Tapper

Test and Automation Infrastructure
User Manual

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1 Synopsis

1.1 Tapper infrastructure

Tapper is an infrastructure.

It consists of applications, tools and protocols for testing software and evaluating the results. One initial main focus was on testing Operating Systems in virtualization environments. It is now a modular infrastructure for lots of other, related scenarios, like benchmarking or build systems.

There are 3 important layers:

- **Reports Framework**
- **Test Suites**
- **Automation System**

The layers can work completely autonomously, though can also be connected together and are targeted to be stacked in this order:

- The **Report Framework** is for receiving and evaluating test reports sent by any source. The only requirement is that the result reports are using TAP, the Test Anything Protocol.
- The **Test Suites** are either directed test suites or wrappers around existing test projects doing conversion of their results into TAP. These are the TAP producers that create reports and send them to the Reports Framework.
- The **Automation System** is taking care of setting up machines, installing dependencies and test suites and running the latter. It can set up virtualized environments.

To fully exploit the system you need to learn:

- **Connect and prepare a new machine into the infrastructure**
- **Write tests using the Test Anything Protocol (TAP)**
- **Write preconditions to describe automation tasks**
- **Review results via Web interface**
- **Evaluate results via Report Query interface**

1.2 Vocabulary

1.2.1 Master Control Program (MCP)

There is a central server controlling the automation by running the **Master Control Program**, aka. **MCP**. Usually it also centralizes several other services: it is the TFTP server for network booting, runs the daemons of the reports framework (reports receiver, remote api) and the web application, including the mysql databases, and also serves the file repository via NFS.

1.2.2 Program Run Control (PRC)

When machines run automated tests, these test program runs are controlled by a **Program Run Control**, aka. **PRC**. In virtualization scenarios, each host and guest has its own PRC, numbered PRC0 (for the host), PRC1 (1st guest), PRC2 (2nd guest), etc.

1.2.3 Reports Receiver

The **Reports Receiver** means the daemons that accept reports. We often run them on the same machine as the MCP and the Web framework, but that's not neccessary.

1.2.4 Reports API

Similar to the reports receiver is the **Reports API** which is the daemon for all more complex interfaces, like uploading files, downloading files, querying the reports. Similar to reports API we often run them on the same machine as the MCP and the Web application, but that's not neccessary.

1.2.5 Web User Interface

The **Web User Interface** is an independent web application. Similar to the reports receiver and the reports API it can run anywhere, either standalone or in Apache, via mod_perl, FCGI, etc.. The only common thing for all those central applications (MCP, reports receiver, reports api, web application) is the config to use the same databases.

1.2.6 Reports DB

The **Reports DB** contains all data that are reported. It's the base for the reports receiver, the reports API, the web application.

1.2.7 Testrun DB

The **Testrun DB** is the DB for the automation layer. It contains hosts, testrun specifications and scheduling information.

1.2.8 Testrun

A **Testrun** is a request to the automation layer to set up a host machine and run a workload on it. It consists of "preconditions" and scheduling information (host name, wanted host features, scheduling queue).

1.2.9 Preconditions

Preconditions are specifications that describe how to set up a host. They are the essential part of a testrun.

1.2.10 Report

A **Report** is the reported result of any workload, regardless of how it was produced (automatically, by a tes suite, manually via echo and netcat). Its only requirement is to be formatted in TAP (the Test Anything Protocol), or as TAP archive.

1.2.11 Test Anything Protocol (TAP)

The **Test Anything Protocol** aka. **TAP** is the syntax to describe test results.

1.2.12 TAP archives

A **TAP archive** is a .tar.gz file that contains files of TAP. It's the result of a test suite that can consist of many parts compressed into a single file.

2 Technical Infrastructure

See also the "Getting Started Guide" for more complete step-by-step instructions how to install the infrastructure from scratch up to a first example test run.

2.1 Adding a new host into automation

This chapter describes what you need to do in order to get a new machine into the Tapper test scheduling rotation.

2.1.1 Make machine remote hard resetable

Connect the machine physically to some facility to programmatically switch it completely off.

This can be the Reset cable wires connected to a dedicated reset box which can be programmed usually with an external tool. It can also be a TCP/IP controllable Power Control.

As an example Tapper comes with a plugin for the "Infratec PM211 MIP" ethernet controllable multi socket outlet. To use it write this in the configuration file:

```
reset_plugin: PM211MIP
reset_plugin_options:
  ip: 192.168.1.39
  user: admin
  passwd: secret
  outletnr:
    johnconnor: 1
    sarahconnor: 2
```

This configures to use the PM211MIP plugin for reset and gives it the configuration that the host "johnconnor" is connected on port 0 and the host "sarahconnor" on port 1, together with IP address, username and password of the multi-socket outlet.

If you have other hardware then write your own reset plugin `FooBar` in a Perl module `Tapper::MCP::Net::Reset::FooBar`. Look into the code of `Tapper::MCP::Net::Reset::PM211MIP` to get inspiration.

2.1.2 Make machine PXE boot aware

- Set booting order in BIOS to network first
- Configure DHCP for each connected machine

  The following example configures two hosts '`sarahconnor`' and '`johnconnor`' to use the respective files '`/tftpboot/sarahconnor.lst`' and '`/tftpboot/johnconnor.lst`' as grub config.

  ```
  # example dhcp config with invalid ethernet addresses
  subnet 192.168.1.0 netmask 255.255.255.0 {
  group
  {
   filename '/tftpboot/pxegrub';
   # offer the host the here given name as host name
   option host-name = host-decl-name;
   option dhcp-parameter-request-list = concat(option dhcp-parameter-request-list,96);
   host sarahconnor
   {
     hardware ethernet 00:09:11:11:11:11;
     fixed-address 192.168.1.2;
     option configfile "/tftpboot/sarahconnor.lst";
  ```

```
 }
 host johnconnor
 {
  hardware ethernet 00:09:22:22:22:22;
  fixed-address 192.168.1.3;
  option configfile "/tftpboot/johnconnor.lst";
 }
}
```

These grub config files are later dynamically overwritten for each boot by your application server's "Master Control Program" (MCP).

The example above assumes the DHCP also running on the central Master Control Program (MCP) server. To use a DHCP server running on another host configure it with some grub/tftp redirection chains to in the end lead to the same files '`/tftpboot/sarahconnor.lst`' and '`/tftpboot/johnconnor.lst`' loaded from the MCP server.

- Force DHCP server to reread its configuration

```
$ kill -HUP $pid_of_dhcpd
```

2.1.3 Configure TFTP on central MCP machine

The MCP server is also acting as a TFTP server, so it has to be configured as such:

- Install a TFTP server

```
$ sudo apt-get install inetutils-inetd
$ sudo apt-get install atftpd
$ sudo chmod 777 /var/lib/tftpboot/
$ sudo ln -s /var/lib/tftpboot /tftpboot
```

- Create symlinks to point TFTP dir into Tapper working dir

  The TFTP daemon only serves files from '`/tftpboot`', as seen above in the DHCP config. To supply files from the Tapper working dir make the '`/tftpboot`' a symlink to the Tapper working dir.

```
$ ln -s /data/tapper/live/configs/tftpboot /tftpboot
```

  When Tapper creates tftp files it works with absolute path names. Because the TFTP daemon interprets all absolute pathnames relative to its root dir we supply a '`tftpboot`' symlink inside the tftp root (which is also our Tapper working dir), so we can use the same absolute path name in both contexts (Tapper and TFTP):

```
$ ln -s /data/tapper/live/configs/tftpboot \
        /data/tapper/live/configs/tftpboot/tftpboot
```

2.1.4 Make the hosts known in the TestrunDB

```
$ tapper-testrun newhost --name=sarahconnor --active=1
$ tapper-testrun newhost --name=johnconnor  --active=1
```

This makes the hosts generally available (active) for scheduling testruns by machine name. For scheduling hosts by more detailed machine features (cpu, memory, family, etc.) you need to add according key/value pairs in the '`HostFeature`' table.

2.1.5 Optionally: enable '`temare`' to generate tests for this host

'`Temare`' is an utility that generates preconditions according to a test matrix of host/guest virtualization scenarios (but not yet shipped publicly).

For generating preconditions for a host, you can register the host in '`temare`'.

If you want tests scheduled for the new machine then follow these steps:

- Login as root on MCP server
- Set the `PYTHONPATH` to include the *temare* src directory
  `export PYTHONPATH=$PYTHONPATH:/opt/tapper/python/temare/src`
- Add the host to temare hostlist

```
$ /opt/tapper/python/temare/temare hostadd $hostname \
                                           $memory \
                                           $cores \
                                           $bitness
```

Add the Tapper ssh key to your image.

`cat /home/tapper/.ssh/id_dsa.pub >> /root/.ssh/authorized_keys`

(FIXME) Actually this does not belong into the host preparation but into a separate image preparation chapter which does not yet exist.

3 Test Protocol

In order to write test suites you need to understand the output protocol, which is '`TAP`', the '`Test Anything Protocol`'.

The protocol is trivially to produce, you can do it with simple Shell '`echo`'s or you can use TAP emitting toolchains, like practically all '`Test::*`' modules from the Perl world.

This chapter explains the protocol and the Tapper specific extensions, which are usually headers that can be transported inside TAP comments.

3.1 Test Anything Protocol (TAP)

3.2 Tutorial

3.2.1 Just plan and success

Example:

```
1..3
ok
ok
not ok
```

Remarks:

- 3 single tests planned
- the two first went good
- the last went wrong

3.2.2 Succession numbers

Example:

```
1..3
ok 1
ok 2
not ok 3
```

Remarks:

- Missing test lines (eg. due to internal bummers) can be detected.

Example with missing test:

```
1..3
ok 1
not ok 3
```

Remarks:

- Parsing will later say " test 2 expected but got 3"

3.2.3 Test descriptions

Example:

```
1..3
ok 1 - input file opened
ok 2 - file content
not ok 3 - last line
```

Remarks:

- Readability.

3.2.4 Mark tests as TODO

Example:

```
1..3
ok 1 - input file opened
ok 2 - file content
not ok 3 - last line # TODO
```

Remarks:

- mark not yet working tests as "TODO"
- allows test-first development
- "ok" TODOs are recognized later ("unexpectedly succeeded")
- We also use it to ignore known issues with still being able to find them later.

3.2.5 Comment TODO tests with reason

Example:

```
1..3
ok 1 - input file opened
ok 2 - file content
not ok 3 - last line # TODO just specced
```

Remarks:

- comment the TODO reason

3.2.6 Mark tests as SKIP (with reason)

Example:

```
1..3
ok 1 - input file opened
ok 2 - file content
ok 3 - last line # SKIP missing prerequisites
```

Remarks:

- mark tests when not really run (note it's set to "ok" anyway)
- keeps succession numbers in sync

3.2.7 Diagnostics

Example:

```
1..3
ok 1 - input file opened
ok 2 - file content
not ok 3 - last line # TODO just specced
# Failed test 'last line'
# at t/data_dpath.t line 410.
# got: 'foo'
# expected: 'bar'
```

Remarks:

- Unstructured details

3.2.8 YAML Diagnostics

Example:

```
1..3
ok 1 - input file opened
ok 2 - file content
not ok 3 - last line # TODO just specced
  ---
  message: Failed test 'last line' at t/data_dpath.t line 410.
  severity: fail
  data:
    got: 'foo'
    expect: 'bar'
  ...
```

Remarks:

- Structured details
- allows parsable diagnostics
- we use that to track values inside TAP
- have a leading test line with number+description
- track complete data structures according to it
  - e.g., benchmark results

3.2.9 Meta information headers for reports

TAP allows comment lines, starting with '#'. We allow meta information transported inside those comment lines when declared with Tapper specific headers.

Example:

```
1..3
# Tapper-Suite-Name: Foo-Bar
# Tapper-Suite-Version: 2.010013
ok 1 - input file opened
ok 2 - file content
not ok 3 - last line # TODO just specced
```

Remarks:

- we use diagnostics lines ("hot comments")
- semantics only to our TAP applications

These are the headers that apply to the whole report:

```
# Tapper-suite-name:                -- suite name
# Tapper-suite-version:             -- suite version
# Tapper-machine-name:              -- machine/host name
# Tapper-machine-description:       -- more details to machine
# Tapper-reportername:              -- user name of the reporter
# Tapper-starttime-test-program:    -- start time for complete test
                                       (including guests)
# Tapper-endtime-test-program:      -- end time for complete test
                                       (including guests)
# Tapper-reportgroup-testrun:       -- associate this report with other
                                       reports of same testrun_id
# Tapper-reportgroup-arbitrary:     -- associate this report with other
                                       reports of same arbitrary id
                                       (can be any string, but should be
                                       unique between all groups of the db,
```

```
                                    eg., an md5-hash of common
                                    characteristics of all test of one
                                    group)
```

There are more headers that apply to single sections of a report.

3.2.10 Report sections

Standard TAP contains of exactly one block with one plan (eg., 1..5) and some TAP lines. In Tapper you can concatenate several such blocks at once. They are interpreted like different files, and are named *sections* in Tapper jargon.

The delimiter between such sections is the plan line. This requires the plan to come first for each section. See chapters "Explicit section markers with lazy plans" and "TAP archives" below for explicitely providing other TAP section delimiters.

Please remember: **Concatenating several sections into one big block of TAP is an Tapper extension. To interact with other TAP toolchains you should try to use "TAP archives" when submitting sections into Tapper.**

Example:

```
1..2
# Tapper-section: arithmetics
ok 1 add
ok 2 multiply
1..1
# Tapper-section: string handling
ok 1 concat
1..3
# Tapper-section: benchmarks
ok 1
ok 2
ok 3
```

Remarks:

- we recognize "sections", each with its own plan
- allows structuring of results,
- better readability later in web interface

3.2.11 Meta information headers for report sections

These are the headers that apply to single sections:

```
# Tapper-explicit-section-start:   -- explicitely start a section now
                                       instead of autorecognition
# Tapper-ram:                      -- memory
# Tapper-cpuinfo:                  -- what CPU
# Tapper-uname:                    -- kernel information
# Tapper-osname:                   -- OS information
# Tapper-bios:                     -- BIOS information
# Tapper-flags:                    -- flags, usually linux kernel
# Tapper-changeset:                -- exact changeset of the currently
                                       tested software or kernel
# Tapper-description:              -- more description of the currently
                                       tested software or kernel,
```

```
                                        e.g., if changeset is not enough
# Tapper-uptime:                     -- uptime, maybe the test run time
# Tapper-language-description:       -- for Software tests,
                                        like "Perl 5.10", "Python 2.5"
# Tapper-reportcomment:              -- Freestyle comment

# Tapper-xen-version:                -- Xen version
# Tapper-xen-changeset:              -- particular Xen changeset
# Tapper-xen-dom0-kernel:            -- the kernel version of the dom0
# Tapper-xen-base-os-description:    -- more verbose OS information
# Tapper-xen-guest-description:      -- description of a guest
# Tapper-xen-guest-test:             -- the started test program
# Tapper-xen-guest-start:            -- start time of test
# Tapper-xen-guest-flags:            -- flags used for starting the guest

# Tapper-kvm-module-version:         -- version of KVM kernel module
# Tapper-kvm-userspace-version:      -- version of KVM userland tools
# Tapper-kvm-kernel:                 -- version of kernel
# Tapper-kvm-base-os-description:    -- more verbose OS information
# Tapper-kvm-guest-description:      -- description of a guest
# Tapper-kvm-guest-test:             -- the started test program
# Tapper-kvm-guest-start:            -- start time of test
# Tapper-kvm-guest-flags:            -- flags used for starting the guest

# Tapper-simnow-version:             -- version of simnow
# Tapper-simnow-svn-version:         -- svn commit id of simnow
# Tapper-simnow-svn-repository:      -- used svn repository
# Tapper-simnow-device-interface-version: -- internal simnow device
                                             interface version
# Tapper-simnow-bsd-file:            -- used BSD file (machine model)
# Tapper-simnow-image-file:          -- used OS image botted in simnow
                                        (usually similar to
                                        Tapper-osname or
                                        Tapper-xen-base-os-description or
                                        Tapper-kvm-base-os-description)
```

3.2.12 Meta information structure summary

There are groups of reports (e.g. for virtualization scenarios), optionally identified by a testrun ID or by an arbitrary ID. Every report has an ID and a set of meta information. A report consists of sections, which can each have section specific set of meta information.

The resulting meta information hierarchy looks like this.

- Reportgroup
  - `testrun reportgroup ID`
  - `arbitrary reportgroup ID`
    - Report
      - `report ID`
      - `Tapper-suite-name`
      - `Tapper-suite-version`
      - `Tapper-machine-name`
      - `Tapper-machine-description`

- Tapper-reportername
- Tapper-starttime-test-program
- Tapper-endtime-test-program
- Tapper-reportgroup-testrun
- Tapper-reportgroup-arbitrary

  - Section

    - Tapper-explicit-section-start
    - Tapper-ram
    - Tapper-cpuinfo
    - Tapper-uname
    - Tapper-osname
    - Tapper-bios
    - Tapper-flags
    - Tapper-changeset
    - Tapper-description
    - Tapper-uptime
    - Tapper-language-description
    - Tapper-reportcomment
    - Tapper-xen-version
    - Tapper-xen-changeset
    - Tapper-xen-dom0-kernel
    - Tapper-xen-base-os-description
    - Tapper-xen-guest-description
    - Tapper-xen-guest-test
    - Tapper-xen-guest-start
    - Tapper-xen-guest-flags
    - Tapper-kvm-module-version
    - Tapper-kvm-userspace-version
    - Tapper-kvm-kernel
    - Tapper-kvm-base-os-description
    - Tapper-kvm-guest-description
    - Tapper-kvm-guest-test
    - Tapper-kvm-guest-start
    - Tapper-kvm-guest-flags
    - Tapper-simnow-version
    - Tapper-simnow-svn-version
    - Tapper-simnow-svn-repository
    - Tapper-simnow-device-interface-version
    - Tapper-simnow-bsd-file
    - Tapper-simnow-image-file

3.2.13 Explicit section markers with lazy plans

In TAP it is allowed to print the plan (1..n) after the test lines (a "lazy plan"). In our Tapper environment with concatenated sections this would break the default section splitting which uses the plan to recognize a section start.

If you want to use such a "lazy plan" in your report you can print an Tapper header `Tapper-explicit-section-start` to explictely start a section. Everything until the next header `Tapper-explicit-section-start` is building one section. This also means that if you used this header **once** in a report you need to use it for **all** sections in this report.

The `Tapper-explicit-section-start` typically ignores its value but it is designed anyway to allow any garbage after the value that can help you visually structure your reports because explicit sections with "lazy plans" make a report hard to read.

Example:

```
# Tapper-explicit-section-start: 1 ------ arithmetics -------
# Tapper-section: arithmetics
ok 1 add
ok 2 multiply
1..2
# Tapper-explicit-section-start: 1 ------ string handling -------
# Tapper-section: string handling
ok 1 concat
1..1
# Tapper-explicit-section-start: 1 ------ benchmarks -------
# Tapper-section: benchmarks
ok 1
ok 2
ok 3
1..3
```

Please note again: **The sectioning in general and this auxiliary header for marking sections is an Tapper extension, not standard TAP. An alternative way better than fiddling with this sectioning is to produce TAP archives and submit them instead. See chapter "TAP Archives".**

3.2.14 Developing with TAP

TAP consuming is provided via the `Test::Harness` aka. `TAP::Parser` Perl toolchain. The frontend utility to execute TAP emitting tests and evaluate statistics is `prove`.

```
$ prove t/*.t
t/00-load.........ok
t/boilerplate.....ok
t/pod-coverage....ok
All tests successful.
Files=4, Tests=6, 0 wallclock secs
( 0.05 usr 0.00 sys + 0.28 cusr 0.05 csys = 0.38 CPU)
Result: PASS
```

Remarks:

- TAP::Parser
  - `prove` tool
  - overall success and statistics
  - allows '`formatters`'
  - used to produce web reports

It helps to not rely on Tapper extensions (like report sections) when using the `prove` command.

3.2.15 TAP tips

- TAP is easy to produce but using it **usefully** can be a challenge.
- Use **invariable** test descriptions.
- Put meta information in diagnostics lines, **not** into test descriptions.
- Use the description after `# TODO/SKIP`.
- Cheat visible (or: don't cheat invisible).

- Really use `# TODO/SKIP`.

These tips keep later TAP evaluation consistent.

3.3 Particular use-cases

3.3.1 Report Groups

3.3.1.1 Report grouping by same testrun

If we have a Xen environment then there are many guests each running some test suites but they don't know of each other.

The only thing that combines them is a common testrun-id. If each suite just reports this testrun-id as the group id, then the receiving side can combine all those autonomously reporting suites back together by that id.

So simply each suite should output

```
# Tapper-reportgroup-testrun: 1234
```

with 1234 being a testrun ID that is available via the environment variable `$TAPPER_TESTRUN`. This variable is provided by the automation layer.

3.3.1.2 Report grouping by arbitrary idenitifier

If the grouping id is not a testrun id, e.g., because you have set up a Xen environment without the Tapper automation layer, then generate one random value once in dom0 by yourself and use that same value inside all guests with the following header:

- get the value:

  ```
  TAPPER_REPORT_GROUP=‘date|md5sum|awk ’{print $1}’‘
  ```

- use the value:

  ```
  # Tapper-reportgroup-arbitrary: $TAPPER_REPORT_GROUP
  ```

How that value gets from *dom0* into the guests is left as an exercise, e.g. via preparing the init scripts in the guest images before starting them. That's not the problem of the test suite wrappers, they should only evaluate the environment variable `TAPPER_REPORT_GROUP`.

3.4 TAP Archives

Some TAP emitting toolchains allow the generation of .tar.gz files containing TAP, so called *TAP archives*. E.g., via ‘`prove`’:

```
$ prove -a /tmp/myresults.tgz t/
```

You can later submit such TAP archive files to the Tapper reports receiver tha same way as you report raw TAP.

3.5 Reporting TAP to the reports receiver

The Tapper reports receiver is a daemon that listens on a port and slurps in everything between the open and close of a connection to it. Therefore you can use ‘`netcat`’ to report TAP.

Remember that using ‘`netcat`’ in turn can be a mess, the are several flavours with different options which are also changing their behaviour over time. So to be sure, you better do your own socket communication with Perl or Python: open socket, print to socket, close socket, done. We just keep with ‘`netcat`’ for illustrating the examples.

3.5.1 Submitting raw TAP

Simply submit all TAP directly into the socket of the reports receiver:

```
$ ./my_tap_emitting_test_suite | netcat tapper_server 7357
```

3.5.2 Submitting TAP Archives

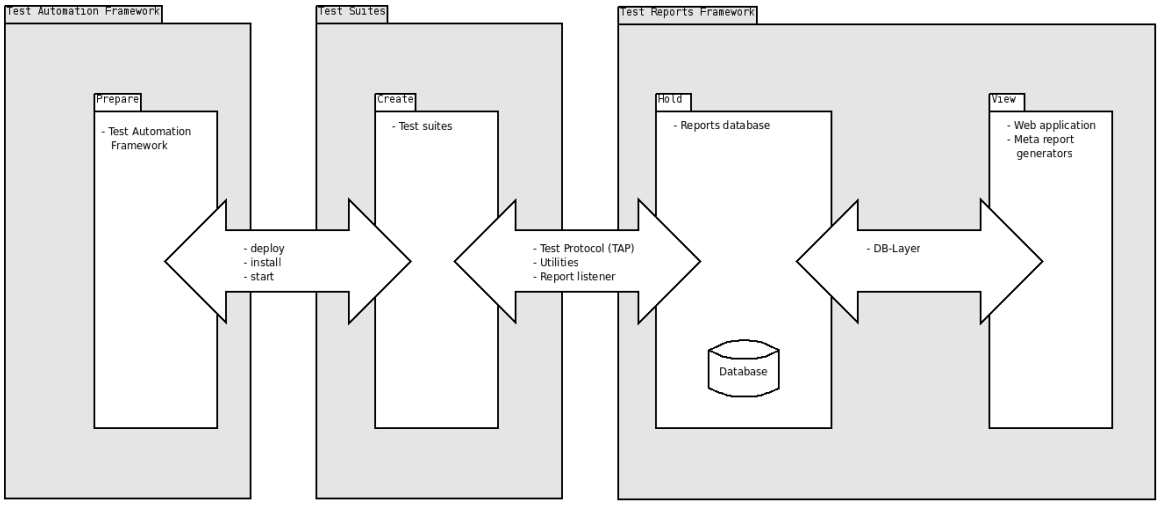
You submit the content of a .tar.gz file in the same way you submit raw TAP, via the same API. The receiver recognizes the .tar.gz contenttype by itself.

```
$ prove -a /tmp/myresults.tgz t/
$ cat /tmp/myresults.tgz | netcat tapper_server 7357
```

4 Test Suite Wrappers

This section is about the test suites and wrappers around existing suites. These wrappers are part of our overall test infrastructure.

It's basically about the middle part in the following picture:



We have wrappers for existing test and benchmark suites.

Wrappers just run the suites as a user would manually run them but additionally extract results and produce TAP (Test Anything Protocol).

We have some specialized, small test suites that complement the general suites, e.g. for extracting meta information or parsing logs for common problems.

If the environment variables

`TAPPER_REPORT_SERVER`
`TAPPER_REPORT_PORT`

are set the wrappers report their results by piping their TAP output there, else they print to STDOUT.

4.1 Available test suite wrappers

Originally we had a lot of direct wrappers available but do not publish all. For OS testing the most important wrapper which is also publicly available is *tapper-testsuite-autotest* aka. *Tapper-Testsuite-AutoTest*. You should look at that.

4.1.1 tapper-testsuite-autotest

tapper-testsuite-autotest

A suite that wraps the *autotest* client with the export of TAP and sends the resulting TAP archives to Tapper server.

That is the primary testsuite wrapper for OS testing.

4.2 Environment variables

The TAPPER automation layer provides some environment variables that the wrappers can use:

TAPPER_TESTRUN
: Currently active Testrun ID.

TAPPER_SERVER
: The controlling automation Server that initiated this testrun.

TAPPER_REPORT_SERVER
: The target server to which the tests should report their results in TAP.

TAPPER_REPORT_PORT
: The target port to which the tests should report their results in TAP. Complements `TAPPER_REPORT_SERVER`.

TAPPER_REPORT_API_PORT
: The port on which the more sophisticated Remote Reports API is available. It's running on the same host as `TAPPER_REPORT_SERVER`.

TAPPER_TS_RUNTIME
: Maximum runtime after which the testprogram will not be restarted when it runs in a loop. (This is a more passive variant than a timeout.)

TAPPER_GUEST_NUMBER
: Virtualisation guests are ordered, this is the guest number or 0 if not a guest.

TAPPER_NTP_SERVER
: The server where to request NTP dates from.

These variables should be used in the TAP of the suite as *Tapper*headers. Important use-case is "report groups", see next chapter.

5 Preconditions

The central thing that is needed before a test is run is a so called *precondition*. Creating those preconditions is the main task needed to do when using the automation framework.

Most of the *preconditions* describe packages that need to be installed. Other preconditions describe how subdirs should be copied or scripts be executed.

A *precondition* can depend on other preconditions, leading to a tree of preconditions that will be installed from the leaves to the top.

5.1 SYNOPSIS

- Create a (maybe temporary) file
- Define conditions for a testrun: the *preconditions*
- Put the precondition into the database, maybe referring to other preconditions
- Create a testrun in the database, referring to the precondition
- Wait until the testrun is executed and results are reported

5.2 Layers of preconditions

There are "normal preconditions" and "macro preconditions".

5.2.1 Normal preconditions

We store preconditions in the database and assign *testruns* to them (also in the database).

Usually the preconditions were developed in a (temporary) file and then entered into the database with a tool. After that the temporary file can be deleted. Note that such a precondition file can contain multiple precondition as long as they are formated as valid YAML.

Preconditions can be kept in files to re-use them when creating testruns but that's not needed for archiving purposes, only for creation purposes.

Please note: **Normal preconditions are usually not what you want.** It's the low level mechanism. Its advantage is in reusing the preconditions by referring to IDs and creating trees of preconditions. This reuse is usually too complex. **What you typically want are Macro Preconditions**.

5.2.2 Macro preconditions

There is another mechanism on top of normal preconditions: *Macro Preconditions*. These allow to bundle **multiple** preconditions at once into a common use-case.

A *macro precondition* is evaluated when the testrun is added via the cmdline utils (or the web app, both use the same underlying layer). The result are "normal preconditions" which are inserted into the DB everytime together with the testrun, so there is no reuse of preconditions and preconditions are always a list, no tree. Anyhow, they are much easier to handle.

Macro preconditions are template files which should be archived in the precondition repository, as only the finally resulting preconditions are stored in the database.

5.3 Precondition repository

Macro preconditions can be stored in

`/data/tapper/live/repository/macropreconditions/`

5.4 Overview: Precondition Types

There are two variants of preconditions: *Action preconditions* and *Highlevel preconditions*. Action preconditions describe single actions, like "copy a file" or "execute a program". Highlevel preconditions can contain other (action) preconditions and are used for instance for virtualization install scenarios where hosts and guests are described.

Please note the wording: A precondition is the particular YAML block with all the details (think of an object instance). Such a block is of a "precondition type" which defines its allowed structure (think of a class).

5.4.1 Overview: Action precondition types

The following *action* precondition types are allowed:

package

A package (kernel, library, etc.), of type *.tar*, *.tar.gz* or *.tar.bz2*

image

A complete OS image of type *.iso*, *.tar.gz*, *.tgz*, *.tar*, *.tar.bz2*

prc

Create a config for the *PRC* module of the automation layer.

copyfile

One file that can just be copied/rsync'd

installer_stop

Don't reboot machine after system installer finished

grub

Overwrite automatically generated grub config with one provided by the tester

fstab

Append a line to /etc/fstab

repository

Fetch data from a git, hg or svn repository

exec

Execute a script during installation phase

reboot

Requests a reboot test and states how often to reboot.

5.4.2 Overview: Highlevel precondition types

Currently only the following *high level* precondition type is allowed:

virt

Generic description for Xen or KVM

High level preconditions both define stuff and can also contain other preconditions.

They are handled with some effort to *Do The Right Thing*, i.e., a defined root image in the high level precondition is always installed first. All other preconditions are installed in the order defined by its tree structure (depth-first).

5.5 Details: Precondition Types

We describe preconditions in YAML files (http://www.yaml.org/).

All preconditions have at least a key

```
precondition_type: TYPE
```

and optionally

```
name: VERBOSE DESCRIPTION
shortname: SHORT DESCRIPTION
```

then the remaining keys depend on the TYPE.

5.5.1 installer_stop

stop run after system installer

```
---
precondition_type: installer_stop
```

5.5.2 grub

overwrite automatically generated grub config

```
---
precondition_type: grub
config: |
  title Linux
    root $grubroot
    kernel /boot/vmlinuz root=$root"
```

- Note: multiple lines in the grub file have to be given as one line separated by "\n" (literally a backslash and the letter n) in YAML
- the variables $grubroot and $root are substituted with grub and /dev/* notation of the root partition respectively
- $root substitution uses the notation of the installer kernel. This may cause issues when the installer detects /dev/sd? and the kernel under test detects /dev/hd? or vice versa
- since grub always expects parentheses around the device, they are part of the substitution string for $grubroot
- note the syntax, to get multiline strings in YAML you need to start them with `|`, a newline and some indentation

5.5.3 package

```
---
precondition_type: package
filename: /data/tapper/live/repository/packages/linux/linux-2.6.27.7.tar.bz2
```

- path names can be absolut or relative to /data/tapper/development/repository/packages/
- supported packages types are rpm, deb, tar, tar.gz and tar.bz2
- package type is detected automatically
- absolute path: usually /data/tapper/...
- relative path: relative to /data/tapper/(live|development)/

5.5.4 copyfile

a file that just needs to be scp or copied:

```
---
precondition_type: copyfile
```

```
protocol: nfs
source: osko:/export/image_files/official_testing/README
dest: /usr/local/share/tapper/
```

- supported protocols are “scp”, “nfs” and “local”
- the part before the first colon in the unique name is used as server name
- the server name part is ignored for local
- if dest ends in a slash, the file is copied with its basename preserved into the denoted directory
- whether the “dest” is interpreted as a directory or a file is decided by the underlying “scp” or “cp” semantics, i.e., it depends on whether a directory already exists.

5.5.5 fstab

a line to add to /etc/fstab, e.g., to enable mounts once the system boots

```
---
precondition_type: fstab
line: "165.204.85.14:/vol/osrc_vol0 /home nfs auto,defaults 0 0"
```

5.5.6 image

usually the root image that is unpacked to a partition (this is in contrast to a guest file that's just there)

```
---
precondition_type: image
mount: /
partition: testing
image: /data/tapper/live/repository/images/rhel-5.2-rc2-32bit.tgz
```

- partition and mount are required, all other options are optional
- mount points are interpreted as seen inside the future installed system
- if no image is given, the already installed one is reused, i.e., only the mountpoint is mounted; make sure this is possible or your test will fail!
- can be either an iso file which is copied with dd or a tar, tar.gz or tar.bz2 package which is unpacked into the partition
- partitions are formated ext3 (only when image is given) and mounted to mount afterwards (this is why image exists at all, copyfile does not provide this)
- “image”: absolute or relative path (relative to /data/tapper/live/repository/images/)
  If not given, then it re-uses the partition without formatting/unpacking it.
- partition: Can be /dev/XXX or LABEL or UUID.

5.5.7 repository

```
---
precondition_type: repository
type: git
url: git://git.kernel.org/pub/scm/linux/kernel/git/avi/kvm.git
target: kvm
revision: c192a1e274b71daea4e6dd327d8a33e8539ed937
```

- git and hg are supported
- type and url are mandatory, target and revision are optional
- target denotes the directory where the source is placed in, the leading slash can be left out (i.e., paths can be given relative to root directory ‘/’).

5.5.8 type: prc

Is typically contained implicitely with the abstract precondition *virt*. But can also be defined explicitely, e.g., for kernel tests.

Creates config for PRC. This config controls what is to be run and started when the machine boots.

```
precondition_type: prc
config:
     runtime: 30
     test_program: /bin/uname_tap.sh
     timeout_after_testprogram: 90
     guests:
      - svm:  /xen/images/..../foo.svm
      - svm:  /xen/images/..../bar.svm
      - exec: /xen/images/..../start_a_kvm_guest.sh
```

- guest number

  If it is a guest, for host system use 0.

- test_program

  startet after boot by the PRC

- runtime

  The wanted time, how long it runs, in seconds, this value will be used to set an environment variable `TAPPER_TS_RUNTIME`, which is used by the test suite wrappers.

- timeout_testprogram

  Time that the testprogram is given to run, at most, after that it is killed (SIGINT, SIGKILL).

- guests

  Only used for virtualization tests. Contains an array, one entry per guest which defines how a guest is started. Can be a SVM file for Xen or an executable for KVM.

5.5.9 type: exec

Defines which program to run at the installation phase.

```
precondition_type: exec
filename: /bin/some_script.sh
options:
  - -v
  - --foo
  - --bar="hot stuff"
```

The quotes in this example are actually wrong but left in so you learn the following lesson:

5.5.10 type: hint

Such a precondition provides hints where normal behaviour needs to be changed. It contains any hash keys needed for the special handling. The special handling itself is done in the MCP and needs to be prepared for what you specify here.

We currently use it to handle SimNow testing.

```
precondition_type: hint
simnow: 1
script: family10_sles10_xen.simnow
```

5.5.11 quote subtleties

Please note some subtlety about quotes.

- This is YAML. And YAML provides its own way of quoting.

  So this

  ```
  precondition_type: exec
  filename: /bin/some_script.sh
  options:
    - --foo
  ```

  and this

  ```
  precondition_type: exec
  filename: /bin/some_script.sh
  options:
    - "--foo"
  ```

  are actually the same (the value is always: `--foo`) because quotes at the beginning and end of a YAML line are used by YAML. When you use quotes at other places like in

  ```
  precondition_type: exec
  filename: /bin/some_script.sh
  options:
    - --bar="hot stuff"
  ```

  then they are not part of the YAML line but part of the value, so this time the value is: `--bar="hot stuff"`.

- Quotes are not shell quotes.

  So if you used quotes and they are not YAML quotes but part of the value then you should know that they are **not** evaluated by a shell when `some_script.sh` is called, because we use `system()` without a shell layer to start it.

  That's why in above example the quoted value `"hot stuff"` (with quotes!) is given as parameter `--bar` to the program. This usually **not** what you want.

- Summary: Yo nearly never need quotes.

  This is good enough:

  ```
  precondition_type: exec
  filename: /bin/some_script.sh
  options:
    - -v
    - --foo
    - --bar=hot stuff
  ```

5.5.12 type: reboot

Requests a reboot test and states how often to reboot.

Note: Reboot count of 1 actually means boot two times since the first boot is always counted as number 0.

```
precondition_type: reboot
count: 2
```

5.5.13 type: autoinstall

Install a system using autoinstall scripts. The filename denotes the grub config to be used. It is mandatory and can be given as absolut path or relative to /data/tapper/.../repository/install_grub/. The optional timeout is measured in second. If its absent a default value is used.

```
precondition_type: autoinstall
filename: suse/SLES10SP3_x86_64.lst
timeout: 1800
```

5.5.14 type: testprogram

Define which test program to run. This way of defining a test program should be prefered to using the **PRC** type precondition. Only the **testprogram** precondition guarantees parsing that sets all internal Tapper variables correctly.

```
precondition_type: testprogram
runtime: 30
program: /bin/uname_tap.sh
timeout: 90
parameters:
- --verbose
```

5.5.15 type: virt

A virtualization environment.

(The linebreaks with \ are not part of the actual file, but only for this document.)

```
precondition_type: virt
name: automatically generated Xen test
host:
  preconditions:
  - precondition_type: package
    filename: /data/tapper/live/repository/packages/xen/builds/\
              x86_64/xen-3.3-testing/\
              xen-3.3-testing.2009-03-20.18614_f54cf790ffc7.x86_64.tgz
  - precondition_type: package
    filename: /data/tapper/live/repository/packages/tapperutils/\
              sles10/xen_installer_suse.tar.gz
  - precondition_type: exec
    filename: /bin/xen_installer_suse.pl
  root:
    precondition_type: image
    partition: testing
    image: suse/suse_sles10_64b_smp_raw.tar.gz
    mount: /
    arch: linux64
  testprogram:
    execname: /opt/tapper/bin/tapper_testsuite_dom0_meta.sh
    timeout_testprogram: 10800
guests:
- config:
    precondition_type: copyfile
    protocol: nfs
    name: tapper:/data/tapper/live/repository/configs/\
                 xen/001-sandschaki-1237993266.svm
    dest: /xen/images/
    svm: /xen/images/001-sandschaki-1237993266.svm
  root:
    precondition_type: copyfile
    protocol: nfs
```

```
    arch: linux64
    name: osko:/export/image_files/official_testing/\
          redhat_rhel4u7_64b_up_qcow.img
    dest: /xen/images/
    mountfile: /xen/images/001-sandschaki-1237993266.img
    mounttype: raw
  testprogram:
    execname: /opt/tapper/bin/py_ltp
    timeout_after_testprogram: 10800
```

  - guest root always needs to name the file to mount since its not easy or even impossible to get this name for some ways to install the root image (like tar.gz packages or subdir)
  - guest root and guest config are installed inside the host, guest preconditions are installed inside the guest image
  - guests can be started with xm create $xenconf, evaluation of $kvmconf or executing the $execconf script, thus only one of these three must be provided
- "'Note"': virt instead of virtualisation is used to reduce confusion for users whether British English (virtualisation) or American English (virtualization) is expected
- key "arch" arch: linux64 | linux32 (needed for for tapper toolchain)

5.5.16 General precondition keys "mountfile"

These 2 options are possible in each precondition. With that you can execute the precondition inside guest images:

```
mountfile: ...
mountpartition: ...
mounttype: @TODO{is this the same as mountfile, mountpartition?}
```

- 1. only mountfile: eg. rawimage, file loop-mounted
- 2. only mountpartition: then mount that partition
- 3. image file with partitions: mount the imagefile and from that only the given partition

5.6 Macro Preconditions

This section describes macro precondition files as they are stored in `/data/tapper/live/repository/macropreconditions/`.

A macro precondition denotes a file containing one or multiple preconditions and additional TemplateToolkit code.

In most cases "normal preconditions" for similar tests will only differ in one or very few keys. Thus precondition files could easily be reused by only changing these few keys. This is made easier with using "macro preconditions".

The macro precondition file should contain all "normal preconditions" to be reused. All variable keys should be substituted by appropriate TemplateToolkit variables. When creating the new testrun actual values for these TemplateToolkit variables have to provided.

Macro preconditions are **not** stored in the database. They are only a tool to ease the creation of preconditions. Only the **resulting** preconditions are stored in database.

To make parsing macro preconditions easier required and optional fields can be named after a comment field in the first lines of the file after the keys `tapper-mandatory-fields` and `tapper-optional-fields` respectively as in the following example:

```
# tapper-mandatory-fields: id
# tapper-optional-fields: kernel
```

These `# tapper-*` headers are also used in web frontend to render forms out of it and submit testruns from there.

The values for the placeholders can be filled via such a command line:

```
$ tapper-testrun new [all usual options] \
     --macroprecond=FILENAME \
      -Did=value1 \
      -Dkernel=2.6.37
```

The FILENAME is a complete filename with absolute path.

There is no restriction on TemplateToolkit code for variable substitution. The following example could be used to generate a default value for the precondition key id.

```
[%id = BLOCK%][%IF id%][%id%][%ELSE%]2009-06-29-perfmon[%END%][%END%]
```

5.6.1 A real live example - kernel boot test

- Macroprecondition

```
# tapper-mandatory-fields: kernel_version
# tapper-optional-fields: kernelpkg
---
precondition_type: image
arch: linux64
image: suse/suse_sles10_64b_smp_raw.tar.gz
mount: /
partition: testing
---
precondition_type: copyfile
name: /data/tapper/live/repository/testprograms/uname_tap/uname_tap.sh
dest: /bin/
protocol: local
---
precondition_type: copyfile
name: /data/tapper/live/repository/packages/tapperutils/kernel/gen_initrd.sh
dest: /bin/
protocol: local
---
[% kernelpkg = BLOCK %]\
[% IF kernelpkg %]\
[% kernelpkg %]\
[%ELSE%]kernel/linux-[% kernel_version %].tar.gz[% END %]\
[% END %]
precondition_type: package
filename: [% kernelpkg %]
---
precondition_type: exec
filename: /bin/gen_initrd.sh
options:
  - [% kernel_version %]
---
precondition_type: prc
config:
      runtime: 30
      test_program: /bin/uname_tap.sh
```

```
timeout_testprogram: 90
```

- The test script

  The test script `uname_tap.sh` to which the macro precondition refers is just a shell script that examines uname output:

```
#! /bin/sh
echo "1..2"
echo "# Tapper-Suite-Name: Kernel-Boot"
echo "# Tapper-Suite-Version: 1.00"
echo "# Tapper-Machine-Name: " `hostname`

if [ x`uname` != xLinux ] ; then echo -n "not " ; fi
echo "ok - We run on Linux"

if uname -a | grep -vq x86_64 ; then echo -n "not " ; fi
echo "ok - Looks like x86_64"
```

- Command line

  Once you wrote the macro precondition and the test script all you need is this command line:

```
tapper-testrun new \
  --hostname=dickstone \
  --macroprecond \
    /data/tapper/live/repository/macropreconditions/kernel/kernel_boot.mpc \
   -Dkernelpkg=perfmon-682-x86_64.tar.gz \
   -Dkernel_version=2.6.28-rc3
```

  or with some more information (owner, topic):

```
tapper-testrun new \
  --owner=mhentsc3 \
  --topic=Kernel \
  --hostname=dickstone \
  --macroprecond \
    /data/tapper/live/repository/macropreconditions/kernel/kernel_boot.mpc \
   -Dkernelpkg=perfmon-682-x86_64.tar.gz \
   -Dkernel_version=2.6.28-rc3
```

5.7 Precondition Producers

Sometimes, parameters for preconditions shall be defined when the testrun, this precondition is assigned to, is choosen for execution. This might apply for example when you want to test the newest build of a certain package. Also in combination with autorerun testruns dynamic assignment of preconditions is useful. These testruns are reinserted into the database automatically as soon as the scheduler chooses them for execution. In this case dynamic precondition assignment allows these rerun tests to differ slightly. Preconditions with dynamically assigned parameters are called *Lazy Precondition*.

Dynamic precondition assignment is implemented using *Precondition Producers*. A producer is a modul that is called by the scheduler for handling of lazy preconditions. To use a lazy preconditio the user has to assign a precondition of type '`producer`' to the testrun. This precondition has to contain the basename of an existing producer module and may contain additional parameters. The producer will substitute the '`producer`' precondition with a normal precondition that has values assigned to all parameters.

5.7.1 Lazy precondition

Lets assume for example that you want to include the newest kernel package into your test. This can be achieved with the existing "Kernel" producer. Instead of a precondition of type '`package`' with a certain filename you should assign the following precondition to your testrun.

```
precontition_type: producer
producer: Kernel
```

This precondition will be substituted with a package precondition that has the latest Sysint kernel build set as filename.

5.7.2 Producer API

Producer are modules loaded into the scheduler. Thus they need to be written in Perl and reside inside the `Tapper::MCP::Scheduler::PreconditionProducer::` namespace. A producer has to implement a method '`produce`'. This function gets a job object as first parameter and a hash containing all additional options from the precondition as second parameter. It suggested that each producer inherits from `Tapper::MCP::Scheduler::PreconditionProducer`. Producers shall return a hash that has the produced preconditions as YAML text assigned to the hash key `precondition_yaml`. An optional key `topic` allows the producer to set the topic for the test. If the hash key `error` is set, the associated error string is reported and the testrun is cancled. In this case the other hash keys are not evaluated.

5.7.3 Existing producers

Currently the following producers exist:

- DummyProducer.pm

  Dummy producer for testing.
- Kernel.pm

  Produces preconditions for kernel tests.
- NewestPackage.pm

  Produces a package precondition that installs the newest package from a given directory.
- SimnowKernel.pm

  Produces preconditions for simnow kernel tests.
- Temare.pm

  Wraps the existing temare producer utility.

5.7.4 Example: "Kernel" precondition producer

The kernel producer returns a package precondition that contains the latest kernel package from the kernel package path. Furthermore, it returns an exec precondition that triggers the creation of an initrd file for the kernel.

Valid options:

- arch

  May be x86_64 or i686. The latest kernel package from the associated path are used.
- version

  Only use kernel packages that contain the given version string
- stable

  Use stable kernels when true

5.7.4.1 Lazy precondition

The lazy precondition, pointing to the "Kernel" precondition producer:

```
precondition_type: produce
producer: Kernel
arch: i686
version: 2.6.32
stable: 1
```

5.7.4.2 Resulting preconditions

The resulting preconditions may look like this:

```
---
precondition_type: package
filename: kernel/stable/i686/kernel-2.6.32-rc1.tar.gz
---
precondition_type: exec
filename: /bin/gen_initrd.sh
options:
  - 2.6.32-rc1
```

6 Command line interface

6.1 Commandline Synopsis

- Get host usage/scheduling overview
- Create hosts
- Create queues
- Create hosts/queue bindings

6.2 Scheduling

6.2.1 Create new queue and new host and bind both together

- Show existing queues with priorities

```
$ tapper-testrun listqueue -v
        10 |              AdHoc |  1000
        11 |      kernel_reboot |   100
         4 | xen-3.3-testing-32 |   100
         5 | xen-3.3-testing-64 |   100
         7 | xen-3.4-testing-32 |   100
         6 | xen-3.4-testing-64 |   100
         9 |    xen-unstable-32 |   100
         8 |    xen-unstable-64 |   100
```

- Create new queue *oprofile*

```
$ tapper-testrun newqueue --name=oprofile \
                          --priority=200
12
```

- Create new host *bullock* and bind it to queue *oprofile*

```
$ tapper-testrun newhost --name=bullock \
                         --queue=oprofile
10
```

- Show existing hosts

  Note that the new host *bullock* is initially deactivated.

```
$ tapper-testrun listhost -v
         8 |  amarok | deactivated |   free
         1 |  athene |      active | in use
         9 |   azael | deactivated |   free
        10 | bullock | deactivated |   free | oprofile
         4 |    cook | deactivated |   free
         6 | incubus | deactivated |   free
         2 |  kobold |      active | in use
         5 |  lemure |      active | in use
         3 |   satyr |      active | in use
         7 |    uruk | deactivated |   free
```

- Activate host *bullock*

  Note that this command is ID based (bullock has id 10) because you can rename hosts.

```
$ tapper-testrun updatehost --id=10 --active
10 | bullock | active | free | oprofile
```

- Again, show existing hosts

  Host *bullock* is now activated.

```
$ tapper-testrun listhost -v
         8 |  amarok | deactivated |   free
         1 |  athene |      active | in use
         9 |   azael | deactivated |   free
        10 | bullock |      active |   free | oprofile
         4 |    cook | deactivated |   free
         6 | incubus | deactivated |   free
         2 |  kobold |      active | in use
         5 |  lemure |      active | in use
         3 |   satyr |      active | in use
         7 |    uruk | deactivated |   free
```

Done.

6.2.2 Change queue priority

- List existing queues

```
$ tapper-testrun listqueue -v
        10 |              AdHoc |  1000
        11 |      kernel_reboot |   100
        12 |           oprofile |   200 | bullock
         4 | xen-3.3-testing-32 |   100
         5 | xen-3.3-testing-64 |   100
         7 | xen-3.4-testing-32 |   100
         6 | xen-3.4-testing-64 |   100
         9 |    xen-unstable-32 |   100
         8 |    xen-unstable-64 |   100
```

- Update queue

```
$ tapper-testrun updatequeue --name=oprofile \
                             --priority=1000
12
```

- Again, list existing queues

```
$ tapper-testrun listqueue -v
        10 |              AdHoc |  1000
        11 |      kernel_reboot |   100
        12 |           oprofile |  1000 | bullock
         4 | xen-3.3-testing-32 |   100
         5 | xen-3.3-testing-64 |   100
         7 | xen-3.4-testing-32 |   100
         6 | xen-3.4-testing-64 |   100
         9 |    xen-unstable-32 |   100
         8 |    xen-unstable-64 |   100
```

  Done.

6.2.3 requested features

Hosts for testruns can be choosen based on requested features. Supported features are:

- hostname
- mem
- vendor

- family
- model
- stepping
- revision
- socket
- cores
- clock
- l2cache
- l3cache

6.2.4 Cancel current testrun on host

Freeing a host need the config for the currently running testrun. Thus, the command is only tested on bancroft and may not work on other machines.

```
$ tapper-testrun freehost \
                 --name=bullock\
                 --desc='I need this host right now'
```

7 Web User Interface

The Web User Interface is a frontend to the Reports database. It allows to overview reports that came in from several machines, in several test suites.

It can filter the results by dates, machines or test suite, gives colorful (RED/YELLOW/GREEN) overview about success/failure ratios, allows to zoom into details of single reports.

To evaluate reported test results in a more programmatic way, have a look into the *DPath Query Language* that is part of the ⟨undefined⟩ [Reports API], page ⟨undefined⟩.

7.1 Usage

The main URL is typically somerthing like

`http://tapper/tapper`

7.2 Understanding Tapper Details

7.2.1 Part 1 Overview

- Go to `https://tapper/tapper/reports`
- Click "Last weeks test reports", aka. `https://tapper/tapper/reports/date/7`
- Below day "Wed Oct 7, 2009" find the line

  ```
  20856  2009-10-07  Topic-xen-unstable  satyr  PASS testrun 9617
  ```

  To find this report you probably need to go more back into the past than just 7 days, or you use the direct link below.
- Note that there are other reports in this group that are greyed-out, i.e. all report ids of this testrun are:

  ```
  20856    Topic-xen-unstable
  20855    LMBench
  20854    CTCS
  20852    Host-Overview
  20851    Hardwaredb Overview
  ```
- Note that something FAILed in the CTCS run (20854).
- What we know until here:
  - It is a test for Xen-unstable (Topic-xen-unstable)
  - The running of the guests+suites itself worked well (20856 PASS)
  - There were 2 guest runs:

    ```
    LMBench      satyr:celegorm                PASS
    CTCS         satyr:eriador                 FAIL
    ```
- Click on the ID link "20856" aka. `https://tapper/tapper/reports/id/20856`

7.2.2 Part 2 Details

- Here you see the details of this report 20856.

  You see:
  - green PASSED results for the "MCP overview". This means the starting and finishing of the guests worked.
  - attachments of console logs.
  - some links to more information (raw TAP report, preconditions)
- Note below the group of all the other reports, again it's the group of those IDs:

```
20856    Topic-xen-unstable
20855    LMBench
20854    CTCS
20852    Host-Overview
20851    Hardwaredb Overview
```

- The most meta information is in "20852 Host-Overview".
- Click on the ID link "20852" aka. https://tapper/tapper/reports/id/20852
- Now you see the details of "20852 Host-Overview" with lots of meta information as "Context".

  You see:

```
Metainfo
    cpuinfo:  1x Family: 15, Model: 67, Stepping: 2
    ram:      3950 MB
    uptime:   0 hrs

XEN-Metainfo
    xen_dom0_kernel:  2.6.18.8-xen x86_64
    xen_base_os_description:  SUSE Linux Enterprise Server 10 SP2 (x86_64)
    xen_changeset:    20273:10cfcbef68ee
    xen_version:      3.5-unstable

guest_1_redhat_rhel5u4_32bpae_qcow
    xen_guest_description:    001-lmbench
    xen_guest_flags:
    xen_guest_start:

guest_2_suse_sles10_sp3_gmc_32b_up_qcow
    xen_guest_description:    002-ctcs
    xen_guest_flags:
    xen_guest_start:
```

- If you are interested in what went wrong in the CTCS run, click on ID link "20854" aka. https://tapper/tapper/reports/id/20854
- Here you see
  - one RED bar in CTCS-results
  - several RED bars in var_log_messages

  You can click on them to unfold the details.

7.2.3 Part 3 Testrun

- Imagine that the testrun completely failed and no usable reports arrived in, except that primary one from the MCP, then you can use the link at the end of the line

```
20856  2009-10-07  Topic-xen-unstable  satyr  PASS testrun 9617
                                                ------------
```

- Click on that link "testrun 9617" aka. https://tapper/tapper/testruns/id/9617
- That contains the description what was **planned** in this testrun, regardless of whether it succeeded.

  (That's the main difference between the two complementary concepts "Testrun" vs. "Reports". The "Testrun" contains the specification, the "Reports" contain the results.)

  You see:

```
Name                    Automatically generated Xen test
Host
    Architecture        linux64
    Root image          /suse_sles10_sp2_64b_smp_raw.tar.gz
    Test                metainfo
Guest number 1
    Architecture        linux32
    Root image          /redhat_rhel5u4_32bpae_qcow.img
    Test                py_lmbench
Guest number 2
    Architecture        linux32
    Root image          /suse_sles10_sp3_gmc_32b_up_qcow.img
    Test                py_ctcs
```

- That's it, basically.

8 Reports API

8.1 Overview

There runs yet another daemon, the so called `Tapper::Reports::API`, on the same host where already the `TAP Receiver` runs. This '`Reports API`' is meant for everything that needs more than just dropping TAP reports to a port, e.g., some interactive dialog or parameters.

This `Tapper::Reports::API` listens on Port `7358`. Its API is modeled after classic unix script look&feel with a first line containing a description how to interpret the rest of the lines.

The first line consists of a shebang (`#!`), a *api command* and *command parameters*. The rest of the file is the *payload* for the *api command*.

The syntax of the '`command params`' varies depending on the '`api command`' to make each command intuitively useable. Sometimes they are just positional parameters, sometimes they look like the start of a HERE document (i.e., they are prefixed with `<<` as you can see below).

8.2 Raw API Commands

In this section the raw API is described. That's the way you can use without any dependencies except for the minimum ability to talk to a port, e.g., via `netcat`.

See section ⟨undefined⟩ [tapper-api], page ⟨undefined⟩ for how to use a dedicated command line utility that makes talking to the reports API easier, but is a dependency that might not be available in your personal test environment.

8.2.1 upload aka. attach a file to a report

This api command lets you upload files, aka. attachments, to reports. These files are available later through the web interface. Use this to attach log files, config files or console output.

8.2.1.1 upload Synopsis

```
#! upload REPORTID FILENAME [ CONTENTTYPE ]
payload
```

8.2.1.2 Parameters

- REPORTID

  The id of the report to which the file is assigned
- FILENAME

  The name of the file
- CONTENTTYPE

  Optional MIME type; defaults to `plain`; use `application/octet-stream` to make it downloadable later in browser.

8.2.1.3 upload Payload

The raw content of the file to upload.

8.2.1.4 upload Example usage

Just `echo` the first api-command line and then immediately `cat` the file content:

```
$ ( echo "#! upload 552 xyz.tmp" ; cat xyz.tmp ) | netcat -w1 bascha 7358
```

8.2.2 download - download a file which is attached to a report

This api command lets you download files, aka. attachments, from reports.

8.2.2.1 download Synopsis

```
#! upload REPORTID FILENAME
```

There is no other payload neccessary here, just this single line.

8.2.2.2 download Parameters

- REPORTID

  The id of the report to which the file is assigned
- FILENAME

  The name of the file as it was specified on upload

8.2.2.3 download Example usage

Just `echo` the first api-command line and redirect the answer into a file.

```
$ ( echo "#! download 552 xyz.tmp" ) | netcat -w1 bascha 7358 > xyz.tmp
```

8.2.3 mason - Render templates with embedded query language

To query report results we provide sending templates to the API in which you can use a query language to get report details: This api-command is called like the template engine so that we can provide other template engines as well.

8.2.3.1 mason Synopsis

```
#! mason debug=0 <<ENDMARKER
payload
ENDMARKER
```

8.2.3.2 mason Parameters

- debug=1

  If '`debug`' is specified and value set to 1 then any error message that might occur is reported as result content. If debug is omitted or false and an error occurs then the result is just empty.
- <<ENDMARKER

  You can choose any word instead of ENDMARKER which should mark the end of input, like in HERE documents, usually some word that is not contained in the template payload.

8.2.3.3 mason Payload

A mason template.

Mason is a template language, see `http://masonhq.com`. Inside the template we provide a function `reportdata` to access report data via a query language. See section ⟨undefined⟩ [Query language], page ⟨undefined⟩ for details about this.

8.2.3.4 Example usage

This is a raw Mason template:

```
% my $world = "Mason World";
Hello <% $world %>!
% my @res = reportdata '{ "suite.name" => "perfmon" } :: //tap/tests_planned';
Planned perfmon tests:
% foreach (@res) {
   <% $_ %>
% }
```

If you want to submit such a Mason template you can add the api-command line and the EOF marker like this:

```
$ EOFMARKER="MASONTEMPLATE".$$
$ payload_file="perfmon_tests_planned.mas"
$ ( echo "#! mason <<$EOFMARKER" ; cat $payload_file ; echo "$EOFMARKER" ) \
    | netcat -w1 bascha 7358
```

The output of this is the rendered template. You can extend the line to save the rendered result into a file:

```
$ ( echo "#! mason <<$EOFMARKER" ; cat $payload_file ; echo "$EOFMARKER" ) \
    | netcat -w1 bascha 7358 > result.txt
```

The answer for this looks like this:

```
Hello Mason World!
Planned perfmon tests:
   3
   4
   17
```

8.3 Query language DPath

The query language, which is the argument to the `reportdata` as used embedded in the '`mason`' examples above:

```
 reportdata '{ "suite.name" => "perfmon" } :: //tap/tests_planned'
```

consists of 2 parts, divided by the '`::`'.

We call the first part in braces *reports filter* and the second part *data filter*.

8.3.1 Reports Filter (SQL-Abstract)

The *reports filter* selects which reports to look at. The expression inside the braces is actually a complete `SQL::Abstract` expression (http://search.cpan.org/~mstrout/SQL-Abstract/) working internally as a `select` in the context of the object relational mapper, which targets the table `Report` with an active JOIN to the table `Suite`.

All the matching reports are then taken to build a data structure for each one, consisting of the table data and the parsed TAP part which is turned into a data structure via `TAP::DOM` (http://search.cpan.org/~schwigon/TAP-DOM/).

The *data filter* works then on that data structure for each report.

8.3.1.1 SQL::Abstract expressions

The filter expressions are best described by example:

- Select a report by ID

  ```
  { 'id' => 1234 }
  ```

- Select a report by suite name

  ```
  { 'suite_name' => 'oprofile' }
  ```

- Select a report by machine name

  ```
  { 'machine_name' => 'bascha' }
  ```

- Select a report by date

  Here the value that you want to select is a structure by itself, consisting of the comparison operator and a time string:

  ```
  { 'created_at' => { '<', '2009-04-09 10:00' }  }
  ```

8.3.1.2 The data structure

8.3.2 Data Filter

The data structure that is created for each report can be evaluated using the *data filter* part of the query language, i.e., everything after the `::`. This part is passed through to `Data::DPath` (http://search.cpan.org/~schwigon/Data-DPath/).

8.3.2.1 Data-DPath expressions

8.3.3 Optimizations

Using the query language can be slow. The biggest slowdown occurs with the '`ANYWHERE`' element `//`, again with several of them, because they span up a big search tree.

Therefore, if you know the depth of your path, try to replace the `//` with some `*` because that only spans up on the current step not every possible step, like this:

```
{ ... } :: //section/stats-proc-interrupts-before//tap//data/TLB";
{ ... } :: /results/*/section/stats-proc-interrupts-before/tap/lines/*/_children/*/data/TL
```

8.4 Client Utility tapper-api

There is a command line utility `tapper-api` that helps with using the API without the need to talk the protocol and fiddle with `netcat` by yourself.

8.4.1 help

You can aquire a help page to each sub command:

```
$ /opt/tapper/perl/bin/tapper-api help upload
```

prints

```
tapper-api upload --reportid=s --file=s [ --contenttype=s ]
   --verbose          some more informational output
   --reportid         INT; the testrun id to change
   --file             STRING; the file to upload, use '-' for STDIN
   --contenttype      STRING; content-type, default 'plain',
                      use 'application/octed-stream' for binaries
```

8.4.2 upload

Use it from the Tapper path, like:

```
$ /opt/tapper/perl/bin/tapper-api upload \
  --file /var/log/messages \
  --reportid=301
```

You can also use the special filename '`-`' to read from STDIN, e.g., if you need to pipe the output of tools like `dmesg`:

```
$ dmesg | /opt/tapper/perl/bin/tapper-api upload \
  --file=- \
  --filename dmesg \
  --reportid=301
```

8.4.3 mason

TODO

9 Complete Use Cases

In this chapter we describe how the single features are put together into whole use-cases.

9.1 Automatic Xen testing

This is a description on how to run Xen tests with Tapper using `SLES10` with one `RHEL5.2` guest (64 bit) as an example.

The following mainly applies to **manually** assigning Xen tests. In the OSRC we use *temare* (not yet published) to automatically create the here described steps.

9.1.1 Paths

- Host **tapper**: /data/tapper/live/
- Host **osko**: /export/image_files/official_testing/

9.1.2 Choose an image for Dom0 and images for each guest

We use suse/suse_sles10_64b_smp_raw.tar.gz as Dom0 and

```
osko:/export/images/testing/raw/redhat_rhel5u2_64b_smp_up_small_raw.img
```

as the only guest.

The SuSE image is of precondition type image. Thus its path is relative to `/mnt/images` which has `tapper:/data/tapper/live/repository/images/` mounted.

The root partition is named in the section '`root`' of the Xen precondition. Furthermore, you need to define the destination partition to be Dom0 root. We use `/dev/sda2` as an example. The partition could also be named using its UUID or partition label. Thus you need to add the following to the dom0 part of the Xen precondition:

```
root:
  precondition_type: image
  mount: /
  image: suse/suse_sles10_64b_smp_raw.tar.gz
  partition: /dev/sda2
```

The RedHat image is of type '`copyfile`'.

It is copied from `osko:/export/image_files/official_testing/raw_img/` which is mounted to `/mnt/nfs` before.

This mounting is done automatically because the protocol type nfs is given. The image file is copied to the destination named as dest in the '`copyfile`' precondition. We use `/xen/images/` as an example. To allow the System Installer to install preconditions into the guest image, the file to mount and the partition to mount need to be named. Note that even though in some cases, the mountfile can be determined automatically, in other cases this is not possible (e.g. when you get it from a tar.gz package). The resulting root secition for this guest is:

```
root:
  precondition_type: copyfile
  name: osko:/export/images/testing/raw/redhat_rhel5u2_64b_smp_up_small_raw.img
  protocol: nfs
  dest: /xen/images/
```

```
  mountfile: /xen/images/redhat_rhel5u2_64b_smp_up_small_raw.img
  mountpartition: p1
```

9.1.3 PRC configuration

PRC (Program Run Control) is responsible for starting guests and test suites.

9.1.3.1 Guest Start Configuration

Making PRC able to start Xen guests is very simple. Every guest entry needs to have a section named "config". In this section, a precondition describing how the config file is installed and a filename have to be given. As for guest images the file name is needed because it can't be determined in some cases. We use 001.svm installed via copyfile to /xen/images/001.svm. The resulting config section is:

```
  config:
    precondition_type: copyfile
    name: /usr/share/tapper/packages/mhentsc3/001.svm
    protocol: local
    dest: /xen/images/
    filename: /xen/images/001.svm
```

9.1.3.2 Testsuite Configuration

You need to define, where you want which test suite to run. This can be done in every guest and the Dom0. In this example, the Dom0 and the single guest will run different testsuites. this chapter only describes the Dom0 test program. See the summary at the end for details on the guest test program.

The section testprogram consists of a precondition definition describing how the test suite is installed. In our example we use a precondition type package with a relative path name. This path is relative to "'/data/tapper/live/repository/packages/"'. Since "'tapper:/data/tapper/"' is mounted to "'/data/tapper/"' in the install system, this directory can be accessed at "'tapper:/data/tapper/live/repository/packages/"'.

Beside the precondition you need to define an execname which is the full path name of the file to be executed (remember, it can't be determined). This file is called in the root directory ("'/"') in the test system thus in case you need to use relative paths inside your test suite they need to be relative to this. The program may take parameters which are named in the optional array "'parameters"' and taken as is. The parameter is "'timeout_after_testprogram"' which allows you to define that your test suite shall be killed (and an error shall be reported) after that many seconds. Even though this parameter is optional, leaving it out will result in Tapper waiting forever if your test doesn't send finish messages. The resulting testprogram section looks like this:

```
testprogram:
  precondition_type: package
  filename: tapper-testsuite-system.tar.gz
  path: mhentsc3/
  timeout_after_testprogram: ~
  execname: /opt/system/bin/tapper_testsuite_system.sh
  parameters:
    - --report
```

9.1.4 Preconditions

Usually your images will not have every software needed for your tests installed. In fact the example images now do but for the purpose of better explanation we assume that we need to install dhcp, python-xml and bridge-utils in Dom0. Furthermore we need a script to enable network and console. At last we install the Xen package and a Xen installer package. These two are still needed on our test images. Package preconditions may have a "'scripts"' array attached that name a number of programs to be executed after the package was installed. This is used in our example to call the Xen installer script after the Xen package and the Xen installer package were installed. See the summary at the end for the resulting precondition section. The guest image only needs a DHCP client. Since this precondition is appended to the precondition list of the appropriate guest entry, the System Installer will automatically know that the guest image has to be mounted and the precondition needs to be installed inside relative to this mount.

9.1.5 Resulting YAML config

After all these informations are gathered, put the following YAML text into a file. We use /tmp/xen.yml as an example.

```
precondition_type: xen
name: SLES 10 Xen with RHEL5.2 guest (64 bit)
dom0:
  root:
    precondition_type: image
    mount: /
    image: suse/suse_sles10_64b_smp_raw.tar.gz
    partition: /dev/sda2
  testprogram:
    precondition_type: package
    filename: tapper-testsuite-system.tar.gz
    path: mhentsc3/
    timeout_after_testprogram: 3600
    execname: /home/tapper/x86_64/bin/tapper_testsuite_ctcs.sh
    parameters:
      - --report
  preconditions:
    - precondition_type: package
      filename: dhcp-3.0.3-23.33.x86_64.rpm
      path: mhentsc3/sles10/
    - precondition_type: package
      filename: dhcp-client-3.0.3-23.33.x86_64.rpm
      path: mhentsc3/sles10/
    - precondition_type: package
      filename: python-xml-2.4.2-18.7.x86_64.rpm
      path: mhentsc3/sles10/
    - precondition_type: package
      filename: bridge-utils-1.0.6-14.3.1.x86_64.rpm
      path: mhentsc3/sles10/
# has to come BEFORE xen because config done in here is needed for xens initrd
    - precondition_type: package
      filename: network_enable_sles10.tar.gz
      path: mhentsc3/sles10/
      scripts:
```

```
        - /bin/network_enable_sles10.sh
    - precondition_type: package
      filename: xen-3.2_20080116_1546_16718_f4a57e0474af__64bit.tar.gz
      path: mhentsc3/
      scripts: ~
    - precondition_type: package
      filename: xen_installer_suse.tar.gz
      path: mhentsc3/sles10/
      scripts:
        - /bin/xen_installer_suse.pl
# only needed for debug purpose
    - precondition_type: package
      filename: console_enable.tar.gz
      path: mhentsc3/
      scripts:
        - /bin/console_enable.sh
guests:
  - root:
      precondition_type: copyfile
      name: osko:/export/images/testing/raw/redhat_rhel5u2_64b_smp_up_small_raw.img
      protocol: nfs
      dest: /xen/images/
      mountfile: /xen/images/redhat_rhel5u2_64b_smp_up_small_raw.img
      mountpartition: p1
      #       mountpartition: /dev/sda3 # or label or uuid
    config:
      precondition_type: copyfile
      name: /usr/share/tapper/packages/mhentsc3/001.svm
      protocol: local
      dest: /xen/images/
      filename: /xen/images/001.svm
    testprogram:
      precondition_type: copyfile
      name: /usr/share/tapper/packages/mhentsc3/testscript.pl
      protocol: local
      dest: /bin/
      timeout_after_testprogram: 100
      execname: /bin/testscript.pl
    preconditions:
      - precondition_type: package
        filename: dhclient-4.0.0-6.fc9.x86_64.rpm
        path: mhentsc3/fedora9/
```

9.1.6 Grub

For Xen to run correctly, the defaults grub configuration is not sufficient. You need to add another precondition to your test. System Installer will replace `$root` with the `/dev/*` notation of the root partition and `$grubroot` with the grub notation of the root partition (including parenthesis). Put the resulting precondition into a file. We use `/tmp/grub.yml` as an example. This file may read like this:

```
precondition_type: grub
config: |
 serial --unit=0 --speed=115200
 terminal serial
 timeout 3
 default 0
 title XEN-test
   root $grubroot
   kernel /boot/xen.gz com1=115200,8n1 console=com1
   module /boot/vmlinuz-2.6.18.8-xen root=$root showopts console=ttyS0,115200
   module /boot/initrd-2.6.18.8-xen
```

9.1.7 Order Testrun

To order your test run with the previously defined preconditions you need to stuff them into the database. Fortunatelly there are commandline tools to help you with this job. They can be found at `/opt/tapper/perl/perls/current/bin`. In our production environment the server for Tapper is `tapper`. Log in to this server (as use `tapper`). Make sure that `/opt/tapper/perl/perls/current/bin/` is at the beginning of your `$PATH` (so the correct perl will always be found). For each precondition you want to put into the database you need to define a short name. Call `tapper-testrun newprecondition` with the appropriate options, e.g. in our example:

```
$ tapper-testrun newprecondition --shortname=grub \
                                 --condition_file=/tmp/grub.yml

$ tapper-testrun newprecondition --shortname=xen \
                                 --condition_file=/tmp/xen.yml
```

`tapper-testrun` will return a precondition ID in each case. You will need those soon so please keep them in mind. In the example the precondition id for grub is 4 and for Xen its 5.

You can now put your test run into the database using `tapper-testrun new`. This expects a hostname, a test program and all preconditions. The test program is never evaluated and only there for historical reasons. Put in anything you like. Add `--owner` with an appropriate user if you don't want the default `tapper`. The resulting call looks like this:

```
tapper-testrun new --hostname=bullock \
                   --precondition=4 \
                   --precondition=5 \
                   --test_program=whatever \
                   --owner=mhentsc3
```

Please note: There is a more central approach to describe all needed preconditions at once, see ⟨undefined⟩ [Macro Preconditions], page ⟨undefined⟩ and ⟨undefined⟩ [A real live example - kernel boot test], page ⟨undefined⟩.

When the requested testrun is scheduled Tapper will setup the system you requested and execute your defined testrun. When everything went well, you'll see test output soon after. For more information on what is going on with Tapper, see `/var/log/tapper-debug`.