

# ALTAIR

ONLY FORWARD

Altair Accelerator Plus 2022.1.1

User Guide

# Contents

<b>Accelerator Plus User Guide</b> .....	4
<b>Use Accelerator Plus Help</b> .....	6
<b>Accelerator Plus Quick Start</b> .....	8
<b>Command Line Interface</b> .....	11
<b>User Shell Setup</b> .....	12
Verify Your Setup.....	16
<b>Running a Job</b> .....	17
Submitted Job Information Display.....	18
Scheduled Jobs.....	19
<b>Submit Jobs to Accelerator Plus</b> .....	20
Queue Selection.....	21
Submit Jobs with CLI Commands.....	22
Job Arrays.....	24
Environment Control.....	25
Select a Named Environment.....	26
Use Snapshot with Named Environment.....	26
Pre-Command and Post-Command Job Conditions.....	28
Use Jobclasses.....	30
Choose the FairShare Group.....	32
Job Submission Arguments.....	33
Priority.....	34
<b>Modify Running Jobs</b> .....	35
Interactive Jobs.....	36
Modify Scheduled Jobs.....	39
Restrictions and Consequences.....	41

<b>Monitor the Workload</b> .....	43
Get Detailed Information about a Job.....	44
Job Status.....	45
Job Runtime - Monitor and Profile.....	46
Job Profiling.....	47
List Jobs.....	50
wx list.....	50
Job Summary.....	53
Invoke the GUI.....	54
Icons.....	56
Show the Hosts/Taskers.....	58
Use vovselect for Querying.....	59
Monitor Jobs, Taskers and Resources.....	64
<b>Manage Jobs</b> .....	66
Wait for Jobs.....	67
wx wait.....	67
Stop Jobs.....	69
Forget Jobs.....	72
wx forget.....	72
Clean Up Log Files.....	73
<b>Debug Jobs without Running Accelerator Plus</b> .....	75
Debug Jobs Example.....	76
<b>LSF Emulation</b> .....	77
<b>Intellectual Property Rights Notice</b> .....	80
<b>Technical Support</b> .....	84
<b>3rd Party Licenses</b> .....	86
<b>Index</b> .....	113

Accelerator Plus is a high-performance hierarchical scheduler designed for distributed High Performance Computing (HPC) environments.

Accelerator Plus is based on the patented concepts described in US Patent 9,658,893 about multi-layered resource scheduling.

The current implementation is designed to be run in conjunction with a base scheduler such as Accelerator™, or Altair PBS Professional®.

With its sub-millisecond latency, Accelerator Plus improves the throughput of difficult workloads, especially those consisting of large numbers of short duration jobs perhaps with complex dependencies, while off-loading the base scheduler. Accelerator Plus allows any user or group to have their own high-performance scheduler without requiring the intervention of the IT department. Since all computing resources are negotiated by means of the base scheduler, Accelerator Plus always obeys all policies established by IT with respect to sharing such resources.

## Theory of Operation

During the initial setup, the Accelerator Plus host server (vovserver) establishes a main port for communication and additional ports for web access and read-only access. Afterwards, the vovserver waits for and responds to incoming connection requests from clients.

Clients consist of *regular* clients that request a particular service, *taskers* (server farms) that provide computing resources, and *notify* clients that listen for events.

A fresh instance of Accelerator Plus typically has only one persistent or permanent tasker, dedicated to launching requests to get more taskers from the underlying base scheduler, depending on the workload.

Regular clients can submit the workload, which consists of one or more jobs, or query data about jobs or system status. When a job is created, it is placed in a queued state. Queued jobs are sorted into buckets. Jobs that have the same characteristics go in the same bucket.

Each job bucket is analyzed, by an external daemon called `vovwxd`. If a bucket is waiting for hardware resources, then the external daemon issues a request to the underlying base scheduler for resources that match that job bucket. In other words, Accelerator Plus requests from the base scheduler a tasker that can run the jobs in a specific bucket. Once the base scheduler grants the request by running a proxy job, the submitted wx-tasker connects back to the Accelerator Plus instance advertising the available resources. Jobs from the matching bucket begin executing without any further intervention from the base scheduler. Multiple buckets and multiple jobs from each bucket can be serviced concurrently. With a large base scheduler and a significant workload, thousands of jobs can be run concurrently.

When a job completes, the wx-tasker notifies the vovserver. The resources, both tasker-based and central, are recovered, allowing subsequent jobs (queued in the buckets) to be dispatched. When completed, the job status is updated to either `VALID` or `FAILED`.

In addition to dispatching jobs and processing their status, the vovserver responds to queries about system and job requests, publishes events to notify clients, and continues to process incoming job requests.

## Examples of Modes of Operation

Accelerator Plus can be used in many ways. Here are some typical examples.

#### *Single User Mode, Persistent*

Here a Accelerator Plus instance is started on a dedicated compute node using a role account. Another application, for example a Jenkins build server, is used to create the workload. In this scenario, Accelerator Plus is used primarily as an efficient distributed build engine, interfacing with the base scheduler. Multiple Accelerator Plus instances can be deployed concurrently to accelerate multiple flows in the form of execution "lanes." The underlying scheduler is used to balance the resource allocation across the Accelerator Plus instances.

#### *Single User Mode, On-Demand*

Similar to the first mode but this time the Accelerator Plus instance itself is also run on the underlying batch system. Upon completion of the workload, the Accelerator Plus instance is halted and all compute resources are returned to the farm. This model is useful for occasional, self-contained resource intensive workloads.

#### *Multi User Mode, Persistent*

This mode implements full hierarchical scheduling. The Accelerator Plus instance runs on a dedicated node with a publicly known host name and port number. Multiple Accelerator Plus instances can be used concurrently to provide each team with their own scheduler. While it is possible to allocate Accelerator Plus instances on a per-project basis, the preferred allocation method is on a functional or workload basis. For example, providing an Accelerator Plus instance for each of the Design Verification, Circuit Design and Physical Design teams allows similar work flows to be grouped together on a single Accelerator Plus instance. Commonality of work flow within an Accelerator Plus instance allows more optimal tuning while sharing a common base scheduler.

---

Accelerator Plus documentation is available in HTML and PDF format.

## Access the Help when Accelerator Plus is Running

When Accelerator Plus is running, it displays the documentation through its browser interface. To access it from browser, you need to know which host and port Accelerator Plus is running on. Ask your administrator, or find the URL for Accelerator Plus with the following command:

```
% Accelerator Plus cmd vovbrowser
http://comet:6271/project
```

In the example below, assume Accelerator Plus is running on host comet, port 6271. The URL for Accelerator Plus is:

```
http://comet:6271
```

To get the entire suite of Altair Accelerator documents, including FlowTracer™, Accelerator™, Monitor™ and the VOV subsystem, use the following URL:

```
http://comet:6271/doc/html/bookshelf/index.htm
```

## Access the Help when Accelerator Plus is not Running

All the documentation files are in the Altair Accelerator install directory, so you can access them even if vovserver is not running. To do this, open `/installation_directory/common/doc/html/bookshelf/index.htm` in your browser.

 **Tip:** Bookmark the above URL for future reference.

## Access the Help PDF Files

Altair Accelerator also provides PDF files for each of the guides. All the PDF files are in the directory `/installation_directory/common/doc/pdf`

## Access the Help via the Command Line

The main commands of Accelerator are `nc` and `ncmgr`, with some subcommands and options. You can get usage help, descriptions and examples of the commands by running the command without any options, or with the `-h` option. For example,

```
% nc info -h
nc:
nc:  NC INFO:
nc:  Get information about a specific job or list of jobs.
nc:  USAGE:
nc:  % nc info <jobId> [options]...
nc:  -h          -- Show this message
nc:  -l          -- Show the log file
nc:
```

## Access the Help via the vovshow Command

Another source of live information is using the command vovshow. The following options are often useful:

- |                           |   |
|---------------------------|---|
| <b>vovshow -env RX</b>    | Displays the environment variables that match the regular expression RX provided. |
| <b>vovshow -fields</b>    | Shows the fields known to the version of VOV in use.                              |
| <b>vovshow -failcodes</b> | Shows the table of known failure codes.   |

For example, to find a variable that controls the name of the stdout/stderr files, without knowing the exact name of that variable, the following command can be used:

```
% vovshow -env STD
VOV_STDOUT_SPEC          Control the names of file used to save stdout and
                          stderr. The value is computed by substituting
                          the substrings @OUT@ and @UNIQUE@ and @ID@.
                          Examples: % setenv VOV_STDOUT_SPEC
                          .std@OUT@.@UNIQUE@ % setenv VOV_STDOUT_SPEC
                          .std@OUT@.@ID@
```

The output provides a description of all the variables used by the FlowTracer system that include the substring "STD". In this example, the output result VOV\_STDOUT\_SPEC.

Accelerator Plus has two main commands, `wx` and `wxmgr`.

This chapter covers the following:

- [wx](#) (p. 9)
- [wxmgr](#) (p. 10)

Accelerator Plus has two main commands:

- `wx` is used to submit, query, and stop jobs. This command can also be invoked as `vnc` or as `nc`.
- `wxmgr` is used to start and stop a queue, that is, an Accelerator Plus instance.



## WX

wx: Usage Message

Usage: wx [-q queueName] <command> [command options]

Queue selection:

The default queue is called "wx".

You can specify a different queue with the option -q <queueName>  
or by setting the environment variable NC\_QUEUE.

Commands:

clean	Cleanup log files and env files.
debug	Show how to run the same job without WorkloadXelerator.
dispatch	Force dispatch of a job to a specific tasker.
forget	Forget old jobs from the system.
getfield	Get a field for a job.
gui	Start a simple graphical interface.
help	This help message.
hosts	Show farm hosts (also called taskers).
info	Get information about a job and its outputs.
list	List the jobs in the system.
jobclass	List the available job classes.
kerberos	Interface to Kerberos (experimental).
modify	Modify attributes of scheduled jobs.
monitor	Monitor network activity.
rerun	Rerun a job already known to the system.
resources	Shows resource list and current statistics.
resume	Resume a job previously suspended.
run <job>	Run a new job (also called 'submit').
preempt	Preempt a job.
stop	Stop jobs.
submit <job>	Same as 'run'.
summary	Get a summary report for all my jobs.
suspend	Suspend the execution of a job.
taskerlist	Show available tasker lists.
wait	Wait for a job to complete.
who	Report on who is using the system.
why	Analyze job status reasons.

Deprecated Commands:

slavelist	Show available slave lists.
-----------	-----------------------------

Unique abbreviations for commands are accepted.

Advanced features:

cmd <command>	Execute an arbitrary VOV command in the context of the WorkloadXelerator server.
source <file.tcl>	Source the given Tcl file.
-	Accept commands from stdin.

For more help type:

% wx <command> -h

Copyright (c) 1998-2021, Altair Engineering.

## wxmgr

This program manages the vovserver for Accelerator Plus.

```
vncmgr: Usage Message

This program manages the vovserver for WorkloadXelerator.
Copyright (c) 1998-2021, Altair Engineering.

USAGE:
  wxmgr help|info|reset|start|stop|cm [OPTIONS]

ACTIONS:
  info  [-queue|-q <name>] [-v]
  reset [-soft | -hard | -h ]
  start [-dir <server_working_dir>] [-force] [-queue|-q <name>]
        [-port <port> ] [-webport <port>] [-roport <port>]
        [-dbhost <host>] [-dbroot <path>] [-dbport <port>]
        [-prod nc|wx|he] [-basequeue <name>]
        The default <server_working_dir> is
        <...>/wx.
        This is the parent of the configuration (.swd) directory for
        the queue.
  stop  [-force] [-freeze] [-queue|-q <name>] [-writeprdir <dirname>]
        -force          Do not prompt for confirmation
        -freeze         Instruct taskers to keep running and wait for a
                        new server
        -writeprdir     Writes the PR file to the specified directory
                        (which is created if necessary)
  cm    [-queue|-q name] <ACTION> [ARGUMENTS]
        Configuration Management. Pass "help" for detailed usage.

EXAMPLES:
  % wxmgr
  % wxmgr -h
  % wxmgr start -queue wx2
  % wxmgr start -port 6699 -queue wx99
  % wxmgr info
  % wxmgr reset -soft
  % wxmgr reset -hard
  % wxmgr cm help

EXAMPLE TO STOP AND RESTART SERVER:
  % wxmgr stop -freeze
  % wxmgr start -force
  % wxmgr stop -freeze -force -writeprdir /tmp/abc123
```

All user commands have the following structure:

```
% wx subcommand [options]
```

The subcommand is one of the following:

- clean
- debug
- dispatch
- forget
- getfield
- gui
- help
- hosts
- info
- list
- jobclass
- modify
- monitor
- rerun
- resume
- run
- source
- stop
- summary
- suspend
- wait

For example:

```
% wx help
% wx run sleep 10
% wx list
% wx forget -mine
```

Any unique prefix for the subcommand is accepted, which allows abbreviated forms of commands to be used.

```
% wx l
% wx li
% wx lis
% wx list
```

To set up your user shell with Accelerator Plus you need to know where the Altair Accelerator software has been installed.

This chapter covers the following:

- [User Setup: C-Shell, TCSH](#) (p. 13)
- [User Setup: Bourne Shell, K-Shell, Z-Shell, Bash](#) (p. 14)
- [User Setup: Windows Command Shell](#) (p. 15)
- [Verify Your Setup](#) (p. 16)

Ask your system administrator.

## User Setup: C-Shell, TCSH

Choose one of two choices:

- a) Modify your `~/ .cshrc` file directly by adding the following line:

```
# Add this to your .cshrc
source /<installation_directory>/<version>/<platform>/common/etc/vovrc.csh
```

- b) Run the `vovsetupuser` script, which creates a `~/ .vovrc` file and modifies your `~/ .cshrc` file to source the `~/ .vovrc` file.

```
% cd <installation_directory>/<version>/<platform>/
% cd common/scripts
% ./vovsetupuser -csh
```

## User Setup: Bourne Shell, K-Shell, Z-Shell, Bash

Choose one of two choices:

- a) Source the file `$VOVDIR/etc/vovrc.sh`. It is recommended that you add the following line to your `~/.profile` file:

```
# Add this to your .profile or .bashrc
. <installation_directory>/<version>/<platform>//common/etc/vovrc.sh
```

- b) Run the `vovsetupuser` script.

```
% cd <installation_directory>/<version>/<platform>/
% cd common/scripts
% ./vovsetupuser -sh
```

## User Setup: Windows Command Shell

If Accelerator is installed in directory R:\rtda\2019.01, you can set up your cmd shell by executing:

```
c:> R:\rtda\2019.01\win64\bat\vovinit.bat
```

## Verify Your Setup

1. Run the following Altair Accelerator command to verify that your setup works:

```
% vovarch  
linux64
```

2. Run the command `vovversion` to show the version of Accelerator Plus that is installed.

```
% vovversion  
2019.01
```

---



This section summarizes how to submit and run a job.

This chapter covers the following:

- [Submitted Job Information Display](#) (p. 18)
- [Scheduled Jobs](#) (p. 19)

Information about submitting jobs is covered in [Submit Jobs to Accelerator Plus](#).



**Note:** To run a job, the working environment must be set. For information, refer to [User Shell Setup](#).

## Submitted Job Information Display

By default, nc run provides information when a job is submitted.

The following example shows information that is output with a simple command. The amount of information displayed is determined by the verbose level. In the following example, verbose is at the default level of 4.

 **Note:** The environment is set with a snapshot.

```
% nc run sleep 10
Fairshare= /time/users.andrea
Resources= macosx CPUS/1 RAM/500
Env = SNAPSHOT(vnclogs/snp/joe/macosx/env27227.env)
Command = vw sleep 10
Logfile = vnc_logs/20130220/104930.33137
JobId = 024609542
```

- **FairShare:** the FairShare ranking of this job.
- **Resources:** the resources used to run this job: the machine, number of CPUs, amount of RAM, and so on.
- **Env:** the environment in which the job was submitted.
- **Command:** the command that was used to execute this job.
- **Logfile:** the name of the logfile.
- **JobID:** the unique identifier of this job.

The amount of information can be changed by setting the verbose level by using the `-v` level option, such as

```
wx run -v 1 sleep 10 002020291
```

Verbose Level	Effect
0	Silent: no output is generated
1	Only the job ID is displayed
4	Default level
9	Very verbose

## Scheduled Jobs

Jobs that cannot be dispatched immediately due to a delay in acquiring the resources from the underlying scheduler, such as CPUs or software licenses, are put on the job queue.

If the base scheduler is Accelerator, then the FairShare policy in that queue primarily determines what resources (taskers) are made available to Accelerator Plus and those resources are allocated to Accelerator Plus jobs of a specific FairShare group. This effectively by-passes the Accelerator Plus FairShare algorithm. The rules described below are applicable to other base schedulers:

- Scheduling is first determined by the FairShare mechanism. All active FairShare groups, all groups with queued jobs, are ranked based on their distance from the target share of computing resources and the current number of running jobs. The FairShare group that is farthest behind the target has rank 0 (zero) and is selected first for scheduling. If none of the jobs from the FairShare group with rank 0 can be dispatched, Accelerator Plus looks at the jobs for the FairShare group for rank +1 and so on.
- For a given FairShare group, jobs with higher priority are scheduled ahead of lower priority jobs.
- For a given FairShare group of a given priority, jobs are scheduled on a first-come first-serve basis.

To check the status of the jobs in the queue, use the command `wx summary`. This page gives a report on all the classes of queued jobs (known as *buckets*):

- The characteristics of the bucket: user, group, priority, and tool.
  - The number of jobs in the bucket and the age of the bucket: how long ago a job from that bucket was successfully dispatched.
  - The resources the jobs are waiting for.
-

This chapter covers the following:

- [Queue Selection](#) (p. 21)
- [Submit Jobs with CLI Commands](#) (p. 22)
- [Job Arrays](#) (p. 24)
- [Environment Control](#) (p. 25)
- [Pre-Command and Post-Command Job Conditions](#) (p. 28)
- [Use Jobclasses](#) (p. 30)
- [Choose the FairShare Group](#) (p. 32)
- [Job Submission Arguments](#) (p. 33)
- [Priority](#) (p. 34)

## Queue Selection

There may be multiple instances of Accelerator Plus running at a given site. You choose which one to use with the variable `NC_QUEUE`, which by the way is the same variable also used to select the instance of Accelerator.

If you want to use the default Accelerator Plus queue (i.e. "wx"), use:

```
% unsetenv NC_QUEUE
% wx cmd vsi
...output about the default wx queue ...
```

To use a different queue, for example one called "mywx", use:

```
% setenv NC_QUEUE mywx
% wx cmd vsi
...output about the mywx queue ...
```

It is also possible to override the value of `NC_QUEUE` by using the `-q` option with the `wx` command:

Examples:

```
% wx -q mywx hosts
...
% wx -q wx hosts
...
```


Alternatively, you can use the `NC_QUEUE` variable to refer to the `setup.tcl` file in the `SWD` directory of the desired Accelerator Plus instance. This method avoids the use of the `NC_CONFIG_DIR` directory, (usually `$VOVDIR/local/vncConfig`) which may not have write permissions for ordinary users, and is also best if you are running multiple versions of the Accelerator Plus code. This method is recommended for all `WX` queues.

Example:


```
% setenv NC_QUEUE /home/bob/vov/mywx.swd/setup.tcl
```

## Submit Jobs with CLI Commands

This chapter provides examples of submitting jobs using CLI (command line interface) commands.

 **Note:** CLI commands are case insensitive. For example, `timetolerance` and `timeTolerance` represent the same command.

## Submit a Single Job

 **Note:** In the job examples provided, each job performs `sleep xx`, which is wait, do nothing, for the duration specified by the integer value `xx`.

When submitting a single job:

- Use an environment snapshot.
- The default resource list is the `vovarch` of the machine that submits the job.
- The name of the log file is automatically computed.

### Run a Job, No Specifications

```
% wx run sleep 30
Fairshare= /time/users
Resources= linux64 CORES/1 RAM/500
Env       = SNAPSHOT(wx_logs/snapshots/jon/linux64/env16220.env)
Command   = vw sleep 30
Logfile   = wx_logs/20180404/132352.71209
JobURL    = http://SOMEHOST:SOMEPORT/cgi/node.cgi?id=001241627
JobId     = 001241627
```

### Run a Job, Environment Specified (-e)

```
% nc run -e BASE sleep 30
...
```

### Run a Job, Environment and Resources Specified (-r)


```
% wx run -e BASE -r RAM/333 -- sleep 30
Fairshare= /time/users
Resources= RAM/333 CORES/1
Env       = BASE
Command   = vw sleep 10
Logfile   = wx_logs/20180404/132618.92050
JobURL    = http://SOMEHOST:SOMEPORT/cgi/node.cgi?id=001241648
JobId     = 001241648
```

## Run a Job, Environment and Resources Specified, Limited Verbosity (-v)

```
# Control verbosity: print the jobId only.  
% nc run -v 1 -e BASE -r linux -- sleep 30  
00002579  
# Running a job, environment and resources specified, limited verbosity and wait for  
job to finish (-w):  
% nc run -w -v 0 -e BASE -r linux -- sleep 30
```

## Submit Multiple Jobs

When a list of similar jobs is to be submitted, it is much more efficient to submit them all at once.

 **Note:** When submitting multiple jobs use the same environment and the same resources, and the same priority level is scheduled for each job. Each job has its unique identification.

1. Prepare a file with one command on each line. Empty lines are ignored and lines that begin with # are considered comments.

```
# Example of file used to submit multiple jobs at once.  
sleep 10  
sleep 11  
sleep 12  
sleep 13
```

2. Use the option -f to specify the command file, as in the following example:

```
% nc run -r unix -e BASE -f commandFile
```

## Default Output of wx run

The default output from `nc run` includes the following information:

- The [resource list](#) resource list assigned to the job, which can be controlled with the option -r.
- The environment used for the job, which can be controlled with the option -e.
- The command line.
- The log file used to store both stderr and stdout of the command, which can be controlled with the option -l
- The JobId assigned by Accelerator Plus to this job. Job IDs are used as handles with many of the Accelerator Plus commands.

## Job Arrays

Using an array provides the option of submitting multiple jobs in a specific order.

Each job in an array is assigned its own job ID and is treated as an individual job. The syntax is: `nc run -array <n>`

To submit an array, use option `-array N` in `nc run`. The value of `N` is between 1 and the value specified by the `maxJobArray` configuration parameter. `maxJobArray` is normally set to 1000.

For example:

```
% nc run -array 100 sleep 10
```

The job specification may contain the symbolic element `@INDEX@` in either the command line, the environment, or the directory specification. The `@INDEX@` element is substituted when the job array is created. Use `@INDEX@` in the command line of the job array or in its environment.

### Examples

```
% nc run -array 100 -e "BASE" sleep @INDEX@  
nc run -array 100 -e "BASE+D(MYINDEX=@INDEX@)" sleep 10
```




# Environment Control

Setting the environment is critical for correct job execution. Accelerator provides two methods to control the execution environment.


1. Use a **snapshot of the environment** used at submission time.

This method is the simplest and is automatically selected if the environment variable `VOV_ENV` is not defined. The disadvantage of this method is that the snapshot may not be portable across platforms.

 **Note:** This method is not available for Windows.

2. Use a **named environment**, which allows the tasker to create the environment on the fly using the VOV Environment Utilities.

This method offers several advantages: strict control on the environment, greater efficiency, less disk space utilization, easier execution across multiple platforms. This method is used if the environment variable `VOV_ENV` is defined; the value of the variable indicates the name of the environment to use.

 **Note:** This method is required for Windows.

## Use Environment Snapshots

An environment snapshot will be created and used under the following conditions:

- The environment variable `VOV_ENV` is not set.
- The environment variable `VOV_ENV` is set to the value "" (the empty string) or the value `DEFAULT`.
- The environment variable `VOV_ENV` contains the substring `SNAPSHOT`.


The snapshot is represented by a file, the location of which is controlled by the environment variable `NC_SNAPSHOTDIR`. This variable can take one of the following symbolic values:

Possible values of <code>nc_snapshotdir</code>	
<code>homedir</code>	Use directory <code>~/ .ncsnapshots/\$VOVARCH</code>
<code>serverdir</code>	Use directory <code>PROJECTNAME .swd/snapshots/\$USER/\$VOVARCH</code>
any other value	Use the directory <code>\$LOGDIR/snapshots/\$USER/\$VOVARCH</code> , where <code>LOGDIR</code> is controlled by the variable <code>NC_LOGDIR</code> and has default value <code>./vnc_logs</code>

The environment snapshot is a file in Bourne-Shell syntax, which contains most of the variables in the current environment. The variables that are excluded from the snapshot include the following: `HOST OSREV OSTYPE TERMCAP SHELL PWD`. These variables are defined in the file `$VOVDIR/tcl/vtcl/vovenvutils.tcl`

An environment snapshot may be shared by many jobs.

When using a snapshot, the job is submitted with environment SNAPSHOT(name\_of\_snapshot\_file).

 **Note:** This is a *named environment*.

To force the creation of an environment snapshot:

- Ensure sure the environment variable VOV\_ENV is not defined.
- Do not use the option -e.

```
% unsetenv VOV_ENV
% wx run sleep 10
Resources= linux
Env       = SNAPSHOT(vnc_logs/snapshots/joe/linux/env4590.env)
Command  = vw sleep 10
Logfile   = vnc_logs/20020704/180936.7793
JobId     = 00350601
vnc: message: Scheduled jobs: 1          Total estimated time: 0s
```

## Named Environments

The Accelerator Environment Utilities consist of two commands: `vel`, lists the available environments; `ves` switches between environments. For more information, refer to *Environment Management*.

The following example lists the available environments and switch to the environment called BASE.

```
% vel
vel: message: Environment directories:
1 /release/VOV/latest/sun5/local/environments
1 . tcl BASE          UNIX utilities, X windows, and VOV
1 . tcl D             Define vars: Usage: ves "+D(VAR1=value1,...)"
1 . tcl DEFAULT      Just a name for whatever you already have.
% ves BASE
```

## Select a Named Environment

1. When submitting a job, to select the environment in which to run the job, use the option -e. Examples are shown below:

```
% wx run -e BASE sleep 10
...output omitted...
% wx run -e BASE+SPICE sleep 10
...output omitted...
% wx run -e "BASE+D(MYVAR=somevalue)" sleep 10
...output omitted...
```

## Use Snapshot with Named Environment

1. A combination of an environment snapshot and a name environment can be set up. Try the following example shows using the -e option to set up a combined environment with a SNAPSHOT plus a name environment CALIBRE:

```
% wx run -e SNAPSHOT+CALIBRE sleep 10
...output omitted...
% wx run -e SNAPSHOT+MODULE1+CALIBRE sleep 10
...output omitted...
```

## Pre-Command and Post-Command Job Conditions

When a job is being submitted, a pre-condition and/or a post-condition can be specified.

- **pre-condition:** a script that is executed before the job is executed.
- **post-condition:** a script that is executed after the job has completed. The post-condition is typically used to perform cleanup, such as deleting temporary files in `/usr/tmp`.

Example scripts are available in the following directories: `$VOVDIR/etc/pre` and `$VOVDIR/etc/post`.

### Pre-condition

A pre-condition is executed before the job is run. It is invoked with a single argument: the ID of the job. A pre-condition is executed with the same credentials as the job (userid, os-groupid) and is in the same directory of the job.

- If the precondition script fails by exiting with a status different from 0 (zero), the job will not be run and the exit status of the job will be the exit status of the pre-condition script.
- If the exit status of the pre-condition script is within the range 201-215, the automatic rescheduling condition will occur and the job will be rescheduled on a different host or on a different tasker.

### Post-condition

The post-condition script is invoked with two arguments: the ID of the job and the exit status of the job. The post-condition is executed with the same credentials as the job (userid, os-groupid) and in the same directory of the job.

- When the post-condition script is invoked, the job is still running.
- The post-condition is executed after the job, even if the job fails, but it is not executed if the pre-condition fails.
- The exit status of the post condition overrides the exit status of the job. It needs to explicitly return the exit status of the job when that is the requested behavior (see the example scripts).

### Submit Jobs with Conditions

Use the options `-pre` and `-post` with `wx run` to specify the pre- and post- conditions.

```
% wx run -pre $VOVDIR/etc/pre/pre_check.csh sleep 10  
% wx run -post $VOVDIR/etc/post/post_cleanup.csh sleep 10
```

### Log Files

The standard output from the pre- and post-commands is saved in log files. The location of the log files is determined by the value of the environment variable `NC_LOGDIR`. If `NC_LOGDIR` is not set, the files are stored in the directory `./vnc_logs`, relative to the current launch directory.

In the following example, `NC_LOGDIR` is not set, and the run directory is `~/testrundir`:

```
[goetz@goetz1 ~/testrundir]$ pwd  
/home/goetz/testrundir  
[goetz@goetz1 ~/testrundir]$ ls  
vnc_logs  
[goetz@goetz1 ~/testrundir]$ ls -a vnc_logs/  
. .. 20210726 .precmd.000083865.log .precmd.000083885.log snapshots
```

The log files are created with zero size if the pre- and post-commands redirect all the output of the files. At the end of the job, if these files are zero length, they are automatically deleted to reduce disk space overhead.

The log files are named according to the following rules:

```
.precmd.$jobID.log  
.postcmd.$jobID.log
```

The pre- and post-command log files can optionally be located in the same directory as the job logfile. For example:

```
wx run -pre "myprecommand > @JOBLOGDIR@/@JOBID@_pre.out" -l path/to/an/existing/  
directory/mycommand.out -- mycommand  
wx run -post "mypostcommand > @JOBLOGDIR@/@JOBID@_post.out" -l path/to/an/existing/  
directory/mycommand.out -- mycommand
```

This would result in the respective pre- and post-command logfiles being written to the directory path/to/an/existing/directory.



**Note:** When using the `wx run` command after forgetting jobs that have pre- and/or post-commands, it does not automatically remove the pre- and post-command `.log` files. If these files are not zero length, they must be removed manually.

## Use Jobclasses

A jobclass allows multiple job parameters to be set in a single object that can be requested at submission time.

For example, there may be a job that requires 3 different licenses, 4GB of RAM, and 4 cores. Instead of requesting all 3 licenses, a jobclass can be created that is called with the `-C` submission option to the `wx run` command. Jobclasses are often used to emulate queues that are found in other batch processing systems.

 **Note:** A jobclass can only be created by an Accelerator Plus administrator.

## Find Jobclasses

To list the available classes from the command line, use the `jobclass` subcommand of the `wx` command.

```
wx: Usage Message
WX JOBCLASS:
    List classes defined for job submission
USAGE:
    % wx jobclass [OPTIONS]
OPTIONS:
    -h                -- This help
    -l                -- Long format (with description)
    -ll              -- Longer format.
    -v                -- Increase verbosity.
EXAMPLES:
    % wx jobclass
    % wx jobclass -l
    % wx jobclass -ll
```

For example:

```
% wx jobclass
1 short
2 interactive
```

The `jobclass` subcommand accepts the repeatable option `-l`. The first option includes the description, and the second option shows the values to which `VOV_JOB_DESC` slots will be set.

In addition, Accelerator Plus provides the Jobclass page. This page shows a table of the jobclass, with links to the definitions of each class, and to the sets containing the jobs in that class. It also shows the pass/fail status as a bar graph.

## Submit Jobs Using Jobclasses

To submit a job in a given class, use the option `-C` of `wx run`.

```
% wx run -C short sleep 10
```

Jobs in a class are automatically added to a set named after the class, for example `Class:interactive`.

The options to `wx run` are parsed sequentially, so it is possible to do a command line override of the parameters set in the jobclass. For example, the following commands behave differently:

```
% wx run -C verilog -e DEFAULT -- run_sim chip  
% wx run -e DEFAULT -C verilog -- run_sim chip
```

In the first invocation, the option `-e` overrides the specifications for the environment to be used for the job. In the second invocation, the environment is determined by the definition of the *verilog* jobclass.

## Choose the FairShare Group

While Accelerator Plus supports the use of FairShare groups, their utility depends upon the underlying batch system.

If the underlying batch system is Accelerator then the recommendation is that no additional FairShare configuration (with access control lists, weights and time windows) is done in the Accelerator Plus queue. Instead Accelerator Plus just passes on the requested FairShare group on to Accelerator where the existing policies and allocations are enforced. For base schedulers other than Accelerator, the Accelerator Plus FairShare model may be used to prioritize jobs of different categories within the Accelerator Plus queue.

In Accelerator Plus, FairShare groups are managed by either the information in the `vwx.swd` directory that contains the `policy.tcl` file, or the `vovfsgroup` utility. Every user has a default FairShare group, which is set in the `policy.tcl` file. Use `wx run` with the option `-g` to select a different group.

Examples:

```
% wx cmd vovshow -users
% wx run -g /time/regression sleep 10
```

### FairShare Subgroup

Subgroups can be specified by using the `-sg` option. Subgroups can be created at submit time as opposed to groups, which must be defined ahead of time. Subgroups allow a user to allocate shares of computing resources to subsets of their own workload.

Examples are shown below:

```
% wx run -sg subgroup sleep 10 (/time/users.john:subgroup)
% wx run -g /time/regression -sg subgroup sleep 10 (/time/regression.john:subgroup)
```



## Job Submission Arguments

Job submission can be affected by the value of the optional variables `NC_RUN_ARGS` and `NC_RUN_ARGS_AFTER`, which specify a list of arguments that are pre-pended and appended to the argument list passed to the submission command.

For example, if the variables are defined as follows:

```
% setenv NC_RUN_ARGS "-D"  
% setenv NC_RUN_ARGS_AFTER "-jobproj myproj123"
```

Then the submission

```
% nc run -p high sleep 10
```

Becomes effectively

```
% nc run -D -p high -jobproj myproj123 sleep 10
```

## Priority

The scheduling priority affects the order in which the jobs are scheduled. The range is 1 to 15.

Two types of priorities are supported:

- Scheduling priority: Determine the order in which jobs are scheduled. The range is 1(low) to 15(top).
- Execution priority: Influence the execution of the job on the remote machine. The range is 1(low) to 15(top).

There are conditions in which lower priorities supersede higher priorities, such as:

- FairShare weightings are not currently supported in Accelerator Plus. For the jobs of a given user, higher priority jobs are scheduled before lower priority ones.
- A low priority job will be dispatched before a high priority job if the resources for the low priority job are available while the resources for the high priority job are not.

In Accelerator Plus, set the priority of a job at submission time with the option `-p`.

```
% wx run -p high sleep 10
% wx run -p 12 sleep 10
% wx run -p 12.low sleep 10
```

The priority can be set from the GUI using the Retrace Priority Flags dialog from the console. With the command `vsr`, you can use the option `-priority` (which can be abbreviated to `-p`) as shown in the example below:

```
% vsr -p high target           # Use high scheduling priority.
% vsr -p h target             # Abbreviated form.
% vsr -p high.high target     # Set both scheduling and execution priority
```

### Priorities Relative to Previous Run

When specifying a priority, it is possible to use also the following symbolic values:

Symbolic Name	Meaning
<b>Same</b>	Same priority as before. If not defined, then use low priority.
<b>Incr</b>	Increase previous priority by 1, without exceeding the maximum priority for the user.
<b>Decr</b>	Decrease previous priority by 1, but no less than low priority.

Example: rerun the job 123456 with increased priority:

```
% wx rerun -p incr 000123456
```

This chapter covers the following:

- [Interactive Jobs](#) (p. 36)
- [Modify Scheduled Jobs](#) (p. 39)
- [Restrictions and Consequences](#) (p. 41)

## Interactive Jobs

Interactive jobs require attention as they run, whereas batch jobs are run unattended.

Interactive jobs are only supported on UNIX in Accelerator Plus. There are three types of interactive jobs, which are described in the table below.

Interactive Job	Example	Option	Example
Job that requires a X display.	<code>xterm -e vi abc</code>	<code>-Ix</code>	<code>% wx run -Ix xterm -e vi abc</code>
Job that requires a TTY with remote control of signal dispatching by means of Ctrl-C and Ctrl-Z.	<code>bash</code>	<code>-Ir</code>	<code>% wx run -Ir bash</code>
Job that requires a TTY (stdin, stdout) but keep local control of signal dispatching by means of Ctrl-C and Ctrl-Z. These are jobs where you want redirect stdin to a file.	n/a	<code>-Il</code>	<code>% date   wx run -Il tr '[a-z]' '[A-Z]'</code>

You can limit the number of interactive jobs that can run concurrently, both at the global and user level. This is accomplished by creating a limit resource and setting it as the interactive job limit in the `vnccrun.config.tcl` file. For example:

```
set VOV_JOB_DESC(interactive,limit) Limit:interactive
```

Or, for a per-user limit:

```
set VOV_JOB_DESC(interactive,limit) Limit:interactive_@USER@
```

The resource must exist prior to adding these lines to the file.

### Use the `-splitederr` Option

Use the `-splitederr` option to write the stderr output of the interactive job to stderr. The default is to write the job's stderr output to stdout. Note that using this option will probably result in garbled terminal output due to intermingling of stdout and stderr outputs.

### When to Use `-Il` and `-Ir`

If you use the option `-Ir`, then handling Ctrl-C and Ctrl-Z are done **remotely** on the remote host where the job is running. Use `-Ir` to interact with the job.

If you use the option `-Il`, then handling Ctrl-C and Ctrl-Z are done **locally** with the submission shell. Use `-Il` to redirect the stdout of the job to a file or a pipe.

## Interactive Job Logs

Logging is supported for interactive job. For example, the following command will produce a transcript in `mylog.txt`:

```
% wx run -I -l mylog.txt - /bin/bash
```

Options to Use with Interactive Job Logging	Conditions
-I option	Only use for jobs that require attention as they run. -I should not be used in scripted jobs where the intent is to capture output. In general, each user should never have more than one or two interactive jobs running concurrently.
-wl option	Intended for when the job is launched at a terminal and real time logging is required. -wl is preferred over -I when only output tailing is required. A pseudo terminal server is not employed (keyboard input is not processed) and the job is more robust over network and window glitches.
-w option	Preferred method for blocking a job and capturing its output in a script. The job can be issued with a -w option. This blocks until the job completes. The log can then be accessed via <code>nc info -l</code> .



**Note:** Neither `-wl` or `-I` should be used in scripts where there is no controlling terminal providing supervision.

For further information, please submit a support request at [Altair Community](#).

## Jobs That Require a DISPLAY: Option -Ix

To run a graphical tool interactively, use the option `-Ix` with `nc run`. This option adds the component `+D(DISPLAY=$DISPLAY)` to the job environment.

- To use this option, the `DISPLAY` environment variable must be set for the display to refer to the host that you want to view.
- If `DISPLAY` does not contain a hostname component, such as `"unix:0.0"` or `":0.0"`, then `nc run` command substitutes the hostname of the submission host. You must set a `nc run` value containing a hostname component to display the windows on a host other than the submission host.

For most graphical tools, all interactions occur through the windows and no terminal is needed. Batch jobs, and those started with only the `-Ix` option, do not have a pty allocated.

There are tools, such as Cadence NanoRoute and some simulators, which expect to have the regular streams connected to a pty, and will not operate properly (that is, just exit) unless there is a pty. For such jobs, use the `-Ir` or `-Il` option to ensure a pty is allocated.

For tools such as simulators that interpret the INT (interrupt) signal, typically ^C, to stop the simulation and return to interactive control, you may need to start in an xterm (x terminal) to gain full functionality. In this case, how to submit the job is similar to the following example:

```
% wx run -Ix xterm -e vsim -do ...
```

## Modify Scheduled Jobs

The `wx modify` command allows modifying fields in the scheduled jobs.

### wx modify

```
wx: Usage Message

WX MODIFY:
    Modify scheduled jobs

USAGE:
    % wx modify [OPTIONS] [jobId] ...
                                     (operate on job with that id)
    % wx modify [OPTIONS] [!] ...
                                     (operate on most recent job)
    % wx modify [OPTIONS] [-set setName] ...
                                     (operate on all jobs in setName)
    % wx modify [OPTIONS] [-selrule rule] ...
                                     (operate on all jobs selected by rule)

OPTIONS:
    -h                                -- This help.
    -v                                -- Increase verbosity.
    -showfields                       -- Show fields that can be modified.
    -<FIELDNAME> <NEWVALUE>          -- Set the specified field to the
                                     specified value.
    -changegrab <RESMAP> [-]<N>      -- Change the quantity of a resourcemap
                                     grabbed for a running job. May not
                                     combine with other options.

EXAMPLES:
    % wx modify -jobclass short 0012345
    % wx modify -res License:xxx 0012345
    % wx modify -jobname superman 0012345
    % wx modify -res License:xxx -set MySet
    % wx modify -group /time/users !
    % wx modify -jpp smallest -numa pack 0012345
    % wx modify -changegrab Limit:foo -1 -selrule 'user=mary AND resources~foo'
```

To see a list of the fields that can be modified, use the `-showfields` option as shown below:

```
autoflow
autoforget
autokill
cmd
deadline
dir
env
fstokens
group
jobclass
jobname
jobproj
jpp
legalexit
nojournal
```

```
numa  
preemptable  
priority  
res  
res ,aux  
scheddate  
submithost  
systemjob  
tool  
xdur  
xpriority
```



## Restrictions and Consequences

The following fields can be changed any time, including when the job is running.

<b>autokill</b>	Duration job runs before being killed automatically
<b>fstokens</b>	FairShare tokens; when changed, moves the job to the proper FairShare bucket
<b>xpriority</b>	Execution priority
<b>jobname</b>	Can only be changed by job's owner
<b>jpp</b>	Job placement policy
<b>legalexit</b>	If the job is not running, the exit status is checked again with the new legal values; if it does not match, the job is invalidated
<b>numa</b>	Job placement non-uniform memory access policy; Linux only
<b>preemptable</b>	Flag indicating the job can be preempted
<b>priority</b>	Schedule priority
<b>systemjob</b>	Flag that indicates it is a system job; not normally modified this way
<b>xdur</b>	Expected duration

The following fields cannot be changed while the job is running. They can be changed by the job's owner or an administrator.

<b>autoflow</b>	Flag that indicates a job should be skipped; if changed, job is moved to proper bucket
<b>nojournal</b>	Flag that turns off journal entries for the job
<b>res</b>	Resources; if changed for a scheduled job, the job is re-queued
<b>scheddate</b>	Date/time job was scheduled

The following fields cannot be changed while the job is running. They can only be changed by the job's owner (not an administrator).

<b>autoforget</b>	Flag that indicates the job will be forgotten after completion
<b>cmd</b>	Command line of job; job is invalidated if changed
<b>deadline</b>	The desired date/time the job should be completed
<b>dir</b>	File system path where job runs; job is invalidated if changed
<b>env</b>	Named environment of job; job is invalidated if changed
<b>group</b>	FairShare group; if changed for a scheduled job, the job is re-queued

---

<b>jobclass</b>	Resource group; if changed for a scheduled job, the job is re-queued
<b>jobproj</b>	Project associated with job; if changed for a scheduled job, the job is re-queued
<b>res,aux</b>	Aux resources; if changed for a scheduled job, the job is re-queued
<b>submithost</b>	Host from which job is submitted
<b>tool</b>	Name of tool associated with command

Modifying job fields will be restricted if a VovUserGroup named System:jobmodify exists. If this VovUserGroup exists, only users who are a member of the group will be able to modify job fields. Users not in the VovUserGroup will receive an authorization error.

This chapter covers the following:

- [Get Detailed Information about a Job](#) (p. 44)
- [Job Status](#) (p. 45)
- [Job Runtime - Monitor and Profile](#) (p. 46)
- [Job Profiling](#) (p. 47)
- [List Jobs](#) (p. 50)
- [Job Summary](#) (p. 53)
- [Invoke the GUI](#) (p. 54)
- [Icons](#) (p. 56)
- [Show the Hosts/Taskers](#) (p. 58)
- [Monitor Jobs, Taskers and Resources](#) (p. 64)

## Get Detailed Information about a Job

The command `wx` displays information about a job.

### Get Detailed Information About a Job

The command `wx getfield` also gives information about a job, but in an undecorated form that is in scripts.

```
wx: Usage Message

WX GETFIELD:
  Get one or all fields of one or more WX jobs.  Specify the jobID
  or use '!' for the most recent job in the current working directory.

  If the -J jobName option is given, only the first match
  is reported.  If there is no match, an error is reported.

OPTIONS:
  -h          Show this help.  You can also get the
              usage message by specifying no option at all.
  -v          Increase verbosity.
  -J JOBNAME  Find first job with given JOBNAME
              The search is restricted to the jobs that
              belong to the current user.
              This is significantly more expensive than
              using jobIDs.  Use sparingly.
  -f field    Specify field when giving multiple jobIDs
  -showid     Show jobId
  -s          Same as -showid
  -sep STRING Use STRING as separator (default is a single space)
  -tab        Use a TAB character as separator.

EXAMPLES:
  % wx getfield -h
  % wx getfield 01234455
  % wx getfield 00123445 jobclass
  % wx getfield ! status
  % wx getfield -J JOBNAME
  % wx getfield 01234455 0123458 -f jobclass
  % wx getfield -s 01234455 0123458 -f jobclass
```


### Examples:

```
% wx getfield 00012345 jobclass
normal
% wx getfield 00012345 cputime
7.125
% wx getfield 00012345
... get list of all known fields (more than 100 of them)...
```

## Job Status

In Accelerator Plus, each job goes through a number of states until completion.

The states are described in the following table:

Status	Color	Description
Idle	BlueViolet	If the node is a job, either it has not been run successfully yet or it needs to be run again, because one of its inputs has been modified since the last time the job was executed. If the node is a file, it is the output of a job that is not Idle.
Queued	Light blue	The job is scheduled to be run. It may be already queued or it will go in the queue as soon as all its inputs are ready.
Running	Orange	The job is currently being retraced; it has been dispatched to one of the taskers. All the outputs of such a job are either RETRACING or RUNNING.
Done	Green	If the node is a job, it has run successfully. If the node is a file, it is up-to-date with respect to all other files and jobs on which it depends.
Failed	Red	The job ran and failed.
Transfer	Cream	The job is being transferred to another cluster and it is not yet running.
Suspended	Pink	The job was running (or retracing) and one of the processes belonging to the job is currently suspended.
Sleeping	Black	Either the job caused an output conflict upon submission (bad dependencies) or the job was not reclaimed by any tasker upon crash recovery.
Withdrawn	Gray	A job has been withdrawn after dispatching, such as by the preemption daemon.   <b>Note:</b> This status occurs rarely and tends to be hard to observe.

The normal sequence for a successful job is **Idle > Queued > Running > Done**

The normal sequence for a failing job is **Idle > Queued > Running > Failed**

## Job Runtime - Monitor and Profile

When a job is running through a vovtasker, the tasker automatically monitors RAM and CPU utilization of the job, including all of its children.

Job statistics are sampled about once a minute. This data sampling rate does not capture jobs that complete in less time than the sampling period.

The MAXRAM is expressed in Megabytes (MB), where 1MB =  $1 \ll 20$  bits (left-shift decimal "1" 20 times is the binary equivalent of 1 million). The CPU time is stored in ms (milliseconds), but is expressed in s (seconds).

### CPU Progress and Run Status Indicators

Accelerator Plus monitors CPU and RAM utilization for all the running jobs. The CPU utilization information is available in four fields:

<b>CPUTIME</b>	The total accumulated CPU time in milliseconds.
<b>CPUPROGRESS</b>	Percentage of CPU accumulated in the unit time. For example, if in 60 seconds a job uses 60 seconds of CPU time, then the CPUPROGRESS is going to be 100. This field can be 0 (zero) for jobs that are stuck: holding onto the CPU resource but not running, which makes the CPU unavailable for other jobs. This field can also be greater than 100 for multi-threaded jobs.
<b>LASTCPUPROGRESS</b>	A timestamp indicating the last time CPU usage has increased. This is used to identify stuck jobs.
<b>RUNSTATUS</b>	A descriptive text field that shows how well the job is doing. Some typical values are Good, Paging, NoCpu. The complete list of values is shown below.

Table 1: Values of the RUNSTATUS Field

n/a	Insufficient information to determine CPU progress. Typical for jobs that have just started.
Good	The progress is greater than 70%
Medium	Progress is between 10% and 70%
Poor	Less than 10% CPU utilization, but no swapping of pages.
Paging	The progress is less than 10% and the job is swapping at a rate greater than 1000 pages per second.
NoCpu	The job is not accumulating any CPU time.
Susp	The job is suspended.

## Job Profiling

When job profiling is activated, Accelerator Plus tracks and plots performance statistics over the time the job is running.

The profiling plots show, in order, the following performance data over time:

1. RAM usage
2. VM size
3. CPU utilization
4. Cumulative Read I/O
5. Cumulative Write I/O
6. License checkouts (one plot per license)

The output of job profiling is a set of plots as shown below:

---

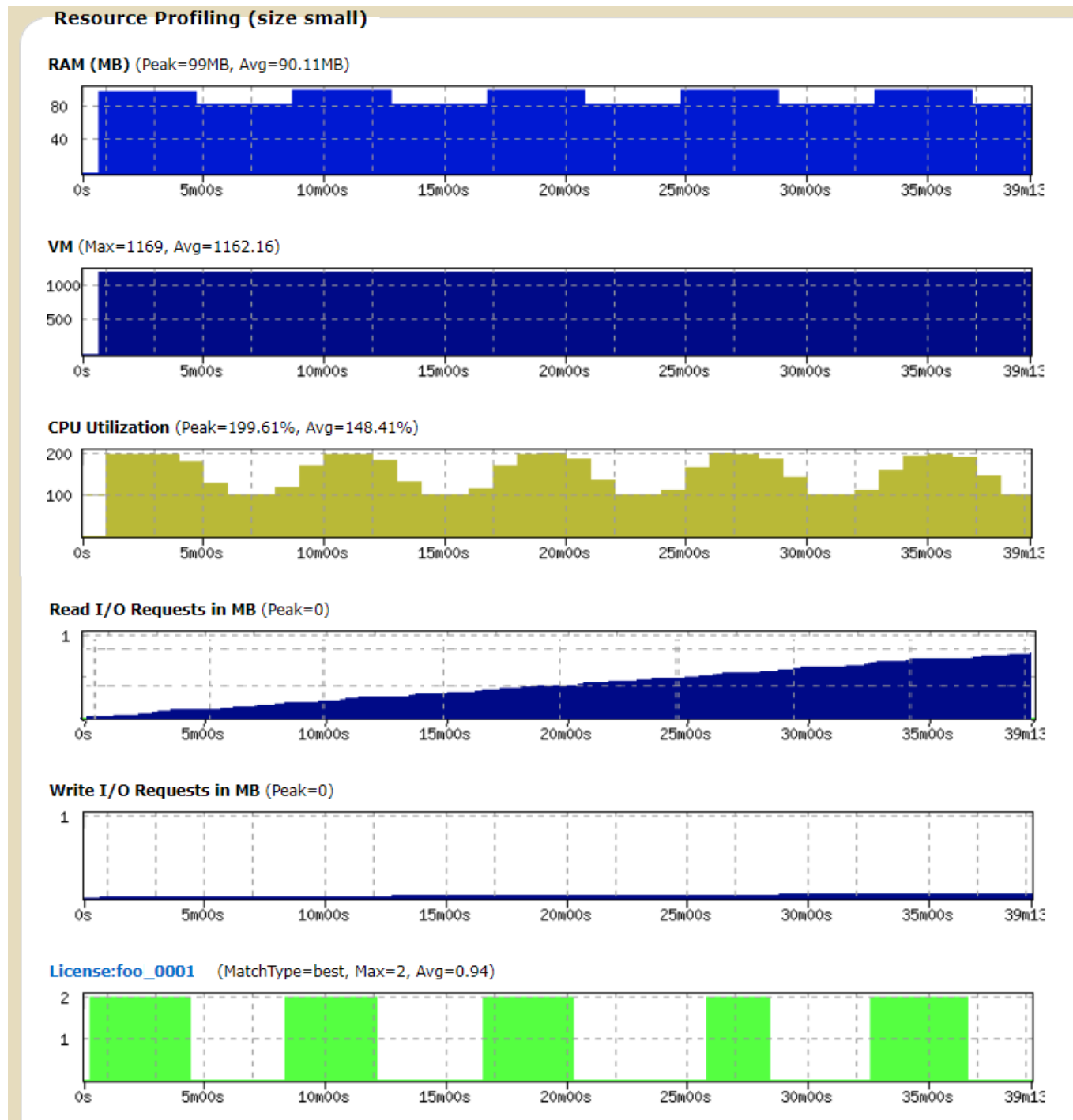


Figure 1:

To activate profiling on a single job, use the option `-profile` of `wx run` as shown below:

```
% wx run -profile myJob
```

To view a profile, use the browser interface and visit the specific page for the job.



To activate job profiling for a jobclass, set the following:

```
# In a job class definition
set VOV_JOB_DESC(profile) 1
```

To activate job profiling for all jobs, use the file `$VOVDIR/local/vncrun.config.tcl` and add a line like this:

```
# In the file $VOVDIR/local/vncrun.config.tcl
...
set VOV_JOB_DESC(profile) 1
...
```

---

## List Jobs

To show the status of jobs recently submitted, use `wx list`.

The default is to show up to 20 jobs submitted by the user running `wx list`. With some options, described below, you may also view jobs belonging to other users.



**Note:** This command can impose a significant load on the system. Please review the help info below for suggestions how to obtain job info efficiently.

The Accelerator Plus Administrator may have configured methods to mitigate this load, including caching.

### wx list

```
wx: Usage Message

WX LIST:
  List jobs currently in the system.
  The list is ordered by increasing job id,
  normally the same as the submission order.

  The behavior can be controlled by $VOVDIR/local/vnclist.config.tcl
  and by the variables
  NC_LIST_FORMAT
  NC_LIST_CACHE_DIR
  NC_LIST_CACHE_TIMEOUT

NOTE ON CACHES and MORE EFFICIENT METHODS:
  This command may use local, client-side caches.
  Caches are activated by setting NCLIST(cache,enable) to 1
  in the file $VOVDIR/local/vnclist.config.tcl

  These caches can significantly reduce
  the load on the scheduler in the case of repeated calls.
  The default timeout for these caches is 30s.

  There are better ways to get information about jobs, especially in
  scripts. Please consider the following efficient methods:
  % wx getfield $JOBID ...
    -- To get specific info about a job
  % wx cmd vovset count SETNAME ...
    -- To count jobs in sets by status
  % wx wait ...
    -- To block waiting for jobs to complete

USAGE:
  % wx list [OPTIONS]

OPTIONS:
  -O <format>      -- Specify a different Output format.
                    Refer to the manual for a description
                    of formats. For experts.
                    This can also be specified via the NC_LIST_FORMAT
                    environment variable.
```

```
-O+ <format>      -- Add one or more fields to the default output
                    format.
-H                -- When used with -O, show header line.
-l               -- Long format: show group, user, host,
                    and full command.
-L               -- Very long format: show start and end dates,
                    duration.
-c               -- Count jobs: this option affects the output
                    format.
                    It adds a column with the the position of each
                    job in the list of jobs to be shown.

-S <rule>
-select <rule>
-selrule <rule>   -- 3 ways to specify the selection rule. For
                    experts. The clause 'isjob' is added to the
                    selection rule.

-S+ <rule>        -- Alternate (OR) selrule; jobs that match any
                    selrule will be shown. The clause 'isjob' is
                    added to the selection rule.

-subjobs         -- Show also sub-jobs too
                    (e.g. jobresumer, partialtool)
-systemjobs     -- Show also system-jobs
-alljobs       -- Show all types of jobs,
                    including sub-jobs and system-jobs.
-a              -- Show jobs for all users.
-r              -- Show only running jobs.
-f              -- Show only failed jobs.
-s              -- Show only suspended jobs.
-q              -- Show only queued jobs.
-u <user>       -- Show jobs belonging to given user. Ignored if
                    used with -selrule or -set option.

-first <index>   -- Show jobs starting at index. By default,
                    first index is 1.
-last <index>   -- Show jobs ending at index. By default, last
                    index is -1, which is the last job.
<num>           -- Show first <num> jobs if <num> is positive.
                    Show last <num> jobs if <num> is negative number
-J <jobName>    -- Show only jobs with given job name.
                    WARNING: this option can place a high load on
                    the WorkloadXelerator server in large workload
                    environments due to the need to compare strings
                    for each job, it is recommended to avoid calling
                    this unless truly required.

-set <setName>  -- Show only jobs in the given set.
                    This option can be repeated to show the content
                    of multiple sets. If a job belongs to multiple
                    sets, it may be reported more than once.

-dir <directory> -- Show only jobs in the given directory.
-cache         -- Use result cache. It is recommended to utilize
                    the result cache to reduce the load on the
                    WorkloadXelerator server
                    in cases where list queries are scripted.
                    By default, the cache expires after 30s.

-v             -- Increase verbosity.
-h             -- Print brief usage.
```

EXAMPLES:

```
% wx list
% wx list -c
% wx list -a -l
% wx list -O "@USER@ @GROUP@ @DURATION@"
                    -selrule "duration>60"
```

```
% wx list -H -O "@USER@ @GROUP@ @DURATION@"  
                -selrule "statusnc==Failed"  
% wx list -dir .  
% wx list -a -r -s  
                (Show all running and suspended jobs)  
% wx list -selrule "duration>600 statusnc==Running"  
% wx list -first 10 -last 20  
% wx list 5  
% wx list -10
```

## Job Summary

The command `wx summary` is used to show a short summary of jobs in the system.

```
wx: Usage Message

WX SUMMARY:
    Get a summary report for all of my jobs.
USAGE:
    % wx summary [options]
OPTIONS:
    -h                -- This message.
    -w                -- Show detailed info about wait reasons.
    -b                -- Show buckets.
    -P                -- Print report for all projects
    -p PROJECT        -- Print report for given project (repeatable)
    -u USER          -- Print report for given user (repeatable)
    -all_sets         -- Show all sets
    -a, -all          -- Print report for all users.
    -all_users        -- Same as -a
    -set SETNAME      -- Show report for just that set.
```

### Examples

The following is an example of the output of `wx summary`:

```
% wx summary -all
Accelerator Plus Summary For All Users
TOTAL JOBS      2101      Duration: 6h33m
Done            2005
Queued          95
Running         1

JOBS  GROUP  USER  TOOL  WAITING FOR...
50   groupA  john  vtclsh  ' License:fintronic#1'
45   groupB  mary  vtclsh  ' License:fintronic#1'
```

To view the summary of jobs for a specific user, use option `-u name`:

```
% wx summary -u john
Accelerator Plus Summary For User john
TOTAL JOBS      1101      Duration: 2h30m
Done            2005
Queued          50
Running         0

JOBS  GROUP  USER  TOOL  WAITING FOR...
50   groupA  john  vtclsh  ' License:fintronic#1'
```

## Invoke the GUI

Job execution can be monitored with `wx gui`.

This command opens a monitoring tool; no interactive capabilities (such as configuration or running jobs) are provided. Interactive capabilities are available with `wx cmd vovconsole`.

### wx gui

Show a grid view of the jobs in a specified set.

```
wx: Usage Message

WX GUI:
    Show a grid view of the jobs in a specified set.
USAGE:
    % wx gui [OPTIONS] &
OPTIONS:
    With no options, the GUI shows all jobs of the current
    user.

    -all
    -a                -- Show all jobs.
    -u <user>        -- Show jobs for specified user.
    -s <SETNAME>
    -set <SETNAME>
    -setname <SETNAME> -- Show specified set.
    -timeout <TIMESPEC> -- Stop async update after this time (default 2h).
    -submit
    -limitGui <N>    -- Override the limit of 3 max GUI per user.

    -batch <file>    -- Execute specified file after the GUI is ready

    -metrics
    -metricsConfig <file> -- Use specified metrics configuration file.
    -slaves
    -taskers
    -fontsize <size>  -- Specify the normal font size. Default is 10.
    Legal range is 3 to 36.

    -title <title>  -- Choose title of X11 window.

EXAMPLES:
    % wx gui &                -- Show all my jobs
    % wx gui -all &           -- Show all jobs.
    % wx gui -set SomeSetName -- Show specified set.

    % wx gui -submit          -- Job submission dialog.
    % wx gui -limitGui 5     -- Allow you to run up to 5 "nc gui" (default 3)

    % wx gui -metrics &     -- Show the scheduler metrics.
```

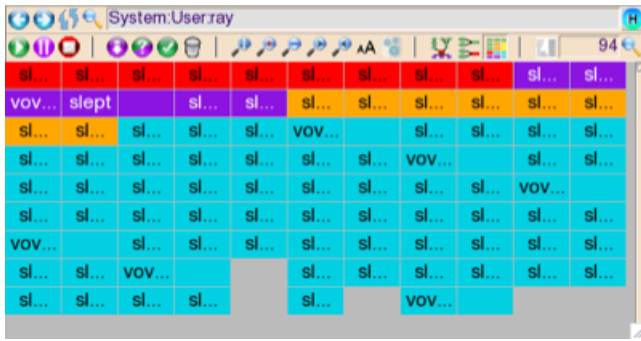


Figure 2:

```
% wx cmd vovconsole &
```

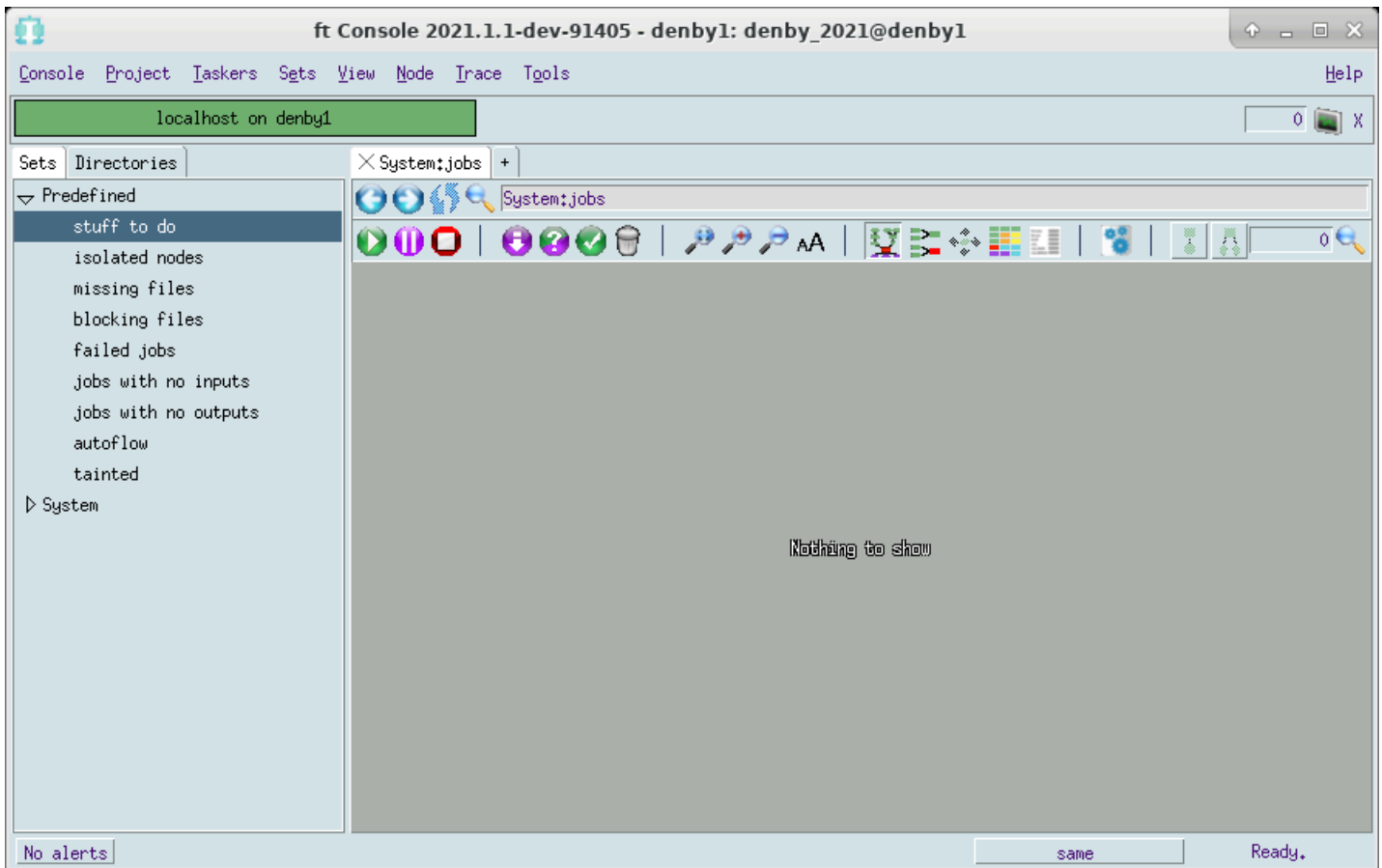

















Figure 3:

## Icons

All icons provide descriptions that you can find by hovering over the icon.

	Run/Rerun	Update the current object, whether a set or a node. All jobs necessary to bring the object up to date are scheduled for execution. The jobs that can run now start running.
	Stop/Dequeue	Un-schedule a job that is not yet running or abort a retrace request. Running jobs are unharmed and keep running. Graceful Stop. Cyan/asked-to-run jobs will turn back purple/invalid.
	Stop/Dequeue	Stop a running job or a retrace request. This does the same thing as the dequeue above, but in addition kills the selected running jobs. It's a forced stop. Running jobs that have been stopped will turn red.
	Navigate Backward	Display the previous set that you were browsing.
	Navigate Forward	Display the next set that you were browsing, when you already went backward.
	Refresh	Recompute the current set based on the selection rule.
	Find	Finds files or jobs in the trace. There are two identical Find icons. The left one close to the name of the set being displayed triggers changing the setname box into a search box for the current graph. The other on the extreme right brings up a new dialog that lets you search for files or jobs.
	Invalidate	Invalidates the selected nodes.
	Try Validate	Tries to validate the selected jobs and its downcone.
	Force Validate	Equivalent of <code>make -t</code> .
	Forget	Removes the job/file from the graph of dependencies. This does NOT remove the file from disk. It just removes it from the dependencies allowing blocked jobs to start. Usually rerunning <code>vovbuild</code> is enough to bring the dependency back.
	Fit	Reduces/expands the graph so that it fits in the window.



	Zoom In	Expands the graph to better see some nodes.
	Zoom Out	Reduces the graph to see more nodes.
	Select Font Size	Reduce or enlarge the size of the characters in the nodes.
	Vertical View	Display the current set using the "graph" widget.
	Horizontal View	Display the current set using the "horizontal" widget.
	Grid View	Display the current set using the "grid" widget.
	Stats View	Display the current set using the "stats" widget.
	Graph Settings	Set the various preferences for Weight Driven Placement. This takes you to the <b>Graph</b> tab of the Preferences dialog.

## Show the Hosts/Taskers

The command `wx hosts` shows the list of the hardware resources currently connected to an instance of Accelerator. These hardware resources are called "taskers" in Accelerator Plus.

```
wx: Usage Message

WX HOSTS
  Show taskers that are currently in the cluster along with tasker metadata.

  The default output includes:
  NAME LOAD STATUS RUN/SUSP SLOTS HEARTBEAT RESERVATIONS MESSAGE

  Each tasker takes on the name of its host by default.

  The "RUN/SUSP" column shows running jobs and suspended jobs,
  respectively.

  The "SLOTS" column shows total job slots.

  The heartbeat is the age of the most recent heartbeat received by the
  vovserver for that specific tasker.

  The reservations column shows shorthand representations for who or what
  the tasker is reserved and the time remaining for the reservation. The
  shorthand format is TYPE:NAME, where TYPE is one of:
  G (group), I (ID), B (bucket), C (jobclass), P (project), or U (user).

USAGE:
  % wx hosts [OPTIONS]

OPTIONS:
  -h                -- This help
  -c                -- Show consumable resources (e.g. RAM and CPUs)
  -f                -- Show list of tasker fields
  -r                -- Show status and resources for each tasker
  -rl              -- Show resources (legacy: pre-2013.03 format)
  -m                -- Show machine parameters (RAM, CPUfreq, ...)
  -a                -- Show all known hosts (used with -m)
  -hw <HW>         -- Show only taskers that match HW constraints.
  -rule <SELRULE> -- Show only taskers that match the given selection rule.
                   Use "vovselect fieldname from taskers" for the complete
                   list of fields that can be used in the rule.
                   Example rules:
                       "status==READY"
                       "status!=OVRLD slots>8"
                   Can accept multiple constraints.
  -O <fmt>         -- Specify output format. The format string can contain
                   elements like @FIELDNAME@ or @FIELDNAME:WIDTH@ where
                   a negative width means left-align and a positive width
                   means right-align.
  -RAM              -- Same as -O "@NAME@ RAM/@RAM@ RAMFREE#@RAMFREE@
                   RAMTOTAL#@RAMTOTAL@"
  -SLOTS            -- Same as -O "@NAME@ SLOTS/@SLOTS@ SLOTSTOTAL#@SLOTSTOTAL@
                   CORES/@CORES@ CORESTOTAL#@CORESTOTAL@"
  -LOAD             -- Same as -O ...selection of fields about load...
  -INFO             -- Same as -O ...fields about host, arch, model, ...
  -ALL              -- Show resources for each tasker
```

```
-slowdown      -- Used only for testing

EXAMPLES:
% wx hosts
% wx hosts -m
% wx hosts -a -m
% wx hosts -hw 'RAMTOTAL>18000'
% wx hosts -f
% wx hosts -O "RAMFREE#@RAMFREE@ SWAP/@SWAP@ M=@MODEL@"
% wx hosts -O "@I:4@ @NAME:-14@ @STATUS:-8@ @HOST@ "
% wx hosts -RAM
% wx hosts -hw 'RAMTOTAL>18000' -RAM
% wx hosts -ALL | grep -A8 ^lnx001
% wx hosts -rule "cores>4 ramtotal<20000" -O "@name@ @coretotal@"
```

An example is shown below:

```
% wx hosts
# TASKER      LOAD STATUS  JOBS  MESSAGE
1 alpaca      0.01 ready    0/1   Workstation idle
2 bison       0.07 ready    0/1   Workstation idle
3 blue-srv    0.15 ready    0/1
4 cayman      0.00 susp    0/1   Off hour tasker (will start at 19:00)
5 cheetah     0.00 ready    0/1   Workstation idle
6 comet-srv   0.23 ready    0/1
7 everett     0.00 ready    0/2
8 jupiter-srv 0.07 ready    0/2
9 mars-srv    0.06 ready    0/2
10 moon-srv   0.09 ready    0/1

% wx hosts -r
...
% wx hosts -m
...
```

## Use vovselect for Querying

The `nc hosts` command can be used for querying, but it can sometimes take several minutes to return results, which causes some nodes to show up as "N/A". `nc hosts` will query the server and return significant amounts of data, but the server loading will directly affect the response time of the command.

In order to avoid such delay, you can use `vovselect` to run the query, as it prefilters the output server-side before returning it to the client.

Use the table below to understand the mapping of fields between the `nc hosts` and `vovselect` commands.

<b>nc hosts</b>	<b>vovselect from TASKERS</b>	<b>vovselect from HOSTS</b>
ARCH	ARCH	ARCH
CAPABILITIES	CAPABILITIES	NA

<b>nc hosts</b>	<b>vovselect from TASKERS</b>	<b>vovselect from HOSTS</b>
CAPACITY	CAPACITY	CPUS
CLASSRESOURCES	CLASSRESOURCES	NA
CLOCK	CLOCK	CPUCLOCK
COEFF	COEFF	NA
CONSUMABLES	CONSUMABLES	NA
CORES	CORES_AVAIL	NA
CORES_AVAIL	CORES_AVAIL	NA
CORESTOTAL	CORESTOTAL	CPUS
CORESUSED	CORESUSED	NA
CPUS	CPUS	CPUS
CURLOAD	CURLOAD	NA
DOEXEC	DOEXEC	NA
DONETINFO	DONETINFO	NA
DOPROCINFO	DOPROCINFO	NA
DORTTRACING	DORTTRACING	NA
EFFLOAD	NA	NA
EXTRAS	EXTRAS	NA
FULLINFO	FULLINFO	NA
GROUP	GROUP	NA
HB	NA	NA
HBPP	NA	NA
HEARTBEAT	HEARTBEAT	NA
HOST	HOST	NAME
ID	ID	NA
IDINT	IDINT	NA

<b>nc hosts</b>	<b>vovselect from TASKERS</b>	<b>vovselect from HOSTS</b>
LASTJOBID	NA	NA
LASTUPDATE	LASTUPDATE	NA
LIFETIMEJOBS	LIFETIMEJOBS	NA
LOAD1	NA	NA
LOAD15	NA	NA
LOAD5	NA	NA
LOADEFF	NA	NA
MACHINE	MACHINE	MACHINE
MANUALPOWER	NA	NA
MAXLOAD	MAXLOAD	NA
MESSAGE	MESSAGE	NA
MESSAGESYS	MESSAGESYS	NA
MESSAGEUSER	MESSAGEUSER	NA
MODEL	MODEL	NA
NAME	NAME	NAME
NUMJOBS	NA	NA
OSCLASS	OSCLASS	NA
PERCENT	PERCENT	NA
PERSISTENT	PERSISTENT	NA
PID	PID	NA
POWER	POWER	NA
RAM	RAM	NA
RAMFREE	RAMFREE	NA
RAMTOTAL	RAMTOTAL	RAMTOTAL
RAWPOWER	NA	NA

<b>nc hosts</b>	<b>vovselect from TASKERS</b>	<b>vovselect from HOSTS</b>
RELEASE	RELEASE	NA
RESERVEDBY	RESERVEDBY	NA
RESERVEEND	RESERVEEND	NA
RESERVEFORBUCKETID	RESERVEFORBUCKETID	NA
RESERVEFORID	RESERVEFORID	NA
RESERVEGROUP	RESERVEGROUP	NA
RESERVEJOBCLASS	RESERVEJOBCLASS	NA
RESERVEJOBPROJ	RESERVEJOBPROJ	NA
RESERVEOSGROUP	RESERVEOSGROUP	NA
RESERVESTART	RESERVESTART	NA
RESERVEUSER	RESERVEUSER	NA
RESOURCECMD	RESOURCECMD	NA
RESOURCES	NA	NA
RESOURCESEXTRA	NA	NA
RESOURCESPEC	RESOURCESPEC	NA
RUNNINGJOBS	RUNNINGJOBS	NA
SLOTS	NA	NA
SLOTSTOTAL	SLOTSTOTAL	NA
STATSREJECTCORES	STATSREJECTCORES	NA
STATSREJECTOTHER	STATSREJECTOTHER	NA
STATSREJECTRAM	STATSREJECTRAM	NA
STATSREJECTRESERVED	STATSREJECTRESERVED	NA
STATSREJECTSLOTS	STATSREJECTSLOTS	NA
STATSVISITS	NA	NA
STATUS	NA	NA

<b>nc hosts</b>	<b>vovselect from TASKERS</b>	<b>vovselect from HOSTS</b>
SWAP	SWAP	NA
SWAPFREE	SWAPFREE	NA
SWAPTOTAL	SWAPTOTAL	NA
TASKERGROUP	TASKER	NA
TASKERNAME	TASKERNAME	NAME
TASKERSLOTSSUSPENDABLE	TASKERSLOTSSUSPENDABLE	NA
TASKERSLOTSSUSPENDED	TASKERSLOTSSUSPENDED	NA
TASKERSLOTSUSED	TASKERSLOTSUSED	NA
TASKERTYPE	TASKERTYPE	NA
TIMELEFT	TIMELEFT	NA
TMP	TMP	NA
TYPE	TYPE	NA
UPTIME	NA	NA
UPTIMEPP	UPTIMEPP	NA
USER	USER	NA
VERSION	VERSION	NA
VOVVERSION	VOVVERSION	NA

## Monitor Jobs, Taskers and Resources

The activity of Accelerator Plus can be monitored with a dialog.

The dialog is invoked with:

```
% wx monitor
```

The following is a list of the tabs available in the dialog:

<b>TaskersGroups</b>	The activity of tasker groups.
<b>Taskers</b>	The activity of taskers.
<b>Taskers HW</b>	The hardware offered by taskers.
<b>Taskers Resources</b>	The resources offered by taskers.
<b>Who</b>	Who is running jobs.
<b>Running Jobs</b>	The progress of running jobs.
<b>Running Commands</b>	The details of running commands.
<b>Running Details</b>	The details of running jobs.
<b>Resources</b>	The usage and availability of resources.
<b>Queued Jobs</b>	The jobs in the job queue.
<b>Queue Buckets</b>	The jobs in the job queue organized by groups of similar jobs (called 'buckets').
<b>FairShare</b>	The FairShare statistics.



TaskerGroups	Taskers	Tasker HW	Tasker Resources	Who	Running Jobs	Running Commands	Running Details	Resources	Queued Jobs	Queue Buckets	FairShare
Type:Name	Total	InUse	Rsrvd	ooQ	Available	%Util.	MapsTo				
1 License:AL002_HMPoll	unlim	0	0	0	unlim						
2 Limit:user0265_justo	1	0	0	0	1	99.12%					
3 License:AL002_HFSoli	100000	0	0	0	100000	0.00%					
4 License:AL003_HMPSO_	unlim	0	0	0	unlim						
5 Limit:user0418_justo	1	0	0	0	1	99.79%					
6 Limit:user0354_justo	1	0	0	0	1	97.64%					
7 Limit:user0100_justo	1	0	0	0	1	98.94%					
8 License:AL003_HMPSO_	unlim	0	0	0	unlim						
9 License:SolverNode	100000	0	0	0	100000	0.00%					
10 Limit:user1312_justo	1	0	0	0	1	98.16%					
11 License:AL003_HMPano	unlim	0	0	0	unlim						
12 License:AL003_SIMLAB	100000	0	0	0	100000	0.00%					
13 License:AL001_HWActi	unlim	0	0	0	unlim						

Figure 4:

Accelerator Plus provides several commands of job controls, including wait, stop, cleaning and debugging.

This chapter covers the following:

- [Wait for Jobs](#) (p. 67)
- [Stop Jobs](#) (p. 69)
- [Forget Jobs](#) (p. 72)
- [Clean Up Log Files](#) (p. 73)

## Wait for Jobs

To wait for one or more jobs to complete, use the `wx wait` command.

```
% wx wait [options] jobId ...
```

### wx wait

```
wx: Usage Message

WX WAIT:
    Wait for a specific job or list of jobs to complete,
    fail, or be forgotten

USAGE:
    % wx wait [OPTIONS] <jobId> ...

OPTIONS:
    -h                -- Print this message.
    -q                -- Quiet wait.
    -v                -- Verbose (may be repeated up to 3 times)

    -dir <directory> -- Wait for all jobs in the given directory.
    -subdirs <directory> -- Wait for all jobs in the given directory and
                        subdirectories.
    -select <rule>    -- Wait for all jobs in set defined by 'rule'.
                        The predicate 'isjob' is automatically added
                        to the rule.
    -set <setName>    -- Wait for all jobs in a set.
    -start            -- Wait for the specified jobs to start.
    -p               -- Use polling method (automatic delay)
    -poll <MS>       -- Use polling method with a delay of <MS>
                        milliseconds.
                        MS values are between 2000 and 60000.
    -k               -- Jobs are killed if you interrupt wait
                        by Ctrl-C.
    -l               -- Show log file of last job while waiting.
                        The log is shown either as it is created
                        if the job has been submitted with option -wl
                        or all at once upon job completion.
    -maxwait <timespec> -- Specify a maximum wait time.
    -timeout <timespec> -- Same as -maxwait
    -jobinfo         -- Show info about jobs being executed.
    -callback <cmd>  -- Execute 'cmd JOBID JOBSTATUS' for every job
                        that completes. Output to stdout.
                        Errors ignored.
    -file <file>     -- For experts. Source <file>, mostly to define
                        overrides for procedure VncWaitCallback
                        { cmd jobId status }
```

```
RETURN:
    0    -- All jobs are done, or started if -start is specified.
    1    -- Some jobs are still invalid.
    2    -- Some jobs are failed.
```

```
3      -- Some jobs have unexpected status.  
4      -- Some jobs have been lost.  
5      -- Waited for long enough (see -maxwait option)
```

## EXAMPLES:

```
% wx wait 22345 22356  
% wx wait -dir .  
% wx wait -subdirs .  
% wx wait -select "command~spice"  
% wx wait -set "myset"  
% wx wait -callback ./myScript -set myset  
% wx wait -jobinfo -set myset  
% wx wait -p -set myset  
% wx wait -poll 5000 -set myset  
% wx wait -maxwait 1m -set myset
```

## Stop Jobs

A job can be stopped when it is running or queued. Stopping a job does not "forget it" from the vovserver database. A job can only be stopped by the owner or the Accelerator Plus administrator.

### wx stop

wx: Usage Message

WX STOP:

Stop jobs.

1. If the jobs are running, they are killed (unless you use option `-dequeueonly`).
2. If the jobs are scheduled in the queue, they are removed from the queue.

In either case, the jobs remain in the system.

To remove them from the system, use the "forget" command.

Jobs in the system can be rerun with the "rerun" command.

When stopping a single job, the procedure checks for the properties `NC_STOP_SIGNALS` and `NC_STOP_SIG_DELAY` attached to the job to be stopped.

The list of signals is also controlled by the environment variables `VOV_STOP_SIGNALS` and `NC_STOP_SIGNALS`. If both `NC_STOP_SIGNALS` and `VOV_STOP_SIGNALS` are present in the environment, the value of `VOV_STOP_SIGNALS` will be used. Their functionality is otherwise identical.

The default list of signals is `TERM,HUP,INT,KILL` and can be customized with the variable `defaultStopSignalCascade` in `policy.tcl`.

USAGE:

```
% wx stop [OPTIONS] <jobId> ...
```

OPTIONS:

```
-h                -- This message
-set <setname>   -- Stop all my jobs in the given set.
-J <jobname>     -- Stop all my jobs with given jobname.
-mine           -- Stop all my jobs.
-dir <directory> -- Stop all jobs in the given directory.
-allusers      -- Stop all jobs (only ADMIN can do it).
-dequeueonly    -- Just remove jobs from the queue.
                  All currently running jobs are not affected.
                  Can be abbreviated to -d.
-d              -- Same as -dequeueonly.
-signals <SIGLIST> -- Comma separated list of signals to send to the jobs
                  (default is the sequence TERM,HUP,INT,KILL )
                  This can be also set with property NC_STOP_SIGNALS
                  or with the environment variables NC_STOP_SIGNALS
                  or VOV_STOP_SIGNALS.
                  Priority: 1. Option -signals
                           2. job property NC_STOP_SIGNALS
                           3. env variable VOV_STOP_SIGNALS,
                              NC_STOP_SIGNALS
                           4. default (can be configured as
                              defaultStopSignalCascade
                              in policy.tcl)
```

```

See also:  vovshow -env VOV_STOP_SIGNALS
           vovshow -env NC_STOP_SIGNALS

-sig      <SIGLIST> -- Same as -signals.
-exclude  <PROCLIST> -- List of processes to exclude from receiving the
                    signal.
-include  <PROCLIST> -- List of processes to receive the signal.
-after    <s>        -- Start sending signals after specified seconds.
                    This is an initial delay, between 0 and 20s.
-delay    <s>        -- Minimum delay between signals (in seconds),
                    between 0 and 20s. Default is 3.
                    This can also be set with the property
                    NC_STOP_SIG_DELAY, or with the environment
                    variables NC_STOP_SIG_DELAY or
                    VOV_STOP_SIGNAL_DELAY. If both NC_STOP_SIG_DELAY
                    and VOV_STOP_SIGNAL_DELAY are present in the
                    environment, the value of NC_STOP_SIGNAL_DELAY
                    will be used.
                    Priority: 1. Option -delay
                               2. job property NC_STOP_SIG_DELAY
                               3. env variable VOV_STOP_SIGNAL_DELAY,
                                   NC_STOP_SIG_DELAY
                               4. default
-skiptop  <0|1>     -- Whether to kill the top process.
                    This is normally the job wrapper (e.g. vw, vwi).
                    Default is 0.
-why      <reason>  -- Give a reason for the stop.
                    This is stored on the WHYSTATUS
                    field of the stopped jobs.

```

**EXAMPLES:**

```

% wx stop 00123456
% wx stop -d -mine
% wx stop -after 3 -mine
% wx stop -set Class:hsim
% wx stop -mine -why "Jobs no longer needed"
% wx stop -sig "TERM,KILL" -delay 4 0012345
% env VOV_STOP_SIGNALS=TERM,INT,KILL wx stop 0012345

```

**SEE ALSO:**

```

% vovshow -env VOV_STOP_SIGNALS
% vovshow -env NC_STOP_SIGNALS
% vovshow -env VOV_STOP_SIGNAL_DELAY
% vovshow -env NC_STOP_SIG_DELAY

```

**Override Signals to Stop a Job**

A job can be stopped by overriding the sequence of signals that are sent for the job. To do so, set the properties `NC_STOP_SIGNALS` and `NC_STOP_SIG_DELAY`.

**Automatic Stopping Based on Elapsed Time**

If a job is submitted with the `-autokill` option, it will be stopped after the specified amount of time has elapsed. The check to stop the job is performed by the tasker itself at an interval of about one minute, which can be controlled with the `-U` option of `vovtasker`).

For example:

```
% wx run -autokill 30m sleep 1000000
```

### Automatic Stopping Based on CPU Time

To stop a job that exceeds a specific duration of CPU time, set the variable `VOV_LIMIT_cputime`. A job that exceeds the limit will be killed by UNIX and will have status "Failed".

For example:

```
% wx run -e "BASE+D(VOV_LIMIT_cputime=10)" vovmentime 10 100 0
```

## Forget Jobs

Under normal operation, jobs are automatically forgotten from the server database as follows:

1. Completed jobs are forgotten after one hour.
2. Failed and idle jobs are forgotten after two days.
3. Queued and running jobs are never forgotten.

The `wx forget` command immediately deletes the specified job from the server database. If a job is running and the `-forcerunning` flag is used, the job is stopped before it is forgotten.

### wx forget

```
wx: Usage Message

WX FORGET:
  Forget jobs from the trace.
  If the jobs are running they are first stopped (if you use -forcerunning)
  If the jobs are queued, they are removed from the queue.

USAGE:
  % wx forget [OPTIONS] <jobId> ...

OPTIONS:
  -normal          -- Forget all my jobs older than 1 day.
  -n              -- Shortcut for -normal.
  -age <age>      -- Forget all my jobs older than the
                  specified age (except running jobs).
  -J <jobname>    -- Forget all my jobs with given name.
  -set <setname>  -- Forget all jobs in given set.
  -mine          -- Forget all my jobs (regardless of age).
  -allusers      -- Forget jobs belonging to other users too.
                  Need to be ADMIN.
  -dir <dirname> -- Forget all jobs in the given directory.
  -subdirs <dirname> -- Forget all jobs in the given directory and
                  all subdirectories.
  -selrule <rule> -- Selection rule for jobs to forget.
  -forcerunning  -- Force deletion of running jobs.
  -h            -- This message.
  -v           -- Increase verbosity.
  -quiet       -- Quiet forget. Ignore errors.
  -system     -- Include system jobs (implied for explicit jobIds)

EXAMPLES:
  % wx forget -n
  % wx forget -age 1h
  % wx forget -mine -dir .
  % wx forget -allusers -dir .
  % wx forget -set MyExperiment
  % wx forget -set MyExperiment -forcerunning
```



## Clean Up Log Files

All log files are normally stored under the subdirectory `./wx_logs`. To remove all obsolete log files in the current working directory, use the `wx clean` command.

### wx clean

This command cleans up obsolete log files and environment files that have been generated by jobs submitted to the scheduler.

wx: Usage Message

#### WX CLEAN:

This command cleans up obsolete log files and environment files that have been generated by jobs submitted to the scheduler. By default the command cleans the current working directory (i.e. removes logs and environment files of the jobs executed in the current working directory).

If a list of directories is provided, the command will clean up the files in those directories instead.

#### USAGE:

```
% wx clean [OPTIONS] [LIST_OF_DIRS]
```

#### OPTIONS:

```
-nozap      -- Do not 'zap' isolated nodes (see man vsz for more info).
              In this way, the cleaning of the current directory
              may proceed faster.
-zap        -- Do 'zap' of isolated nodes (see man vsz for more info).
-deep N     -- Clean the jobs from all directories in which the user
              has executed jobs in the past N days. The directories
              are found from the journals.
-dir <dir>  -- Specify additional paths to check.
-P PERIOD   -- Install a periodic job to run the cleaning automatically.
-R          -- Clean the directories recursively.
-v          -- Increase verbosity.
-h          -- This help.
```

#### EXAMPLES:

```
% wx clean -h
% wx clean
% wx clean -dir /tools/logs/VNC_LOGS -dir /scratch/logs/VNC
% wx clean . /tools/logs/VNC_LOGS /scratch/logs/VNC
% wx clean -zap
% wx clean -deep 10
% wx clean -deep 3 -P 3d
```

### Examples

```
% wx clean -h
% wx clean
```

```
% wx clean -dir /tools/logs/VNC_LOGS -dir /scratch/logs/VNC
% wx clean . /tools/logs/VNC_LOGS /scratch/logs/VNC
% wx clean -zap
% wx clean -deep 10
% wx clean -deep 3 -P 3d
```

## Comments

Use the option `-R` (recursive) to also clean up the subdirectories.

```
% wx clean -R
```

From within scripts, it is recommended to use the option `-nozap`, which tells `wx clean` to skip the calling of the zapping utility `vsz`, which can be expensive in terms of time and load on the server.

```
% wx clean -nozap
```

If you do not remember the directories where you have run jobs, you can use the deep cleaning option `-deep` that automatically looks in the journals to find out all the directories in which jobs have been run. This option accepts an integer parameter that specifies the number of days to go back in the journals. The following example will go back 10 days:

```
% wx clean -deep 10
```

To have Accelerator Plus automatically run `wx clean` every day, schedule a periodic job. For example, the following command schedules a cleanup once a day in the current directory:

```
% wx clean -P 1d
```

On occasion, jobs that run successfully outside of Accelerator Plus fail when run through Accelerator Plus. When this occurs, mostly likely the setups are not the same: the environment, inputs or other parameters may be different, a misconfiguration or there is a problem with NFS.

This chapter covers the following:

- [Debug Jobs Example](#) (p. 76)

To resolve such issues, using the command `wx debug` can show you the steps that Accelerator Plus takes to run the job.

When some jobs are not behaving as expected, use the command `wx debug jobID` to get the steps that Accelerator Plus uses to run the job.

## wx debug

```
wx: Usage Message
```

```
WX DEBUG:
```

```
If a job appears to behave differently when executed by WX  
than when it runs without using WX, you can use this command  
to debug the problem.
```

```
The command gives you the step-by-step description of what  
WX does to run the job, so that you can do  
the same thing without going through WX.
```

```
For example, if you find a job runs fine without WX, but fails  
in WX, it might simply be that the environment is not set correctly.  
By following the steps provided by this command, you will be able  
to determine what is wrong.
```

```
USAGE:
```

```
% wx debug <jobId>
```

```
OPTIONS:
```

```
-h                - Show this message
```

## Debug Jobs Example

Following the steps in the example below, modified or as is, you can check if you are running the same job in the same setup as it would be in Accelerator Plus.

By eliminating vovserver and vovtasker from the picture, it very often becomes obvious or easy to figure out what the problem is. Sometimes it is a missing environment variable. Sometimes it is an NFS problem, etc. In the unlikely event that run the same job successfully following these steps, there might be something missing or wrong in how Accelerator Plus runs the job, or something is misconfigured.

Example:

```
% nc debug 01597942

# This job was run on host bear. To run the same
# job without going through Accelerator, please follow these steps:

# 1. Logon to the machine (if necessary)
rsh bear -l john      ; # or ssh bear

# 2. Change to the directory
cd /home/john

# 3. Switch to the environment
ves SYNOPSIS

# 4. Run the job without wrappers or redirection
./myscript input1 input2
```

This document is intended for those who have been using the Platform LSF batch system and are now moving to using Accelerator Plus on top of the LSF batch system.

The following information describes the available resources, specific scripts, and guidelines of using those resources.

The Altair Accelerator installation includes scripts that are designed to minimize the impact of transitioning workloads from using LSF directly and instead using the Accelerator Plus hierarchical scheduler. Ideally, the use of these scripts, will enable the redirection of workloads from using an LSF cluster directly to one using an Accelerator Plus scheduler in front of the same LSF cluster. While the scripts cover the common usage of LSF, higher performance and a richer set of scheduling directives will be achieved with using the native Accelerator Plus command set.

The emulated commands include the following:

- `bhist`
- `bhosts`
- `bjobs`
- `bkill`
- `bmgroup`
- `bpeek`
- `bqueues`
- `bstat`
- `bsub`
- `lshosts`
- `lsid`

The scripts that emulate the above commands are available in the directory `$VOVDIR/scripts/lsemulation`, which is not in the `PATH` in the default setup. This setup avoids collision with the platform scripts and commands.

The emulated commands are added to the path by adding the Altair Accelerator named environment `LSFEMUL`. The `LSFEMUL` environment setup is installed in `$VOVDIR/etc/environments/LSFEMUL.*`.

```
% ves +LSFEMUL
% bsub sleep 10
% bjobs -a
```

## Configure Resource Mapping

The resources used by LSF, expressed by the `-R` option in `bsub`, are significantly different from the resource maps in Accelerator.

To map resources from one system to the other, customize the file `$VOVDIR/local/lsemulation/config.bsub.tcl`

This file contains a set of assignments to the Tcl arrays `MAP_LSF2NC()` and `MAP_RUSAGE()`.



**Note:** This file is used only by the Altair Accelerator `bsub` emulator.

An example for `config.bsub.tcl` can be found in the usual location for configuration files, a subdirectory of `$VOVDIR/etc/config`:

File: `$VOVDIR/etc/config/lsemulation/config.bsub.tcl`

```
#
# Sample configuration of the bsub emulation.
#
# This file must be placed in $VOVDIR/local/lsemulation/config.bsub.tcl
#

# If you want support for exclusive access to machines (option -x)
# you need to:
# 1. Uncomment the line below 'set bsubopt(percent) 1'
# 2. Make sure all taskers offer the resource PERCENT/100
# 3. Make sure all jobs request at least PERCENT/1 (see vnc_policy.tcl)
set bsubctrl(percent) 1

# Set this to 1 to cause bsub to always send email
set bsubctrl(alwaysmail) 1

# Truncate emailed log files after this many bytes
# negative values (e.g. -1) mean mail the whole file (BEWARE)
# zero means accept the default (65536 bytes)
set bsubctrl(logmax) 0

# Emulation transforms -m hostnames into an OR expression,
# which can slow down the NC scheduler if too complex.
# Hosts after this count are silently dropped to avoid slow scheduling
set bsubctrl(moptmax) 6

# Map LSF 'select' resources into NC resources.
# select[rhel4] -> "linux"
set MAP_LSF2NC(rhel3) "linux"
set MAP_LSF2NC(rhel4) "linux"
set MAP_LSF2NC(rhel5) "linux"
set MAP_LSF2NC(RH4_64) "linux x86_64"

# Map LSF 'rusage' resources into NC resources,
# typically resources of type License:
# Example:
# rusage[dc=1] -> "License:Design-Compiler"

set MAP_RUSAGE(dc) "License:Design-Compiler"
set MAP_RUSAGE(pt) "License:PrimeTime"
set MAP_RUSAGE(drc) "License:lic_drc"
set MAP_RUSAGE(lvs) "License:lic_lvs"
set MAP_RUSAGE(erc) "License:lic_erc"
```

### Emulate the LSF Report in the Output Log

Some legacy scripts expect some LSF specific lines in the log file of a job. This can be achieved with a post-command that adds those lines to the log. An example of such command is `post_job_report.csh`.

```
#!/bin/csh -f
# -*- Tcl -*- \
    exec vovsh -f $0 $*:q

set usage "
Description:
```

```
post_job_report.csh

Used for some jobs submitted with the bsub emulator:

Example:
% ves +LSFEMUL
% bsub -Ep $VOVDIR/etc/post/post_job_report.csh -J test.lsf_with_jobreport cal 2015
"

if { $argv == {} } {
    VovPrintUsage $usage
}

source $env(VOVDIR)/tcl/vtcl/vovlsfemulib.tcl

set jobId      [lindex $argv 0]
set logFileName [lsfEmuGetJobLogFileName $jobId]
set report     [lsfEmuFmtJobReport $jobId]

if { $logFileName ne "" } {
    VovMessage "Adding job report to $logFileName"
    set fp [open $logFileName "a"]
    puts $fp [lsfEmuFmtJobReport $jobId]
    close $fp
} else {
    VovMessage "No log file found for job $jobId\n$report"

    set whyOld ""
    set whyNew "Cannot find a log file for this job $jobId"
    if { [catch {set whyOld [vtk_prop_get $jobId WHY]}] } {
        set why $whyNew
    } else {
        set why "$whyOld\n$whyNew\n$report"
    }
    catch {vtk_prop_set $jobId WHY $why}
}

exit 0
```

The post command can be specified with the option `-Ep` of the `bsub` emulator. For example:

```
% bsub -Ep $VOVDIR/etc/post/post_job_report.csh [OTHER OPTIONS]
... command
```

### Debug the LSF Emulation Layer Usage

To debug as well as test and verify an LSF emulation script, it can be helpful to view the issued commands and the used options and values.

If the environment is set with variable `VOV_LOG_LSFEMUL` to the name of a file, all emulation commands will be logged in that file. For example:

```
% setenv VOV_LOG_LSFEMUL ~/lsfemul.log
% bsub sleep 11
% lsid
% cat $VOV_LOG_LSFEMUL
```

# Intellectual Property Rights Notice

Copyrights, trademarks, trade secrets, patents and third party software licenses.

Copyright © 1986-2022 Altair Engineering Inc. All Rights Reserved.

This Intellectual Property Rights Notice is exemplary, and therefore not exhaustive, of intellectual property rights held by Altair Engineering Inc. or its affiliates. Software, other products, and materials of Altair Engineering Inc. or its affiliates are protected under laws of the United States and laws of other jurisdictions. In addition to intellectual property rights indicated herein, such software, other products, and materials of Altair Engineering Inc. or its affiliates may be further protected by patents, additional copyrights, additional trademarks, trade secrets, and additional other intellectual property rights. For avoidance of doubt, copyright notice does not imply publication. Copyrights in the below are held by Altair Engineering Inc. except where otherwise explicitly stated. Additionally, all non-Altair marks are the property of their respective owners.

This Intellectual Property Rights Notice does not give you any right to any product, such as software, or underlying intellectual property rights of Altair Engineering Inc. or its affiliates. Usage, for example, of software of Altair Engineering Inc. or its affiliates is governed by and dependent on a valid license agreement.

## **Altair Simulation Products**

Altair® AcuSolve® ©1997-2022

Altair Activate® ©1989-2022

Altair® BatteryDesigner™ ©2019-2022

Altair Compose® ©2007-2022

Altair® ConnectMe™ ©2014-2022

Altair® EDEM™ © 2005-2022 Altair Engineering Limited, © 2019-2022 Altair Engineering Inc.

Altair® ElectroFlo™ ©1992-2022

Altair Embed® ©1989-2022

Altair Embed® SE ©1989-2022

Altair Embed®/Digital Power Designer ©2012-2022

Altair Embed® Viewer ©1996-2022

Altair® ESAComp® ©1992-2022

Altair® Feko® ©1999-2022 Altair Development S.A. (Pty) Ltd., ©1999-2022 Altair Engineering Inc.

Altair® Flow Simulator™ ©2016-2022

Altair® Flux® ©1983-2022

Altair® FluxMotor® ©2017-2022

Altair® HyperCrash® ©2001-2022

Altair® HyperGraph® ©1995-2022

Altair® HyperLife® ©1990-2022

Altair® HyperMesh® ©1990-2022



---

Altair® HyperStudy® ©1999-2022  
Altair® HyperView® ©1999-2022  
Altair® HyperWorks® ©1990-2022  
Altair® HyperXtrude® ©1999-2022  
Altair® Inspire™ ©2009-2022  
Altair® Inspire™ Cast ©2011-2022  
Altair® Inspire™ Extrude Metal ©1996-2022  
Altair® Inspire™ Extrude Polymer ©1996-2022  
Altair® Inspire™ Form ©1998-2022  
Altair® Inspire™ Friction Stir Welding ©1996-2022  
Altair® Inspire™ Mold ©2009-2022  
Altair® Inspire™ PolyFoam ©2009-2022  
Altair® Inspire™ Play ©2009-2022  
Altair® Inspire™ Print3D ©2022  
Altair® Inspire™ Render ©1993-2016 Solid Iris Technologies Software Development One PLLC, © 2016-2022 Altair Engineering Inc.  
Altair® Inspire™ Resin Transfer Molding ©1990-2022  
Altair® Inspire™ Studio ©1993-2022  
Altair® Material Data Center™ ©2019-2022  
Altair® MotionSolve® ©2002-2022  
Altair® MotionView® ©1993-2022  
Altair® Multiscale Designer® ©2011-2022  
Altair® nanoFluidX® ©2013-2022 Altair Engineering GmbH, © 2018-2022 Altair Engineering Inc.  
Altair® OptiStruct® ©1996-2022  
Altair® PollEx™ ©2003-2022  
Altair® Pulse™ ©2020-2022  
Altair® Radioss® ©1986-2022  
Altair® SEAM® © 1985-2019 Cambridge Collaborative, Inc., © 2019-2022 Altair Engineering Inc.  
Altair® SimLab® ©2004-2022  
Altair® SimSolid® ©2015-2022  
Altair® ultraFluidX® ©2010-2022 Altair Engineering GmbH, © 2018-2022 Altair Engineering Inc.  
Altair® Virtual Wind Tunnel™ ©2012-2022  
Altair® WinProp™ ©2000-2022

---

Altair® WRAP™ ©1998-2022 Altair Engineering AB

Altair® S-FRAME® © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

Altair® S-STEEL™ © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

Altair® S-PAD™ © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

Altair® S-CONCRETE™ © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

Altair® S-LINE™ © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

Altair® S-TIMBER™ © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

Altair® S-FOUNDATION™ © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

Altair® S-CALC™ © 1995-2022 Altair Engineering Canada, Ltd., © 2021-2022 Altair Engineering Inc.

### **Altair Packaged Solution Offerings (PSOs)**

Altair® Automated Reporting Director™ ©2008-2022

Altair® e-Motor Director™ ©2019-2022

Altair® Geomechanics Director™ ©2011-2022

Altair® Impact Simulation Director™ ©2010-2022

Altair® Model Mesher Director™ ©2010-2022

Altair® NVH Director™ ©2010-2022

Altair® Squeak and Rattle Director™ ©2012-2022

Altair® Virtual Gauge Director™ ©2012-2022

Altair® Weld Certification Director™ ©2014-2022

Altair® Multi-Disciplinary Optimization Director™ ©2012-2022

### **Altair HPC & Cloud Products**

Altair® PBS Professional® ©1994-2022

Altair® Control™ ©2008-2022

Altair® Access™ ©2008-2022

Altair® Accelerator™ ©1995-2022

Altair® Accelerator™ Plus ©1995-2022

Altair® FlowTracer™ ©1995-2022

Altair® Allocator™ ©1995-2022

Altair® Monitor™ ©1995-2022

Altair® Hero™ ©1995-2022

Altair® Software Asset Optimization (SAO) ©2007-2022

Altair Mistral™ ©2022

Altair Drive ©2021-2022

Altair® Grid Engine® ©2001, 2011-2022

Altair® DesignAI™ ©2022

Altair Breeze™ ©2022

### **Altair Data Analytics Products**

Altair® Knowledge Studio® © 1994-2022 Altair Engineering Canada, Ltd., © 2018-2022 Altair Engineering Inc.

Altair® Knowledge Studio® for Apache Spark © 1994-2022 Altair Engineering Canada, Ltd., © 2018-2022 Altair Engineering Inc.

Altair® Knowledge Seeker™ © 1994-2022 Altair Engineering Canada, Ltd., © 2018-2022 Altair Engineering Inc.

Altair® Knowledge Hub™ © 2017-2022 Datawatch Corporation, © 2018-2022 Altair Engineering Inc.

Altair® Monarch® © 1996-2022 Datawatch Corporation, © 2018-2022 Altair Engineering Inc.

Altair® Panopticon™ © 2004-2022 Datawatch Corporation, © 2018-2022 Altair Engineering Inc.

Altair® SmartWorks™ © 2021-2022

Altair SmartCore™ © 2011-2022

Altair SmartEdge™ © 2011-2022

Altair SmartSight™ © 2011-2022

**Altair One™** ©1994-2022

### **Third Party Software Licenses**

AcuConsole contains material licensed from Intelligent Light ([www.ilight.com](http://www.ilight.com)) and used by permission.

For a complete list of Altair Accelerator Third Party Software Licenses, please click [here](#).

---

# Technical Support

Altair provides comprehensive software support via web FAQs, tutorials, training classes, telephone and e-mail.

## Altair One Customer Portal

Altair One (<https://altairone.com/>) is Altair's customer portal giving you access to product downloads, Knowledge Base and customer support. We strongly recommend that all users create an Altair One account and use it as their primary means of requesting technical support.

Once your customer portal account is set up, you can directly get to your support page via this link: [www.altair.com/customer-support/](http://www.altair.com/customer-support/).

## Altair Training Classes

Altair training courses provide a hands-on introduction to our products, focusing on overall functionality. Courses are conducted at our main and regional offices or at your facility. If you are interested in training at your facility, please contact your account manager for more details. If you do not know who your account manager is, e-mail your local support office and your account manager will contact you

## Telephone and E-mail

If you are unable to contact Altair support via the customer portal, you may reach out to the technical support desk via phone or e-mail. You can use the following table as a reference to locate the support office for your region.

When contacting Altair support, please specify the product and version number you are using along with a detailed description of the problem. It is beneficial for the support engineer to know what type of workstation, operating system, RAM, and graphics board you have, so please include that in your communication.

Location	Telephone	E-mail
Australia	+61 3 9866 5557 +61 4 1486 0829	<a href="mailto:anz-pbssupport@altair.com">anz-pbssupport@altair.com</a>
China	+86 21 6117 1666	<a href="mailto:pbs@altair.com.cn">pbs@altair.com.cn</a>
France	+33 (0)1 4133 0992	<a href="mailto:pbssupport@europe.altair.com">pbssupport@europe.altair.com</a>
Germany	+49 (0)7031 6208 22	<a href="mailto:pbssupport@europe.altair.com">pbssupport@europe.altair.com</a>
India	+91 80 66 29 4500 +1 800 208 9234 (Toll Free)	<a href="mailto:pbs-support@india.altair.com">pbs-support@india.altair.com</a>
Italy	+39 800 905595	<a href="mailto:pbssupport@europe.altair.com">pbssupport@europe.altair.com</a>
Japan	+81 3 6225 5821	<a href="mailto:pbs@altairjp.co.jp">pbs@altairjp.co.jp</a>
Korea	+82 70 4050 9200	<a href="mailto:support@altair.co.kr">support@altair.co.kr</a>
Malaysia	+91 80 66 29 4500	<a href="mailto:pbs-support@india.altair.com">pbs-support@india.altair.com</a>

Location	Telephone	E-mail
	+1 800 208 9234 (Toll Free)	
North America	+1 248 614 2425	<a href="mailto:pbssupport@altair.com">pbssupport@altair.com</a>
Russia	+49 7031 6208 22	<a href="mailto:pbssupport@europe.altair.com">pbssupport@europe.altair.com</a>
Scandinavia	+46 (0) 46 460 2828	<a href="mailto:pbssupport@europe.altair.com">pbssupport@europe.altair.com</a>
Singapore	+91 80 66 29 4500 +1 800 208 9234 (Toll Free)	<a href="mailto:pbs-support@india.altair.com">pbs-support@india.altair.com</a>
South Africa	+27 21 831 1500	<a href="mailto:pbssupport@europe.altair.com">pbssupport@europe.altair.com</a>
South America	+55 11 3884 0414	<a href="mailto:br_support@altair.com">br_support@altair.com</a>
United Kingdom	+44 (0)1926 468 600	<a href="mailto:pbssupport@europe.altair.com">pbssupport@europe.altair.com</a>

See [www.altair.com](http://www.altair.com) for complete information on Altair, our team and our products.

# 3rd Party Licenses

## **argparse**

Copyright (c) 2017, Hilton Bristow

All rights reserved.

## **ArgumentParser**

A slimline C++ class for parsing command-line arguments

Copyright (c) 2017, Hilton Bristow All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

## **Boost**

Portions of the Boost collection of C++ libraries are used in certain Altair Engineering software to aid in software portability across platforms.

Boost Software License - Version 1.0 - August 17th, 2003

Permission is hereby granted, free of charge, to any person or organization obtaining a copy of the software and accompanying documentation covered by this license (the "Software") to use, reproduce, display, distribute, execute, and transmit the Software, and to prepare derivative works of the Software, and to permit third-parties to whom the Software is furnished to do so, all subject to the following:

The copyright notices in the Software and this entire statement, including the above license grant, this restriction and the following disclaimer, must be included in all copies of the Software, in whole or in part, and all derivative works of the Software, unless such copies or derivative works are solely in the form of machine-executable object code generated by a source language processor.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR ANYONE DISTRIBUTING

THE SOFTWARE BE LIABLE FOR ANY DAMAGES OR OTHER LIABILITY, WHETHER IN CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## **Bootstrap**

Version: 4.3.1

The MIT License (MIT)

Copyright (c) 2011-2021 Twitter, Inc.

Copyright (c) 2011-2021 The Bootstrap Authors

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## **client-oauth2**

Version: 4.2.5

Copyright 2014 (c) MuleSoft, Inc.

Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at <http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

## **commander.js**

(The MIT License)

Copyright (c) 2011 TJ Holowaychuk <tj@vision-media.ca>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the 'Software'), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED 'AS IS', WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY

CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **esbuild**

MIT License

Copyright (c) 2020 Evan Wallace

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **formik**

Version: 1.5.2

Apache License

Version 2.0, January 2004

<https://www.apache.org/licenses/>

## **TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION**

### **1. Definitions.**

"License" shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document. "Licensor" shall mean the copyright owner or entity authorized by the copyright owner that is granting the License. "Legal Entity" shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, "control" means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50%) or more of the outstanding shares, or (iii) beneficial ownership of such entity.

"You" (or "Your") shall mean an individual or Legal Entity exercising permissions granted by this License. "Source" form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files. "Object" form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types. "Work" shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is included in or attached to the work (an example is provided in the Appendix below).

"Derivative Works" shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original



work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

"Contribution" shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner. For the purposes of this definition, "submitted" means any form of electronic, verbal, or written communication sent to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as "Not a Contribution."

"Contributor" shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

**2. Grant of Copyright License.**

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.

**3. Grant of Patent License.**

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses granted to You under this License for that Work shall terminate as of the date such litigation is filed.

**4. Redistribution.**

You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:

- a.** You must give any other recipients of the Work or Derivative Works a copy of this License; and
- b.** You must cause any modified files to carry prominent notices stating that You changed the files; and
- c.** You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and
- d.** If the Work includes a "NOTICE" text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and may provide additional or different license terms and conditions for use, reproduction, or distribution of Your modifications, or for any such Derivative Works as a whole, provided Your use, reproduction, and distribution of the Work otherwise complies with the conditions stated in this License.

**5. Submission of Contributions.**

Unless You explicitly state otherwise, any Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.

**6. Trademarks.**

This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

**7. Disclaimer of Warranty.**

Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.

**8. Limitation of Liability.**

In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

**9. Accepting Warranty or Additional Liability.**

While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify, defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

**END OF TERMS AND CONDITIONS**

Copyright 2020 Formik, Inc.

Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at <https://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

---

## Fossil SCM

The Fossil software configuration management tool is used in certain Altair Engineering software to provide versioning capabilities for various configuration files. Fossil is released under a 2-clause BSD license:

Copyright 2007 D. Richard Hipp. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE AUTHORS ``AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHORS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The views and conclusions contained in the software and documentation are those of the authors and contributors and should not be interpreted as representing official policies, either expressed or implied, of anybody else.

## GD Graphics Library

The built-in graphics capabilities of the software take advantage of the GD Graphics Library, which is available from <http://www.boutell.com/gd>. More detail on the GD Graphics Library is available at <http://www.boutell.com/gd/index.html> on the <http://www.boutell.com> web site.

The GD Graphics Library distribution used is *gd-2.0.33*.

## GNU Utilities for Windows

The LicenseMonitor™ LicenseManager functionality employs CVS (Concurrent Versions System) to maintain a history of changes to licensing files. It also makes use of the file program in order to determine file types. This utility requires the magic, regex, and zlib DLLs on Windows. On Unix-based systems, these utilities and their required libraries are normally already present in the operating system loadset, but they are not normally present on Windows systems. The cvs, file, and gzip programs are included in the Windows distribution of Altair Engineering software, as are the aforementioned DLLs that are required for the file program.

The distribution of CVS included in this version of Altair Engineering software is 1.11.22. The distribution of file (and magic) included in this version of Altair Engineering software is 5.03.3414.

The distribution of regex2 included in this version of Altair Engineering software is 2.7.2853. The distribution of zlib1 included in this version of Altair Engineering software is 1.2.8.

The distribution of gzip included in this version of Altair Engineering software is 1.2.4.

All of these software components are released under the [GNU Public License \(GPL\)](#).

## Graphviz -- Graphical Visualization Software

Altair Engineering software makes use of Graphviz libraries as part of its console Graphical User Interface (GUI). The version of Graphviz distributed with this version of Altair Engineering software is 2.38.0. The Graphviz license can be viewed at <http://www.graphviz.org/License.php>.

Altair Engineering has modified the Graphviz libraries for its use with Altair Engineering products. To obtain a copy of the modified Graphviz libraries, please contact <https://www.pbsworks.com/ContactSupport.aspx>.

### history

Version: 4.9.0

MIT License

Copyright (c) React Training 2016-2018

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### hwloc

Altair Engineering uses version 2.0.4 of the [hwloc](#) library. *hwloc* is distributed under the [New BSD License](#), listed below.

Copyright © 2004-2006 The Trustees of Indiana University and Indiana University Research and Technology Corporation. All rights reserved.

Copyright © 2004-2005 The University of Tennessee and The University of Tennessee Research Foundation. All rights reserved.

Copyright © 2004-2005 High Performance Computing Center Stuttgart, University of Stuttgart. All rights reserved.

Copyright © 2004-2005 The Regents of the University of California. All rights reserved.

Copyright © 2009 CNRS

Copyright © 2009-2016 Inria. All rights reserved.

Copyright © 2009-2015 Université Bordeaux

Copyright © 2009-2015 Cisco Systems, Inc. All rights reserved.

Copyright © 2009-2012 Oracle and/or its affiliates. All rights reserved.

Copyright © 2010 IBM

Copyright © 2010 Jirka Hladky

Copyright © 2012 Aleksey Saushev, The NetBSD Foundation

Copyright © 2012 Blue Brain Project, EPFL. All rights reserved.

Copyright © 2013-2014 University of Wisconsin-La Crosse. All rights reserved.

Copyright © 2015 Research Organization for Information Science and Technology (RIST). All rights reserved.

Copyright © 2015-2016 Intel, Inc. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE AUTHOR ``AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

### **[incr Tcl]**

The [incr Tcl] software is used in constructing single-file distributables of Altair Engineering software. The distribution of [incr Tcl] included in this version of Altair Engineering software is that which is included in the TclKit 1.8.5 distribution. [incr Tcl] is licensed under a BSD-style license:

This software is copyrighted by Lucent Technologies, Inc., and other parties. The following terms apply to all files associated with the software unless explicitly disclaimed in individual files.

The authors hereby grant permission to use, copy, modify, distribute, and license this software and its documentation for any purpose, provided that existing copyright notices are retained in all copies and that this notice is included verbatim in any distributions. No written agreement, license, or royalty fee is required for any of the authorized uses. Modifications to this software may be copyrighted by their authors and need not follow the licensing terms described here, provided that the new terms are clearly indicated on the first page of each file where they apply.

IN NO EVENT SHALL THE AUTHORS OR DISTRIBUTORS BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS SOFTWARE, ITS DOCUMENTATION, OR ANY DERIVATIVES THEREOF, EVEN IF THE AUTHORS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE AUTHORS AND DISTRIBUTORS SPECIFICALLY DISCLAIM ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT. THIS SOFTWARE IS PROVIDED ON AN "AS IS" BASIS, AND THE AUTHORS AND DISTRIBUTORS HAVE NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

## **jsdom**

Copyright (c) 2010 Elijah Insua

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## **jwt-decode**

Version: 2.2.0

The MIT License (MIT)

Copyright (c) 2015 Auth0, Inc. <support@auth0.com> (<http://auth0.com>)

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## **Metakit**

The Metakit software is used in constructing single-file distributables of Altair Engineering software. The distribution of Metakit included in this version of Altair Engineering software is that which is included in the TclKit 1.8.5 distribution. Metakit is licensed under an MIT-style license:

Copyright (c) 1996-2020 Jean-Claude Wippler

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

---

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **mysqldb**

Altair Engineering makes use of the [mysqldb](#) MySQL Tcl Interface library. Distribution version: 3.05.

Copyright (c) 1994, 1995 Hakan Soderstrom, Enskede, Sweden and Tom Poindexter, Denver, Colorado

Permission to use, copy, modify, distribute, and sell this software and its documentation for any purpose is hereby granted without fee, provided that the above copyright notice and this permission notice appear in all copies of the software and related documentation.

THE SOFTWARE IS PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EXPRESS, IMPLIED OR OTHERWISE, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL HAKAN SODERSTROM OR SODERSTROM PROGRAMVARUVERKSTAD AB BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND, OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER OR NOT ADVISED OF THE POSSIBILITY OF DAMAGE, AND ON ANY THEORY OF LIABILITY, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

### **nginx**

The nginx software is used by Altair Engineering software to provide the entry point for HTTP/HTTPS communications between the Altair Engineering web server and remote web clients. The distribution of nginx included in this version of Altair Engineering software is 1.9.2. nginx is licensed under a [BSD-style license](#).

### **node-canvas**

This is free and unencumbered software released into the public domain.

Anyone is free to copy, modify, publish, use, compile, sell, or distribute this software, either in source code form or as a compiled binary, for any purpose, commercial or non-commercial, and by any means.

In jurisdictions that recognize copyright laws, the author or authors of this software dedicate any and all copyright interest in the software to the public domain. We make this dedication for the benefit of the public at large and to the detriment of our heirs and successors. We intend this dedication to be an overt act of relinquishment in perpetuity of all present and future rights to this software under copyright law.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

For more information, please refer to <http://unlicense.org>

## Oat++

Copyright 2021 Altair Engineering, Inc.

Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at <http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.

See the License for the specific language governing permissions and limitations under the License.

## Octtools

This software also uses packages from the Octtools-5.1 distribution from UC Berkeley, namely: *errtrap options st timer utility*

Octtools are covered by the following copyright notice:

Oct Tools Distribution 5.1

Copyright © 1988, 1989, 1990, 1991 Regents of the University of California.

All rights reserved.

Use and copying of this software and preparation of derivative works based upon this software are permitted. However, any distribution of this software or derivative works must include the above copyright notice.

This software is made available AS IS, and neither the Electronics Research Laboratory or the University of California make any warranty about the software, its performance or its conformity to any specification.

Suggestions, comments, or improvements are welcome and should be addressed to:

[octtools@eros.berkeley.edu](mailto:octtools@eros.berkeley.edu)

These packages have been developed at UC Berkeley from 1985 to 1991 by the Berkeley CAD group. Special thanks to David Harrison, Tom Laidig, Peter Moore, Richard Rudell, Rick Spickelmeir.

## OpenLDAP

The [OpenLDAP](#) client library is utilized by the `vovserver` binary to perform LDAP-based authentication. OpenLDAP software is released under the [OpenLDAP Public License](#):

The OpenLDAP Public License Version 2.8, 17 August 2003

Redistribution and use of this software and associated documentation ("Software"), with or without modification, are permitted provided that the following conditions are met:

1. Redistributions in source form must retain copyright statements and notices,
2. Redistributions in binary form must reproduce applicable copyright statements and notices, this list of conditions, and the following disclaimer in the documentation and/or other materials provided with the distribution, and
3. Redistributions must contain a verbatim copy of this document.

The OpenLDAP Foundation may revise this license from time to time. Each revision is distinguished by a version number. You may use this Software under terms of this license revision or under the terms of any subsequent revision of the license.

THIS SOFTWARE IS PROVIDED BY THE OPENLDAP FOUNDATION AND ITS CONTRIBUTORS ``AS IS'' AND ANY EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL



THE OPENLDAP FOUNDATION, ITS CONTRIBUTORS, OR THE AUTHOR(S) OR OWNER(S) OF THE SOFTWARE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The names of the authors and copyright holders must not be used in advertising or otherwise to promote the sale, use or other dealing in this Software without specific, written prior permission. Title to copyright in this Software shall at all times remain with copyright holders.

OpenLDAP is a registered trademark of the OpenLDAP Foundation.

Copyright 1999-2020 The OpenLDAP Foundation, Redwood City, California, USA. All Rights Reserved. Permission to copy and distribute verbatim copies of this document is granted.

## **OpenSSL**

Altair Engineering software makes use of OpenSSL libraries to provide secure communications to various services. The version of OpenSSL distributed with this version of Altair Engineering software on Unix-based platforms is 1.0.2a, and on Windows, is 1.0.2e. The OpenSSL license can be viewed at <https://www.openssl.org/source/license.html>.

## **pgtcl-ng**

Altair Engineering software makes use of the **pgtcl-ng** PostgreSQL Tcl Interface library. Distribution version: 2.0.0.

This is the license for pgtcl-ng:

Portions Copyright © 2004-2020, L Bayuk

Portions Copyright © 1996-2020, PostgreSQL Global Development Group

Portions Copyright © 1994, The Regents of the University of California

PostgreSQL is Copyright © 1996-2020 by the PostgreSQL Global Development Group and is distributed under the terms of the license of the University of California below.

Postgres95 is Copyright © 1994-5 by the Regents of the University of California.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose, without fee, and without a written agreement is hereby granted, provided that the above copyright notice and this paragraph and the following two paragraphs appear in all copies.

IN NO EVENT SHALL THE AUTHORS OR DISTRIBUTORS BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, ARISING OUT OF THE USE OF THIS SOFTWARE AND ITS DOCUMENTATION, EVEN IF THE AUTHORS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE AUTHORS AND DISTRIBUTORS SPECIFICALLY DISCLAIM ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE SOFTWARE PROVIDED HEREUNDER IS ON AN "AS IS" BASIS, AND THE AUTHORS AND DISTRIBUTORS HAVE NO OBLIGATIONS TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

## PostgreSQL

Altair Engineering software makes use of [PostgreSQL](#) database for its back-end data storage reporting needs. PostgreSQL database is released under the [PostgreSQL License](#). Distribution version: 9.6.1.

PostgreSQL is released under the PostgreSQL License, a liberal Open Source license, similar to the BSD or MIT licenses.

PostgreSQL Database Management System (formerly known as Postgres, then as Postgres95)

Portions Copyright (c) 1996-2020, The PostgreSQL Global Development Group

Portions Copyright (c) 1994, The Regents of the University of California

Permission to use, copy, modify, and distribute this software and its documentation for any purpose, without fee, and without a written agreement is hereby granted, provided that the above copyright notice and this paragraph and the following two paragraphs appear in all copies.

IN NO EVENT SHALL THE UNIVERSITY OF CALIFORNIA BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, ARISING OUT OF THE USE OF THIS SOFTWARE AND ITS DOCUMENTATION, EVEN IF THE UNIVERSITY OF CALIFORNIA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE UNIVERSITY OF CALIFORNIA SPECIFICALLY DISCLAIMS ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE SOFTWARE PROVIDED HEREUNDER IS ON AN "AS IS" BASIS, AND THE UNIVERSITY OF CALIFORNIA HAS NO OBLIGATIONS TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

## react

Version: 16.9.0

MIT License

Copyright (c) Facebook, Inc. and its affiliates.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## react-bootstrap

Version: 1.0.0-beta.12

The MIT License (MIT)

Copyright (c) 2014-present Stephen J. Collings, Matthew Honnibal, Pieter Vanderwerff

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-bootstrap-table-next**

Version: 4.0.3

MIT License

Copyright (c) 2018 react-bootstrap-table2

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-cookies**

Version: 0.1.1

MIT License

Copyright (c) 2019 Bu Kinoshita <bukinoshita@gmail.com>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE,

ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-data-grid**

Version: 7.0.0-canary.15

The MIT License (MIT)

Original work Copyright (c) 2014 Prometheus Research

Modified work Copyright 2015 Adazzle

For the original source code please see <https://github.com/prometheusresearch/react-grid>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-dom**

Version: 16.11.0

MIT License

Copyright (c) Facebook, Inc. and its affiliates.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-grid-layout**

Version: 0.16.6

The MIT License (MIT)

---

Copyright (c) 2016 Samuel Reed

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-items-carousel**

Version: 2.8.0

Copyright (c) 2017, Gajus Kuizinas (<http://gajus.com/>)

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of the Gajus Kuizinas (<http://gajus.com/>) nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL ANY PARTY BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFITS OR BUSINESS INTERRUPTION) ARISING FROM ANY CAUSE WHATSOEVER, INCLUDING WHETHER OR NOT SUCH DAMAGE IS CAUSED BY ANY INFORMATION SYSTEMS PROVIDER, WHETHER OR NOT THE SAME IS PROMOTED OR OTHERWISE RECOMMENDED BY THE DISTRIBUTOR, SPONSOR OR OTHERWISE REPRESENTED BY THE COPYRIGHT HOLDERS OR CONTRIBUTORS OF THIS SOFTWARE.

### **react-page-visibility**

Version: 6.4.0

The MIT License (MIT)

Copyright (c) Gilad Peleg <[gilad@giladpeleg.com](mailto:gilad@giladpeleg.com)> (<https://www.giladpeleg.com>)

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

---

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-resize-detector**

Version: 5.2.0

The MIT License (MIT)

Copyright (c) 2016 Denis Rul

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-responsive-modal**

Version: 4.0.1

The MIT License (MIT)

Copyright (c) 2020 Léo Pradel

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-router-dom**

Version: 5.1.2

MIT License

---

Copyright (c) React Training 2016-2018

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

**react-scripts**

Version: 3.2.0

MIT License

Copyright (c) 2013-present, Facebook, Inc.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

**react-select**

Version: 3.1.0

MIT Licensed. Copyright (c) Jed Watson 2019.

**react-sparklines**

Version: 1.7.0

The MIT License (MIT)

Copyright (c) 2015 Boris Yankov

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-time-ago**

Version: 6.2.1

(The MIT License)

Copyright (c) 2016 @catamphetamine <purecatamphetamine@gmail.com>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the 'Software'), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED 'AS IS', WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **react-tooltip**

Version: 3.11.1

The MIT License (MIT)

Copyright (c) 2015 Wang Zixiao

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### **reactstrap**

Version: 8.0.1



## The MIT License (MIT)

Copyright (c) 2016-Present Eddy Hernandez, Chris Burrell, Evan Sharp

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## Reprise

This software includes and ships with Reprise Software Licensing Manager (RLM) binaries (v9.3rel) which are used to validate Altair Engineering Licenses.

Copyright © 2006-2020, Reprise Software, Inc. All Rights Reserved.

Reprise License Manager, OpenUsage, and Transparent License Policy are all trademarks of Reprise Software, Inc. RLM contains software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org>) Copyright © 1998-2020 The OpenSSL Project. All rights reserved.

<http://www.reprisesoftware.com>

## rxjs

Version: 6.3.3

Apache License

Version 2.0, January 2004

<http://www.apache.org/licenses/>

## TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

### 1. Definitions.

"License" shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

"Licensor" shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

"Legal Entity" shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, "control" means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50%) or more of the outstanding shares, or (iii) beneficial ownership of such entity.

"You" (or "Your") shall mean an individual or Legal Entity exercising permissions granted by this License.

"Source" form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

"Object" form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

"Work" shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is included in or attached to the work (an example is provided in the Appendix below).

"Derivative Works" shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

"Contribution" shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner. For the purposes of this definition, "submitted" means any form of electronic, verbal, or written communication sent to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as "Not a Contribution."

"Contributor" shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

## 2. Grant of Copyright License.

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.

## 3. Grant of Patent License.

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses granted to You under this License for that Work shall terminate as of the date such litigation is filed.

## 4. Redistribution

You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:

- a. You must give any other recipients of the Work or Derivative Works a copy of this License; and
- b. You must cause any modified files to carry prominent notices stating that You changed the files; and
- c. You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and

- d. If the Work includes a "NOTICE" text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and may provide additional or different license terms and conditions for use, reproduction, or distribution of Your modifications, or for any such Derivative Works as a whole, provided Your use, reproduction, and distribution of the Work otherwise complies with the conditions stated in this License.

**5. Submission of Contributions.**

Unless You explicitly state otherwise, any Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.

**6. Trademarks.**

This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

**7. Disclaimer of Warranty.**

Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.

**8. Limitation of Liability.**

In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

**9. Accepting Warranty or Additional Liability.**

While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify, defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS

APPENDIX: How to apply the Apache License to your work.

To apply the Apache License to your work, attach the following boilerplate notice, with the fields enclosed by brackets "[ ]" replaced with your own identifying information. (Don't include the brackets!) The text should be enclosed in the appropriate comment syntax for the file format. We also recommend that a file or class name and description of purpose be included on the same "printed page" as the copyright notice for easier identification within third-party archives.

Copyright (c) 2015-2018 Google, Inc., Netflix, Inc., Microsoft Corp. and contributors

Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at

<http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

## Sharp

Copyright 2022 Altair Engineering, Inc.

Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License.

You may obtain a copy of the License at <http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.

See the License for the specific language governing permissions and limitations under the License.

## SQLite

The SQLite database is public domain as described in <http://www.sqlite.org/copyright.html>. Distribution version: 3.8.3.

## Swagger UI

The VOV REST API interactive documentation is enabled through the use of the Swagger UI library. Swagger is licensed under the Apache 2.0 license, as described in <https://swagger.io/license/>. Distribution version: 3.18.3.

## Tcl/Tk

The graphical user interface is implemented with Tcl 8.6.5/Tk 8.6.5.

Tcl/Tk includes the following copyright notice:

This software is copyrighted by the Regents of the University of California, Sun Microsystems, Inc., and other parties. The following terms apply to all files associated with the software unless explicitly disclaimed in individual files.

The authors hereby grant permission to use, copy, modify, distribute, and license this software and its documentation for any purpose, provided that existing copyright notices are retained in all copies and that this notice is included verbatim in any distributions. No written agreement, license, or royalty fee is required for any of the authorized uses. Modifications to this software may be copyrighted by their authors and need not follow the licensing terms described here, provided that the new terms are clearly indicated on the first page of each file where they apply.

IN NO EVENT SHALL THE AUTHORS OR DISTRIBUTORS BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS SOFTWARE, ITS DOCUMENTATION, OR ANY DERIVATIVES THEREOF, EVEN IF THE AUTHORS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE AUTHORS AND DISTRIBUTORS SPECIFICALLY DISCLAIM ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT. THIS SOFTWARE IS PROVIDED ON AN "AS IS" BASIS, AND THE AUTHORS AND DISTRIBUTORS HAVE NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

GOVERNMENT USE: If you are acquiring this software on behalf of the U.S. government, the Government shall have only "Restricted Rights" in the software and related documentation as defined in the Federal Acquisition Regulations (FARs) in Clause 52.227.19 © (2). If you are acquiring the software on behalf of the Department of Defense, the software shall be classified as "Commercial Computer Software" and the Government shall have only "Restricted Rights" as defined in Clause 252.227-7013 © (1) of DFARs. Notwithstanding the foregoing, the authors grant the U.S. Government and others acting in its behalf permission to use and distribute the software in accordance with the terms specified in this license.

### **tclrmq**

The tclrmq library is used to interface with an externally-hosted RabbitMQ message broker server. The distribution of tclrmq included in this version of Altair Engineering software is 1.3.8.

Copyright (c) 2017, FlightAware LLC All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- \* Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- \* Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- \* Neither the name of the FlightAware LLC nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

### **TclVfs**

The TclVfs software is used in constructing single-file distributables of Altair Engineering software. The distribution of TclVfs included in this version of Altair Engineering software is that which is included in the TclKit 1.8.5 distribution. TclVfs is licensed under a BSD-style license:

This software is copyrighted by the Vince Darley, and other parties. The following terms apply to all files associated with the software unless explicitly disclaimed in individual files.

The authors hereby grant permission to use, copy, modify, distribute, and license this software and its documentation for any purpose, provided that existing copyright notices are retained in all copies and that this notice is included verbatim in any distributions. No written agreement, license, or royalty fee is required for any of the authorized uses. Modifications to this software

may be copyrighted by their authors and need not follow the licensing terms described here, provided that the new terms are clearly indicated on the first page of each file where they apply.

IN NO EVENT SHALL THE AUTHORS OR DISTRIBUTORS BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS SOFTWARE, ITS DOCUMENTATION, OR ANY DERIVATIVES THEREOF, EVEN IF THE AUTHORS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE AUTHORS AND DISTRIBUTORS SPECIFICALLY DISCLAIM ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT. THIS SOFTWARE IS PROVIDED ON AN "AS IS" BASIS, AND THE AUTHORS AND DISTRIBUTORS HAVE NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

### **tcpkill**

The utility 'tcpkill' has been included in the release, under the name 'vovtcpkill'. The utility comes with this copyright notice.

Copyright (c) 1999-2020 Dug Song <dugsong@monkey.org>, et al. All rights reserved, all wrongs reversed.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The names of authors may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED ``AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

### **TkConsole**

Copyright 1995-2020 Jeffrey Hobbs, jeff(a)hobbs(.)org

Release Info: v2.4, CVS v1.82 2004/11/11 17:22:13

Documentation available at: <http://tkcon.sourceforge.net>

### **treemap-squarify**

Version: 1.0.1

MIT License

Copyright (c) 2020 Clément Bataille

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge,

publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## **TWAPI**

On Windows, the TWAPI Tcl library is used to interface with the Windows API for various functions, such as service management. Distribution version: 3.1.17.

TWAPI includes the following copyright notice:

Copyright (c) 2003-2020, Ashok P. Nadkarni

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- The name of the copyright holder and any other contributors may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

## **XYNTService**

The XYNTService utility is a general-purpose Windows service wrapper that allows for the creation of custom services for programs that do not have native service support. This utility is only included in the Windows distribution of Altair Engineering software. The distribution of XYNTService included in this version of Altair Engineering software is dated 02.22.2008 and is released under the [Code Project Open License \(CPOL\)](#).

## **yup**

Version: 0.27.0"

The MIT License (MIT)

---

Copyright (c) 2014 Jason Quense

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

## **Zlib**

The 'zlib' compression library provides in-memory compression and decompression functions, including integrity checks of the uncompressed data. Distribution version: 1.2.8.

Zlib includes the following copyright notice:

Copyright © 1995-2020 Jean-loup Gailly and Mark Adler

This software is provided 'as-is', without any express or implied warranty. In no event will the authors be held liable for any damages arising from the use of this software.

Permission is granted to anyone to use this software for any purpose, including commercial applications, and to alter it and redistribute it freely, subject to the following restrictions: 1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required. 2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software. 3. This notice may not be removed or altered from any source distribution.

Jean-loup Gailly [jloup@gzip.org](mailto:jloup@gzip.org)

Mark Adler [madler@alumni.caltech.edu](mailto:madler@alumni.caltech.edu)

The data format used by the zlib library is described by RFCs (Request for Comments) 1950 to 1952 in the files <http://www.ietf.org/rfc/rfc1950.txt> (zlib format), <http://www.ietf.org/rfc/rfc1951.txt> (deflate format) and <http://www.ietf.org/rfc/rfc1952.txt> (gzip format).



# Index

## Special Characters

\$subdirectories, cleaning [73](#)

## A

Accelerator Plus User Guide overview [4](#)

access to help [6](#)

ADE, Cadence [77](#)

allocate resources, FairShare [32](#)

## B

bhist, emulated [77](#)

bhosts, emulated [77](#)

bjobs, emulated [77](#)

bkill, emulated [77](#)

bsub, emulated [77](#)

## C

c-shell, TCSH user setup [13](#)

caching, nc list [50](#)

choosing the FairShare group [32](#)

clean up log files [73](#)

command line interface [11](#)

command line, run jobs [22](#)

command, wx [9](#)

command, wxmgr [10](#)

control the environment [25, 26](#)

CPU progress and run status indicators [46](#)

CPUPROGRESS, percentage of CPU time [46](#)

CPUTIME, total CPU time accumulated [46](#)

## D

debug jobs example [76](#)

debug jobs without running Accelerator [75](#)

deep, clean option [73](#)

## E

emulation, LSF [77](#)

environment control [25, 26](#)

example, submit a single job [22](#)

example, submit multiple jobs [23](#)

## **F**

find jobclasses [30](#)

forget jobs [72](#)

## **G**

get detailed information about a job [44](#)

## **H**

help, Accelerator [6](#)

## **I**

icons [56](#)

interactive jobs [36](#)

interactive jobs restrictions and consequences [41](#)

invoke the GUI [54](#)

## **J**

job arrays [24](#)

job profiling [47](#)

job running overview [17](#)

job runtime - monitoring and profiling [46](#)

job status [45](#)

job submission arguments [33](#)

job summary [53](#)

jobclass, submit [31](#)

jobs, show current information [54](#)

## **L**

listing jobs [50](#)

log file, interactive job [36](#)

log files [28](#)

LSF

    emulation [77](#)

LSF emulation [77](#), [77](#)

LSF, platform [77](#)

## **M**

manage jobs [66](#)

metrics, scheduler [54](#)

modify running jobs [35](#)

modify scheduled jobs [39](#)

monitor job, RAM, CPU and children [46](#)

monitor workload [43](#)

monitoring jobs, taskers and resources [64](#)  
multiple jobs, submit [23](#)

## **N**

nc forget [72](#)  
nc list [50](#)  
nc stop [69](#)  
nc wait [67](#)  
nozap, clean option [73](#)

## **O**

online help [6](#)

## **P**

PDF, access [6](#)  
post-condition [28](#)  
pre-command and post-command job condition [28](#)  
pre-condition [28](#)  
pre-pending and appending arguments in a job submission [33](#)  
priority [34](#)

## **Q**

queue selection [21](#)  
quick start [8](#)

## **R**

run jobs with CLI commands [22](#)  
running interactive jobs [36](#)  
RUNSTATUS field values [46](#)

## **S**

scheduled jobs [19](#)  
scheduler metrics [54](#)  
select a named environment [26](#)  
setting up the user shell [12](#)  
showing the hosts/taskers [58](#)  
single job submit example [22](#)  
status of jobs [45](#)  
stop jobs [69](#)  
stuck job, troubleshoot with LASTCUPROGRESS [46](#)  
submission of jobs with pre-condition or post-condition [28](#)  
submit jobs to Accelerator Plus [20](#)  
submit jobs using jobclasses [31](#)  
submit jobs with CLI commands [22](#)

submitted job information display [18](#)

## T

third party licenses [86](#)

troubleshoot stuck jobs [46](#)

## U

use Accelerator help [6](#)

use jobclasses [30](#)

use vovselect for querying [59](#)

user setup: bourne shell, k-shell, z-shell, bash [14](#)

user setup: c-shell, TCSH [13](#)

user setup: Windows command shell [15](#)

user shell setup [12](#)

using snapshot with named environment [26](#)

## V

verify your setup [16](#)

vnc\_logs, cleaning [73](#)

vov [12](#)

VOV [77](#)

VOV\_ENV [25](#)

VOV\_JOB\_DESC [47](#)

VOV\_LIMIT\_cputime [69](#)

VOV\_LOG\_LSFEMUL [77](#)

VOV\_STDOUT\_SPEC [6](#)

VOV\_STOP\_SIGNAL\_DELAY [69](#)

VOV\_STOP\_SIGNALS [69](#)

vovarch [12](#)

VOVARCH [25](#)

vovbrowser [6](#)

vovbuild [6](#), [56](#)

vovconsole [54](#)

VOVDIR [12](#), [47](#)

vovdoc [6](#), [6](#)

vovenvutils [25](#)

vovfsgroup [32](#)

vovid [6](#)

vovinit [12](#)

vovlsfemulib [77](#)

vovmemtime [69](#)

VovMessage [77](#)

VovPrintUsage [77](#)

vovrc [12](#)

vovselect [58](#)

vovserver [6](#), [75](#), [76](#)  
vovsetupuser [12](#)  
vovsh [77](#)  
vovshow [32](#), [69](#)  
vovtasker [46](#), [69](#), [75](#), [76](#)  
vovtaskers [58](#)  
vovversion [12](#)  
vovwxd [4](#)  
vsz, cleaning [73](#)  
vtk\_prop\_get [77](#)  
vtk\_prop\_set [77](#)  
vtk\_resourcemap\_set [34](#)

## **W**

waiting, stopping, cleaning, debugging jobs [67](#)  
what happens when jobs are running [17](#)  
wx clean [73](#)  
wx command [9](#)  
wx forget [72](#)  
wx gui [54](#)  
wx wait [67](#)  
wxmgr command [10](#)