer arguments that must be 1 or more.
<code>validate_int</code>	Parser helper function for validating integer arguments in a range.
<code>truth_value</code>	Parser helper function for truth values like '0', 'y', or 'false'.

## Constants

<code>NIC_TYPES</code>	List of NIC type strings recognized as canonical.
------------------------	---

### **exception InvalidInputError**

Bases: `exceptions.ValueError`

Miscellaneous error during validation of user input.

### **exception ValueMismatchError**

Bases: `exceptions.ValueError`

Values which were expected to be equal turned out to be not equal.

### **exception ValueTooHighError** (*value\_type, actual\_value, expected\_value*)

Bases: `COT.data_validation.ValueUnsupportedError`

A numerical input was higher than the highest supported value.

#### **Parameters**

- **value\_type** (*str*) – descriptive string
- **actual\_value** (*int*) – invalid value that was provided
- **expected\_value** (*int*) – maximum supported value

### **exception ValueTooLowError** (*value\_type, actual\_value, expected\_value*)

Bases: `COT.data_validation.ValueUnsupportedError`

A numerical input was less than the lowest supported value.

**Parameters**

- **value\_type** (*str*) – descriptive string
- **actual\_value** (*int*) – invalid value that was provided
- **expected\_value** (*int*) – minimum supported value

**exception ValueUnsupportedError** (*value\_type, actual\_value, expected\_value*)

Bases: *COT.data\_validation.InvalidInputError*

An unsupported value was provided.

**Parameters**

- **value\_type** (*str*) – descriptive string
- **actual\_value** (*str*) – invalid value that was provided
- **expected\_value** (*object*) – expected/valid value(s) (item or list)

**\_\_init\_\_** (*value\_type, actual\_value, expected\_value*)

Create an instance of this class.

**class ValidRange** (*minimum, maximum*)

Bases: *tuple*

Simple helper class representing a range of valid values.

**maximum**

Alias for field number 1

**minimum**

Alias for field number 0

**alphanum\_split** (*key*)

Split the key into a list of [text, int, text, int, ..., text].

**Parameters** **key** (*str*) – String to split.

**Returns** *list* – List of tokens

**Examples**

```
>>> alphanum_split("hello1world27")
['hello', 1, 'world', 27, '']
>>> alphanum_split("1istheloneliestnumber")
['', 1, 'istheloneliestnumber']
```

**canonicalize\_helper** (*label, user\_input, mappings, re\_flags=0*)

Try to find a mapping of input to output.

**Parameters**

- **label** (*str*) – Label to use in any error raised
- **user\_input** (*str*) – User-provided string
- **mappings** (*list*) – List of (*expr*, *canonical*) pairs for mapping.
- **re\_flags** (*int*) – *re.IGNORECASE*, etc. if desired

**Returns** *str* – The canonical string

**Raises** *ValueUnsupportedError* – If no `expr` in mappings matches the given `user_input`.

**canonicalize\_ide\_subtype** (*subtype*)

Try to convert the given IDE controller string to a canonical form.

**Parameters** *subtype* (*str*) – User-provided string

**Returns**

*str* – The canonical string, one of:

- PIIX4
- virtio

**Raises** *ValueUnsupportedError* – If the canonical string cannot be determined

### Examples

```
>>> canonicalize_ide_subtype('VirtIO')
'virtio'
>>> canonicalize_ide_subtype('PIIX4')
'PIIX4'
>>> try:
...     canonicalize_ide_subtype('usb')
... except ValueUnsupportedError as e:
...     print(e)
Unsupported value 'usb' for IDE controller subtype...
```

**canonicalize\_nic\_subtype** (*subtype*)

Try to convert the given NIC subtype string to a canonical form.

**Parameters** *subtype* (*str*) – User-provided string

**Returns** *str* – The canonical string, one of *NIC\_TYPES*

**Raises** *ValueUnsupportedError* – If the canonical string cannot be determined

### Examples

```
>>> canonicalize_nic_subtype('e1000')
'E1000'
>>> canonicalize_nic_subtype('vmxnet 3')
'VMXNET3'
>>> try:
...     canonicalize_nic_subtype('foobar')
... except ValueUnsupportedError as e:
...     print(e)
Unsupported value 'foobar' for NIC subtype ...
```

**See also:**

`COT.platforms.Platform.validate_nic_type()`

**canonicalize\_scsi\_subtype** (*subtype*)

Try to convert the given SCSI controller string to a canonical form.

**Parameters** *subtype* (*str*) – User-provided string

**Returns**

*str* – The canonical string, one of:

- buslogic
- lsilogic
- lsilogicsas
- virtio
- VirtualSCSI

**Raises** *ValueUnsupportedError* – If the canonical string cannot be determined

**Examples**

```
>>> canonicalize_scsi_subtype('LSI Logic')
'lsilogic'
>>> canonicalize_scsi_subtype('VirtIO')
'virtio'
>>> try:
...     canonicalize_scsi_subtype('baz')
... except ValueUnsupportedError as e:
...     print(e)
Unsupported value 'baz' for SCSI controller subtype...
```

**check\_for\_conflict** (*label*, *refs*)

Make sure the list does not contain references to more than one object.

**Parameters**

- **label** (*str*) – Descriptive label to be used if an error is raised
- **refs** (*list*) – List of object references (which may include None)

**Raises** *ValueMismatchError* – if references differ

**Returns** *object* – the object or None

**Examples**

```
>>> check_for_conflict("example", ['foo', None, 'foo'])
'foo'
>>> try:
...     check_for_conflict("conflict", [None, 'foo', 'bar'])
... except ValueMismatchError as e:
...     print(e)
Found multiple candidates for the conflict:
foo
...and...
bar
Please correct or clarify your search parameters.
```

**device\_address** (*string*)

Parser helper function for device address arguments.

Validate string is an appropriately formed device address such as '1:0'.

**Parameters** `string (str)` – String to validate

**Raises** `InvalidInputError` – if string is not a well-formatted device address

**Returns** `str` – Validated string (with leading/trailing whitespace stripped)

## Examples

```
>>> device_address(" 1:0\n")
'1:0'
>>> try:
...     device_address("1:0:1")
... except InvalidInputError as e:
...     print(e)
'1:0:1' is not a valid device address
```

**file\_checksum** (`path_or_obj`, `checksum_type`)

Get the checksum of the given file.

### Parameters

- **path\_or\_obj** (`str`) – File path to checksum OR an opened file object
- **checksum\_type** (`str`) – Supported values are 'md5', 'sha1', 'sha256'.

**Returns** `str` – Hexadecimal file checksum

**mac\_address** (`string`)

Parser helper function for MAC address arguments.

Validate whether a string is a valid MAC address. Recognized formats are:

- XX:XX:XX:XX:XX:XX
- XX-XX-XX-XX-XX-XX
- XXXX.XXXX.XXXX

**Parameters** `string (str)` – String to validate

**Raises** `InvalidInputError` – if string is not a valid MAC address

**Returns** `str` – Validated string (with leading/trailing whitespace stripped)

**match\_or\_die** (`first_label`, `first`, `second_label`, `second`)

Make sure "first" and "second" are equal or raise an error.

### Parameters

- **first\_label** (`str`) – Descriptive label for first
- **first** (`object`) – First object to compare
- **second\_label** (`str`) – Descriptive label for second
- **second** (`object`) – Second object to compare

**Raises** `ValueMismatchError` – if `first != second`



## Examples

```
>>> try:
...     match_or_die("old", 1, "new", 2)
... except ValueError as e:
...     print(e)
old 1 does not match new 2
```

### **natural\_sort** (*iterable*)

Sort the given list "naturally" rather than in ASCII order.

E.g, "10" comes after "9" rather than between "1" and "2".

See also [http://nedbatchelder.com/blog/200712/human\\_sorting.html](http://nedbatchelder.com/blog/200712/human_sorting.html)

**Parameters** *iterable* (*list*) – List to sort

**Returns** *list* – Sorted list

## Examples

```
>>> natural_sort(["Eth3", "Eth1", "Eth10", "Eth2"])
['Eth1', 'Eth2', 'Eth3', 'Eth10']
>>> natural_sort(["3rd", "1st", "10th", "101st"])
['1st', '3rd', '10th', '101st']
```

### **no\_whitespace** (*string*)

Parser helper function for arguments not allowed to contain whitespace.

**Parameters** *string* (*str*) – String to validate

**Raises** *InvalidInputError* – if string contains internal whitespace

**Returns** *str* – Validated string (with leading/trailing whitespace stripped)

## Examples

```
>>> no_whitespace("    hello    ")
'hello'
>>> try:
...     no_whitespace('hello world')
... except InvalidInputError as e:
...     print(e)
'hello world' contains invalid whitespace
```

### **non\_negative\_int** (*string*, *label=None*)

Parser helper function for integer arguments that must be 0 or more.

Alias for *validate\_int()* setting minimum to 0.

**Parameters**

- **string** (*str*) – String to validate.
- **label** (*str*) – Label to include in any errors raised

**Returns** *int* – Validated integer value

**Raises**

- *ValueUnsupportedError* – if string can't be converted to int
- *ValueTooLowError* – if value is less than 0

### Examples

```
>>> non_negative_int('0')
0
>>> non_negative_int('1000')
1000
>>> try:
...     non_negative_int('-1')
... except ValueTooLowError as e:
...     print(e)
Value '-1' for input is too low - must be at least 0
```

**positive\_int** (*string*, *label=None*)

Parser helper function for integer arguments that must be 1 or more.

Alias for *validate\_int()* setting minimum to 1.

#### Parameters

- **string** (*str*) – String to validate.
- **label** (*str*) – Label to include in any errors raised

**Returns** *int* – Validated integer value

#### Raises

- *ValueUnsupportedError* – if string can't be converted to int
- *ValueTooLowError* – if value is less than 1

### Examples

```
>>> positive_int('1')
1
>>> try:
...     positive_int('0')
... except ValueTooLowError as e:
...     print(e)
Value '0' for input is too low - must be at least 1
```

**truth\_value** (*value*)

Parser helper function for truth values like '0', 'y', or 'false'.

Makes use of *distutils.util strtobool()*, but returns True/False rather than 1/0.

**Parameters** **value** (*str*) – String to parse/validate

**Returns** *bool* – True or False

**Raises** *ValueUnsupportedError* – if the value can't be parsed to a boolean.

## Examples

```
>>> truth_value('y')
True
>>> truth_value('false')
False
>>> truth_value(True)
True
>>> try:
...     truth_value('foo')
... except ValueError as e:
...     print(e)
Unsupported value 'foo' for truth value - expected ['y', ...
```

**validate\_int** (*string*, *minimum=None*, *maximum=None*, *label=None*)

Parser helper function for validating integer arguments in a range.

### Parameters

- **string** (*str*) – String to convert to an integer and validate
- **minimum** (*int*) – Minimum valid value (optional)
- **maximum** (*int*) – Maximum valid value (optional)
- **label** (*str*) – Label to include in any errors raised

**Returns** *int* – Validated integer value

### Raises

- *ValueUnsupportedError* – if string can't be converted to int
- *ValueTooLowError* – if value is less than minimum
- *ValueTooHighError* – if value is more than maximum

## Examples

```
>>> validate_int('1')
1
>>> try:
...     validate_int('foo', label='x')
... except ValueError as e:
...     print(e)
Unsupported value 'foo' for x - expected integer
>>> try:
...     validate_int('100', label='x', maximum=10)
... except ValueError as e:
...     print(e)
Value '100' for x is too high - must be at most 10
```

**NIC\_TYPES** = ['E1000e', 'E1000', 'PCNet32', 'virtio', 'VMXNET3']

List of NIC type strings recognized as canonical.

## 8.1.2 COT.file\_reference module

Wrapper classes to abstract away differences between file sources.

## Classes

<code>FileReference</code>	Semi-abstract base class for file references.
<code>FileOnDisk</code>	Wrapper for a 'real' file on disk.
<code>FileInTAR</code>	Wrapper for a file inside a TAR archive or OVA.

**class** `FileInTAR` (*tarfile\_path*, *filename*, **\*\*kwargs**)

Bases: `COT.file_reference.FileReference`

Wrapper for a file inside a TAR archive or OVA.

**\_\_init\_\_** (*tarfile\_path*, *filename*, **\*\*kwargs**)

Create a reference to a file contained in a TAR archive.

### Parameters

- **tarfile\_path** (*str*) – Path to TAR archive to read
- **filename** (*str*) – File name in the TAR archive.
- **\*\*kwargs** – Passed through to `FileReference.__init__()`.

**Raises** `IOError` – if *tarfile\_path* doesn't reference a TAR file, or the TAR file does not contain *filename*.

**add\_to\_archive** (*tarf*)

Copy this file into the given tarfile object.

**Parameters** **tarf** (*tarfile.TarFile*) – Add this file to that archive.

**copy\_to** (*dest\_dir*)

Extract this file to the given destination directory.

**Parameters** **dest\_dir** (*str*) – Destination directory or filename.

**open** (*\*args*, **\*\*kws**)

Open the TAR and return a reference to the relevant file object.

**Parameters** **mode** (*str*) – Only 'r' and 'rb' modes are supported.

**Yields** *file* – File object

**Raises** `ValueError` – if mode is not valid.

**exists**

True if the file exists in the TAR archive, else False.

**size**

The size of this file in bytes.

**class** `FileOnDisk` (*container\_path*, *filename*, *checksum\_algorithm=None*, *expected\_checksum=None*, *expected\_size=None*)

Bases: `COT.file_reference.FileReference`

Wrapper for a 'real' file on disk.

**add\_to\_archive** (*tarf*)

Copy this file into the given tarfile object.

**Parameters** **tarf** (*tarfile.TarFile*) – Add this file to that archive.

**copy\_to** (*dest\_dir*)

Copy this file to the given destination directory.

**Parameters** **dest\_dir** (*str*) – Destination directory or filename.

**open** (\*args, \*\*kws)

Open the file and return a reference to the file object.

**Parameters** *mode* (*str*) – Mode such as 'r', 'w', 'a', 'w+', etc.

**Yields** *file* – File object

**exists**

True if the file exists on disk, else False.

**file\_path**

Directory + filename.

**size**

The size of this file, in bytes.

**class FileReference** (*container\_path*, *filename*, *checksum\_algorithm=None*, *expected\_checksum=None*, *expected\_size=None*)

Bases: `object`

Semi-abstract base class for file references.

**\_\_init\_\_** (*container\_path*, *filename*, *checksum\_algorithm=None*, *expected\_checksum=None*, *expected\_size=None*)

Common initialization and validation logic.

**Parameters**

- **container\_path** (*str*) – Path to container (directory, TAR file, etc.)
- **filename** (*str*) – Relative path within the container to the file itself
- **checksum\_algorithm** (*str*) – 'sha1', 'sha256', etc.
- **expected\_checksum** (*str*) – Expected checksum of the file, if any.
- **expected\_size** (*int*) – Expected size of the file, in bytes, if any.

**Raises** `IOError` – if the file does not actually exist or is not readable.

**classmethod create** (*container\_path*, *filename*, \*\*kwargs)

Create a reference to a file in a container of some sort.

**Parameters**

- **container\_path** (*str*) – Absolute path to a container such as a directory or a TAR file.
- **filename** (*str*) – Name of file within the container in question.
- **\*\*kwargs** – See :meth:\_\_init\_\_()

**Returns** *FileReference* – instance of appropriate subclass

**open** (\*args, \*\*kws)

Open the file and yield a reference to the file object.

Automatically closes the file when done. Some subclasses may not support all modes.

**Parameters** *mode* (*str*) – Mode such as 'r', 'w', 'a', 'w+', etc.

**Yields** *file* – File object

**refresh** ()

Make sure all information in this reference is still valid.

**checksum**

Checksum of the referenced file.

**exists**

Report whether this file actually exists.

**file\_path**

Actual path to a real file, if any.

**size**

Size of the referenced file, in bytes.

### 8.1.3 COT.utilities module

General-purpose utility functions for COT.

**Functions**

<code>available_bytes_at_path</code>	Get the available disk space in a given directory.
<code>directory_size</code>	Total bytes consumed by the contents of a directory.
<code>pretty_bytes</code>	Pretty-print the given bytes value.
<code>tar_entry_size</code>	The space a file of the given size will actually require in a TAR file.
<code>to_string</code>	Get string representation of an object, special-case for XML Element.

**available\_bytes\_at\_path** (*path*)

Get the available disk space in a given directory.

**Parameters** **path** (*str*) – Directory path to check.

**Returns** *int* – Available space, in bytes

**Raises** `OSError` – if the specified path does not exist or is not readable.

**directory\_size** (*path*)

Total bytes consumed by the contents of a directory.

**Parameters** **path** (*str*) – Directory path

**Returns** *int* – Total bytes consumed by files in this directory.

**Raises** `OSError` – if the specified path does not exist or is not a directory.

**pretty\_bytes** (*byte\_value*, *base\_shift=0*)

Pretty-print the given bytes value.

**Parameters**

- **byte\_value** (*float*) – Value
- **base\_shift** (*int*) – Base value of byte\_value (0 = bytes, 1 = KiB, 2 = MiB, etc.)

**Returns** *str* – Pretty-printed byte string such as "1.00 GiB"

#### Examples

```
>>> pretty_bytes(512)
'512 B'
>>> pretty_bytes(512, 2)
'512 MiB'
>>> pretty_bytes(65536, 2)
```

```
'64 GiB'
>>> pretty_bytes(65547)
'64.01 KiB'
>>> pretty_bytes(65530, 3)
'63.99 TiB'
>>> pretty_bytes(1023850)
'999.9 KiB'
>>> pretty_bytes(1024000)
'1000 KiB'
>>> pretty_bytes(1048575)
'1024 KiB'
>>> pretty_bytes(1049200)
'1.001 MiB'
>>> pretty_bytes(2560)
'2.5 KiB'
>>> pretty_bytes(.0001, 3)
'104.9 KiB'
>>> pretty_bytes(.01, 1)
'10 B'
>>> pretty_bytes(.001, 1)
'1 B'
>>> pretty_bytes(.0001, 1)
'0 B'
>>> pretty_bytes(100, -1)
Traceback (most recent call last):
...
ValueError: base_shift must not be negative
```

### **tar\_entry\_size** (*filesize*)

The space a file of the given size will actually require in a TAR file.

The entry has a 512-byte header followed by the actual file data, padded to a multiple of 512 bytes if necessary.

**Parameters** **filesize** (*int*) – File size in bytes

**Returns** *int* – Bytes consumed in a TAR archive by this file.

### Examples

```
>>> tar_entry_size(1)
1024
>>> tar_entry_size(511)
1024
>>> tar_entry_size(512)
1024
>>> tar_entry_size(513)
1536
```

### **to\_string** (*obj*)

Get string representation of an object, special-case for XML Element.

**Parameters** **obj** (*object*) – Object to represent as a string.

**Returns** *str* – string representation

## Examples

```
>>> to_string("Hello")
'Hello'
>>> to_string(27.5)
'27.5'
>>> e = ET.Element('hello', attrib={'key': 'value'})
>>> print(e)
<Element ...hello... at ...>
>>> print(to_string(e))
<hello key="value" />
```

### 8.1.4 COT.xml\_file module

Reading, editing, and writing XML files.

**class XML** (*xml\_file*)

Bases: `object`

Class capable of reading, editing, and writing XML files.

**\_\_init\_\_** (*xml\_file*)

Read the given XML file and store it in memory.

The memory representation is available as properties *tree* and *root*.

**Parameters** *xml\_file* (*str*) – File path to read.

**Raises** `xml.etree.ElementTree.ParseError` – if parsing fails

**classmethod add\_child** (*parent*, *new\_child*, *ordering=None*, *known\_namespaces=None*)

Add the given child element under the given parent element.

**Parameters**

- **parent** (`xml.etree.ElementTree.Element`) – Parent element
- **new\_child** (`xml.etree.ElementTree.Element`) – Child element to attach
- **ordering** (*list*) – (Optional) List describing the expected ordering of child tags under the parent; if a new child element is created, its placement under the parent will respect this sequence.
- **known\_namespaces** (*list*) – (Optional) List of well-understood XML namespaces. If a new child is created, and *ordering* is given, any tag (new or existing) that is encountered but not accounted for in *ordering* will result in COT logging a warning **if and only if** the unaccounted-for tag is in a known namespace.

**classmethod find\_all\_children** (*parent*, *tag*, *attrib=None*)

Find all matching child elements under the specified parent element.

**Parameters**

- **parent** (`xml.etree.ElementTree.Element`) – Parent element
- **tag** (*iterable*) – Child tag string (or list of tags) to match on
- **attrib** (*dict*) – Child attributes to match on

**Returns** *list* – (Possibly empty) list of matching child Elements



**classmethod** `find_child` (*parent*, *tag*, *attrib=None*, *required=False*)

Find the unique child element under the specified parent element.

**Parameters**

- **parent** (*xml.etree.ElementTree.Element*) – Parent element
- **tag** (*str*) – Child tag to match on
- **attrib** (*dict*) – Child attributes to match on
- **required** (*boolean*) – Whether to raise an error if no child exists

**Raises**

- `LookupError` – if more than one matching child is found
- `KeyError` – if no matching child is found and `required` is `True`

**Returns** *xml.etree.ElementTree.Element* – Child element found, or `None`

**static** `get_ns` (*text*)

Get the namespace prefix from an XML element or attribute name.

**Parameters** **text** (*str*) – Element name or attribute name, such as "`{http://schemas.dmtf.org/ovf/envelope/1}Element`".

**Returns** *str* – "" if no prefix is present, or a namespace prefix, such as "`http://schemas.dmtf.org/ovf/envelope/1`".

**classmethod** `set_or_make_child` (*parent*, *tag*, *text=None*, *attrib=None*, *ordering=None*, *known\_namespaces=None*)

Update or create a child element under the specified parent element.

**Parameters**

- **parent** (*xml.etree.ElementTree.Element*) – Parent element
- **tag** (*str*) – Child element text tag to find or create
- **text** (*str*) – Value to set the child's text attribute to
- **attrib** (*dict*) – Dict of child attributes to match on while searching and set in the final child element
- **ordering** (*list*) – See `add_child()`
- **known\_namespaces** (*list*) – See `add_child()`

**Returns** *xml.etree.ElementTree.Element* – New or updated child Element.

**static** `strip_ns` (*text*)

Remove a namespace prefix from an XML element or attribute name.

**Parameters** **text** (*str*) – Element name or attribute name, such as "`{http://schemas.dmtf.org/ovf/envelope/1}Element`".

**Returns** *str* – Bare name, such as "Element".

**write\_xml** (*xml\_file*)

Write pretty XML out to the given file.

**Parameters** **xml\_file** (*str*) – Filename to write to

**static** `xml_reindent` (*parent*, *depth=0*)

Recursively add indentation to XML to make it look nice.

**Parameters**

- **parent** (*xml.etree.ElementTree.Element*) – Current parent element
- **depth** (*int*) – How far down the rabbit hole we have recursed. Increments by 2 for each successive level of nesting.

**root = None**

Root `xml.etree.ElementTree.Element` instance of the tree.

**tree = None**

`xml.etree.ElementTree.ElementTree` describing this file.

## 8.2 Sub-packages

<i>COT.commands</i>	Package describing various operations COT can perform on a VM description.
<i>COT.disks</i>	Package for handling various disk file types (VMDK, ISO, QCOW2, etc.).
<i>COT.helpers</i>	Provides a common interface for interacting with various non-Python programs.
<i>COT.platforms</i>	Package for identifying guest platforms and handling platform differences.
<i>COT.ui</i>	Package providing common API for the COT user interface (UI) of whatever type.
<i>COT.vm_description</i>	Support for various virtual machine description formats (OVF, OVA, etc.).

### 8.2.1 COT.commands module

Package describing various operations COT can perform on a VM description.

#### API

<i>Command</i>	Abstract interface for COT commands.
<i>ReadCommand</i>	Command, such as 'deploy', that reads from a VM file to create its vm.
<i>ReadWriteCommand</i>	Command that reads from and writes to a VM description.

#### Command modules

<i>COT.commands.add_disk</i>	Module for adding disks to VMs.
<i>COT.commands.add_file</i>	Module for adding files to VM definitions.
<i>COT.commands.deploy</i>	Module for deploying VM descriptions to a hypervisor to instantiate VMs.
<i>COT.commands.deploy_esxi</i>	Module for deploying VMs to ESXi, vCenter, and vSphere.
<i>COT.commands.edit_hardware</i>	Module for editing hardware details of a VM.
<i>COT.commands.edit_product</i>	Module for editing product information in a VM description.
<i>COT.commands.edit_properties</i>	Module for managing VM environment configuration properties.

Continued on next page

Table 8.9 – continued from previous page

<code>COT.commands.help</code>	Provide 'help' keyword for COT CLI.
<code>COT.commands.info</code>	Implements "info" subcommand.
<code>COT.commands.inject_config</code>	Implements "inject-config" command.
<code>COT.commands.install_helpers</code>	Implements "install-helpers" command.
<code>COT.commands.remove_file</code>	Module for removing files from VM definitions.

**COT.commands.add\_disk module**

Module for adding disks to VMs.

**Functions**

<code>add_disk_worker</code>	Worker function for actually adding the disk.
<code>confirm_elements</code>	Get user confirmation of any risky or unusual operations.
<code>guess_controller_type</code>	If a controller type wasn't specified, try to guess from context.
<code>search_for_elements</code>	Search for a unique set of objects based on the given criteria.
<code>validate_elements</code>	Validate any existing file, disk, controller item, and disk item.
<code>validate_controller_address</code>	Check validity of the given address string for the given controller.

**Classes**

<code>COTAddDisk</code>	Add or replace a disk in a virtual machine.
-------------------------	---

**class COTAddDisk (ui)**

Bases: `COT.commands.command.ReadWriteCommand`

Add or replace a disk in a virtual machine.

Inherited attributes: `ui`, `package`, `output`

Attributes: `disk_image`, `drive_type`, `file_id`, `controller`, `subtype`, `address`, `diskname`, `description`

**\_\_init\_\_ (ui)**

Instantiate this command with the given UI.

**Parameters** `ui` (UI) – User interface instance.

**create\_subparser ()**

Create 'add-disk' CLI subparser.

**ready\_to\_run ()**

Check whether the module is ready to `run ()`.

**Returns** `tuple` – (True, `ready_message`) or (False, `reason_why_not`)

**run ()**

Do the actual work of this command.

**Raises** `InvalidInputError` – if `ready_to_run ()` reports False

**address**

Disk device address on controller (1 -- 0, etc.).

**Raises** `InvalidInputError` – see `validate_controller_address()`

**controller**

Disk controller type (`ide`, `sata`, `scsi`).

**Raises** `InvalidInputError` – see `validate_controller_address()`

**description = None**

Description of the disk.

**disk\_image**

Disk image file to add to the VM.

**Raises** `InvalidInputError` – if the file does not exist.

**diskname = None**

Name string for the disk.

**drive\_type = None**

Disk drive type ('harddisk' or 'cdrom').

**file\_id = None**

File identifier to map disk to file.

**subtype = None**

Controller subtype, such as "virtio".

**add\_disk\_worker** (*vm*, *ui*, *disk\_image*, *drive\_type=None*, *file\_id=None*, *controller=None*, *subtype=None*,  
*address=None*, *diskname=None*, *description=None*)

Worker function for actually adding the disk.

All parameters except *vm*, *ui*, and *disk\_image* are optional and will be automatically determined by COT if unspecified.

**Parameters**

- **vm** (`VMDescription`) – The virtual machine being edited.
- **ui** (`UI`) – User interface in effect.
- **disk\_image** (`DiskRepresentation`) – Disk image to add to the VM.
- **drive\_type** (`str`) – Disk drive type: 'cdrom' or 'harddisk'. If not specified, will be derived automatically from the *disk\_image* file name extension.
- **file\_id** (`str`) – Identifier of the disk file in the VM. If not specified, the VM will automatically derive an appropriate value.
- **controller** (`str`) – Disk controller type: "ide" or "sata" or "scsi". If not specified, will be derived from the *type* and the *platform* of the given *vm*.
- **subtype** (`str`) – Controller subtype ('virtio', 'lsilogic', etc.)
- **address** (`str`) – Disk device address on its controller (such as '1:0'). If this matches an existing disk device, that device will be overwritten. If not specified, the first available address not already occupied by an existing device will be selected.
- **diskname** (`str`) – Name for disk device
- **description** (`str`) – Description of disk device

**confirm\_elements** (*vm*, *ui*, *file\_obj*, *disk\_image*, *disk\_obj*, *disk\_item*, *drive\_type*, *controller*, *ctrl\_item*,  
*subtype*)

Get user confirmation of any risky or unusual operations.

**Parameters**

- **vm** (*VMDescription*) – Virtual machine object
- **ui** (*UI*) – User interface object
- **file\_obj** (*object*) – Known file object
- **disk\_image** (*str*) – Filename or path for disk file
- **disk\_obj** (*object*) – Known disk object
- **disk\_item** (*object*) – Known disk device object
- **drive\_type** (*str*) – "harddisk" or "cdrom"
- **controller** (*str*) – Controller type ("ide", "sata", or "scsi")
- **ctrl\_item** (*object*) – Known controller device object
- **subtype** (*str*) – Controller subtype (such as "virtio")

**guess\_controller\_type** (*platform, ctrl\_item, drive\_type*)

If a controller type wasn't specified, try to guess from context.

#### Parameters

- **platform** (*Platform*) – Platform instance to guess controller for
- **ctrl\_item** (*object*) – Any known controller object, or None
- **drive\_type** (*str*) – "cdrom" or "harddisk"

**Returns** *str* – 'ide', 'sata', or 'scsi'

**Raises** `ValueUnsupportedError` – if `ctrl_item` is not None but is also not an IDE, SATA, or SCSI controller device.

## Examples

```
>>> from COT.platforms import Platform
>>> guess_controller_type(Platform(), None, 'harddisk')
'ide'
```

**search\_for\_elements** (*vm, disk\_file, file\_id, controller, address*)

Search for a unique set of objects based on the given criteria.

A disk is defined by up to four different sections in the OVF:

- File (references the actual disk image file)
- Disk (references the File, only used for HD not CD-ROM)
- Item (defines the SCSI/IDE controller)
- Item (defines the disk drive, links to controller and File or Disk)

For each of these four sections, we need to know whether to add a new one or overwrite an existing one. Depending on the user arguments, we can do this by as many as three different approaches:

1. Check whether the DISK\_IMAGE file name matches an existing File in the OVF (and from there, find the associated Disk and Items)
2. Check whether the file-id matches an existing File and/or Disk in the OVF (and from there, find the associated Items)

3. Check whether controller type and/or device address match existing Items in the OVF (and from there, find the associated Disk and/or File)

Where it gets extra fun is if the user has specified more than one of the above arguments - in which case we need to make sure that all relevant approaches agree on what sections we're talking about...

#### Parameters

- **vm** (*VMDescription*) – Virtual machine object
- **disk\_file** (*str*) – Disk file name or path
- **file\_id** (*str*) – File identifier
- **controller** (*str*) – controller type – "ide", "sata", or "scsi"
- **address** (*str*) – device address, such as "1:0"

**Raises** `ValueMismatchError` – if the criteria select a non-unique set.

**Returns** *tuple* – (file\_object, disk\_object, controller\_item, disk\_item)

**validate\_controller\_address** (*controller, address*)

Check validity of the given address string for the given controller.

Helper method for the controller/address setters.

#### Parameters

- **controller** (*str*) – "ide", "sata", or "scsi"
- **address** (*str*) – A string like '0:0' or '2:10'

**Raises** `InvalidInputError` – if the address/controller combo is invalid.

### Examples

```
>>> validate_controller_address("ide", "0:0")
>>> try:
...     validate_controller_address("ide", "1:3")
... except InvalidInputError as e:
...     print(e)
IDE disk address must be between 0:0 and 1:1
>>> validate_controller_address("scsi", "1:3")
>>> try:
...     validate_controller_address("scsi", "4:0")
... except InvalidInputError as e:
...     print(e)
SCSI disk address must be between 0:0 and 3:15
>>> validate_controller_address("sata", "0:0")
>>> validate_controller_address("sata", "1:3")
```

**validate\_elements** (*vm, file\_obj, disk\_obj, disk\_item, ctrl\_item, file\_id, ctrl\_type*)

Validate any existing file, disk, controller item, and disk item.

**Raises** `ValueMismatchError` – if the search criteria select a non-unique set.

#### Parameters

- **vm** (*VMDescription*) – Virtual machine object
- **file\_obj** (*object*) – Known file object
- **disk\_obj** (*object*) – Known disk object

- **disk\_item**(*object*) – Known disk device object
- **ctrl\_item**(*object*) – Known controller device object
- **file\_id**(*str*) – File identifier string
- **ctrl\_type**(*str*) – Controller type ("ide", "sata", or "scsi")

### COT.commands.add\_file module

Module for adding files to VM definitions.

---

<i>COTAddFile</i> ( <i>ui</i> )	Add a file (such as a README) to the package.
---------------------------------	---

---

#### class COTAddFile(*ui*)

Bases: COT.commands.command.ReadWriteCommand

Add a file (such as a README) to the package.

Inherited attributes: *ui*, *package*, *output*

Attributes: *file*, *file\_id*

**\_\_init\_\_**(*ui*)

Instantiate this command with the given UI.

**Parameters** *ui* (UI) – User interface instance.

**create\_subparser**()

Create 'add-file' CLI subparser.

**ready\_to\_run**()

Check whether the module is ready to *run*().

**Returns** *tuple* – (True, *ready\_message*) or (False, *reason\_why\_not*)

**run**()

Do the actual work of this command.

**Raises** *InvalidInputError* – if *ready\_to\_run*() reports False

**file**

File to be added to the package.

**Raises** *InvalidInputError* – if the file does not exist.

**file\_id** = None

File identifier string.

### COT.commands.deploy module

Module for deploying VM descriptions to a hypervisor to instantiate VMs.

#### Classes

---

<i>COTDeploy</i>	Semi-abstract class for commands used to deploy a VM to a hypervisor.
<i>SerialConnection</i>	Generic class defining a serial port connection.

---

**class COTDeploy (ui)**

Bases: `COT.commands.command.ReadCommand`

Semi-abstract class for commands used to deploy a VM to a hypervisor.

Provides some baseline parameters and input validation that are expected to be common across all concrete subclasses.

Inherited attributes: `ui`, `package`,

Attributes: `generic_parser`, `parser`, `subparsers`, `hypervisor`, `configuration`, `username`, `password`, `power_on`, `vm_name`, `network_map`

**\_\_init\_\_ (ui)**

Instantiate this command with the given UI.

**Parameters** `ui` (`UI`) – User interface instance.

**create\_subparser ()**

Create 'deploy' CLI subparser if it doesn't already exist.

---

**Note:** Unlike most commands, this one has subparsers of its own - 'cot deploy PACKAGE <hypervisor>' so subclasses of this module should call `super().create_subparser()` (to create the main 'deploy' subparser if it doesn't already exist) then call `self.ui.add_parser(..., parent=self.subparsers, ...)` to add their own sub-subparser.

---

**ready\_to\_run ()**

Check whether the module is ready to `run()`.

**Returns** `tuple` – (True, `ready_message`) or (False, `reason_why_not`)

**run ()**

Do the actual work of this command.

**configuration**

VM configuration profile to use for deployment.

**Raises** `InvalidInputError` – if not a profile defined in the VM.

**generic\_parser = None**

Generic parser object providing args that most subclasses will use.

Subclasses can call `self.subparsers.add_parser(parents=[self.generic_parser])` to automatically inherit this set of args

**hypervisor**

Hypervisor to deploy to.

**Raises** `InvalidInputError` – if not a recognized value.

**network\_map**

Mapping of network names to networks.

**password = None**

Server login password.

**power\_on**

Whether to automatically power on the VM after deployment.

**serial\_connection**

Mapping of serial ports to various connection types.



**subparsers = None**

Subparser grouping for hypervisor-specific sub-subparsers.

Subclasses should generally have their `create_subparser()` implementations create their sub-subparsers with `parent=subparsers`.

**username = None**

Server login username.

**vm\_name = None**

Name of the created virtual machine

**class SerialConnection** (*kind, value, options*)

Bases: `object`

Generic class defining a serial port connection.

**\_\_init\_\_** (*kind, value, options*)

Construct a SerialConnection object of the given kind and value.

**Parameters**

- **kind** (*str*) – Connection type string, possibly in need of munging.
- **value** (*str*) – Connection value such as `'/dev/ttyS0'` or `'1.1.1.1:80'`
- **options** (*dict*) – Input options dictionary.

**classmethod from\_cli\_string** (*cli\_string*)

Parse a string `'kind:value[,opts]'` to build a SerialConnection.

Based on the QEMU CLI for serial ports.

**Parameters** **cli\_string** (*str*) – String of the form `'kind:value[,opts]'`

**Returns** *SerialConnection* – Created instance or None.

**Raises** `InvalidInputError` – if `cli_string` cannot be parsed

## Examples

```
>>> str(SerialConnection.from_cli_string('/dev/ttyS0'))
'<SerialConnection kind: device value: /dev/ttyS0 options: {}>'
>>> str(SerialConnection.from_cli_string('tcp::22,server'))
"<SerialConnection kind: tcp value: :22 options: {'server': True}>"
>>> str(SerialConnection.from_cli_string('telnet://1.1.1.1:1111'))
'<SerialConnection kind: telnet value: 1.1.1.1:1111 options: {}>'
```

**classmethod validate\_kind** (*kind*)

Validate the connection type string and munge it as needed.

**Parameters** **kind** (*str*) – Connection type string, possibly in need of munging.

**Returns** *str* – A valid type string

**Raises** `ValueUnsupportedError` – if `kind` is not recognized as valid

**classmethod validate\_options** (*kind, value, options*)

Check that the given set of options are valid for this connection.

**Parameters**

- **kind** (*str*) – Validated 'kind' string.

- **value** (*str*) – Validated 'value' string. Currently unused.
- **options** (*dict*) – Input options dictionary.

**Returns** *dict* – Validated options

**Raises** `InvalidInputError` – if options are not valid.

**classmethod validate\_value** (*kind, value*)

Check that the given value is valid for the given connection kind.

**Parameters**

- **kind** (*str*) – Connection type, valid per `validate_kind()`.
- **value** (*str*) – Connection value such as `'/dev/ttyS0'` or `'1.1.1.1:80'`

**Returns** *str* – Munged value string.

**Raises**

- `InvalidInputError` – if value string is not recognized as valid
- `NotImplementedError` – if kind is not valid

**kind** = `None`

Connection type string

**options** = `None`

Dictionary of connection options.

**value** = `None`

Connection value such as `'/dev/ttyS0'` or `'1.1.1.1 - 80'`

## **COT.commands.deploy\_esxi module**

Module for deploying VMs to ESXi, vCenter, and vSphere.

### **Classes**

<code>COTDeployESXi</code>	Sub-command for deploying VMs on ESXi and VMware vCenter/vSphere.
<code>SmarterConnection</code>	A smarter version of pyVmomi's SmartConnection context manager.
<code>PyVmomiVMReconfigSpec</code>	Context manager for reconfiguring an ESXi VM using PyVmomi.

**class COTDeployESXi** (*ui*)

Bases: `COT.commands.deploy.COTDeploy`

Sub-command for deploying VMs on ESXi and VMware vCenter/vSphere.

Inherited attributes: `ui`, `package`, `generic_parser`, `parser`, `subparsers`, `hypervisor`, `configuration`, `username`, `password`, `power_on`, `vm_name`, `network_map`, `serial_connection`

Attributes: `locator`, `datastore`, `ovftool_args`

**\_\_init\_\_** (*ui*)

Instantiate this command with the given UI.

**Parameters** **ui** (`UI`) – User interface instance.

**create\_subparser()**

Add subparser for the CLI of this command.

This will create the shared `parser`, then create our own sub-subparser under `subparsers`.

**fixup\_ovftool\_args** (*ovftool\_args*, *target*)

Make any needed modifications to the ovftool arguments.

**Parameters**

- **ovftool\_args** (*list*) – Any existing ovftool arguments to begin with.
- **target** (*str*) – deployment target URI

**Returns** *list* – Updated ovftool arguments

**fixup\_serial\_ports()**

Use PyVmomi to create and configure serial ports for the new VM.

**Raises** `NotImplementedError` – If any `SerialConnection` in *serial\_connection* has a kind other than 'tcp', 'telnet', or 'device'

**ready\_to\_run()**

Check whether the module is ready to *run()*.

**Returns** *tuple* – (True, *ready\_message*) or (False, *reason\_why\_not*)

**run()**

Do the actual work of this command - deploying to ESXi.

**Raises** `InvalidInputError` – if *ready\_to\_run()* reports False

**datastore = None**

ESXi datastore to deploy to.

**host = None**

vSphere host to deploy to - set implicitly by *self.locator*.

**locator**

Target vSphere locator.

**ovftool\_args**

List of CLI arguments to pass through to *ovftool*.

**serial\_connection**

Mapping of serial ports to various connection types.

**server = None**

vCenter server or vSphere host - set implicitly by *self.locator*.

**class PyVmomiVMReconfigSpec** (*service\_instance*, *vm\_name*)

Bases: `object`

Context manager for reconfiguring an ESXi VM using PyVmomi.

**\_\_init\_\_** (*service\_instance*, *vm\_name*)

Use the given name to look up a VM using the given *service\_instance*.

**Parameters**

- **service\_instance** (`pyVmomi.VmomiSupport.vim.ServiceInstance`) – Connection to ESXi.
- **vm\_name** (*str*) – Virtual machine name.

**lookup\_object** (*vimtype*, *name*)

Look up an object by name.

**Parameters**

- **vimtype** (*object*) – currently only `vim.VirtualMachine`
- **name** (*str*) – Name of the object to look up.

**Returns** *object* – Located object

**class SmarterConnection** (*ui*, *host*, *user*, *pwd*, *port=443*)

Bases: `pyVim.connect.SmartConnection`

A smarter version of `pyVmomi`’s `SmartConnection` context manager.

**\_\_init\_\_** (*ui*, *host*, *user*, *pwd*, *port=443*)

Create a connection to the given server.

**Parameters** **ui** (`UI`) – User interface instance.

For the other parameters, see `pyVim.connect.SmartConnection`

**static unwrap\_connection\_error** (*outer\_e*)

Extract inner attributes from a `ConnectionError`.

`ConnectionError` often wraps another exception with more context; this function dives inside the `ConnectionError` to find that context.

**Parameters** **outer\_e** (`ConnectionError`) – `ConnectionError` to unwrap

**Returns** *tuple* – extracted (errno, inner\_message)

## **COT.commands.edit\_hardware module**

Module for editing hardware details of a VM.

### **Functions**

---

<code>expand_list_wildcard</code>	Expand a list containing a wildcard to the desired length.
<code>guess_list_wildcard</code>	Inverse of <code>expand_list_wildcard()</code> .

---

### **Classes**

---

<code>COTEditHardware</code>	Edit hardware information (CPUs, RAM, NICs, etc.).
------------------------------	--

---

**class COTEditHardware** (*ui*)

Bases: `COT.commands.command.ReadWriteCommand`

Edit hardware information (CPUs, RAM, NICs, etc.).

Inherited attributes: `ui`, `package`, `output`

Attributes: `profiles`, `delete_all_other_profiles`, `cpus`, `memory`, `nics`, `nic_types`, `mac_addresses_list`, `nic_networks`, `nic_names`, `network_descriptions`, `serial_ports`, `serial_connectivity`, `scsi_subtypes`, `ide_subtypes`, `virtual_system_type`

**\_\_init\_\_** (*ui*)

Instantiate this command with the given UI.

**Parameters** `ui` (`UI`) – User interface instance.

**create\_subparser** ()

Create 'edit-hardware' CLI subparser.

**ready\_to\_run** ()

Check whether the module is ready to `run` ().

**Returns** *tuple* – (True, `ready_message`) or (False, `reason_why_not`)

**run** ()

Do the actual work of this command.

**Raises** `InvalidInputError` – if `ready_to_run` () reports False

**MEMORY\_REGEX** = '^\\s\*(\\d+)\\s\*([mMgG])?i?[bB]?\\s\*\$'

**cpus**

Number of CPUs to set.

**delete\_all\_other\_profiles** = None

Delete all profiles other than those set in `profiles`.

**ide\_subtype**

IDE controller subtype string to set.

Deprecated since version 1.5: Use `ide_subtypes` instead.

**ide\_subtypes**

IDE controller subtype string(s) to set.

**mac\_addresses\_list** = None

List of MAC addresses to set.

**memory**

Amount of RAM (in megabytes) to set.

**network\_descriptions** = None

List of network description strings.

Can use wildcards as described in `expand_list_wildcard` ().

**nic\_names** = None

List of NIC name strings.

Can use wildcards as described in `expand_list_wildcard` ().

**nic\_networks** = None

List of NIC-to-network mappings.

Can use wildcards as described in `expand_list_wildcard` ().

**nic\_type**

NIC type string to set.

Deprecated since version 1.5: Use `nic_types` instead.

**nic\_types**

List of NIC type strings to set.

**nics**

Number of NICs to set.

**profiles** = None

Configuration profile(s) to edit.

**scsi\_subtype**

SCSI controller subtype string to set.

Deprecated since version 1.5: Use *scsi\_subtypes* instead.

**scsi\_subtypes**

SCSI controller subtype string(s) to set.

**serial\_connectivity = None**

List of serial connection strings.

**serial\_ports**

Serial port count to set.

**virtual\_system\_type = None**

Virtual system type

**expand\_list\_wildcard** (*name\_list*, *length*, *quiet=False*)

Expand a list containing a wildcard to the desired length.

**Parameters**

- **name\_list** (*list*) – List of names to assign, or None
- **length** (*list*) – Length to expand to
- **quiet** (*bool*) – Silence usual log messages generated by this function.

**Returns** *list* – Expanded list, or empty list if *name\_list* is None or empty.

Since various items (NIC names, network names, etc.) are often named or numbered sequentially, we provide this API to allow the user to specify a wildcard value to permit automatically expanding a list of input strings to the desired length. The syntax for the wildcard option is { followed by a number (indicating the starting index for the name) followed by }.

## Examples

```
>>> expand_list_wildcard(None, 3)
[]
>>> expand_list_wildcard(["eth{0}"], 3)
['eth0', 'eth1', 'eth2']
>>> expand_list_wildcard(["mgmt0", "eth{10}"], 4)
['mgmt0', 'eth10', 'eth11', 'eth12']
```

**guess\_list\_wildcard** (*known\_values*)

Inverse of *expand\_list\_wildcard()*. Guess the wildcard for a list.

**Parameters** **known\_values** (*list*) – Values to guess from

**Returns** *list* – Guessed wildcard list, or None if unable to guess

## Examples

```
>>> guess_list_wildcard(['foo', 'bar', 'baz'])
>>> guess_list_wildcard(['foo1', 'foo2', 'foo3'])
['foo{1}']
>>> guess_list_wildcard(['foo', 'bar', 'baz3', 'baz4', 'baz5'])
['foo', 'bar', 'baz{3}']
>>> guess_list_wildcard(['Eth0/1', 'Eth0/2', 'Eth0/3'])
```

```
['Eth0/{1}']
>>> guess_list_wildcard(['Eth0/0', 'Eth1/0', 'Eth2/0'])
['Eth{0}/0']
>>> guess_list_wildcard(['fake1', 'fake2', 'real4', 'real5'])
['fake1', 'fake2', 'real{4}']
```

## COT.commands.edit\_product module

Module for editing product information in a VM description.

### Classes

---

*COTEditProduct*

Edit product, vendor, and version information strings.

---

#### **class** COTEditProduct(ui)

Bases: COT.commands.command.ReadWriteCommand

Edit product, vendor, and version information strings.

Inherited attributes: ui, package, output

Attributes: *product\_class product vendor version, full\_version product\_url vendor\_url application\_url*

**\_\_init\_\_**(ui)

Instantiate this command with the given UI.

**Parameters** *ui* (UI) – User interface instance.

**create\_subparser**()

Create 'edit-product' CLI subparser.

**ready\_to\_run**()

Check whether the module is ready to *run*().

**Returns** *tuple* – (True, ready\_message) or (False, reason\_why\_not)

**run**()

Do the actual work of this command.

**Raises** *InvalidInputError* – if *ready\_to\_run*() reports False

**application\_url** = None

Application URL string.

**full\_version** = None

Long version string.

**product** = None

Product description string.

**product\_class** = None

Product class identifier.

**product\_url** = None

Product URL string.

**vendor** = None

Vendor string.

**vendor\_url = None**

Vendor URL string.

**version = None**

Short version string.

## **COT.commands.edit\_properties module**

Module for managing VM environment configuration properties.

### **Classes**

---

*COTEditProperties*

Edit OVF environment XML properties.

---

**class COTEditProperties** (*ui*)

Bases: COT.commands.command.ReadWriteCommand

Edit OVF environment XML properties.

Inherited attributes: *ui*, *package*, *output*

Attributes: *config\_file*, *properties*, *transports*, *user\_configurable*

**\_\_init\_\_** (*ui*)

Instantiate this command with the given UI.

**Parameters** *ui* (*UI*) – User interface instance.

**create\_subparser** ()

Create 'edit-properties' CLI subparser.

**edit\_properties\_interactive** ()

Present an interactive UI for the user to edit properties.

**ready\_to\_run** ()

Check whether the module is ready to *run* ().

**Returns** *tuple* – (True, *ready\_message*) or (False, *reason\_why\_not*)

**run** ()

Do the actual work of this command.

**Raises** *InvalidInputError* – if *ready\_to\_run* () reports False

**config\_file**

Path to plaintext file to read configuration lines from.

**Raises** *InvalidInputError* – if the file does not exist.

**descriptions = None**

List of description strings to set for updated properties.

**labels = None**

List of label strings to set for the properties being updated.

**properties**

List of property (key, value, type) tuples to update.

Properties may also be set from strings (such as by CLI) with the syntax  
<key>[=<value>] [+<type>].



## Examples

```
>>> from COT.ui import UI
>>> i = COTEditProperties(UI())
>>> i.properties
[]
>>> i.properties = [
...     "no_value",
...     "key=value",
...     "string_type+string",
...     "full-type=yes+boolean",
... ]
>>> print("\n".join([str(p) for p in i.properties]))
('no_value', None, None)
('key', 'value', None)
('string_type', None, 'string')
('full-type', 'yes', 'boolean')
>>> i.properties = [
...     "ssh=autopubkey=ssh-rsa AA...q+t0...Tuw== root@MASTER",
...     "tricky+=foo",
...     "tricky_value==++foo==++",
...     "trickiest=bar+foo=hello+boolean",
... ]
>>> print("\n".join([str(p) for p in i.properties]))
('ssh', 'autopubkey=ssh-rsa AA...q+t0...Tuw== root@MASTER', None)
('tricky', '', 'foo')
('tricky_value', '++foo==++', None)
('trickiest', 'bar+foo=hello', 'boolean')
```

### transports

Transport mechanism(s) for environment properties.

### user\_configurable = None

Value to set the user\_configurable flag on properties we edit.

## COT.commands.help module

Provide 'help' keyword for COT CLI.

### class COTHelp(ui)

Bases: COT.commands.command.Command

Provide 'help <subcommand>' syntax.

Inherited attributes: ui

Attributes: *subcommand*

### \_\_init\_\_(ui)

Instantiate this command with the given UI.

**Parameters** **ui** (**UI**) – User interface instance.

### create\_subparser()

Create 'help' CLI subparser.

### run()

Display the help menu for the specified subcommand.

**subcommand**

CLI subcommand to give help for.

If None, then help will be displayed for the COT global parser.

**COT.commands.info module**

Implements "info" subcommand.

**class COTInfo (ui)**

Bases: COT.commands.command.Command

Display VM information string.

Inherited attributes: ui

Attributes: *package\_list*, *verbosity*

**\_\_init\_\_ (ui)**

Instantiate this command with the given UI.

**Parameters** **ui** (UI) – User interface instance.

**create\_subparser ()**

Create 'info' CLI subparser.

**ready\_to\_run ()**

Check whether the module is ready to *run ()*.

**Returns** *tuple* – (True, ready\_message) or (False, reason\_why\_not)

**run ()**

Do the actual work of this command.

**Raises** *InvalidInputError* – if *ready\_to\_run ()* reports False

**package\_list**

List of VM definitions to get information for.

**verbosity**

Verbosity of information displayed.

**COT.commands.inject\_config module**

Implements "inject-config" command.

**class COTInjectConfig (ui)**

Bases: COT.commands.command.ReadWriteCommand

Wrap configuration file(s) into a disk image embedded into the VM.

Inherited attributes: ui, package, output

Attributes: *config\_file*, *secondary\_config\_file*, *extra\_files*

**\_\_init\_\_ (ui)**

Instantiate this command with the given UI.

**Parameters** **ui** (UI) – User interface instance.

**create\_subparser ()**

Create 'inject-config' CLI subparser.

**ready\_to\_run()**

Check whether the module is ready to `run()`.

**Returns** *tuple* – (True, ready\_message) or (False, reason\_why\_not)

**run()**

Do the actual work of this command.

**Raises**

- `InvalidInputError` – if `ready_to_run()` reports False
- `ValueUnsupportedError` – if the `BOOTSTRAP_DISK_TYPE` of the associated VM's *platform* is not 'cdrom' or 'harddisk'
- `LookupError` – if unable to find a disk drive device to inject the configuration into.

**working\_dir\_disk\_space\_required()**

How much space this module will require in `working_dir`.

**Returns** *int* – Predicted temporary storage requirements

**config\_file**

Primary configuration file.

**Raises**

- `InvalidInputError` – if the file does not exist
- `InvalidInputError` – if the platform described by `package` doesn't support configuration files.

**extra\_files**

Additional files to be embedded as-is.

**Raises** `InvalidInputError` – if any file in the list does not exist

**secondary\_config\_file**

Secondary configuration file.

**Raises**

- `InvalidInputError` – if the file does not exist
- `InvalidInputError` – if the platform described by `package` doesn't support secondary configuration files.

**COT.commands.install\_helpers module**

Implements "install-helpers" command.

**class COTInstallHelpers(ui)**

Bases: `COT.commands.command.Command`

Install all helper tools that COT requires.

Inherited attributes: `ui`,

**\_\_init\_\_(ui)**

Instantiate this command with the given UI.

**Parameters** `ui (UI)` – User interface instance.

**create\_subparser()**

Create 'install-helpers' CLI subparser.

**install\_helper** (*helper*)

Install the given helper module.

**Parameters** **helper** (*Helper*) – Helper module to install.

**Returns** *tuple* – (result, message)

**manpages\_helper** ()

Verify or install COT's manual pages.

**Returns** *tuple* – (result, message)

**run** ()

Verify all helper tools and install any that are missing.

**guess\_manpath** ()

Guess the directory path where man pages should be installed.

**install\_manpages** (*man\_dir*)

Install COT's manual pages.

**Parameters** **man\_dir** (*str*) – Base directory where manpages should be installed.

**Returns** *tuple* – (result, message)

**verify\_manpages** (*man\_dir*)

Verify installation of COT's manual pages.

**Parameters** **man\_dir** (*str*) – Base directory where manpages should be found.

**Returns** *tuple* – (result, message)

## **COT.commands.remove\_file module**

Module for removing files from VM definitions.

---

*COTRemoveFile*(*ui*)

Remove a file (such as a README) from the package.

---

**class** **COTRemoveFile** (*ui*)

Bases: `COT.commands.command.ReadWriteCommand`

Remove a file (such as a README) from the package.

Inherited attributes:

*ui*, *package*, *output*

Attributes: *file\_path*, *file\_id*

**\_\_init\_\_** (*ui*)

Instantiate this command with the given UI.

**Parameters** **ui** (*UI*) – User interface instance.

**create\_subparser** ()

Create 'remove-file' CLI subparser.

**ready\_to\_run** ()

Check whether the module is ready to *run* ().

**Returns** *tuple* – (True, *ready\_message*) or (False, *reason\_why\_not*)

**run()**

Do the actual work of this command.

**Raises** `InvalidInputError` – if `ready_to_run()` reports `False`

**file\_id = None**

File identifier to be removed from the package.

**file\_path = None**

File name or path to be removed from the package.

**class Command(ui)**

Bases: `object`

Abstract interface for COT commands.

Attributes: `vm`, `ui`

---

**Note:** Generally a command should not inherit directly from this class, but should instead subclass `ReadCommand` or `ReadWriteCommand` as appropriate.

---

**\_\_init\_\_(ui)**

Instantiate this command with the given UI.

**Parameters** `ui` (`UI`) – User interface instance.

**check\_disk\_space** (`required_size`, `location`, `label='File'`, `context=None`, `force_check=False`, `die=False`)

Check if there is sufficient disk space available at a location.

If there is insufficient space, warn the user before continuing.

Caches space requirements per location, so it's safe to call repeatedly, as it will only re-check (and possibly re-prompt the user) if:

1. a different location is requested
2. or the required size changes
3. or `force_check` is `True`.

#### Parameters

- **required\_size** (`int`) – Bytes required
- **location** (`str`) – Path to check availability of.
- **label** (`str`) – Descriptive label to display in user messages.
- **context** (`str`) – Optional string for additional context to provide when prompting the user.
- **force\_check** (`bool`) – If `True`, re-check and re-prompt the user even if this location has previously been checked and its `required_size` has not changed.
- **die** (`bool`) – If `True`, use `confirm_or_die()` instead of `confirm()`

#### Returns

`bool` –

**Whether sufficient space is available (or if not, whether the user has opted to continue anyway).**

**Raises** `SystemExit` – if disk space is insufficient and `die` is `True` and the user declines to continue.

**create\_subparser()**

Add subparser for the CLI of this command.

**destroy()**

Destroy any VM associated with this command.

**finished()**

Do any final actions before being destroyed.

This class does nothing; subclasses may choose to do things like write their VM state out to a file.

**ready\_to\_run()**

Check whether the module is ready to `run()`.

**Returns** *tuple* – (`True`, `ready_message`) or (`False`, `reason_why_not`)

**run()**

Do the actual work of this command.

**Raises** `InvalidInputError` – if `ready_to_run()` reports `False`

**working\_dir\_disk\_space\_required()**

How much space this module will require in `working_dir`.

By default, assumes the entire VM may be written to working directory. Subclasses may wish to extend or override this.

**Returns** *int* – Predicted temporary storage requirements.

**class ReadCommand(ui)**

Bases: `COT.commands.command.Command`

Command, such as 'deploy', that reads from a VM file to create its vm.

Inherited attributes: `vm`, `ui`

Attributes: *package*

**\_\_init\_\_(ui)**

Instantiate this command with the given UI.

**Parameters** `ui` (`UI`) – User interface instance.

**ready\_to\_run()**

Check whether the module is ready to `run()`.

**Returns** *tuple* – (`True`, `ready_message`) or (`False`, `reason_why_not`)

**package**

VM description file to read from.

Calls `COT.vm_description.VMDescription.factory()` to instantiate `self.vm` from the provided file.

**Raises** `InvalidInputError` – if the file does not exist.

**class ReadWriteCommand(ui)**

Bases: `COT.commands.command.ReadCommand`

Command that reads from and writes to a VM description.

Inherited attributes: `vm`, `ui`

Attributes: *package*, *output*

**\_\_init\_\_**(*ui*)

Instantiate this command with the given UI.

**Parameters** *ui* (UI) – User interface instance.

**finished**()

Write the current VM state out to disk if requested.

**ready\_to\_run**()

Check whether the module is ready to *run*() .

**Returns** *tuple* – (True, *ready\_message*) or (False, *reason\_why\_not*)

**run**()

Do the actual work of this command.

If *output* was not previously set, automatically sets it to the value of *PACKAGE*.

**Raises** *InvalidInputError* – if *ready\_to\_run*() reports False

**output**

Output file for this command.

If the specified file already exists, will prompt the user (*confirm\_or\_die*()) to confirm overwriting the existing file.

**package**

VM description file to read from.

Calls *COT.vm\_description.VMDescription.factory()* to instantiate *self.vm* from the provided file.

**Raises** *InvalidInputError* – if the file does not exist.

## 8.2.2 COT.disks package reference

Package for handling various disk file types (VMDK, ISO, QCOW2, etc.).

Tries to provide an API that abstracts away differences in how the various types need to be operated on (e.g., qemu-img, mkisofs, etc.).

### API

<i>DiskRepresentation</i>	Abstract disk image file representation.
---------------------------	--

### Disk modules

<i>COT.disks.iso</i>	Handling of ISO files.
<i>COT.disks.qcow2</i>	Handling of QCOW2 files.
<i>COT.disks.raw</i>	Handling of raw disk image files.
<i>COT.disks.vmdk</i>	Handling of VMDK files.

### COT.disks.iso module

Handling of ISO files.

```
class ISO(path)
    Bases: COT.disks.disk.DiskRepresentation
    ISO 9660 disk image file representation.

    classmethod file_is_this_type(path)
        Detect whether the given file is an ISO image.

        Parameters path (str) – Path to file

        Returns bool – True (file is an ISO) or False (file is not an ISO)

        Raises HelperError – if path is not a file at all.

    classmethod from_other_image(input_image, output_dir, output_subformat=None)
        Convert the other disk image into an image of this type.

        Parameters

        • input_image (DiskRepresentation) – Existing image representation.
        • output_dir (str) – Output directory to store the new image in.
        • output_subformat (str) – Any relevant subformat information.

        Raises NotImplementedError – non-trivial to convert other types to ISO

    disk_format = 'iso'

    disk_subformat
        ISO sub-format.

        Possible values:

        • "" - not Rock Ridge
        • "rockridge" - has Rock Ridge extensions

    files
        The list of files contained in this ISO.

    predicted_drive_type
        Disk drive type typically used for a Disk of this type.

        Returns str – 'cdrom'
```

### COT.disks.qcow2 module

Handling of QCOW2 files.

```
class QCOW2(path)
    Bases: COT.disks.disk.DiskRepresentation
    QCOW2 disk image file representation.

    classmethod from_other_image(input_image, output_dir, output_subformat=None)
        Convert the other disk image into an image of this type.

        Parameters

        • input_image (DiskRepresentation) – Existing image representation.
        • output_dir (str) – Output directory to store the new image in.
        • output_subformat (str) – Any relevant subformat information.
```



**Returns** *QCOW2* – representation of newly created qcow2 image file

`disk_format = 'qcow2'`

## COT.disks.raw module

Handling of raw disk image files.

**class** *RAW* (*path*)

Bases: `COT.disks.disk.DiskRepresentation`

Raw disk image file representation.

**classmethod** *file\_is\_this\_type* (*path*)

Whether this file is a RAW image.

Any file conceivably can be a RAW image; there's no file magic number.

For the parameters, see `DiskRepresentation.file_is_this_type()`.

**classmethod** *from\_other\_image* (*input\_image*, *output\_dir*, *output\_subformat=None*)

Convert the other disk image into an image of this type.

### Parameters

- **input\_image** (*DiskRepresentation*) – Existing image representation.
- **output\_dir** (*str*) – Output directory to store the new image in.
- **output\_subformat** (*str*) – Any relevant subformat information.

**Returns** *RAW* – representation of newly created raw image.

`disk_format = 'raw'`

**files**

List of files on the FAT32 file system of this disk.

## COT.disks.vmdk module

Handling of VMDK files.

**class** *VMDK* (*path*)

Bases: `COT.disks.disk.DiskRepresentation`

VMDK disk image file representation.

**classmethod** *from\_other\_image* (*input\_image*, *output\_dir*, *output\_subformat='streamOptimized'*)

Convert the other disk image into an image of this type.

### Parameters

- **input\_image** (*DiskRepresentation*) – Existing image representation.
- **output\_dir** (*str*) – Output directory to store the new image in.
- **output\_subformat** (*str*) – VMDK subformat string. Defaults to "streamOptimized" if unset.

**Returns** *VMDK* – representation of newly created VMDK file.

**Note:** Creation of streamOptimized subformat VMDKs (ESXi's preferred subformat for OVAs, hence COT's default subformat) is more complex than it seems due to the underlying helpers required.

- Prior to QEMU 2.1.0, `qemu-img` effectively can't write streamOptimized subformat at all (it tends to error out).
- In QEMU 2.1.0 through 2.5.0, `qemu-img` supports output to streamOptimized subformat, but it outputs VMDK images declaring version 1 of the VMDK format, which newer versions of ESXi (and probably other VMware products) reject with the message "Not a supported disk format (sparse VMDK version too old)".
- In QEMU 2.5.1 and later, `qemu-img` produces "version 3" VMDK images, which suffices to make ESXi happy.
- `vmdktool` (any released version) also makes "version 3" VMDKs, but is less likely to be available on most user systems, and it can only convert from RAW format images to streamOptimized VMDK.

So, when creating streamOptimized VMDKs, if we have QEMU 2.5.1+, we're golden. Else, if we have `vmdktool`, use it, after converting the `input_image` to RAW format first if necessary. Else, fail back to QEMU 2.1.0+ but warn the user that the resulting image may not be usable with ESXi.

---

**disk\_format** = 'vmdk'

**disk\_subformat**

Disk subformat, such as 'streamOptimized'.

**class DiskRepresentation** (*path*)

Bases: `object`

Abstract disk image file representation.

**\_\_init\_\_** (*path*)

Create a representation of an existing disk.

**Parameters** *path* (*str*) – Path to existing file.

**static class\_for\_format** (*disk\_format*)

Get the DiskRepresentation subclass associated with the given format.

**Parameters** *disk\_format* (*str*) – Disk format string such as 'iso' or 'vmdk'

**Returns** *DiskRepresentation* – appropriate subclass object.

**convert\_to** (*new\_format*, *new\_directory*, *new\_subformat=None*)

Convert the disk file to a new format and return the new instance.

**Parameters**

- **new\_format** (*str*) – Format to convert to.
- **new\_subformat** (*str*) – (optional) Sub-format to convert to.
- **new\_directory** (*str*) – Directory path to store new image into.

**Returns** *DiskRepresentation* – Converted disk

**Raises** `NotImplementedError` – if *new\_format* is not a supported type

**See also:**

`from_other_image()`

**classmethod create\_file** (*path*, *files=None*, *capacity=None*, *\*\*kwargs*)

Create a new disk image file of this type.

**Parameters**

- **path** (*str*) – Location to create disk file.
- **files** (*list*) – List of files to include in the disk's filesystem.
- **capacity** (*str*) – Disk capacity.
- **\*\*kwargs** – Subclasses and `_create_file()` may accept additional parameters.

**Raises**

- `ValueError` – if path is not a valid string
- `RuntimeError` – if a file already exists at path.
- `RuntimeError` – if neither files nor capacity is specified

**classmethod file\_is\_this\_type** (*path*)

Check if the given file is image type represented by this class.

**Parameters** **path** (*str*) – Path to file to check.

**Returns** *int* – Confidence that this file matches. 0 is definitely not a match, 100 is definitely a match.

**Raises** `HelperError` – if no file exists at path.

**classmethod for\_new\_file** (*path*, *disk\_format*, *\*\*kwargs*)

Create a new disk file and return a `DiskRepresentation`.

**Parameters**

- **path** (*str*) – Path to create file at.
- **disk\_format** (*str*) – Disk format to create, such as 'iso' or 'vmdk'.
- **\*\*kwargs** – Arguments to pass through to appropriate `DiskRepresentation` subclass for this format.

**Returns** `DiskRepresentation` – representation of the created file.

**Raises** `NotImplementedError` – if `disk_format` is not supported.

**static from\_file** (*path*)

Get a `DiskRepresentation` instance appropriate to the given file.

**Parameters** **path** (*str*) – Path of existing file to represent.

**Returns** `DiskRepresentation` – Representation of this file.

**Raises**

- `IOError` – if no file exists at the given path
- `NotImplementedError` – if the file is not a supported type.

**classmethod from\_other\_image** (*input\_image*, *output\_dir*, *output\_subformat=None*)

Convert the other disk image into an image of this type.

**Parameters**

- **input\_image** (`DiskRepresentation`) – Existing image representation.
- **output\_dir** (*str*) – Output directory to store the new image in.
- **output\_subformat** (*str*) – Any relevant subformat information.

**Raises** `NotImplementedError` – Subclasses may implement this.

**static subclasses()**

List of subclasses of DiskRepresentation.

Wraps the `class.__subclasses__()` builtin.

**capacity**

Capacity of this disk image, in bytes.

**disk\_format = None**

**disk\_subformat**

Sub-format of the disk, such as 'rockridge' or 'streamOptimized'.

**files**

List of files embedded in this disk image.

**path**

System path to this disk file.

**predicted\_drive\_type**

Disk drive type typically used for a Disk of this type.

**Returns** *str* – 'cdrom' or 'harddisk'

### 8.2.3 COT.helpers package reference

Provides a common interface for interacting with various non-Python programs.

#### API

Helper	A provider of a non-Python helper program.
helpers	Dictionary of concrete Helper subclasses to be populated at load time.
helper_select	Select the first helper that is available from the given list.

#### Exceptions

<i>HelperError</i>	A helper program exited with non-zero return code.
<i>HelperNotFoundError</i>	A helper program cannot be located.

#### Helper modules

<i>COT.helpers.helper</i>	Common interface for providers of non-Python helper programs.
<i>COT.helpers.apt_get</i>	Wrapper for the 'apt-get' package manager.
<i>COT.helpers.brew</i>	Wrapper for the Homebrew 'brew' package manager for Mac ( <a href="http://brew.sh">http://brew.sh</a> ).
<i>COT.helpers.fatdisk</i>	Give COT access to <code>fatdisk</code> for creating and updating FAT32 file systems.
<i>COT.helpers.gcc</i>	Give COT access to <code>gcc</code> command for building other helpers.
<i>COT.helpers.isoinfo</i>	Give COT access to <code>isoinfo</code> for inspecting ISO images.

Continued on next page

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<i>COT.helpers.make</i>	Give COT access to make command for building other helpers.
<i>COT.helpers.mkisofs</i>	Give COT access to mkisofs, genisoimage, or xorriso for creating ISO images.
<i>COT.helpers.ovftool</i>	Give COT access to ovftool for validating and deploying OVF to ESXi.
<i>COT.helpers.port</i>	Wrapper for the MacPorts 'port' package manager.
<i>COT.helpers.qemu_img</i>	Give COT access to qemu-img for manipulating disk image formats.
<i>COT.helpers.vmdktool</i>	Give COT access to vmdktool for manipulating compressed VMDK files.
<i>COT.helpers.yum</i>	Wrapper for the 'yum' package manager.

**COT.helpers.helper module**

Common interface for providers of non-Python helper programs.

Provides the ability to install the program if not already present, and the ability to run the program as well.

**Classes**

<i>HelperNotFoundError</i>	A helper program cannot be located.
<i>HelperError</i>	A helper program exited with non-zero return code.
<i>Helper</i>	A provider of a non-Python helper program.
<i>PackageManager</i>	Helper program with additional API method <code>install_package()</code> .

**Attributes**

<i>helpers</i>	Dictionary of concrete Helper subclasses to be populated at load time.
----------------	--

**Functions**

<i>check_call</i>	Wrapper for <code>subprocess.check_call()</code> .
<i>check_output</i>	Wrapper for <code>subprocess.check_output()</code> .

**exception HelperError**

Bases: `exceptions.EnvironmentError`

A helper program exited with non-zero return code.

**exception HelperNotFoundError**

Bases: `exceptions.OSError`

A helper program cannot be located.

**class Helper** (*name*, *info\_uri=None*, *version\_args=None*, *version\_regexp='([0-9.]\*)'*)

Bases: `object`

A provider of a non-Python helper program.

**Static Methods**

<code>copy_file</code>	Copy the given src to the given dest, using sudo if needed.
<code>download_and_expand_tgz</code>	Context manager for downloading and expanding a .tar.gz file.
<code>mkdir</code>	Check whether the given target directory exists, and create if not.

### Instance Properties

<code>name</code>	Name of the helper program.
<code>info_uri</code>	URI for more information about this helper.
<code>installable</code>	Whether COT is capable of installing this program on this system.
<code>installed</code>	Whether this helper program is installed and available to run.
<code>path</code>	Discovered path to the helper.
<code>version</code>	Release version of the associated helper program.

### Instance Methods

<code>call</code>	Call the helper program with the given arguments.
<code>install</code>	Install the helper program.
<code>_install</code>	Subclass-specific implementation of installation logic.
<code>unsure_how_to_install</code>	Return a RuntimeError or NotImplementedError for install trouble.

`__init__` (*name*, *info\_uri*=None, *version\_args*=None, *version\_regexp*='([0-9.]+)')

Initializer.

#### Parameters

- **name** (*str*) – Name of helper executable
- **info\_uri** (*str*) – URI to refer to for more info about this helper.
- **version\_args** (*list*) – Args to pass to the helper to get its version. Defaults to ['--version'] if unset.
- **version\_regexp** (*str*) – Regexp to get the version number from the output of the command.

`_install` ()

Subclass-specific implementation of installation logic.

This method should only be called from `install()`, which does the appropriate pre-validation against the `installed` and `installable` properties before calling into this method if appropriate.

`call` (*args*, *capture\_output*=True, *use\_cached*=True, *\*\*kwargs*)

Call the helper program with the given arguments.

#### Parameters

- **args** (*tuple*) – List of arguments to the helper program.
- **capture\_output** (*boolean*) – If True, stdout/stderr will be redirected to a buffer and returned, instead of being displayed to the user. (I.e., `check_output()` will be invoked instead of `check_call()`)

- **use\_cached** (*boolean*) – If True, and `capture_output` is also True, then if there is an entry in `cached_output` for the given args, just return that entry instead of calling the helper again. Ignored if `capture_output` is False.

**Note:** By default no captured output is cached (as it may not necessarily be appropriate to cache the output of many commands.) Subclasses that wish to cache output of certain calls should wrap this method with the appropriate logic, typically along the lines of:

```
output = super(MyHelper, self).call(args, *kwargs)
if output and args[0] == 'info':
    self.cached_output[args] = output
return output
```

**Returns** *str* – Captured stdout/stderr if `capture_output` is True, else None.

For the other parameters, see `check_call()` and `check_output()`.

**Raises** `HelperNotFoundError` – if the helper was not previously installed, and the user declines to install it at this time.

**static** `copy_file(src, dest)`

Copy the given src to the given dest, using sudo if needed.

**Parameters**

- **src** (*str*) – Source path.
- **dest** (*str*) – Destination path.

**Returns** *bool* – True

**Raises** `HelperError` – if file copying fails

**static** `download_and_expand_tgz(*args, **kws)`

Context manager for downloading and expanding a .tar.gz file.

Creates a temporary directory, downloads the specified URL into the directory, unzips and untars the file into this directory, then yields to the given block. When the block exits, the temporary directory and its contents are deleted.

```
with download_and_expand_tgz("http://example.com/foo.tgz") as d:
    # archive contents have been extracted to 'd'
    ...
# d is automatically cleaned up.
```

**Parameters** **url** (*str*) – URL of a .tgz or .tar.gz file to download.

**Yields** *str* – Temporary directory path where the archive has been extracted.

**install()**

Install the helper program.

**Raises**

- `NotImplementedError` – if not *installable* on this platform
- `RuntimeError` – if potentially *installable* on this platform but required helpers (e.g., package managers) are not available.

- `HelperError` – if installation is attempted but fails.

Subclasses should not override this method but instead should provide an appropriate implementation of the `__install()` method.

**static** `makedirs(directory, permissions=493)`

Check whether the given target directory exists, and create if not.

#### Parameters

- **directory** (*str*) – Directory to check/create.
- **permissions** (*int*) – Permission mask to set when creating a directory. Default is `0o755`.

**unsure\_how\_to\_install()**

Return a `RuntimeError` or `NotImplementedError` for install trouble.

**USER\_INTERFACE** = `<COT.ui.cli.CLI object>`

User interface (if any) available to helpers.

**\_\_provider\_package** = `{}`

Mapping of package manager name to package name to install with it.

**cached\_output** = `None`

Cache of call args -> output from this call.

This is opt-in per-subclass - nothing is cached by default.

**info\_uri**

URI for more information about this helper.

**installable**

Whether COT is capable of installing this program on this system.

**installed**

Whether this helper program is installed and available to run.

**name**

Name of the helper program.

**path**

Discovered path to the helper.

**version**

Release version of the associated helper program.

**class** `HelperDict(factory, *args, **kwargs)`

Bases: `dict`

Dictionary of Helper objects by name.

Similar to `collections.defaultdict` but takes the key as a parameter to the factory.

**\_\_init\_\_** (*factory, \*args, \*\*kwargs*)

Create the given dictionary with the given factory class/method.

**Parameters** **factory** (*object*) – Factory class or method to be called to populate a new entry in response to `__missing__()`.

For the other parameters, see `dict`.

**class** `PackageManager(name, info_uri=None, version_args=None, version_regex='([0-9.]*)')`

Bases: `COT.helpers.helper.Helper`

Helper program with additional API method `install_package()`.



**install\_package** (*package*)

Install the requested package if needed.

**Parameters** **package** (*str*) – Name of the package to install, or a list of parameters used to install the package.

**check\_call** (*args*, *require\_success=True*, *retry\_with\_sudo=False*, *\*\*kwargs*)

Wrapper for `subprocess.check_call()`.

Unlike `check_output()` below, this does not redirect stdout or stderr; all output from the subprocess will be sent to the system stdout/stderr as normal.

#### Parameters

- **args** (*list*) – Command to invoke and its associated args
- **require\_success** (*boolean*) – If `False`, do not raise an error when the command exits with a return code other than 0
- **retry\_with\_sudo** (*boolean*) – If `True`, if the command gets an exception, prepend `sudo` to the command and try again.

For the other parameters, see `subprocess.check_call()`.

#### Raises

- `HelperNotFoundError` – if the command doesn't exist (instead of a `OSError`)
- `HelperError` – if `require_success` is not `False` and the command returns a value other than 0 (instead of a `subprocess.CalledProcessError`).
- `OSError` – as `subprocess.check_call()`.

## Examples

```
>>> check_call(['true'])
>>> try:
...     check_call(['false'])
... except HelperError as e:
...     print(e.errno)
...     print(e.strerror)
1
Helper program 'false' exited with error 1
>>> check_call(['false'], require_success=False)
>>> try:
...     check_call(['/non/exist'])
... except HelperNotFoundError as e:
...     print(e.errno)
...     print(e.strerror)
2
Unable to locate helper program '/non/exist'. Please check your $PATH.
>>> try:
...     check_call(['/etc/'])
... except OSError as e:
...     print(e.errno)
...     print(e.strerror)
13
Permission denied
```

**check\_output** (*args*, *require\_success=True*, *retry\_with\_sudo=False*, *\*\*kwargs*)

Wrapper for `subprocess.check_output()`.

Automatically redirects stderr to stdout, captures both to a buffer, and generates a debug message with the stdout contents.

#### Parameters

- **args** (*list*) – Command to invoke and its associated args
- **require\_success** (*boolean*) – If `False`, do not raise an error when the command exits with a return code other than 0
- **retry\_with\_sudo** (*boolean*) – If `True`, if the command gets an exception, prepend `sudo` to the command and try again.

For the other parameters, see `subprocess.check_output()`.

**Returns** *str* – Captured stdout/stderr from the command

#### Raises

- `HelperNotFoundError` – if the command doesn't exist (instead of a `OSError`)
- `HelperError` – if `require_success` is not `False` and the command returns a value other than 0 (instead of a `subprocess.CalledProcessError`).
- `OSError` – as `subprocess.check_output()`.

#### Examples

```
>>> output = check_output(['echo', 'Hello world!'])
>>> assert output == "Hello world!\n"
>>> try:
...     check_output(['false'])
... except HelperError as e:
...     print(e.errno)
...     print(e.strerror)
1
Helper program 'false' exited with error 1:
> false

>>> output = check_output(['false'], require_success=False)
>>> assert output == ''
>>> try:
...     check_output(['/non/exist'])
... except HelperNotFoundError as e:
...     print(e.errno)
...     print(e.strerror)
2
Unable to locate helper program '/non/exist'. Please check your $PATH.
>>> try:
...     check_output(['/etc/'])
... except OSError as e:
...     print(e.errno)
...     print(e.strerror)
13
Permission denied
```

#### **helper\_select** (*choices*)

Select the first helper that is available from the given list.

If no helper in the list is currently installed, will install the first installable helper from the list.

**Raises** *HelperNotFoundError* – if no valid helper is available or installable.

**Parameters** **choices** (*list*) – List of helpers, in order from most preferred to least preferred.  
Each choice in this list can be either:

- a string (the helper name, such as "mkisofs")
- a tuple of (name, minimum version) such as ("qemu-img", "2.1.0").

**Returns** *Helper* – The selected helper class instance.

**helpers** = {'isoinfo': <COT.helpers.isoinfo.ISOInfo object>, 'gcc': <COT.helpers.gcc.GCC object>}

Dictionary of concrete Helper subclasses to be populated at load time.

### COT.helpers.apt\_get module

Wrapper for the 'apt-get' package manager.

#### class AptGet

Bases: *COT.helpers.helper.PackageManager*

The 'apt-get' package manager utility.

**\_\_init\_\_** ()  
Initializer.

**install\_package** (*package*)  
Install the requested package if needed.

**Parameters** **package** (*str*) – Name of the package to install.

### COT.helpers.brew module

Wrapper for the Homebrew 'brew' package manager for Mac (<http://brew.sh>).

#### class Brew

Bases: *COT.helpers.helper.PackageManager*

The 'brew' package manager utility.

**\_\_init\_\_** ()  
Initializer.

**install\_package** (*package*)  
Install the requested package if needed.

**Parameters** **package** (*str*) – Name of the package to install, or a list of parameters used to install the package.

### COT.helpers.fatdisk module

Give COT access to *fatdisk* for creating and updating FAT32 file systems.

<http://github.com/goblinhack/fatdisk>

#### class FatDisk

Bases: *COT.helpers.helper.Helper*

Wrapper for *fatdisk* (<http://github.com/goblinhack/fatdisk>).

```
__init__()  
    Initializer.
```

```
installable  
    Whether COT is capable of installing this program on this system.
```

### **COT.helpers.gcc module**

Give COT access to gcc command for building other helpers.

```
class GCC  
    Bases: COT.helpers.helper.Helper  
    Helper provider for gcc command.  
  
    __init__()  
        Initializer.
```

### **COT.helpers.isoinfo module**

Give COT access to isoinfo for inspecting ISO images.

<http://cdrecord.org/>

```
class ISOInfo  
    Bases: COT.helpers.helper.Helper  
    Helper provider for isoinfo.  
  
    http://cdrecord.org/  
  
    __init__()  
        Initializer.  
  
    call (args, **kwargs)  
        Call isoinfo with the given arguments.  
  
        Caches the output of:  


- isoinfo -i FILE -d (volume descriptor info)
- isoinfo -i FILE -f (find . -print equivalent)
- isoinfo -i FILE -l (ls -lR equivalent)

  
        For the parameters, see COT.helpers.helper.Helper.call() etc.
```

### **COT.helpers.make module**

Give COT access to make command for building other helpers.

```
class Make  
    Bases: COT.helpers.helper.Helper  
    Helper provider for make command.  
  
    __init__()  
        Initializer.
```

**COT.helpers.mkisofs module**

Give COT access to mkisofs, genisoimage, or xorriso for creating ISO images.

<http://cdrecord.org/> <https://www.gnu.org/software/xorriso/>

**Classes**

<i>MkISOFS</i>	Helper provider for mkisofs.
<i>GenISOImage</i>	Helper provider for genisoimage, a fork of mkisofs.
<i>XorrISO</i>	Helper provider for xorriso.

**class GenISOImage**

Bases: *COT.helpers.helper.Helper*

Helper provider for genisoimage, a fork of mkisofs.

`__init__()`  
Initializer.

**class MkISOFS**

Bases: *COT.helpers.helper.Helper*

Helper provider for mkisofs.

<http://cdrecord.org/>

`__init__()`  
Initializer.

**class XorrISO**

Bases: *COT.helpers.helper.Helper*

Helper provider for xorriso.

<https://www.gnu.org/software/xorriso/>

`__init__()`  
Initializer.

**COT.helpers.ovftool module**

Give COT access to ovftool for validating and deploying OVF to ESXi.

<https://www.vmware.com/support/developer/ovf/>

**class OVFTool**

Bases: *COT.helpers.helper.Helper*

Helper provider for ovftool from VMware.

<https://www.vmware.com/support/developer/ovf/>

`__init__()`  
Initializer.

**unsure\_how\_to\_install()**

Return a NotImplementedError about missing install logic.

We override the default install implementation to raise a more detailed error message for ovftool.

**installable**

COT can't install ovftool because of VMware site restrictions.

**COT.helpers.port module**

Wrapper for the MacPorts 'port' package manager.

**class Port**

Bases: *COT.helpers.helper.PackageManager*

The 'port' package manager utility.

**\_\_init\_\_**()  
Initializer.

**install\_package**(*package*)  
Install the requested package if needed.

**Parameters** **package** (*str*) – Name of the package to install.

**COT.helpers.qemu\_img module**

Give COT access to qemu-img for manipulating disk image formats.

<http://www.qemu.org>

**class QEMUImg**

Bases: *COT.helpers.helper.Helper*

Helper provider for qemu-img (<http://www.qemu.org>).

**\_\_init\_\_**()  
Initializer.

**call**(*args*, *\*\*kwargs*)  
Call qemu-img with the given arguments.  
Caches the output of `qemu-img info FILE` commands to save time.  
For the parameters, see *COT.helpers.helper.Helper.call()* etc.

**COT.helpers.vmdktool module**

Give COT access to vmdktool for manipulating compressed VMDK files.

<http://www.freshports.org/sysutils/vmdktool/>

**class VMDKTool**

Bases: *COT.helpers.helper.Helper*

Helper provider for vmdktool.

<http://www.freshports.org/sysutils/vmdktool/>

**\_\_init\_\_**()  
Initializer.

**installable**  
Whether COT is capable of installing this program on this system.

## COT.helpers.yum module

Wrapper for the 'yum' package manager.

### class Yum

Bases: *COT.helpers.helper.PackageManager*

The 'yum' package manager utility.

`__init__()`

Initializer.

`install_package(package)`

Install the requested package if needed.

**Parameters** `package` (*str*) – Name of the package to install.

## 8.2.4 COT.platforms package reference

Package for identifying guest platforms and handling platform differences.

The *Platform* class describes the API and provides a generic implementation that can be overridden by subclasses to provide platform-specific logic.

In general, other modules should not access subclasses directly but should instead use the *for\_product\_string()* API to derive the appropriate subclass object.

### API

<i>Platform</i>	Generic class for operations that depend on guest platform.
-----------------	---

### Platform modules

<i>COT.platforms.platform</i>	API and generic implementation of platform-specific logic.
<i>COT.platforms.cisco_csr1000v</i>	Platform logic for the Cisco CSR1000V virtual router.
<i>COT.platforms.cisco_iosv</i>	Platform logic for the Cisco IOSv virtual router.
<i>COT.platforms.cisco_iosxrv</i>	Platform logic for the Cisco IOS XRV virtual router and its variants.
<i>COT.platforms.cisco_iosxrv_9000</i>	Platform logic for the Cisco IOS XRV 9000 virtual router.
<i>COT.platforms.cisco_nexus_9000v</i>	Platform logic for the Cisco Nexus 9000v virtual switch.
<i>COT.platforms.cisco_nxosv</i>	Platform logic for the Cisco NX-OSv virtual switch.

## COT.platforms.platform module

API and generic implementation of platform-specific logic.

### class Hardware

Bases: *enum.Enum*

Enumeration of hardware types that have integer quantities.

`cpus = 1`

`memory = 2`

```
nic_count = 3
serial_count = 4
```

**class Platform**

Bases: `object`

Generic class for operations that depend on guest platform.

To be used whenever the guest is unrecognized or does not need special handling.

**\_\_init\_\_**()

Create an instance of this class.

**controller\_type\_for\_device**(*device\_type*)

Get the default controller type for the given device type.

**Parameters** *device\_type* (*str*) – 'harddisk', 'cdrom', etc.

**Returns** *str* – 'ide' unless overridden by subclass.

**classmethod for\_product\_string**(*product\_string*)

Get the class of Platform corresponding to a product string.

**Parameters** *product\_string* (*str*) – String such as 'com.cisco.iosxrv'

**Returns** *Platform* – Instance of Platform or the appropriate subclass.

## Examples

```
>>> Platform.for_product_string("com.cisco.n9k")
<class 'COT.platforms.cisco_nexus_9000v.Nexus9000v'>
>>> Platform.for_product_string(None)
<class 'COT.platforms.platform.Platform'>
>>> Platform.for_product_string("frobozz")
<class 'COT.platforms.platform.Platform'>
```

**guess\_nic\_name**(*nic\_number*)

Guess the name of the Nth NIC for this platform.

---

**Note:** This method counts from 1, not from 0!

---

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns** *str* – "Ethernet1", "Ethernet2", etc. unless overridden by subclass.

**validate\_cpu\_count**(*cpus*)

Throw an error if the number of CPUs is not a supported value.

**Parameters** *cpus* (*int*) – Number of CPUs

**Raises**

- `ValueTooLowError` – if *cpus* is less than the minimum required by this platform
- `ValueTooHighError` – if *cpus* exceeds the maximum supported by this platform

**validate\_memory\_amount**(*mebibytes*)

Throw an error if the amount of RAM is not supported.

**Parameters** *mebibytes* (*int*) – RAM, in MiB.



**Raises**

**ValueTooLowError** – if `mebibytes` is less than the minimum required by this platform

**ValueTooHighError**: if `mebibytes` is more than the maximum supported by this platform

**validate\_nic\_count** (*count*)

Throw an error if the number of NICs is not supported.

**Parameters** `count` (*int*) – Number of NICs.

**Raises**

- **ValueTooLowError** – if `count` is less than the minimum required by this platform
- **ValueTooHighError** – if `count` is more than the maximum supported by this platform

**validate\_nic\_type** (*type\_string*)

Throw an error if the NIC type string is not supported.

**See also:**

- `COT.data_validation.canonicalize_nic_subtype()`
- `COT.data_validation.NIC_TYPES`

**Parameters** `type_string` (*str*) – See `COT.data_validation.NIC_TYPES`

**Raises** **ValueUnsupportedError** – if `type_string` is not in `SUPPORTED_NIC_TYPES`

**validate\_nic\_types** (*type\_list*)

Throw an error if any NIC type string in the list is unsupported.

**Parameters** `type_list` (*list*) – See `COT.data_validation.NIC_TYPES`

**Raises** **ValueUnsupportedError** – if any value in `type_list` is not in `SUPPORTED_NIC_TYPES`

**validate\_serial\_count** (*count*)

Throw an error if the number of serial ports is not supported.

**Parameters** `count` (*int*) – Number of serial ports.

**Raises**

- **ValueTooLowError** – if `count` is less than the minimum required by this platform
- **ValueTooHighError** – if `count` is more than the maximum supported by this platform

**BOOTSTRAP\_DISK\_TYPE** = `'cdrom'`

Type of disk (cdrom/harddisk) to use for bootstrap configuration.

Most platforms use a CD-ROM for this purpose.

**CONFIG\_TEXT\_FILE** = `'config.txt'`

When embedding a primary configuration text file, use this filename.

**See also:**

`COT.inject_config.COTInjectConfig.config_file`

**HARDWARE\_LIMITS** = {<Hardware.nic\_count: 3>: ValidRange(minimum=0, maximum=None), <Hardware.memory\_size: 1>: ValidRange(minimum=0, maximum=None), <Hardware.virtio\_nic\_count: 1>: ValidRange(minimum=0, maximum=None)}  
Range of valid values for various hardware properties.

**LITERAL\_CLI\_STRING** = 'config'

Key prefix for converting text config to OVF environment properties.

Most platforms do not support configuration properties in the environment, and so should define this attribute to None.

See also:

*config\_file\_to\_properties()*

**PLATFORM\_NAME** = '(unrecognized platform, generic)'

String used as a descriptive label for this class of Platform.

**PRODUCT\_PLATFORM\_MAP** = {'com.cisco.ios-xrv64': <class 'COT.platforms.cisco\_iosxrv\_9000'>, 'com.cisco.ios-xrv64-2': <class 'COT.platforms.cisco\_iosxrv\_9000'>}

Mapping of product strings to product classes.

**SECONDARY\_CONFIG\_TEXT\_FILE** = None

When embedding a secondary configuration text file, use this filename.

Most platforms do not support a secondary configuration file.

See also:

*COT.inject\_config.COTInjectConfig.secondary\_config\_file*

**SUPPORTED\_NIC\_TYPES** = ['E1000e', 'E1000', 'PCNet32', 'virtio', 'VMXNET3']

List of NIC device types supported by this platform.

### **COT.platforms.cisco\_csr1000v module**

Platform logic for the Cisco CSR1000V virtual router.

**class CSR1000V**

Bases: *COT.platforms.platform.Platform*

Platform-specific logic for Cisco CSR1000V platform.

**controller\_type\_for\_device** (*device\_type*)

CSR1000V uses SCSI for hard disks and IDE for CD-ROMs.

**Parameters** *device\_type* (*str*) – 'harddisk' or 'cdrom'

**Returns** *str* – 'ide' for CD-ROM, 'scsi' for hard disk

**guess\_nic\_name** (*nic\_number*)

GigabitEthernet1, GigabitEthernet2, etc.

**Warning:** In all current CSR releases, NIC names start at "GigabitEthernet1". Some early versions started at "GigabitEthernet0" but we don't support that.

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns**

- "GigabitEthernet1"
- "GigabitEthernet2"
- etc.

**validate\_cpu\_count** (*cpus*)

CSR1000V supports 1, 2, 4, or 8 CPUs.

**Parameters** *cpus* (*int*) – Number of CPUs.

**Raises**

- `ValueTooLowError` – if *cpus* is less than 1
- `ValueTooHighError` – if *cpus* is more than 8
- `ValueUnsupportedError` – if *cpus* is an unsupported value between 1 and 8

`CONFIG_TEXT_FILE = 'iosxe_config.txt'`

`HARDWARE_LIMITS = {<Hardware.cpus: 1>: ValidRange(minimum=1, maximum=8), <Hardware.n`

`LITERAL_CLI_STRING = 'ios-config'`

`PLATFORM_NAME = 'Cisco CSR1000V'`

`SUPPORTED_NIC_TYPES = ['E1000', 'virtio', 'VMXNET3']`

### `COT.platforms.cisco_iosv` module

Platform logic for the Cisco IOSv virtual router.

**class** `IOSv`

Bases: `COT.platforms.platform.Platform`

Platform-specific logic for Cisco IOSv.

**guess\_nic\_name** (*nic\_number*)

GigabitEthernet0/0, GigabitEthernet0/1, etc.

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns**

- "GigabitEthernet0/0"
- "GigabitEthernet0/1"
- etc.

**validate\_memory\_amount** (*mebibytes*)

IOSv has minimum 192 MiB (with minimal feature set), max 3 GiB.

**Parameters** *mebibytes* (*int*) – RAM, in MiB.

**Raises**

- `ValueTooLowError` – if *mebibytes* is less than 192
- `ValueTooHighError` – if *mebibytes* is more than 3072

`BOOTSTRAP_DISK_TYPE = 'harddisk'`

`CONFIG_TEXT_FILE = 'ios_config.txt'`

`HARDWARE_LIMITS = {<Hardware.cpus: 1>: ValidRange(minimum=1, maximum=1), <Hardware.n`

`LITERAL_CLI_STRING = None`

`PLATFORM_NAME = 'Cisco IOSv'`

`SUPPORTED_NIC_TYPES = ['E1000']`

**COT.platforms.cisco\_iosxrv module**

Platform logic for the Cisco IOS XRv virtual router and its variants.

**Classes**

<i>IOSXRv</i>	Platform-specific logic for Cisco IOS XRv platform.
<i>IOSXRvLC</i>	Platform-specific logic for Cisco IOS XRv line card.
<i>IOSXRvRP</i>	Platform-specific logic for Cisco IOS XRv HA-capable RP.

**class IOSXRv**

Bases: *COT.platforms.platform.Platform*

Platform-specific logic for Cisco IOS XRv platform.

**guess\_nic\_name** (*nic\_number*)

MgmtEth0/0/CPU0/0, GigabitEthernet0/0/0/0, Gig0/0/0/1, etc.

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns**

- "MgmtEth0/0/CPU0/0"
- "GigabitEthernet0/0/0/0"
- "GigabitEthernet0/0/0/1"
- etc.

**CONFIG\_TEXT\_FILE** = 'iosxr\_config.txt'

**HARDWARE\_LIMITS** = {<Hardware.cpus: 1>: ValidRange(minimum=1, maximum=8), <Hardware.n

**LITERAL\_CLI\_STRING** = None

**PLATFORM\_NAME** = 'Cisco IOS XRv'

**SECONDARY\_CONFIG\_TEXT\_FILE** = 'iosxr\_config\_admin.txt'

**SUPPORTED\_NIC\_TYPES** = ['E1000', 'virtio']

**class IOSXRvLC**

Bases: *COT.platforms.cisco\_iosxrv.IOSXRv*

Platform-specific logic for Cisco IOS XRv line card.

**guess\_nic\_name** (*nic\_number*)

Fabric interface plus slot-appropriate GigabitEthernet interfaces.

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns** *str* – \* "fabric" \* "GigabitEthernet0/{SLOT}/0/0" \* "GigabitEthernet0/{SLOT}/0/1" \*  
etc.

**CONFIG\_TEXT\_FILE** = None

**HARDWARE\_LIMITS** = {<Hardware.memory: 2>: ValidRange(minimum=3072, maximum=8192), <Ha

**PLATFORM\_NAME** = 'Cisco IOS XRv line card'

**SECONDARY\_CONFIG\_TEXT\_FILE** = None

**class IOSXRvRP**

Bases: `COT.platforms.cisco_iosxrv.IOSXRv`

Platform-specific logic for Cisco IOS XRv HA-capable RP.

**guess\_nic\_name** (*nic\_number*)

Fabric and management only.

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns** *str* – "fabric" or "MgmtEth0/{SLOT}/CPU0/0" only

**HARDWARE\_LIMITS** = {<Hardware.memory: 2>: ValidRange(minimum=3072, maximum=8192), <Ha

**PLATFORM\_NAME** = 'Cisco IOS XRv route processor card'

**COT.platforms.cisco\_iosxrv\_9000 module**

Platform logic for the Cisco IOS XRv 9000 virtual router.

**class IOSXRv9000**

Bases: `COT.platforms.cisco_iosxrv.IOSXRv`

Platform-specific logic for Cisco IOS XRv 9000 platform.

**guess\_nic\_name** (*nic\_number*)

MgmtEth0/0/CPU0/0, CtrlEth, DevEth, GigabitEthernet0/0/0/0, etc.

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns**

- "MgmtEth0/0/CPU0/0"
- "CtrlEth"
- "DevEth"
- "GigabitEthernet0/0/0/0"
- "GigabitEthernet0/0/0/1"
- etc.

**HARDWARE\_LIMITS** = {<Hardware.serial\_count: 4>: ValidRange(minimum=1, maximum=4), <Ha

**PLATFORM\_NAME** = 'Cisco IOS XRv 9000'

**SUPPORTED\_NIC\_TYPES** = ['E1000', 'virtio', 'VMXNET3']

**COT.platforms.cisco\_nexus\_9000v module**

Platform logic for the Cisco Nexus 9000v virtual switch.

**class Nexus9000v**

Bases: `COT.platforms.platform.Platform`

Platform-specific logic for Cisco Nexus 9000v.

**guess\_nic\_name** (*nic\_number*)

The Nexus 9000v has a management NIC and some number of data NICs.

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns**

- mgmt0
- Ethernet1/1
- Ethernet1/2
- ...

```
CONFIG_TEXT_FILE = 'nxos_config.txt'
```

```
HARDWARE_LIMITS = {<Hardware.cpus: 1>: ValidRange(minimum=1, maximum=4), <Hardware.n
```

```
LITERAL_CLI_STRING = None
```

```
PLATFORM_NAME = 'Cisco Nexus 9000v'
```

```
SUPPORTED_NIC_TYPES = ['E1000', 'VMXNET3']
```

**COT.platforms.cisco\_nxosv module**

Platform logic for the Cisco NX-OSv virtual switch.

**class NXOSv**

Bases: *COT.platforms.platform.Platform*

Platform-specific logic for Cisco NX-OSv (Titanium).

**guess\_nic\_name** (*nic\_number*)

NX-OSv names its NICs a bit interestingly...

**Parameters** *nic\_number* (*int*) – Nth NIC to name.

**Returns**

- mgmt0
- Ethernet2/1
- Ethernet2/2
- ...
- Ethernet2/48
- Ethernet3/1
- Ethernet3/2
- ...

```
CONFIG_TEXT_FILE = 'nxos_config.txt'
```

```
HARDWARE_LIMITS = {<Hardware.serial_count: 4>: ValidRange(minimum=1, maximum=2), <Ha
```

```
LITERAL_CLI_STRING = None
```

```
PLATFORM_NAME = 'Cisco NX-OSv'
```

```
SUPPORTED_NIC_TYPES = ['E1000', 'virtio']
```

**8.2.5 COT.ui package reference**

Package providing common API for the COT user interface (UI) of whatever type.

## API

<i>UI</i>	Abstract user interface functionality.
-----------	--

## Implementation modules

<i>COT.ui.cli</i>	CLI entry point for the Common OVF Tool (COT) suite.
-------------------	--

### COT.ui.cli module

CLI entry point for the Common OVF Tool (COT) suite.

#### Classes

<i>CLI</i>	Command-line user interface for COT.
<i>CLILoggingFormatter</i>	Logging formatter with colorization and variable verbosity.

**class CLI** (*terminal\_width=None*)

Bases: COT.ui.ui.UI

Command-line user interface for COT.

<i>confirm</i>	Prompt user to confirm the requested operation.
<i>create_parser</i>	Create parser object for global cot command.
<i>create_subparsers</i>	Populate the CLI sub-parsers for all known commands.
<i>fill_examples</i>	Pretty-print a set of usage examples.
<i>fill_usage</i>	Pretty-print a list of usage strings for a COT subcommand.
<i>get_input</i>	Prompt the user to enter a string.
<i>get_password</i>	Get password string from the user.
<i>main</i>	Main worker function for COT when invoked from the CLI.
<i>parse_args</i>	Parse the given CLI arguments into a namespace object.
<i>run</i>	Parse the given CLI args then run.
<i>set_verbosity</i>	Enable logging and/or change the logging verbosity level.
<i>terminal_width</i>	The width of the terminal in columns.

**\_\_init\_\_** (*terminal\_width=None*)

Create CLI handler instance.

**Parameters** **terminal\_width** (*int*) – (optional) Set the terminal width for this CLI, independent of the actual terminal in use.

**add\_subparser** (*title, parent=None, aliases=None, lookup\_prefix="", \*\*kwargs*)

Create a subparser under the specified parent.

#### Parameters

- **title** (*str*) – Canonical keyword for this subparser
- **parent** (*object*) – Subparser grouping object returned by ArgumentParser.add\_subparsers()

- **aliases** (*list*) – Aliases for `title`. Only used in Python 3.x.
- **lookup\_prefix** (*str*) – String to prepend to `title` and each alias in `aliases` for lookup purposes.
- **kwargs** (*dict*) – Passed through to `parent.add_parser()`

**Returns** *object* – Subparser object

**adjust\_verbosity** (*delta*)

Set the logging verbosity relative to the COT default.

Wrapper for `set_verbosity()`, to be used when you have a delta (number of steps to offset more or less verbose) rather than an actual logging level in mind.

**Parameters** **delta** (*int*) – Shift in verbosity level. 0 = default verbosity; positive implies more verbose; negative implies less verbose.

**static args\_to\_dict** (*args*)

Convert args to a dict and perform any needed cleanup.

**Parameters** **args** (*argparse.Namespace*) – Namespace from `parse_args()`.

**Returns** *dict* – Dictionary of arg to value

**confirm** (*prompt*)

Prompt user to confirm the requested operation.

Auto-accepts if `force` is set to `True`.

**Parameters** **prompt** (*str*) – Message to prompt the user with

**Returns** *bool* – `True` (user accepts) or `False` (user declines)

**create\_parser** ()

Create parser object for global `cot` command.

Includes a number of globally applicable CLI options.

**create\_subparsers** ()

Populate the CLI sub-parsers for all known commands.

Creates an instance of each `Command` subclass in `COT.commands.command_classes`, then calls `create_subparser()` for each.

**fill\_examples** (*example\_list*)

Pretty-print a set of usage examples.

**Parameters** **example\_list** (*list*) – List of (description, CLI example) tuples.

**Returns** *str* – Concatenation of examples, each wrapped appropriately to the `terminal_width()` value. CLI examples will be wrapped with backslashes and a hanging indent.

## Examples

```
>>> print(CLI(68).fill_examples([
...     ("Deploy to vSphere/ESXi server 192.0.2.100 with credentials"
...      " admin/admin, creating a VM named 'test_vm' from foo.ova.",
...      'cot deploy foo.ova esxi 192.0.2.100 -u admin -p admin'
...      ' -n test_vm'),
...     ("Deploy to vSphere/ESXi server 192.0.2.100, with username"
...      " admin (prompting the user to input a password at runtime),")
... ])
```



```
...     " creating a VM based on profile '1CPU-2.5GB' in foo.ova.",
...     'cot deploy foo.ova esxi 192.0.2.100 -u admin -c 1CPU-2.5GB')
... ]))
```

Examples:

Deploy to vSphere/ESXi server 192.0.2.100 with credentials admin/admin, creating a VM named 'test\_vm' from foo.ova.

```
cot deploy foo.ova esxi 192.0.2.100 -u admin -p admin \
-n test_vm
```

Deploy to vSphere/ESXi server 192.0.2.100, with username admin (prompting the user to input a password at runtime), creating a VM based on profile '1CPU-2.5GB' in foo.ova.

```
cot deploy foo.ova esxi 192.0.2.100 -u admin -c 1CPU-2.5GB
```

**fill\_usage** (*subcommand*, *usage\_list*)

Pretty-print a list of usage strings for a COT subcommand.

Automatically prepends a `cot subcommand --help` usage string to the provided list.

#### Parameters

- **subcommand** (*str*) – Subcommand name/keyword
- **usage\_list** (*list*) – List of usage strings for this subcommand.

**Returns** *string* – All usage strings, each appropriately wrapped to the `terminal_width()` value.

#### Examples

```
>>> print(CLI(50).fill_usage('add-file',
...     ["FILE PACKAGE [-o OUTPUT] [-f FILE_ID]"]))

cot add-file --help
cot <opts> add-file FILE PACKAGE [-o OUTPUT]
                        [-f FILE_ID]
```

**get\_input** (*prompt*, *default\_value*)

Prompt the user to enter a string.

Auto-inputs the `default_value` if `force` is set to `True`.

#### Parameters

- **prompt** (*str*) – Message to prompt the user with
- **default\_value** (*str*) – Default value to input if the user simply hits Enter without entering a value, or if `force`.

**Returns** *str* – Input value

**get\_password** (*username*, *host*)

Get password string from the user.

#### Parameters

- **username** (*str*) – Username the password is associated with
- **host** (*str*) – Host the password is associated with

**Raises** `InvalidInputError` – if `force` is `True` (as there is no "default" password value)

**Returns** `str` – Password string

**main** (`args`)

Main worker function for COT when invoked from the CLI.

- Calls `adjust_verbosity()` with the appropriate verbosity level derived from the args.
- Looks up the appropriate `Command` instance corresponding to the subcommand that was invoked.
- Converts `args` to a dict and calls `set_instance_attributes()` to pass these args to the instance.
- Calls `run()` followed by `finished()`.
- Catches various exceptions and handles them appropriately.

**Parameters** `args` (`argparse.Namespace`) – Parser namespace object returned from `parse_args()`.

**Returns**

`int` –

Exit code for the COT executable.

- 0 on successful completion
- 1 on runtime error
- 2 on input error (parser error, `InvalidInputError`, etc.)

**parse\_args** (`argv`)

Parse the given CLI arguments into a namespace object.

**Parameters** `argv` (`list`) – List of CLI arguments, not including `argv0`

**Returns** `argparse.Namespace` – Parser namespace object

**run** (`argv`)

Parse the given CLI args then run.

Calls `parse_args()` followed by `main()`.

**Parameters** `argv` (`list`) – The CLI argv value (not including `argv[0]`)

**Returns** `int` – Return code from `main()`

**static set\_instance\_attributes** (`arg_dict`)

Set attributes of the `instance` based on the given `arg_dict`.

**Parameters** `arg_dict` (`dict`) – Dictionary of (attribute, value).

**Raises** `InvalidInputError` – if attributes are not validly set.

**set\_verbosity** (`level`)

Enable logging and/or change the logging verbosity level.

Will create a `CLILoggingFormatter` and use it for colorized, appropriately verbose log formatting.

**Parameters** `level` (`int`) – Logging level as defined in `logging`.

**terminal\_width**

The width of the terminal in columns.

**class CLILoggingFormatter** (*verbosity=20*)

Bases: `colorlog.colorlog.ColoredFormatter`, `object`

Logging formatter with colorization and variable verbosity.

COT logs are formatted differently (more or less verbosely) depending on the logging level.

**See also:**

`logging.Formatter`

**Parameters** *verbosity* (*int*) – Logging level as defined by `logging`.

Examples:

```
>>> record = logging.LogRecord(
...     "COT.doctests",      # logger name
...     logging.INFO,       # message level
...     "/fakemodule.py",   # file reporting the message
...     22,                 # line number in file
...     "Hello world!",     # message text
...     None,               # %-style args for message
...     None,               # exception info
...     "test_func")        # function reporting the message
>>> record.created = 0
>>> record.msecs = 0
>>> CLILoggingFormatter(logging.NOTICE).format(record)
'\x1b[32mINFO      :\x1b[0m Hello world!'
>>> CLILoggingFormatter(logging.INFO).format(record)
'\x1b[32mINFO      : fakemodule ... Hello world!'
>>> CLILoggingFormatter(logging.VERBOSE).format(
... record)
'\x1b[32mINFO      : fakemodule ... test_func()... Hello world!'
>>> CLILoggingFormatter(logging.DEBUG).format(record)
'\x1b[32mINFO ...:00.0 : fakemodule ...22...test_func()...Hello world!'
```

**\_\_init\_\_** (*verbosity=20*)

Create formatter for COT log output with the given verbosity.

**LOG\_COLORS** = {'INFO': 'green', 'CRITICAL': 'purple,bold', 'NOTICE': 'yellow', 'WARNING': 'yellow,bold'}

**main** ()

Launch COT from the CLI.

**class UI** (*force=False*)

Bases: `object`

Abstract user interface functionality.

Can also be used in test code as a stub that autoconfirms everything.

**Properties**

---

*terminal\_width*

Get the width of the terminal in columns.

---

**API Methods**

---

*choose\_from\_list*

Prompt the user to choose from a list.

*confirm*

Prompt user to confirm the requested operation.

---

Continued on next page

Table 8.40 – continued from previous page

<code>confirm_or_die</code>	If the user doesn't agree, abort the program.
<code>validate_value</code>	Ask the user whether to ignore a <code>ValueError</code> .
<code>fill_examples</code>	Pretty-print a set of usage examples.
<code>fill_usage</code>	Pretty-print a list of usage strings.
<code>get_input</code>	Prompt the user to enter a string.
<code>get_password</code>	Get password string from the user.

`__init__` (*force=False*)  
 Constructor.

**Parameters** *force* (*bool*) – See *force*.

`choose_from_list` (*footer, option\_list, default\_value, header="", info\_list=None*)  
 Prompt the user to choose from a list.

**Parameters**

- **footer** (*str*) – Prompt string to display following the list
- **option\_list** (*list*) – List of strings to choose amongst
- **default\_value** (*str*) – Default value to select if user declines
- **header** (*str*) – String to display prior to the list
- **info\_list** (*list*) – Verbose strings to display in place of *option\_list*

**Returns** *str* – *default\_value* or an item from *option\_list*.

`confirm` (*prompt*)  
 Prompt user to confirm the requested operation.  
 Auto-accepts if *force* is set to `True`.

**Warning:** This stub implementation does not actually interact with the user, but instead returns `default_confirm_response`. Subclasses should override this method.

**Parameters** *prompt* (*str*) – Message to prompt the user with

**Returns** *bool* – `True` (user confirms acceptance) or `False` (user declines)

`confirm_or_die` (*prompt*)  
 If the user doesn't agree, abort the program.  
 A simple wrapper for `confirm()` that calls `sys.exit()` if `confirm()` returns `False`.

**Parameters** *prompt* (*str*) – Message to prompt the user with

**Raises** `SystemExit` – if user declines

`fill_examples` (*example\_list*)  
 Pretty-print a set of usage examples.

**Parameters** *example\_list* (*list*) – List of (example, description) tuples.

**Raises** `NotImplementedError` – Must be implemented by a subclass.

`fill_usage` (*subcommand, usage\_list*)  
 Pretty-print a list of usage strings.

**Parameters**

- **subcommand** (*str*) – Subcommand name/keyword
- **usage\_list** (*list*) – List of usage strings for this subcommand.

**Returns** *str* – Concatenation of all usage strings, each appropriately wrapped to the *terminal\_width* value.

**get\_input** (*prompt*, *default\_value*)

Prompt the user to enter a string.

Auto-inputs the *default\_value* if *force* is set to *True*.

**Warning:** This stub implementation does not actually interact with the user, but instead always returns *default\_value*. Subclasses should override this method.

#### Parameters

- **prompt** (*str*) – Message to prompt the user with
- **default\_value** (*str*) – Default value to input if the user simply hits Enter without entering a value, or if *force*.

**Returns** *str* – Input value

**get\_password** (*username*, *host*)

Get password string from the user.

#### Parameters

- **username** (*str*) – Username the password is associated with
- **host** (*str*) – Host the password is associated with

**Raises** `NotImplementedError` – Must be implemented by a subclass.

**validate\_value** (*helper\_function*, *\*args*)

Ask the user whether to ignore a `ValueError`.

#### Parameters

- **helper\_function** (*function*) – Validation function to call, which may raise a `ValueError`.
- **\*args** – Arguments to pass to *helper\_function*.

**Raises** `ValueError` – if *helper\_function* raises a `ValueError` and the user declines to ignore it.

**terminal\_width**

Get the width of the terminal in columns.

## 8.2.6 COT.vm\_description package reference

Support for various virtual machine description formats (OVF, OVA, etc.).

The `VMDescription` class describes the abstract API that is implemented by various subclasses.

In general, other modules should not access subclasses directly but should instead use the `factory()` API to derive the appropriate subclass object.

## API

<i>VMDescription</i>	Abstract class for reading, editing, and writing VM definitions.
<i>VMInitError</i>	Class representing errors encountered when trying to init/load a VM.

## VM description modules

<i>COT.vm_description.ovf</i>	Package for handling OVF and OVA virtual machine description files.
-------------------------------	---

### COT.vm\_description.ovf package reference

Package for handling OVF and OVA virtual machine description files.

The *OVF* class provides an implementation of the *COT.vm\_description.VMDescription* interface. In general, COT submodules should be agnostic of the internals of this package and should only use the *VMDescription* interface.

## API

<i>OVF</i>	Representation of the contents of an OVF or OVA.
------------	--

## Exceptions

<i>OVFHardwareDataError</i>	The input data used to construct an <i>OVFHardware</i> is not sane.
<i>OVFItemDataError</i>	Data to be added to an <i>OVFItem</i> conflicts with existing data.

## Modules

<i>COT.vm_description.ovf.hardware</i>	Representation of OVF hardware definitions.
<i>COT.vm_description.ovf.item</i>	Module for working with individual hardware elements in an OVF.
<i>COT.vm_description.ovf.name_helper</i>	Module for handling the differences in XML between OVF spec versions.
<i>COT.vm_description.ovf.utilities</i>	Module providing utility functions for OVF and OVA handling.

### COT.vm\_description.ovf.hardware module

Representation of OVF hardware definitions.

#### Classes and Exceptions

---

<i>OVFHardware</i>	Helper class for OVF.
<i>OVFHardwareDataError</i>	The input data used to construct an <i>OVFHardware</i> is not sane.

---

**exception OVFHardwareDataError**

Bases: `exceptions.Exception`

The input data used to construct an *OVFHardware* is not sane.

**class OVFHardware** (*ovf*)

Bases: `object`

Helper class for OVF.

Represents all hardware items defined by this OVF; i.e., the contents of all Items in the VirtualHardwareSection.

Fundamentally it's just a dict of *OVFItem* objects with a bunch of helper methods.

**\_\_init\_\_** (*ovf*)

Construct an OVFHardware object describing all Items in the OVF.

**Parameters** *ovf* (*OVF*) – OVF instance to extract hardware information from.

**Raises** *OVFHardwareDataError* – if any data errors are seen

**clone\_item** (*parent\_item*, *profile\_list*)

Clone an OVFItem to create a new instance.

**Parameters**

- **parent\_item** (*OVFItem*) – Instance to clone from
- **profile\_list** (*list*) – List of profiles to clone into

**Returns** *tuple* – (instance\_id, ovfitem)

**delete\_item** (*item*)

Delete the given Item from the hardware.

**Parameters** *item* (*OVFItem*) – Item to delete

**find\_all\_items** (*resource\_type=None*, *properties=None*, *profile\_list=None*)

Find all items matching the given type, properties, and profiles.

**Parameters**

- **resource\_type** (*str*) – Resource type string like 'scsi' or 'serial'
- **properties** (*dict*) – Properties and their values to match
- **profile\_list** (*list*) – List of profiles to filter on

**Returns** *list* – Matching OVFItem instances

**find\_item** (*resource\_type=None*, *properties=None*, *profile=None*)

Find the only OVFItem of the given resource\_type.

**Parameters**

- **resource\_type** (*str*) – Resource type string like 'scsi' or 'serial'
- **properties** (*dict*) – Properties and their values to match
- **profile** (*str*) – Single profile ID to search within

**Returns** *OVFItem* – Matching instance, or None

Raises `LookupError` – if more than one such Item exists.

**find\_unused\_instance\_id** (*start=1*)

Find the first available InstanceID number.

**Parameters** *start* (*int*) – First InstanceID value to consider (disregarding all lower InstanceIDs, even if available).

**Returns** *str* – An instance ID that is not yet in use.

**get\_item\_count** (*resource\_type, profile*)

Wrapper for `get_item_count_per_profile()`.

**Parameters**

- **resource\_type** (*str*) – Resource type string like 'scsi' or 'serial'
- **profile** (*str*) – Single profile identifier string to look up.

**Returns** *int* – Number of items of this type in this profile.

**get\_item\_count\_per\_profile** (*resource\_type, profile\_list*)

Get the number of Items of the given type per profile.

Items present under "no profile" will be counted against the total for each profile.

**Parameters**

- **resource\_type** (*str*) – Resource type string like 'scsi' or 'serial'
- **profile\_list** (*list*) – List of profiles to filter on (default: apply across all profiles)

**Returns** *dict* – mapping profile strings to the number of items under each profile.

**item\_match** (*item, resource\_type, properties, profile\_list*)

Check whether the given item matches the given filters.

**Parameters**

- **item** (`OvfItem`) – Item to validate
- **resource\_type** (*str*) – Resource type string like 'scsi' or 'serial'
- **properties** (*dict*) – Properties and their values to match
- **profile\_list** (*list*) – List of profiles to filter on

**Returns** *bool* – True if the item matches all filters, False if not.

**new\_item** (*resource\_type, profile\_list=None*)

Create a new OvfItem of the given type.

**Parameters**

- **resource\_type** (*str*) – String such as 'cpu' or 'harddisk' - used as a key to `RES_MAP`
- **profile\_list** (*list*) – Profiles the new item should belong to

**Returns** *tuple* – (*instance\_id, ovfitem*)

**set\_item\_count\_per\_profile** (*resource\_type, count, profile\_list*)

Set the number of items of a given type under the given profile(s).

If the new count is greater than the current count under this profile, then additional instances that already exist under another profile will be added to this profile, starting with the lowest-sequence instance not already present, and only as a last resort will new instances be created.



If the new count is less than the current count under this profile, then the highest-numbered instances will be removed preferentially.

#### Parameters

- **resource\_type** (*str*) – 'cpu', 'harddisk', etc.
- **count** (*int*) – Desired number of items
- **profile\_list** (*list*) – List of profiles to filter on (default: apply across all profiles)

**set\_item\_values\_per\_profile** (*resource\_type*, *prop\_name*, *value\_list*, *profile\_list*, *default=None*)

Set value(s) for a property of multiple items of a type.

#### Parameters

- **resource\_type** (*str*) – Device type such as 'harddisk' or 'cpu'
- **prop\_name** (*str*) – Property name to update
- **value\_list** (*list*) – List of values to set (one value per item of the given resource\_type)
- **profile\_list** (*list*) – List of profiles to filter on (default: apply across all profiles)
- **default** (*str*) – If there are more matching items than entries in value\_list, set extra items to this value

**set\_value\_for\_all\_items** (*resource\_type*, *prop\_name*, *new\_value*, *profile\_list*, *create\_new=False*)

Set a property to the given value for all items of the given type.

If no items of the given type exist, will create a new Item if create\_new is set to True; otherwise will log a warning and do nothing.

#### Parameters

- **resource\_type** (*str*) – Resource type such as 'cpu' or 'harddisk'
- **prop\_name** (*str*) – Property name to update
- **new\_value** (*str*) – New value to set the property to
- **profile\_list** (*list*) – List of profiles to filter on (default: apply across all profiles)
- **create\_new** (*bool*) – Whether to create a new entry if no items of this resource\_type presently exist.

**update\_xml** ()

Regenerate all Items under the VirtualHardwareSection, if needed.

Will do nothing if no Items have been changed.

## COT.vm\_description.ovf.item module

Module for working with individual hardware elements in an OVF.

Represents all variations of a given hardware Item amongst different hardware configuration profiles.

### Functions

---

*list\_union*

Get union of lists.

---

## Classes and Exceptions

<code>OVFItem</code>	Helper class for OVF.
<code>OVFItemDataError</code>	Data to be added to an <code>OVFItem</code> conflicts with existing data.

### exception `OVFItemDataError`

Bases: `exceptions.Exception`

Data to be added to an `OVFItem` conflicts with existing data.

### class `OVFItem` (`ovf`, `item=None`)

Bases: `object`

Helper class for OVF.

Represents all variations of a given hardware `Item` amongst different hardware configuration profiles.

In essence, it is:

- a dict of `Item` properties (indexed by element name)
- each of which is a dict of sets of profiles (indexed by element value)

#### `__init__` (`ovf`, `item=None`)

Create a new `OVFItem` with contents based on the given `Item` element.

#### Parameters

- **`ovf`** (`OVF`) – OVF instance that owns the `Item` (optional)
- **`item`** (`xml.etree.ElementTree.Element`) – ‘Item’ element (optional)

#### `add_item` (`item`)

Add the given `Item` element to this `OVFItem`.

**Parameters** **`item`** (`xml.etree.ElementTree.Element`) – XML `Item` element

#### Raises

- `ValueUnsupportedError` – if the `item` is not a recognized `Item` variant.
- `OVFItemDataError` – if the new `Item` conflicts with existing data already in the `OVFItem`.

#### `add_profile` (`new_profile`, `from_item=None`)

Add a new profile to this item.

#### Parameters

- **`new_profile`** (`str`) – Profile name to add
- **`from_item`** (`OVFItem`) – Item to inherit properties from. If unset, this defaults to `self`.

**Raises** `RuntimeError` – If unable to determine what value to inherit for a particular property.

#### `all_profiles` (`name`, `default=None`)

Superset of all profiles for which this name has a value.

#### Parameters

- **`name`** (`str`) – Property name.
- **`default`** (`object`) – Default value to return if there are no matches

**Returns** Set of profile strings, or the given `default` if no matches.

**generate\_items()**

Get a list of Item XML elements derived from this object's data.

**Returns** *list* – Generated list of XML Item elements

**get(tag)**

Get the dict associated with the given XML tag, if any.

**Parameters** **tag** (*str*) – XML tag to look up

**Returns** *dict* – Dictionary of values associated with this tag (TODO?)

**get\_all\_values(tag)**

Get the list of all value strings for the given tag.

**Parameters** **tag** (*str*) – Tag to retrieve value for

**Returns** *list* – List of value strings.

**get\_nonintersecting\_set\_list()**

Identify the minimal non-intersecting set of profiles.

**Returns** *list* – List of profile-set strings.

**get\_value(tag, profiles=None)**

Get the value for the given tag under the given profiles.

If the tag does not exist under these profiles, or the tag values differ across the profiles, returns *None*.

**Parameters**

- **tag** (*str*) – Tag to retrieve value for
- **profiles** (*set*) – set of profile names, or *None*

**Returns** Value string or list, or *None*

**Raises** *OVFItemDataError* – if *value\_replace\_wildcards()* failed to remove any wildcards from the internally stored value.

**has\_profile(profile)**

Check if this Item exists under the given profile.

**Parameters** **profile** (*str*) – Profile name

**Returns** *bool* – True if the item exists in this profile, False if not.

**property\_profiles(name, value)**

Get set of profiles associated with a property name and value.

**Parameters**

- **name** (*str*) – Property name.
- **value** (*object*) – Property value of interest.

**Returns** *set* – Profile strings associated with this name/value.

**property\_values(name)**

Get list of values known for a given property name.

**Parameters** **name** (*str*) – Property name.

**Returns** *list* – List of values

**remove\_profile(profile, split\_default=True)**

Remove all trace of the given profile from this item.

**Parameters**

- **profile** (*str*) – Profile name to remove
- **split\_default** (*bool*) – If False, do not split out 'default' profile items to specifically exclude this profile. Used when the profile being removed will no longer exist anywhere and so 'default' will continue to exclude this profile.

**set\_property** (*name, value, profiles=None, overwrite=True*)

Store the value and profiles associated with it for the given name.

**Parameters**

- **name** (*str*) – Property name
- **value** (*str*) – Value associated with *name*
- **profiles** (*list*) – If None, set for all profiles currently known to this item, else set only for the given list of profiles.
- **overwrite** (*bool*) – Whether to permit overwriting of existing value set in this item.

**Raises** `OVFItemDataError` – if a value is already defined and would be overwritten, unless `overwrite` is True

**validate** ()

Verify that the OVFItem describes a valid set of items.

Also clean up any oddities (like a property value assigned to 'all profiles' and also redundantly to a specific profile).

**Raises** `RuntimeError` – if validation fails and COT doesn't know how to automatically repair the error(s) identified.

**value\_add\_wildcards** (*name, value, profiles*)

Add wildcard placeholders to a string that may need updating.

If the Description references the ElementName, or the ElementName or Description references the VirtualQuantity, Connection, or ResourceSubType, replace such references with a placeholder that we can regenerate at output time. That way, if any of the linked items change, these strings can change too.

**Parameters**

- **name** (*str*) – Property name
- **value** (*str*) – Value to add wildcards to.
- **profiles** (*list*) – Profiles to which this (name, value) applies.

**Returns** *str* – The updated value string with wildcards added.

**See also:**

`value_replace_wildcards()`

**value\_replace\_wildcards** (*name, value, profiles*)

Replace wildcards with actual values.

**Parameters**

- **name** (*str*) – Property name
- **value** (*str*) – Value to replace wildcards from.
- **profiles** (*list*) – Profiles to which this (name, value) applies.

**Returns** *str* – The updated value string, with wildcards replaced.

See also:

`value_add_wildcards()`

**ATTRIB\_KEY\_SUFFIX** = ' {Item attribute}'

**ELEMENT\_KEY\_SUFFIX** = ' {custom element}'

**hardware\_subtype**

Device hardware subtype such as 'virtio' or 'lsilogic'.

**hardware\_type**

Device hardware type such as 'ide' or 'memory'.

**instance\_id**

Device instance ID.

**properties** = None

Dict of dicts. properties[name][value] = (profile1, profile2).

**property\_names**

List of names of all properties known to this OVFIItem.

**list\_union** (\*lists)

Get union of lists.

**Parameters** **lists** (*list*) – List of lists to unify.

**Returns** *list* – All distinct values across the given lists.

## Examples

```
>>> list_union([1, 2, 3], [0, 4], [1, 5])
[1, 2, 3, 0, 4, 5]
>>> list_union(['foo'], ['bar'], ['bar', 'foo'])
['foo', 'bar']
>>> list_union(['bar', 'foo'], ['foo'], ['bar'])
['bar', 'foo']
```

## COT.vm\_description.ovf.name\_helper module

Module for handling the differences in XML between OVF spec versions.

### Variation between OVF versions

XML can be a pain to work with, and when working with multiple OVF schema versions (currently 3 of them – 0.9, 1.x.y, 2.0.y) it gets extra painful. While we could use `lxml` to *validate* inbound XML against the appropriate schema version, even that package does not (as far as I can determine) provide any assistance in *creating* XML against the appropriate schema definition. So we have to do it ourselves.

Variation	Details and examples
Root namespace	<ul style="list-style-type: none"> <li>• 0.9: <code>"http://www.vmware.com/schema/ovf/1/envelope"</code></li> <li>• 1.x: <code>"http://schemas.dmtf.org/ovf/envelope/1"</code></li> <li>• 2.x: <code>"http://schemas.dmtf.org/ovf/envelope/2"</code></li> </ul> <p>Unfortunately, the <code>xml.etree.ElementTree</code> and <code>lxml.etree</code> modules both rely on the absolute namespace URI (rather than any defined namespace prefix aliases) throughout. Thus, we can't make use of the fact that OVF descriptors of all three versions typically define the prefix "ovf" for whichever of the above URIs is appropriate. We have to use the version-appropriate namespace URI everywhere in code.</p>
Element namespaces	Example: hardware details for network interfaces are in the <code>ResourceAllocationSettingData</code> namespace in versions 0.x and 1.x, but split out into a separate <code>EthernetPortAllocationSettingData</code> namespace in version 2.x.
Element tags	Network definitions are grouped under an <code>ovf:Section</code> element in version 0.x but under an <code>ovf:NetworkSection</code> in versions 1.x and 2.x. Network cards are <code>ovf:Item</code> elements in 0.x and 1.x, but <code>ovf:EthernetPortItem</code> in 2.x.
Element attributes	In version 0.x, the different Section types are identified by a type attribute ( <code>&lt;ovf:Section xsi:type="ovf:DiskSection_Type"&gt;</code> ) while in later versions they are identified by tag ( <code>&lt;ovf:DiskSection&gt;</code> ) and do not have such an attribute.
Element ordering	Most notably, the various child elements under an <code>Item</code> require alphabetical order in OVF 1.x and 2.x, but in 0.9 they require a different, idiosyncratic order.

## Functions

<code>name_helper</code>	Generate an instance of the correct <code>OVFNameHelper</code> variant class.
--------------------------	---

## Classes and Exceptions

<code>OVFNameHelper1</code>	Helper class for OVF version 1.x.
<code>OVFNameHelper0</code>	Helper class for OVF of versions prior to 1.0.
<code>OVFNameHelper2</code>	Helper class for OVF of version 2.x.

### class `OVFNameHelper0`

Bases: `COT.vm_description.ovf.name_helper.OVFNameHelper1`

Helper class for OVF of versions prior to 1.0.

Provides string constants for easier lookup of various OVF XML elements and attributes.

`__init__()`

Create a name helper for OVF version 0.x.

```
NSM = {'vssd': 'http://schemas.dmtf.org/wbem/wscim/1/cim-schema/2/CIM_VirtualSystemSe
```

Shorthand for XML namespace URIs usually seen in a version 0.x OVF.

```
class OV FNameHelper1
```

Bases: `object`

Helper class for OVF version 1.x.

Provides string constants for easier lookup of various OVF XML elements and attributes.

Version-specific subclasses below provide variant properties.

```
__init__()
```

Create a name helper for OVF version 1.x.

```
item_tag_for_namespace(namespace)
```

Get the Item tag for the given XML namespace.

**Parameters** `namespace` (*str*) – XML namespace

**Returns** *str* – 'Item', 'StorageItem', or 'EthernetPortItem' as appropriate.

**Raises** `ValueUnsupportedError` – if the namespace is unrecognized

```
namespace_for_item_tag(tag)
```

Get the XML namespace for the given item tag.

**Parameters** `tag` (*str*) – Un-namespaced XML tag.

**Returns** *str* – XML namespace string, or None.

```
namespace_for_resource_type(resource_type)
```

Get the XML namespace for the given ResourceType.

**Parameters** `resource_type` (*str*) – ResourceType value string.

**Returns** *str* – XML namespace string, or None.

```
NSM = {'vssd': 'http://schemas.dmtf.org/wbem/wscim/1/cim-schema/2/CIM_VirtualSystemSe
```

Shorthand for XML namespace URIs usually seen in a version 1.x OVF.

```
RES_MAP = {'ib': '9', 'usb': '23', 'floppy': '14', 'dvd': '16', 'iscsi': '8', 'ha
```

Mapping of human-readable strings to ResourceType values.

See [http://schemas.dmtf.org/wbem/cim-html/2/CIM\\_ResourceAllocationSettingData.html](http://schemas.dmtf.org/wbem/cim-html/2/CIM_ResourceAllocationSettingData.html) for more details.

```
class OV FNameHelper2
```

Bases: `COT.vm_description.ovf.name_helper.OV FNameHelper1`

Helper class for OVF of version 2.x. TODO.

Provides string constants for easier lookup of various OVF XML elements and attributes.

```
__init__()
```

Create a name helper for OVF version 2.x.

```
NSM = {'vssd': 'http://schemas.dmtf.org/wbem/wscim/1/cim-schema/2/CIM_VirtualSystemSe
```

Shorthand for XML namespace URIs usually seen in a version 2.x OVF.

```
name_helper(version)
```

Generate an instance of the correct OV FNameHelper variant class.

**Parameters** `version` (*float*) – OVF specification version to use, such as 0.9, 1.0, or 2.0

**Returns** Instance of OV FNameHelper[012] as appropriate.

### COT.vm\_description.ovf.utilities module

Module providing utility functions for OVF and OVA handling.

#### Functions

<code>int_bytes_to_programmatic_units</code>	Convert a byte count into OVF-style bytes + multiplier.
<code>parse_manifest</code>	Parse the given manifest file contents into a dictionary.
<code>programmatic_bytes_to_int</code>	Convert a byte value expressed in programmatic units to the raw number.

**int\_bytes\_to\_programmatic\_units** (*byte\_value*)

Convert a byte count into OVF-style bytes + multiplier.

Inverse operation of `programmatic_bytes_to_int()`

**Parameters** `byte_value` (*int*) – Number of bytes

**Returns** *tuple* – (base\_value, programmatic\_units)

#### Examples

```
>>> int_bytes_to_programmatic_units(2147483648)
('2', 'byte * 2^30')
>>> int_bytes_to_programmatic_units(2147483647)
('2147483647', 'byte')
>>> int_bytes_to_programmatic_units(134217728)
('128', 'byte * 2^20')
>>> int_bytes_to_programmatic_units(134217729)
('134217729', 'byte')
```

**parse\_manifest** (*manifest\_text*)

Parse the given manifest file contents into a dictionary.

**Parameters** `manifest_text` (*str*) – Contents of an OVF manifest file

**Returns** *dict* – Mapping of filename to (algorithm, checksum\_string)

#### Examples

```
>>> result = parse_manifest(
...   "SHA1(package.ovf)= 237de026fb285b85528901da058475e56034da95\n"
...   "SHA1(vmdisk1.vmdk)= 393a66df214e192ffbfedb78528b5be75cc9e1c3\n"
... )
>>> sorted(result.keys())
['package.ovf', 'vmdisk1.vmdk']
>>> result["package.ovf"]
('SHA1', '237de026fb285b85528901da058475e56034da95')
>>> result["vmdisk1.vmdk"]
('SHA1', '393a66df214e192ffbfedb78528b5be75cc9e1c3')
```



**programmatic\_bytes\_to\_int** (*base\_value*, *programmatic\_units*)

Convert a byte value expressed in programmatic units to the raw number.

Inverse operation of `int_bytes_to_programmatic_units()`.

See also:

DMTF DSP0004, Common Information Model (CIM) Infrastructure Specification 2.5

**Parameters**

- **base\_value** (*str*) – Base value string (value of `ovf:capacity`, etc.)
- **programmatic\_units** (*str*) – Programmatic units string (value of `ovf:capacityAllocationUnits`, etc.)

**Returns** *int* – Number of bytes

**Examples**

```
>>> programmatic_bytes_to_int("128", "byte")
128
>>> programmatic_bytes_to_int("1", "byte * 2^10")
1024
>>> programmatic_bytes_to_int("128", "byte * 2^20")
134217728
>>> programmatic_bytes_to_int("512", "MegaBytes")
536870912
```

**class OVF** (*input\_file*, *output\_file*)

Bases: `COT.vm_description.vm_description.VMDescription`, `COT.xml_file.XML`

Representation of the contents of an OVF or OVA.

**Properties**

<code>input_file</code>	Data file to read in.
<code>output_file</code>	OVF or OVA file that will be created or updated by <code>write()</code> .
<code>ovf_version</code>	Float representing the OVF specification version in use.
<code>product_class</code>	The product class identifier, such as <code>com.cisco.csr1000v</code> .
<code>platform</code>	The platform type, as determined from the OVF descriptor.
<code>config_profiles</code>	The list of supported configuration profiles.
<code>default_config_profile</code>	The name of the default configuration profile.
<code>environment_properties</code>	The array of environment properties.
<code>environment_transports</code>	The list of environment transport method strings.
<code>networks</code>	The list of network names currently defined in this VM.
<code>network_descriptions</code>	The list of network descriptions currently defined in this VM.
<code>system_types</code>	List of virtual system type(s) supported by this virtual machine.
<code>version_short</code>	Short descriptive version string (XML Version element).

Continued on next page

Table 8.52 – continued from previous page

<i>version_long</i>	Long descriptive version string (XML FullVersion element).
<hr/>	
<b>__init__</b> ( <i>input_file</i> , <i>output_file</i> )	
Open the specified OVF and read its XML into memory.	
<b>Parameters</b>	
<ul style="list-style-type: none"> <li>• <b>input_file</b> (<i>str</i>) – Data file to read in.</li> <li>• <b>output_file</b> (<i>str</i>) – File name to write to. If this VM is read-only, (there will never be an output file) this value should be None; if the output filename is not yet known, use "" and subsequently set <i>output_file</i> when it is determined.</li> </ul>	
<b>Raises</b>	
<ul style="list-style-type: none"> <li>• <b>VMInitError</b> – * if the OVF descriptor cannot be located * if an XML parsing error occurs * if the XML is not actually an OVF descriptor * if the OVF hardware validation fails</li> <li>• <b>Exception</b> – will call <code>destroy()</code> to clean up before reraising any exception encountered.</li> </ul>	
<b>add_controller_device</b> ( <i>device_type</i> , <i>subtype</i> , <i>address</i> , <i>ctrl_item=None</i> )	
Create a new IDE or SCSI controller, or update existing one.	
<b>Parameters</b>	
<ul style="list-style-type: none"> <li>• <b>device_type</b> (<i>str</i>) – 'ide' or 'scsi'</li> <li>• <b>subtype</b> (<i>object</i>) – (Optional) subtype string such as 'virtio' or list of subtype strings</li> <li>• <b>address</b> (<i>int</i>) – Controller address such as 0 or 1 (optional)</li> <li>• <b>ctrl_item</b> (<i>OVFItem</i>) – Existing controller device to update (optional)</li> </ul>	
<b>Returns</b> <i>OVFItem</i> – New or updated controller device object	
<b>Raises</b> <i>ValueTooHighError</i> – if no more controllers can be created	
<b>add_disk</b> ( <i>disk_repr</i> , <i>file_id</i> , <i>drive_type</i> , <i>disk=None</i> )	
Add a new disk object to the VM or overwrite the provided one.	
<b>Parameters</b>	
<ul style="list-style-type: none"> <li>• <b>disk_repr</b> (<i>COT.disks.DiskRepresentation</i>) – Disk file representation</li> <li>• <b>file_id</b> (<i>str</i>) – Identifier string for the file/disk mapping</li> <li>• <b>drive_type</b> (<i>str</i>) – 'harddisk' or 'cdrom'</li> <li>• <b>disk</b> (<i>xml.etree.ElementTree.Element</i>) – Existing object to overwrite</li> </ul>	
<b>Returns</b> <i>xml.etree.ElementTree.Element</i> – New or updated disk object	
<b>add_disk_device</b> ( <i>drive_type</i> , <i>address</i> , <i>name</i> , <i>description</i> , <i>disk</i> , <i>file_obj</i> , <i>ctrl_item</i> , <i>disk_item=None</i> )	
Create a new disk hardware device or overwrite an existing one.	
<b>Parameters</b>	
<ul style="list-style-type: none"> <li>• <b>drive_type</b> (<i>str</i>) – 'harddisk' or 'cdrom'</li> <li>• <b>address</b> (<i>str</i>) – Address on controller, such as "1:0" (optional)</li> <li>• <b>name</b> (<i>str</i>) – Device name string (optional)</li> </ul>	

- **description** (*str*) – Description string (optional)
- **disk** (*xml.etree.ElementTree.Element*) – Disk object to map to this device
- **file\_obj** (*xml.etree.ElementTree.Element*) – File object to map to this device
- **ctrl\_item** (*OVFItem*) – Controller object to serve as parent
- **disk\_item** (*OVFItem*) – Existing disk device to update instead of making a new device.

**Returns** *xml.etree.ElementTree.Element* – New or updated disk device object.

**add\_file** (*file\_path, file\_id, file\_obj=None, disk=None*)

Add a new file object to the VM or overwrite the provided one.

#### Parameters

- **file\_path** (*str*) – Path to file to add
- **file\_id** (*str*) – Identifier string for the file in the VM
- **file\_obj** (*xml.etree.ElementTree.Element*) – Existing file object to overwrite
- **disk** (*xml.etree.ElementTree.Element*) – Existing disk object referencing file.

**Returns** *xml.etree.ElementTree.Element* – New or updated file object

**check\_sanity\_of\_disk\_device** (*disk, file\_obj, disk\_item, ctrl\_item*)

Check if the given disk is linked properly to the other objects.

#### Parameters

- **disk** (*xml.etree.ElementTree.Element*) – Disk object to validate
- **file\_obj** (*xml.etree.ElementTree.Element*) – File object which this disk should be linked to (optional)
- **disk\_item** (*OVFItem*) – Disk device object which should link to this disk (optional)
- **ctrl\_item** (*OVFItem*) – Controller device object which should link to the disk\_item

#### Raises

- `ValueMismatchError` – if the given items are not linked properly.
- `ValueUnsupportedError` – if the disk\_item has a `HostResource` value in an unrecognized or invalid format.

**config\_file\_to\_properties** (*file\_path, user\_configurable=None*)

Import each line of a text file into a configuration property.

#### Parameters

- **file\_path** (*str*) – File name to import.
- **user\_configurable** (*bool*) – Should the resulting properties be configurable at deployment time by the user?

**Raises** `NotImplementedError` – if the *platform* for this OVF does not define `LITERAL_CLI_STRING`

**convert\_disk\_if\_needed** (*disk\_image*, *kind*)

Convert the disk to a more appropriate format if needed.

- All hard disk files are converted to stream-optimized VMDK as it is the only format that VMware supports in OVA packages.
- CD-ROM iso images are accepted without change.

**Parameters**

- **disk\_image** (`COT.disks.DiskRepresentation`) – Image to inspect and possibly convert
- **kind** (*str*) – Image type (harddisk/cdrom)

**Returns** *DiskRepresentation* – *disk\_image*, if no conversion was required, or a new *DiskRepresentation* instance representing a converted image that has been created in *output\_dir*.

**create\_configuration\_profile** (*pid*, *label*, *description*)

Create or update a configuration profile with the given ID.

**Parameters**

- **pid** (*str*) – Profile identifier
- **label** (*str*) – Brief descriptive label for the profile
- **description** (*str*) – Verbose description of the profile

**create\_network** (*label*, *description*)

Define a new network with the given label and description.

Also serves to update the description of an existing network label.

**Parameters**

- **label** (*str*) – Brief label for the network
- **description** (*str*) – Verbose description of the network

**delete\_configuration\_profile** (*profile*)

Delete the profile with the given ID.

**Parameters** **profile** (*str*) – Profile ID to delete.

**Raises** *LookupError* – if the profile does not exist.

**static detect\_type\_from\_name** (*filename*)

Check the given filename to see if it looks like a type we support.

For our purposes, the file needs to match ".ov[af]" to appear to be an OVF/OVA file. We also support names like "foo.ovf.20150101" as those have been seen in the wild.

Does not check file contents, as the given filename may not yet exist.

**Parameters** **filename** (*str*) – File name/path

**Returns** *str* – '.ovf', '.box' or '.ova'

**Raises** *ValueUnsupportedError* – if filename doesn't match ovf/ova

**device\_info\_str** (*device\_item*)

Get a one-line summary of a hardware device.

**Parameters** **device\_item** (*OVFItem*) – Device to summarize

**Returns** *str* – Descriptive string such as "harddisk @ IDE 1:0"

**find\_device\_location** (*device*)

Find the controller type and address of a given device object.

**Parameters** *device* (*OVFItem*) – Hardware device object.

**Returns** *tuple* – (*type*, *address*), such as ("ide", "1:0").

**Raises** *LookupError* – if the controller is not found.

**find\_disk\_from\_file\_id** (*file\_id*)

Find the Disk that uses the given *file\_id* for backing.

**Parameters** *file\_id* (*str*) – File identifier string

**Returns** *xml.etree.ElementTree.Element* – Disk matching the file, or None

**find\_empty\_drive** (*drive\_type*)

Find a disk device that exists but contains no data.

**Parameters** *drive\_type* (*str*) – Either 'cdrom' or 'harddisk'

**Returns** *OVFItem* – Instance representing this disk device, or None.

**Raises** *ValueUnsupportedError* – if *drive\_type* is unrecognized.

**find\_item\_from\_disk** (*disk*)

Find the disk Item that references the given Disk.

**Parameters** *disk* (*xml.etree.ElementTree.Element*) – Disk element

**Returns** *OVFItem* – Corresponding instance, or None

**find\_item\_from\_file** (*file\_obj*)

Find the disk Item that references the given File.

**Parameters** *file\_obj* (*xml.etree.ElementTree.Element*) – File element

**Returns** *OVFItem* – Corresponding instance, or None.

**find\_open\_controller** (*controller\_type*)

Find the first open slot on a controller of the given type.

**Parameters** *controller\_type* (*str*) – 'ide' or 'scsi'

**Returns** *tuple* – (*ctrl\_item*, *address\_string*) or (None, None)

**find\_parent\_from\_item** (*item*)

Find the parent Item of the given Item.

**Parameters** *item* (*OVFItem*) – Item whose parent is desired

**Returns** *OVFItem* – instance representing the parent device, or None

**generate\_manifest** (*ovf\_file*)

Construct the manifest file for this package, if possible.

**Parameters** *ovf\_file* (*str*) – OVF descriptor file path

**Returns** *bool* – True if the manifest was successfully generated, False if not successful (such as if checksum helper tools are unavailable).

**get\_capacity\_from\_disk** (*disk*)

Get the capacity of the given Disk in bytes.

**Parameters** *disk* (*xml.etree.ElementTree.Element*) – Disk element to inspect

**Returns** *int* – Disk capacity, in bytes

**get\_common\_subtype** (*device\_type*)

Get the sub-type common to all devices of the given type.

**Parameters** **device\_type** (*str*) – Device type such as 'ide' or 'memory'.

**Returns** *str* – Subtype string common to all devices of the type, or None, if multiple such devices exist and they do not all have the same sub-type.

**get\_file\_ref\_from\_disk** (*disk*)

Get the file reference from the given opaque disk object.

**Parameters** **disk** (*xml.etree.ElementTree.Element*) – 'Disk' element

**Returns** *str* – 'fileRef' attribute value of this element

**get\_id\_from\_disk** (*disk*)

Get the identifier string associated with the given Disk object.

**Parameters** **disk** (*xml.etree.ElementTree.Element*) – Disk object to inspect

**Returns** *str* – Disk identifier

**get\_id\_from\_file** (*file\_obj*)

Get the file ID from the given opaque file object.

**Parameters** **file\_obj** (*xml.etree.ElementTree.Element*) – 'File' element

**Returns** *str* – 'id' attribute value of this element

**get\_nic\_count** (*profile\_list*)

Get the number of NICs under the given profile(s).

**Parameters** **profile\_list** (*list*) – Profile(s) of interest.

**Returns** *dict* – { profile\_name : nic\_count }

**get\_path\_from\_file** (*file\_obj*)

Get the file path from the given opaque file object.

**Parameters** **file\_obj** (*xml.etree.ElementTree.Element*) – 'File' element

**Returns** *str* – 'href' attribute value of this element

**get\_property\_value** (*key*)

Get the value of the given property.

**Parameters** **key** (*str*) – Property identifier

**Returns** *str* – Value of this property as a string, or None

**get\_serial\_connectivity** (*profile*)

Get the serial port connectivity strings under the given profile.

**Parameters** **profile** (*str*) – Profile of interest.

**Returns** *list* – connectivity strings

**get\_serial\_count** (*profile\_list*)

Get the number of serial ports under the given profile(s).

**Parameters** **profile\_list** (*list*) – Profile(s) of interest.

**Returns** *dict* – { profile\_name : serial\_count }

**info\_string** (*width=79, verbosity\_option=None*)

Get a descriptive string summarizing the contents of this OVF.

**Parameters**

- **width** (*int*) – Line length to wrap to where possible.
- **verbosity\_option** (*str*) – 'brief', None (default), or 'verbose'

**Returns** *str* – Wrapped, appropriately verbose string.

**predicted\_output\_size()**

Estimate how much disk space (in bytes) is needed to write out.

Since OVA (TAR) is an uncompressed format, the disk space required is approximately the same for both OVF and OVA output. Thus we can provide this value even if *output\_file* is None.

In the TAR format, each file in the archive has a 512-byte header and its total size is rounded up to a multiple of 512 bytes. The archive is terminated by 2 512-byte blocks filled with zero, and the overall archive file size is a multiple of 10 kiB.

**Returns**

*int* –

**Estimated number of bytes consumed when writing out to** *output\_file* (plus any associated files).

**profile\_info\_list** (*width=79, verbose=False*)

Get a list describing available configuration profiles.

**Parameters**

- **width** (*int*) – Line length to wrap to if possible
- **verbose** (*bool*) – if True, generate multiple lines per profile

**Returns** *tuple* – (header, list)

**profile\_info\_string** (*width=79, verbosity\_option=None*)

Get a string summarizing available configuration profiles.

**Parameters**

- **width** (*int*) – Line length to wrap to if possible
- **verbosity\_option** (*str*) – 'brief', None (default), or 'verbose'

**Returns** *str* – Appropriately formatted and verbose string.

**remove\_file** (*file\_obj, disk=None, disk\_drive=None*)

Remove the given file object from the VM.

**Parameters**

- **file\_obj** (*xml.etree.ElementTree.Element*) – File object to remove
- **disk** (*xml.etree.ElementTree.Element*) – Disk object referencing file
- **disk\_drive** (*OVFItem*) – Disk drive mapping file to a device

**Raises** *ValueUnsupportedError* – If the *disk\_drive* is a device type other than 'cdrom' or 'harddisk'

**search\_from\_controller** (*controller, address*)

From the controller type and device address, look for existing disk.

This implementation uses the parameters to find matching controller and disk *Item* elements, then using the disk *Item* to find matching *File* and/or *Disk*.

**Parameters**

- **controller** (*str*) – 'ide' or 'scsi'
- **address** (*str*) – Device address such as '1:0'

**Returns** *tuple* – (file, disk, ctrl\_item, disk\_item), any or all of which may be None

**search\_from\_file\_id** (*file\_id*)

From the given file ID, try to find any existing objects.

This implementation uses the given *file\_id* to find a matching *File* in the OVF, then using that to find a matching *Disk* and *Item* entries.

**Parameters** *file\_id* (*str*) – File ID to search from

**Returns**

*tuple* –  
(file, disk, ctrl\_item, disk\_item), any or all of which may be None

**Raises**

- *LookupError* – If the disk entry is found but no corresponding file is found.
- *LookupError* – If the disk\_item is found but no ctrl\_item is found to be its parent.

**search\_from\_filename** (*filename*)

From the given filename, try to find any existing objects.

This implementation uses the given *filename* to find a matching *File* in the OVF, then using that to find a matching *Disk* and *Item* entries.

**Parameters** *filename* (*str*) – Filename to search from

**Returns** *tuple* – (file, disk, ctrl\_item, disk\_item), any or all of which may be None

**Raises** *LookupError* – If the disk\_item is found but no ctrl\_item is found to be its parent.

**set\_capacity\_of\_disk** (*disk*, *capacity\_bytes*)

Set the storage capacity of the given *Disk*.

Tries to use the most human-readable form possible (i.e., 8 GiB instead of 8589934592 bytes).

**Parameters**

- **disk** (*xml.etree.ElementTree.Element*) – Disk to update
- **capacity\_bytes** (*int*) – Disk capacity, in bytes

**set\_cpu\_count** (*cpus*, *profile\_list*)

Set the number of CPUs.

**Parameters**

- **cpus** (*int*) – Number of CPUs
- **profile\_list** (*list*) – Change only the given profiles

**set\_ide\_subtypes** (*type\_list*, *profile\_list*)

Set the device subtype(s) for the IDE controller(s).

**Parameters**

- **type\_list** (*list*) – IDE subtype string list



- **profile\_list** (*list*) – Change only the given profiles

**set\_memory** (*megabytes, profile\_list*)

Set the amount of RAM, in megabytes.

**Parameters**

- **megabytes** (*int*) – Memory value, in megabytes
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_count** (*count, profile\_list*)

Set the given profile(s) to have the given number of NICs.

**Parameters**

- **count** (*int*) – number of NICs
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_mac\_addresses** (*mac\_list, profile\_list*)

Set the MAC addresses for NICs under the given profile(s).

---

**Note:** If the length of `mac_list` is less than the number of NICs, will use the last entry in the list for all remaining NICs.

---

**Parameters**

- **mac\_list** (*list*) – List of MAC addresses to assign to NICs
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_names** (*name\_list, profile\_list*)

Set the device names for NICs under the given profile(s).

**Parameters**

- **name\_list** (*list*) – List of names to assign.
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_networks** (*network\_list, profile\_list*)

Set the NIC to network mapping for NICs under the given profile(s).

---

**Note:** If the length of `network_list` is less than the number of NICs, will use the last entry in the list for all remaining NICs.

---

**Parameters**

- **network\_list** (*list*) – List of networks to map NICs to
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_types** (*type\_list, profile\_list*)

Set the hardware type(s) for NICs.

**Parameters**

- **type\_list** (*list*) – NIC hardware type(s)
- **profile\_list** (*list*) – Change only the given profiles.

**set\_property\_value** (*key*, *value*, *user\_configurable=None*, *property\_type=None*, *label=None*, *description=None*)

Set the value of the given property (converting value if needed).

**Parameters**

- **key** (*str*) – Property identifier
- **value** (*object*) – Value to set for this property
- **user\_configurable** (*bool*) – Should this property be configurable at deployment time by the user?
- **property\_type** (*str*) – Value type - 'string' or 'boolean'
- **label** (*str*) – Brief explanatory label for this property
- **description** (*str*) – Detailed description of this property

**Returns** *str* – the (converted) value that was set.

**Raises** `NotImplementedError` – if *ovf\_version* is less than 1.0; OVF version 0.9 is not currently supported.

**set\_scsi\_subtypes** (*type\_list*, *profile\_list*)

Set the device subtype(s) for the SCSI controller(s).

**Parameters**

- **type\_list** (*list*) – SCSI subtype string list
- **profile\_list** (*list*) – Change only the given profiles

**set\_serial\_connectivity** (*conn\_list*, *profile\_list*)

Set the serial port connectivity under the given profile(s).

**Parameters**

- **conn\_list** (*list*) – List of connectivity strings
- **profile\_list** (*list*) – Change only the given profiles

**set\_serial\_count** (*count*, *profile\_list*)

Set the given profile(s) to have the given number of serial ports.

**Parameters**

- **count** (*int*) – Number of serial ports
- **profile\_list** (*list*) – Change only the given profiles

**tar** (*ovf\_descriptor*, *tar\_file*)

Create a .ova tar file based on the given OVF descriptor.

**Parameters**

- **ovf\_descriptor** (*str*) – File path for an OVF descriptor
- **tar\_file** (*str*) – File path for the desired OVA archive.

**untar** (*file\_path*)

Untar the OVF descriptor from an .ova to the working directory.

**Parameters** **file\_path** (*str*) – OVA file path

**Returns** *str* – Path to extracted OVF descriptor

**Raises** `VMInitError` – if the given file doesn't represent a valid OVA archive.

**validate\_hardware()**

Check sanity of hardware properties for this VM/product/platform.

**Returns** *bool* – True if hardware is sane, False if not.

**write()**

Write OVF or OVA to *output\_file*, if set.

**INFO\_STRING\_DISK\_COLUMNS\_WIDTH** = 41

**INFO\_STRING\_DISK\_TEMPLATE** = '{{0:{0}}} {{1:>9}} {{2:>9}} {{3:.20}}'

**INFO\_STRING\_FILE\_TEMPLATE** = '{{0:{0}}} {{1:>9}}'

**PROFILE\_INFO\_TEMPLATE** = '{{0:{0}}} {{1:>4}} {{2:>9}} {{3:>4}} {{4:>7}} {{5:>14}}'

**application\_url**

Application URL string (XML AppUrl element).

**checksum\_algorithm**

The preferred file checksum algorithm for this OVF.

**config\_profiles**

The list of supported configuration profiles.

If this OVF has no defined profiles, returns an empty list. If there is a default profile, it will be first in the list.

**environment\_properties**

The array of environment properties.

Array of dicts (one per property) with the keys "key", "value", "qualifiers", "type", "user\_configurable", "label", and "description".

**environment\_transports**

The list of environment transport method strings.

**network\_descriptions**

The list of network descriptions currently defined in this VM.

**Returns** *list* – List of network description strings

**networks**

The list of network names currently defined in this VM.

**output\_file**

OVF or OVA file that will be created or updated by *write()*.

**Raises** *ValueUnsupportedError* – if *detect\_type\_from\_name()* fails

**ovf\_version**

Float representing the OVF specification version in use.

Supported values at present are 0.9, 1.0, and 2.0.

**platform**

The platform type, as determined from the OVF descriptor.

This will be the class `Platform` or a more-specific subclass if recognized as such.

**product**

Short descriptive product string (XML Product element).

**product\_class**

The product class identifier, such as `com.cisco.csr1000v`.

**product\_url**

Product URL string (XML ProductUrl element).

**system\_types**

List of virtual system type(s) supported by this virtual machine.

For an OVF, this corresponds to the VirtualSystemType element.

**vendor**

Short descriptive vendor string (XML Vendor element).

**vendor\_url**

Vendor URL string (XML VendorUrl element).

**version\_long**

Long descriptive version string (XML FullVersion element).

**version\_short**

Short descriptive version string (XML Version element).

**exception VMLInitError**

Bases: `exceptions.EnvironmentError`

Class representing errors encountered when trying to init/load a VM.

**class VMDescription** (*input\_file*, *output\_file=None*)

Bases: `object`

Abstract class for reading, editing, and writing VM definitions.

## Examples

Because instantiating this class creates a temporary directory (*working\_dir*), it's important to always clean up. This can be done explicitly:

```
>>> foo = VMDescription("foo.txt", None)
>>> tmpdir = foo.working_dir
>>> os.path.exists(tmpdir)
True
>>> foo.destroy()
>>> os.path.exists(tmpdir)
False
```

or implicitly by using this class as a context manager:

```
>>> with VMDescription("foo.txt", None) as foo:
...     tmpdir = foo.working_dir
...     os.path.exists(tmpdir)
...
True
>>> os.path.exists(tmpdir)
False
```

If the specific VM class is unknown, you can use the *factory()* method to try to obtain an appropriate subclass:

```
>>> try:
...     with VMDescription.factory("foo.txt", None) as foo:
...         print(foo.__class__.__name__)
... except VMLInitError as e:
```

```
...     print(e)
[Errno 2] Unknown VM description type for input file...
```

### Properties

<code>input_file</code>	Data file to read in.
<code>output_file</code>	Filename that <code>write()</code> will output to.
<code>working_dir</code>	Temporary directory this instance can use for storage.
<code>platform</code>	The Platform instance object associated with this VM.
<code>config_profiles</code>	The list of supported configuration profiles.
<code>default_config_profile</code>	The name of the default configuration profile.
<code>environment_properties</code>	The array of environment properties.
<code>environment_transports</code>	The list of environment transport methods.
<code>networks</code>	The list of network names currently defined in this VM.
<code>network_descriptions</code>	The list of network descriptions currently defined in this VM.
<code>system_types</code>	List of virtual system type(s) supported by this virtual machine.
<code>version_short</code>	A short string describing the product version.
<code>version_long</code>	A long string describing the product version.

`__init__(input_file, output_file=None)`

Read the given VM description file into memory.

Also creates a temporary directory as a working directory.

#### Parameters

- `input_file` (*str*) – Data file to read in.
- `output_file` (*str*) – File name to write to.
  - If this VM is read-only, (there will never be an output file) this value should be `None`
  - If the output filename is not yet known, use "" and subsequently set `output` when it is determined.

`add_controller_device(device_type, subtype, address, ctrl_item=None)`

Create a new IDE or SCSI controller, or update existing one.

#### Parameters

- `device_type` (*str*) – 'ide' or 'scsi'
- `subtype` (*str*) – Subtype such as 'virtio' (optional)
- `address` (*int*) – Controller address such as 0 or 1 (optional)
- `ctrl_item` (*object*) – Existing controller device to update (optional)

**Returns** *object* – New or updated controller device object

`add_disk(disk_repr, file_id, drive_type, disk=None)`

Add a new disk object to the VM or overwrite the provided one.

#### Parameters

- `disk_repr` (*DiskRepresentation*) – Disk file representation
- `file_id` (*str*) – Identifier string for the file/disk mapping

- **drive\_type** (*str*) – 'harddisk' or 'cdrom'
- **disk** (*object*) – Existing disk object to overwrite

**Returns** *object* – New or updated disk object

**add\_disk\_device** (*drive\_type, address, name, description, disk, file\_obj, ctrl\_item, disk\_item=None*)

Add a new disk device to the VM or update the provided one.

**Parameters**

- **drive\_type** (*str*) – 'harddisk' or 'cdrom'
- **address** (*str*) – Address on controller, such as "1:0" (optional)
- **name** (*str*) – Device name string (optional)
- **description** (*str*) – Description string (optional)
- **disk** (*object*) – Disk object to map to this device
- **file\_obj** (*object*) – File object to map to this device
- **ctrl\_item** (*object*) – Controller object to serve as parent
- **disk\_item** (*object*) – Existing disk device to update instead of making a new device.

**Returns** *object* – New or updated disk device object.

**add\_file** (*file\_path, file\_id, file\_obj=None, disk=None*)

Add a new file object to the VM or overwrite the provided one.

**Parameters**

- **file\_path** (*str*) – Path to file to add
- **file\_id** (*str*) – Identifier string for the file in the VM
- **file\_obj** (*object*) – Existing file object to overwrite
- **disk** (*object*) – Existing disk object referencing file.

**Returns** *object* – New or updated file object

**check\_sanity\_of\_disk\_device** (*disk, file\_obj, disk\_item, ctrl\_item*)

Check if the given disk is linked properly to the other objects.

**Parameters**

- **disk** (*object*) – Disk object to validate
- **file\_obj** (*object*) – File object which this disk should be linked to (optional)
- **disk\_item** (*object*) – Disk device object which should link to this disk (optional)
- **ctrl\_item** (*object*) – Controller device object which should link to the disk\_item

**Raises** `ValueMismatchError` – if the given items are not linked properly.

**config\_file\_to\_properties** (*file\_path, user\_configurable=None*)

Import each line of a text file into a configuration property.

**Parameters**

- **file\_path** (*str*) – File name to import.
- **user\_configurable** (*bool*) – Should the properties be configurable at deployment time by the user?

**convert\_disk\_if\_needed** (*disk\_image*, *kind*)

Convert the disk to a more appropriate format if needed.

**Parameters**

- **disk\_image** (*DiskRepresentation*) – Disk to inspect and possibly convert
- **kind** (*str*) – Image type (harddisk/cdrom).

**Returns** *DiskRepresentation* – *disk\_image*, if no conversion was required, or a new *DiskRepresentation* instance representing a converted image that has been created in *output\_dir*.

**create\_configuration\_profile** (*pid*, *label*, *description*)

Create/update a configuration profile with the given ID.

**Parameters**

- **pid** (*str*) – Profile identifier
- **label** (*str*) – Brief descriptive label for the profile
- **description** (*str*) – Verbose description of the profile

**create\_network** (*label*, *description*)

Define a new network with the given label and description.

Also serves to update the description of an existing network label.

**Parameters**

- **label** (*str*) – Brief label for the network
- **description** (*str*) – Verbose description of the network

**delete\_configuration\_profile** (*profile*)

Delete the configuration profile with the given ID.

**Parameters** **profile** (*str*) – Profile identifier

**destroy** ()

Clean up after ourselves.

Deletes *self.working\_dir* and its contents.

**classmethod detect\_type\_from\_name** (*filename*)

Check the given filename to see if it looks like a type we support.

Does not check file contents, as the given filename may not yet exist.

**Parameters** **filename** (*str*) – File name or path

**Returns** *str* – A string representing a recognized and supported type of file

**Raises** *ValueUnsupportedError* – if COT can't recognize the file type or doesn't know how to handle this file type.

**classmethod factory** (*input\_file*, *\*args*, *\*\*kwargs*)

Factory method to select and create the appropriate subclass.

**Parameters**

- **input\_file** (*str*) – Input file to test against each class's *detect\_type\_from\_name()* implementation.
- **\*args** – Passed through to selected subclass *\_\_init\_\_()*.
- **\*\*kwargs** – Passed through to selected subclass *\_\_init\_\_()*.

**Returns** *VMDescription* – appropriate subclass instance.

**Raises**

- *VMInitError* – if no appropriate subclass is identified
- *VMInitError* – if the selected subclass fails instantiation

**find\_device\_location** (*device*)

Find the controller type and address of a given device object.

**Parameters** *device* (*object*) – Hardware device object.

**Returns** *tuple* – (*type*, *address*), such as ("ide", "1:0").

**find\_empty\_drive** (*drive\_type*)

Find a disk device that exists but contains no data.

**Parameters** *drive\_type* (*str*) – Disk drive type, such as 'cdrom' or 'harddisk'

**Returns** *object* – Hardware device object, or None.

**find\_open\_controller** (*controller\_type*)

Find the first open slot on a controller of the given type.

**Parameters** *controller\_type* (*str*) – 'ide' or 'scsi'

**Returns** *tuple* – (*controller\_device*, *address\_string*) or (None, None)

**get\_common\_subtype** (*device\_type*)

Get the sub-type common to all devices of the given type.

**Parameters** *device\_type* (*str*) – Device type such as 'ide' or 'memory'.

**Returns** *str* – Subtype string common to all devices of this type, or None, if multiple such devices exist and they do not all have the same sub-type.

**get\_file\_ref\_from\_disk** (*disk*)

Get the file reference from the given opaque disk object.

**Parameters** *disk* (*object*) – Disk object to query

**Returns** *str* – String that can be used to identify the file associated with this disk

**get\_id\_from\_disk** (*disk*)

Get the identifier string associated with the given Disk object.

**Parameters** *disk* (*object*) – Disk object

**Returns** *str* – Identifier string associated with this object

**get\_id\_from\_file** (*file\_obj*)

Get the file ID from the given opaque file object.

**Parameters** *file\_obj* (*object*) – File object to query

**Returns** *str* – Identifier string associated with this object

**get\_nic\_count** (*profile\_list*)

Get the number of NICs under the given profile(s).

**Parameters** *profile\_list* (*list*) – Profile(s) of interest.

**Returns** *dict* – { *profile\_name* : *nic\_count* }

**get\_path\_from\_file** (*file\_obj*)

Get the file path from the given opaque file object.



**Parameters** `file_obj` (*object*) – File object to query

**Returns** *str* – Relative path to the file associated with this object

**get\_property\_value** (*key*)

Get the value of the given property.

**Parameters** `key` (*str*) – Property identifier

**Returns** *str* – Value of this property, or None

**get\_serial\_connectivity** (*profile*)

Get the serial port connectivity strings under the given profile.

**Parameters** `profile` (*str*) – Profile of interest.

**Returns** *list* – List of connectivity strings

**get\_serial\_count** (*profile\_list*)

Get the number of serial ports under the given profile(s).

**Parameters** `profile_list` (*list*) – Change only the given profiles

**Returns** *dict* – { `profile_name` : `serial_count` }

**info\_string** (*width=79, verbosity\_option=None*)

Get a descriptive string summarizing the contents of this VM.

**Parameters**

- `width` (*int*) – Line length to wrap to where possible.
- `verbosity_option` (*str*) – 'brief', None (default), or 'verbose'

**Returns** *str* – Wrapped, appropriately verbose string.

**predicted\_output\_size** ()

Estimate how much disk space (in bytes) is needed to write out.

**Returns**

*int* –

Estimated number of bytes consumed when writing out to *output\_file* (plus any associated files).

**profile\_info\_string** (*width=79, verbosity\_option=None*)

Get a string summarizing available configuration profiles.

**Parameters**

- `width` (*int*) – Line length to wrap to if possible
- `verbosity_option` (*str*) – 'brief', None (default), or 'verbose'

**Returns** *str* – Appropriately formatted and verbose string.

**remove\_file** (*file\_obj, disk=None, disk\_drive=None*)

Remove the given file object from the VM.

**Parameters**

- `file_obj` (*object*) – File object to remove
- `disk` (*object*) – Disk object referencing *file*
- `disk_drive` (*object*) – Disk drive mapping *file* to a device

**search\_from\_controller** (*controller, address*)

From the controller type and device address, look for existing disk.

**Parameters**

- **controller** (*str*) – 'ide' or 'scsi'
- **address** (*str*) – Device address such as '1:0'

**Returns** *tuple* – (file, disk, controller\_device, disk\_device), opaque objects of which any or all may be None

**search\_from\_file\_id** (*file\_id*)

From the given file ID, try to find any existing objects.

**Parameters** **file\_id** (*str*) – File ID to search from

**Returns** *tuple* – (file, disk, controller\_device, disk\_device), opaque objects of which any or all may be None

**search\_from\_filename** (*filename*)

From the given filename, try to find any existing objects.

**Parameters** **filename** (*str*) – Filename to search from

**Returns** *tuple* – (file, disk, controller\_device, disk\_device), opaque objects of which any or all may be None

**set\_cpu\_count** (*cpus, profile\_list*)

Set the number of CPUs.

**Parameters**

- **cpus** (*int*) – Number of CPUs
- **profile\_list** (*list*) – Change only the given profiles

**set\_ide\_subtype** (*subtype, profile\_list*)

Set the device subtype for the IDE controller(s).

Deprecated since version 1.5: Use `set_ide_subtypes()` instead.

**Parameters**

- **subtype** (*str*) – IDE subtype string
- **profile\_list** (*list*) – Change only the given profiles

**set\_ide\_subtypes** (*type\_list, profile\_list*)

Set the device subtype list for the IDE controller(s).

**Parameters**

- **type\_list** (*list*) – IDE subtype string list
- **profile\_list** (*list*) – Change only the given profiles

**set\_memory** (*megabytes, profile\_list*)

Set the amount of RAM, in megabytes.

**Parameters**

- **megabytes** (*int*) – Memory value, in megabytes
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_count** (*count, profile\_list*)

Set the given profile(s) to have the given number of NICs.

**Parameters**

- **count** (*int*) – number of NICs
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_mac\_addresses** (*mac\_list*, *profile\_list*)

Set the MAC addresses for NICs under the given profile(s).

---

**Note:** If the length of *mac\_list* is less than the number of NICs, will use the last entry in the list for all remaining NICs.

---

**Parameters**

- **mac\_list** (*list*) – List of MAC addresses to assign to NICs
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_names** (*name\_list*, *profile\_list*)

Set the device names for NICs under the given profile(s).

**Parameters**

- **name\_list** (*list*) – List of names to assign.
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_networks** (*network\_list*, *profile\_list*)

Set the NIC to network mapping for NICs under the given profile(s).

---

**Note:** If the length of *network\_list* is less than the number of NICs, will use the last entry in the list for all remaining NICs.

---

**Parameters**

- **network\_list** (*list*) – List of networks to map NICs to
- **profile\_list** (*list*) – Change only the given profiles

**set\_nic\_type** (*nic\_type*, *profile\_list*)

Set the hardware type for NICs.

Deprecated since version 1.5: Use `set_nic_types()` instead.

**Parameters**

- **nic\_type** (*str*) – NIC hardware type
- **profile\_list** (*list*) – Change only the given profiles.

**set\_nic\_types** (*type\_list*, *profile\_list*)

Set the hardware type(s) for NICs.

**Parameters**

- **type\_list** (*list*) – NIC hardware type(s)
- **profile\_list** (*list*) – Change only the given profiles.

**set\_property\_value** (*key*, *value*, *user\_configurable=None*, *property\_type=None*, *label=None*, *description=None*)

Set the value of the given property (converting value if needed).

**Parameters**

- **key** (*str*) – Property identifier
- **value** (*object*) – Value to set for this property
- **user\_configurable** (*bool*) – Should this property be configurable at deployment time by the user?
- **property\_type** (*str*) – Value type - 'string' or 'boolean'
- **label** (*str*) – Brief explanatory label for this property
- **description** (*str*) – Detailed description of this property

**Returns** *str* – the (converted) value that was set.

**set\_scsi\_subtype** (*subtype*, *profile\_list*)

Set the device subtype for the SCSI controller(s).

Deprecated since version 1.5: Use `set_scsi_subtypes()` instead.

**Parameters**

- **subtype** (*str*) – SCSI subtype string
- **profile\_list** (*list*) – Change only the given profiles

**set\_scsi\_subtypes** (*type\_list*, *profile\_list*)

Set the device subtype list for the SCSI controller(s).

**Parameters**

- **type\_list** (*list*) – SCSI subtype string list
- **profile\_list** (*list*) – Change only the given profiles

**set\_serial\_connectivity** (*conn\_list*, *profile\_list*)

Set the serial port connectivity under the given profile(s).

**Parameters**

- **conn\_list** (*list*) – List of connectivity strings
- **profile\_list** (*list*) – Change only the given profiles

**set\_serial\_count** (*count*, *profile\_list*)

Set the given profile(s) to have the given number of NICs.

**Parameters**

- **count** (*int*) – Number of serial ports
- **profile\_list** (*list*) – Change only the given profiles

**validate\_hardware** ()

Check sanity of hardware properties for this VM/product/platform.

**Returns** *bool* – True if hardware is sane, False if not.

**write** ()

Write the VM description to *output\_file*, if any.

**config\_profiles**

The list of supported configuration profiles.

If there are no profiles defined, returns an empty list. If there is a default profile, it will be first in the list.

**default\_config\_profile**

The name of the default configuration profile.

**Returns** *str* – Profile name or `None` if none are defined.

**environment\_properties**

The array of environment properties.

**Returns** *list* – Array of dicts (one per property) with the keys "key", "value", "qualifiers", "type", "label", and "description".

**environment\_transports**

The list of environment transport methods.

**input\_file**

Data file to read in.

**network\_descriptions**

The list of network descriptions currently defined in this VM.

**networks**

The list of network names currently defined in this VM.

**output\_file**

Filename that `write()` will output to.

**platform**

The Platform instance object associated with this VM.

An instance of `Platform` or a more specific subclass if recognized as such.

**product\_class**

The product class identifier, such as `com.cisco.csr1000v`.

**system\_types**

List of virtual system type(s) supported by this virtual machine.

**verbosity\_options** = {'verbose': 2, 'brief': 0, 'None': 1}

**version\_long**

A long string describing the product version.

**version\_short**

A short string describing the product version.

**working\_dir**

Temporary directory this instance can use for storage.

Will be automatically erased when `destroy()` is called.

---

**Note:** The hierarchy of permissible imports between sub-packages is as follows:

```
COT.ui
|
|----> COT.commands
|
|          +----> COT.vm_description
|          |
|          |
```

```
|           |           +---> COT.platforms
|           |           |
|           +-----+---> COT.disks
|           |           |
+-----+-----+---> COT.helpers
```

Thus, to avoid circular dependencies, none of the other sub-packages may import `COT.ui` - if they wish to interact with the UI in any way (e.g., *COT.helpers* prompting the user to confirm whether to try to install a helper program), this needs to be done with a callback object (e.g., `COT.helpers.Helper.USER_INTERFACE`) rather than an import of the other module.

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