
Kompira Documentation

Release 1.6.11

Kompira development team

Apr 23, 2025

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ADMINISTRATION GUIDE

Author

Kompira development team

1.1 Introduction

This manual contains useful information to help the user know how best to manage Kompira.

Please refer to this manual to learn about installation, updates, overall Kompira settings and logs etc.

In this manual, we use \$ for general user and # for root user on Linux command prompt.

```
$ echo 'command execution by general user'
# echo 'command execution by root privileged user'
```

1.2 Kompira package management

This manual will explain the installation and updates of Kompira related packages.

See also:

In this section, only the circumstances where the Kompira package is operated on a single server are explained. Please refer to [High Availability \(HA\) Management](#) for details on how to run Kompira in a redundant configuration.

1.2.1 Type of installation package

Kompira has the following types of packages.

Package name	Description
Kompira Pack- age	Packages containing Kompira itself. Including: Kompira core function group, job manager and event transmission script.
Job manager package	Packages that includes a job manager and an event transmission script.
Send-Event package	Packages including Send-Event scripts

If you are using Kompira for the first time, please first install the Kompira package.

Use the job manager package when you want to start the job manager process, in addition to the server on which the Kompira package is installed.

The send-event package is used when you want to send an event to Kompira from another server. For integration between systems using event sending, please refer to *Coordination with other systems* .

1.2.2 Install Script

By using install.sh, you can install Kompira’s various packages.

```
install.sh [options]
```

The installation process includes installation of middleware to be used by Kompira, construction of databases and automatic startup of processes.

install.sh creates a log file named *install.<process number>.log* regardless of the success or failure of the command.

Note: Before installing on Red Hat, you need to subscribe in advance.

Limitation

install.sh is supported only for RHEL / CentOS installation.

Install.sh downloads various middleware used by Kompira. Please run it when you are able to connect to the Internet.

When connecting to the Internet via a proxy, run install.sh with the `--proxy` option as follows:

```
# ./install.sh --proxy proxy:3128
```

Note: Please set “proxy” and “3128” as the proxy server’s host name (or IP address) and port number.

For a proxy server with authentication, run install.sh with “user” as the user name and “password” as the password as shown below.

```
# ./install.sh --proxy user:password@proxy:3128
```

Command Line Options

The options that can be specified for install.sh are as follows.

Options	Description
<code>--https</code>	Restricts access to only HTTPS to the Kompira server (default from Kompira v1.5.0). When accessed with HTTP, it will automatically be redirected to HTTPS.
<code>--no-https</code>	Allows HTTP access to the Kompira server.
<code>--amqps</code>	Protect AMQP access to the Kompira server with SSL (default since Kompira v1.6.8).
<code>--amqps-verify</code>	Protect AMQP access to the Kompira server with SSL (with SSL certificate verification).
<code>--no-amqps</code>	AMQP access to the Kompira server is not protected by SSL.
<code>--allow-insecure-amqp</code>	Allows external non-SSL AMQP access to the Kompira server.
<code>--backup</code>	Backup and restore databases.

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Table 1 – continued from previous page

Options	Description
<code>--no-backup</code>	Skips the database backup and restore processes.
<code>--backup-process</code>	Include process objects when retrieving database backups.
<code>--no-backup-process</code>	Exclude process objects when retrieving database backups.
<code>--rhui</code>	Install in RHUI mode.
<code>--rhel-option-repo</code> <code><repo></code>	Specify RHEL repository.
<code>--skip-python3-install</code>	Skip python3 installation.
<code>--skip-cluster-start</code>	Skip pcs cluster start for update installations in redundant configurations.
<code>--skip-rabbitmq-update</code>	Skip updating rabbitmq-server.
<code>--skip-postgresql-update</code>	Skip updating postgresql.
<code>--rabbitmq-version <ver></code>	Specifies the rabbitmq-server version to install. (e.g. 3.10.*)
<code>--postgresql-version</code> <code><ver></code>	Specifies the postgresql version to install. (16, 16.4, 16.*, etc.)
<code>--initdata</code>	Explicitly initialize the database.
<code>--initfile</code>	Explicitly initialize the storage destination of the attached file.
<code>--secret-key</code> <code><secret-key></code>	The encryption key string for the password field. (The key must be at least 8 characters long.)
<code>--force</code>	Even if the major version of Kompira is different, it will force the installation. Also, it will delete the database without confirmation when there is an existing database, initialize the database and attempt installation.
<code>--proxy <proxy></code>	Specify the URL of the proxy server and install. The proxy server specified here is set as the environment variable of the Kompira service, and it is also applied when accessing external HTTP from the job flow.
<code>--temp-proxy <proxy></code>	Specify the URL of the proxy server to be applied only during installation and install.
<code>--noproxy <hosts></code>	Specify a comma-separated list of hosts to be excluded from the proxy server.
<code>--temp-noproxy <hosts></code>	Specify the proxy exclusion setting for installation only.
<code>--locale-lang <LANG></code>	Specify the locale and install.
<code>--locale-timezone</code> <code><ZONENAME></code>	Specify the time zone and install.
<code>--jobmgr <kompira_ip></code>	Install and update the Job Manager package. It is necessary to specify the host name or IP address of the server on which the Kompira package is installed.
<code>--sendevt <kompira_ip></code>	This will install and update the send-event package. It is necessary to specify the host name or IP address of the server on which the Kompira package is installed.
<code>--with-rpm <rpms></code>	Install with additional rpm packages.
<code>--with-whl <wheels></code>	Install with additional wheel packages.
<code>--with-gdb</code>	Install tools necessary for debugging Kompira.
<code>--offline</code>	Install in offline mode using the kompira-extra package.
<code>--extra</code>	Create the kompira-extra package for offline install.
<code>--extra-without-ha</code>	Create the kompira-extra package without the HA packages.
<code>--install-only</code>	Installation only, each daemon is not started.
<code>--dry-run</code>	Runs in dry run mode. Only parameter check, no actual setup is performed.
<code>--help</code>	Print help message.

The jobmgr and sendevt options are exclusive.

New in version 1.6.2: The `--extra` and `--secret-key` options have been added.

New in version 1.6.4: The `--extra-without-ha` option has been added.

New in version 1.6.6: The `--skip-cluster-start` option has been added.

New in version 1.6.7: The `--install-only` option has been added.

New in version 1.6.8: The `--amqps`, `--amqps-verify`, `--no-amqps` and `--allow-insecure-amqp` options have been added.

New in version 1.6.8.post2: The `--skip-rabbitmq-update` and `--rabbitmq-version` options have been added.

New in version 1.6.10: The `--backup`, `--no-backup-process`, `--skip-postgresql-update` and `--postgresql-version` options have been added.

1.2.3 Kompira Package

How to install and update the Kompira package itself.

Installation

Extract the Kompira package and run `install.sh`. Replace `<version>` with the version number of Kompira.

```
$ tar xzf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh
[2020-09-17 02:00:24] ****:
↳ *****
[2020-09-17 02:00:24] ****: Kompira-1.6.0:
[2020-09-17 02:00:24] ****: Start: Install the Kompira
[2020-09-17 02:00:24] ****:
[2020-09-17 02:00:24] INFO:      SYSTEM                = CENT
[2020-09-17 02:00:24] INFO:      SYSTEM_NAME           = cent8
[2020-09-17 02:00:24] INFO:      SYSTEM_RELEASE        = CentOS Linux release 8.2.2004_
↳ (Core)
[2020-09-17 02:00:24] INFO:      SYSTEM_RELEASEVER       = 8.2.2004
[2020-09-17 02:00:24] INFO:      PLATFORM_PYTHON        = /usr/libexec/platform-python
[2020-09-17 02:00:24] INFO:      PYTHON                 = /bin/python3.6

...

[2020-09-17 02:02:46] ****: -----
↳ ---
[2020-09-17 02:02:46] ****: Test access to kompira.
[2020-09-17 02:02:46] ****:
[2020-09-17 02:02:48] INFO: Access succeeded:  <div class="brand-version">1.6.0</div>
[2020-09-17 02:02:48] ****:
[2020-09-17 02:02:48] ****: Finish: Install the Kompira (status=0)
[2020-09-17 02:02:48] ****:
↳ *****
```

The installer will automatically install the Kompira package. If “Finish: Install the Kompira (status=0)” is displayed, the installation has been a success.

When installation is completed, please access the Kompira server from a Web browser with the following URL and confirm that the login screen is displayed.

At this time, a warning about the server certificate is displayed. To prevent this warning, please install the SSL certificate on Apache on the Kompira server.

```
https://<Hostname or ipaddress of Kompira server>/
```

Note: To access by HTTP, you will need to install it with the `--no-https` option.

For details on how to operate Kompira with a Web browser, see the operation guide manual.

Update

How to update the Kompira package when it is already installed:

Kompira's version number format is specified as follows.

1.<major-version>.<minor-version>

Updates where only minor version numbers are changed are called minor updates, and updates where major version numbers are changed are called major updates.

For example, updating from version 1.5.0 to 1.5.2 is a minor update, updating from version 1.4.10 to 1.5.0 is a major update.

Major updates are updates that may contain changes in architecture configuration and DB schema definition, so a different process may be required.

Please check the current version and the Kompira version that you are updating.

Minor update

For minor updates, run `install.sh` without options.

```
$ tar zxf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh
[2020-09-17 22:56:32] ****:
→ *****
[2020-09-17 22:56:32] ****: Kompira-1.6.0:
[2020-09-17 22:56:32] ****: Start: Install the Kompira
[2020-09-17 22:56:32] ****:
[2020-09-17 22:56:32] INFO:      SYSTEM                = CENT
[2020-09-17 22:56:32] INFO:      SYSTEM_NAME           = cent8
[2020-09-17 22:56:32] INFO:      SYSTEM_RELEASE        = CentOS Linux
→ release 8.2.2004 (Core)
[2020-09-17 22:56:33] INFO:      SYSTEM_RELEASEVER       = 8.2.2004
[2020-09-17 22:56:33] INFO:      PLATFORM_PYTHON        = /usr/libexec/
→ platform-python
[2020-09-17 22:56:33] INFO:      PYTHON                  = /bin/python3.6

...

[2020-09-17 22:57:00] ****: -----
→ -----
[2020-09-17 22:57:00] ****: Check version of Kompira installed.
[2020-09-17 22:57:00] ****:
[2020-09-17 22:57:00] INFO: VERSION=1.6.0b4 [pip=/opt/kompira/bin/pip]
[2020-09-17 22:57:00] INFO: A compatible version is installed.

...
```

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```

[2020-09-17 22:58:18] ****: -----
↪-----
[2020-09-17 22:58:18] ****: Test access to kompira.
[2020-09-17 22:58:18] ****:
[2020-09-17 22:58:19] INFO: Access succeeded: <div class="brand-version">1.6.
↪0</div>
[2020-09-17 22:58:19] ****:
[2020-09-17 22:58:19] ****: Finish: Install the Kompira (status=0)
[2020-09-17 22:58:19] ****:↪
↪*****

```

The installer will automatically update the Kompira package. If “Finish: Install the Kompira (status=0)” is displayed, it has been successfully installed.

When the update is completed, please log in to Kompira from a web browser and confirm that the version number of Kompira has been updated.

Major update

In the case of major update, update it using the following procedure.

- Use the `export_data` command to retrieve data from Kompira
- Install Kompira in database initialization mode with the `--initdata` option with the `install.sh` command
- Save the first data extracted to Kompira with the `import_data` command

Please note that the existing database will be initialized when you run the `install.sh` command.

```

$ cd kompira-<version>-bin
$ /opt/kompira/bin/manage.py export_data --owner-mode --virtual-mode / >↪
↪backup.json
# ./install.sh --force --initdata
$ /opt/kompira/bin/manage.py import_data --owner-mode --overwrite-mode backup.
↪json
[2018-04-09 21:44:15,936:30953:MainProcess] INFO: import data: start...
[2018-04-09 21:44:16,010:30953:MainProcess] INFO: import object: imported
↪"system/types/TypeObject" to "/system/types/TypeObject" (updated)
[2018-04-09 21:44:16,022:30953:MainProcess] INFO: import object: imported
↪"system/types/Directory" to "/system/types/Directory" (updated)
[2018-04-09 21:44:16,033:30953:MainProcess] INFO: import object: imported
↪"system" to "/system" (updated)

...

[2018-04-09 21:44:22,126:30953:MainProcess] INFO: import fields: /user/data: []
[2018-04-09 21:44:22,164:30953:MainProcess] INFO: import fields: /user/data/
↪nodes: []
[2018-04-09 21:44:22,202:30953:MainProcess] INFO: import fields: /user/data/
↪accounts: []
[2018-04-09 21:44:22,218:30953:MainProcess] INFO: import data: finished↪
↪(created=0, updated=59, skipped=0, error=0, warning=0)

```

When running `install.sh`, specify the `--initdata` and `--force` options to initialize the database.

When the import_data process is completed, please log in to Kompira from a Web browser, confirm that the version number of Kompira has been updated, and that previously created Kompira objects still exists.

Note: If you are updating from version 1.5 or earlier to version 1.6, you cannot update by following the above procedure. Please delete the previous version of Kompira and then reinstall version 1.6.

Note: When updating from Kompira to Ver. 1.6 from Ver. 1.5 or earlier, full compatibility is not guaranteed and the migrated job flow and library objects may not work as they are. If necessary, check the operation of each Jobflow or Library object after modifying them.

Upgrade PostgreSQL

From Ver. 1.6.0 to Ver. 1.6.9, PostgreSQL 12 was fixedly installed, but PostgreSQL 12 reached EOL in 2024/11. Therefore, Kompira Ver. 1.6.10 and later support the installation of PostgreSQL 13 or higher.

- When newly installing Kompira, install the latest PostgreSQL supported by Kompira at that time.
- When updating Kompira, the existing major version of PostgreSQL is retained. However, minor updates to PostgreSQL will be performed.

In either case, you can specify the version of PostgreSQL to install with the `--postgresql-version` option of `install.sh`.

- Specifying `--postgresql-version=16` or `--postgresql-version=16.*` in `install.sh` will install the latest major version specified.
- Specifying `--postgresql-version=16.4` or similar to `install.sh` will install a specific version.

When you install PostgreSQL by specifying a version when updating Kompira, for example from 12.17 to 17.0 and so on, a major version increase is called a PostgreSQL upgrade. When `install.sh` detects a PostgreSQL upgrade, it displays a message like the following to confirm that you actually want to perform the upgrade.

```
# ./install.sh --postgresql-version=17

...

[2024-10-29 12:00:00] ****: -----
→ ---
[2024-10-29 12:00:00] ****: Check current PostgreSQL and Kompira database existence.
[2024-10-29 12:00:00] ****:
[2024-10-29 12:00:00] INFO: CUR_PG_BINDIR=/usr/pgsql-12/bin
[2024-10-29 12:00:00] INFO: CUR_PG_DATADIR=/var/lib/pgsql/12/data
[2024-10-29 12:00:00] INFO: CUR_PG_SERVICE=postgresql-12
[2024-10-29 12:00:00] INFO: CUR_PG_VERSION=12.17
[2024-10-29 12:00:00] INFO: CUR_PG_MAJVER=12
[2024-10-29 12:00:00] INFO: Check free space for PostgreSQL migration
[2024-10-29 12:00:00] INFO: Data used:      152,856 KiB (/var/lib/pgsql/12/data)
[2024-10-29 12:00:00] INFO: Free space:    9,344,912 KiB (/var/lib/pgsql)
[2024-10-29 12:00:00] INFO: Free space rate: 6113.54% (OK)
[2024-10-29 12:00:00] WARN: PostgreSQL migration (12->17) detected, Are you sure?

MIGRATE POSTGRESQL 12 TO 17 AND CONTINUE INSTALLATION? (yes/No)
```

Enter **y** if you want to perform the PostgreSQL upgrade and continue the installation. Enter **n** to abort the installation. Note that if you have the `--force` option to `install.sh`, the upgrade and installation will continue without this confirmation.

When performing a PostgreSQL upgrade, run PostgreSQL's `pg_upgrade` utility inside `install.sh` to migrate all data to the new version.

Note: Note that `pg_upgrade` will copy all data in the server, so you will need as much free space as the amount of data used by the database cluster.

The message above shows the amount of data in the existing database cluster and the free space where the new version of the database cluster will be created.

```
[2024-10-29 12:00:00] INFO: Data used:      152,856 KiB (/var/lib/pgsql/12/data)
[2024-10-29 12:00:00] INFO: Free space:    9,344,912 KiB (/var/lib/pgsql)
[2024-10-29 12:00:00] INFO: Free space rate: 6113.54% (OK)
```

The example above shows that there is sufficient free space. If you have less free space, consider freeing up space before performing the upgrade.

Note: `install.sh` checks for free space when upgrading PostgreSQL. If there is not enough free space, equivalent to 120% of the amount of data in the existing database cluster, the installation will be aborted.

Upgrading PostgreSQL in a Redundant Configuration

When upgrading PostgreSQL in a redundant configuration, a dedicated procedure based on the both-system stop update procedure is used. See *Procedure for updating with PostgreSQL upgrade with both systems stopped* for details.

New in version 1.6.10: PostgreSQL 13 or higher installations are now supported. PostgreSQL upgrade with update is now supported.

1.2.4 Job manager package

Explanation of how to conduct an installation/package update including for job manager and send-event script.

Installation

Extract the Kompira package and run `install.sh`. Since the job manager communicates with the Kompira server, you will need to specify the host name or IP address of the server on which the Kompira package is installed as an argument to `install.sh`.

Replace `<version>` with the version number of Kompira.

`<kompira_ip>` is the host name or IP address of the Kompira server.

```
$ tar xzf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh --jobmgr <kompira_ip>
[2020-09-18 00:42:54] ****:
  ****:
[2020-09-18 00:42:54] ****: Kompira-1.6.0:
[2020-09-18 00:42:54] ****: Start: Install the Kompira
```

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```

[2020-09-18 00:42:54] ****:
[2020-09-18 00:42:54] INFO:      SYSTEM                = CENT
[2020-09-18 00:42:54] INFO:      SYSTEM_NAME           = cent8
[2020-09-18 00:42:54] INFO:      SYSTEM_RELEASE        = CentOS Linux release 8.2.2004_
↪ (Core)
[2020-09-18 00:42:54] INFO:      SYSTEM_RELEASEVER       = 8.2.2004
[2020-09-18 00:42:54] INFO:      PLATFORM_PYTHON        = /usr/libexec/platform-python

...

[2020-09-18 00:43:24] ****: -----
↪ ---
[2020-09-18 00:43:24] ****: Setup kompira-jobmgrd.
[2020-09-18 00:43:24] ****:

...

[2020-09-18 00:43:24] VERBOSE: run: systemctl restart kompira_jobmgrd
[2020-09-18 00:43:24] ****:
[2020-09-18 00:43:24] ****: Finish: Install the Kompira (status=0)
[2020-09-18 00:43:24] ****: ↪
↪ *****

```

The installer will automatically install a new job manager package. If “Finish: Install the Kompira (status=0)” is displayed, the installation has been a success.

For details on how to check that the job manager process is running correctly, see [Starting / stopping the Kompira daemon and Checking the status](#).

Also, you can check whether Kompira itself is communicating with the job manager correctly from Kompira’s “Management area setting page”. Please log in to Kompira with Web browser and go “Settings” > “Management area settings” > “default” page. If the host name of the server that the job manager package is installed is displayed in the “Job Manager Status” section, communication should be ok.

Note that if the `-amqps-verify` option is added to `install.sh`, you will be prompted for a password as shown below to copy the SSL certificate from the specified Kompira server by `scp` during installation.

```

[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: Start copying the SSL/CA certificates from the kompira_
↪ server with scp.
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: PLEASE ENTER THE PASSWORD OF THE REMOTE KOMPIRA SERVER (
↪ <kompira_ip>) FOR SCP.
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] VERBOSE: run: scp -q -p -o StrictHostKeyChecking=no -o_
↪ UserKnownHostsFile=/dev/null root@<kompira_ip>:/opt/kompira/ssl/certs/{kompira-bundle-
↪ ca.crt,amqp-client-kompira{.crt,.key}} /opt/kompira/ssl/certs/
root@<kompira_ip>'s password:

```

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...

Changed in version 1.6.8: If the `--amqps-verify` option is added to `install.sh`, the SSL certificate is now copied from the Kompira server by `scp`.

Update

You can update the job manager package by the same procedure as the installation.

1.2.5 Send-Event package

Installation /package updates including event transmission script will be explained here.

Send-Event packages are compatible with Linux and Windows.

Extract the Kompira package and run `install.sh`.

Extract Kompira packages and run `install.sh`

Since the Send-Event script sends data to Kompira itself, you need to specify the host name or IP address of the server on which Kompira packages are installed as an argument to `install.sh`.

Replace `<version>` with the version number of Kompira. `<kompira_ip>` is the host name or IP address of the Kompira server.

```
$ tar zxf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh --sendevt <kompira_ip>
[2023-01-16 18:33:50] ****:
↳ *****
[2023-01-16 18:33:50] ****: Kompira-1.6.8:
[2023-01-16 18:33:50] ****: Start: Install the Kompira
[2023-01-16 18:33:50] ****:
[2023-01-16 18:33:50] INFO:      SYSTEM                = CENT
[2023-01-16 18:33:50] INFO:      SYSTEM_NAME           = cent7
[2023-01-16 18:33:50] INFO:      SYSTEM_RELEASE        = CentOS Linux release 7.7.1908_
↳ (Core)
[2023-01-16 18:33:50] INFO:      SYSTEM_RELEASEVER       = 7.7.1908
[2023-01-16 18:33:50] INFO:      PLATFORM_PYTHON        = /usr/libexec/platform-python
[2023-01-16 18:33:50] INFO:      PYTHON                = /usr/bin/python
[2023-01-16 18:33:50] INFO:      SYSTEMD                = true
[2023-01-16 18:33:50] INFO:      TMPDIR                 = /root/kompira-1.6.8-bin/.tmp.
↳ install-20230116-1833.rQ8X
[2023-01-16 18:33:50] INFO:      LOCALE_LANG            = ja_JP.UTF-8
[2023-01-16 18:33:50] INFO:      PATH                  = /usr/local/sbin:/usr/local/
↳ bin:/usr/sbin:/usr/bin:/root/bin
[2023-01-16 18:33:50] INFO:      HTTPS_MODE             = true
[2023-01-16 18:33:50] INFO:      AMQPS_MODE             = true
...
```

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```

[2023-01-16 18:35:04] VERBOSE: run: chown :kompira /opt/kompira/ssl/certs/kompira-bundle-
↪ca.crt /opt/kompira/ssl/certs/amqp-client-kompira.crt /opt/kompira/ssl/certs/amqp-
↪client-kompira.key
[2023-01-16 18:35:04] ****: -----
↪---
[2023-01-16 18:35:04] ****: Setup kompira common files.
[2023-01-16 18:35:04] ****:
[2023-01-16 18:35:04] INFO: Create log directory: /var/log/kompira
[2023-01-16 18:35:04] VERBOSE: run: install -g kompira -m 775 -d /var/log/kompira
[2023-01-16 18:35:04] VERBOSE: run: find /var/log/kompira -type f -user root ! -name_
↪audit-* -exec chown kompira:kompira {} ;
[2023-01-16 18:35:04] INFO: Create kompira.conf
[2023-01-16 18:35:04] VERBOSE: run: install -m 644 /root/kompira-1.6.8-bin/.tmp.install-
↪20230116-1833.rQ8X/kompira.conf /opt/kompira/kompira.conf
[2023-01-16 18:35:04] ****:
[2023-01-16 18:35:04] ****: Finish: Install the Kompira (status=0)
[2023-01-16 18:35:04] ****:_
↪*****

```

If “Finish: Install the Kompira (status=0)” is displayed, the installation has been a success.

When the installation is completed, the kompira_sendvt will be placed under /opt/kompira/bin

```

$ /opt/kompira/bin/kompira_sendvt --version
kompira_sendvt (Kompira version 1.6.8)

```

Note that if the `--amqps-verify` option is added to `install.sh`, you will be prompted for a password as shown below to copy the SSL certificate from the specified Kompira server by scp during installation.

```

[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: Start copying the SSL/CA certificates from the kompira_
↪server with scp.
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: PLEASE ENTER THE PASSWORD OF THE REMOTE KOMPIRA SERVER (
↪<kompira_ip>) FOR SCP.
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] VERBOSE: run: scp -q -p -o StrictHostKeyChecking=no -o_
↪UserKnownHostsFile=/dev/null root@<kompira_ip>:/opt/kompira/ssl/certs/{kompira-bundle-
↪ca.crt,amqp-client-kompira{.crt,.key}} /opt/kompira/ssl/certs/
root@<kompira_ip>'s password:
...

```

Changed in version 1.6.8: If the `--amqps-verify` option is added to `install.sh`, the SSL certificate is now copied from the Kompira server by scp.

Installation on Windows

1. Installing Python

Install Python 3.6 for Windows.

- <https://www.python.org/downloads/>

Download the latest Python 3.6 installer for Windows from the above mentioned official site and install it on your Windows Operating System.

When the installation is completed, add the environment variable path so that Python can be called from the command line.

Path	Description
C:\Program Files\Python36	Folder that Python commands are stored
C:\Program Files\Python36\Scripts	Folder that pip and other command types are stored

2. Creating a Python virtual environment for Kompira

Create an independent Python virtual environment (venv) for Kompira in C:\Kompira.

```
C:\> python -m venv C:\Kompira
```

3. Create the directory for the log files

Create the directory C:\Kompira\Log as the log file output destination.

```
C:\> mkdir C:\Kompira\Log
```

4. Installation of the kompira_sendvt package

After downloading and unpacking the Kompira package on Windows, Install the Kompira_sendvt-<version>-py3-none-any.whl package with plp.exe.

```
C:\> C:\Kompira\Scripts\pip.exe install Kompira_sendvt-1.6.0-py3-none-any.
→whl
Processing c:\users\kompira\documents\kompira-package\kompira_sendvt-1.6.0-
→py3-none-any.whl
Collecting amqp~=2.6.1 (from Kompira-sendvt==1.6.8)

...

Installing collected packages: amqp, decorator, Kompira-sendvt
Successfully installed Kompira-sendvt-1.6.8 amqp-2.6.1 vine-1.3.0
```

The Send-Event package installation is now complete. The kompira_sendvt will be placed under C:\Kompira\Scripts. Try running the kompira_sendvt command as follows.

```
C:\> C:\Kompira\Scripts\kompira_sendvt.exe --version
kompira_sendvt (Kompira version 1.6.8)
```

If it is correctly installed, it will display the version number.

If you add C:\Kompira\Scripts to the environment variable PATH, you can omit the path and execute it.

5. Obtain an SSL certificate file from the Kompira server

To send a message with `kompira_sendvt` to a Kompira server that has SSL certificate verification enabled, such as by adding the `--amqps-verify` option during installation, you need an SSL certificate issued by that Kompira server. To connect with `kompira_sendvt` using an SSL certificate, obtain the following file from the Kompira server and locate it in the `C:\Kompira\SSL\Certs` directory.

- `/opt/kompira/ssl/certs/kompira-bundle-ca.crt`
- `/opt/kompira/ssl/certs/amqp-client-kompira.crt`
- `/opt/kompira/ssl/certs/amqp-client-kompira.key`

For example, if you have Windows with `scp` command available, you can transfer files from the Kompira server. The `<kompira_ip>` part should be the address of the Kompira server.

```
C:\> mkdir C:\Kompira\SSL\Certs
C:\> scp root@<kompira_ip>:/opt/kompira/ssl/certs/{kompira-bundle-ca.crt,
↪ amqp-client-kompira{.crt,.key}} C:\Kompira\SSL\Certs
```

6. Creating the configuration file `kompira.conf`

Create a configuration file in `C:\Kompira\kompira.conf` that `kompira_sendvt` will read. The default configuration under Windows is shown below, where `<kompira_ip>` is Kompira server address.

```
[kompira]
site_id      = 1

[logging]
logdir       = C:\Kompira\Log

[amqp-connection]
server       = <kompira_ip>
port         = 5671
ssl          = true
ssl_verify   = false
ssl_cacertfile =
ssl_certfile =
ssl_keyfile  =

[event]
channel      = /system/channels/Alert

[agent]
name         = default
```

To use an SSL certificate obtained from a Kompira server, replace the following part.

```
ssl_verify    = true
ssl_cacertfile = C:\Kompira\SSL\Certs\kompira-bundle-ca.crt
ssl_certfile  = C:\Kompira\SSL\Certs\amqp-client-kompira.crt
ssl_keyfile   = C:\Kompira\SSL\Certs\amqp-client-kompira.key
```

Update

With the same procedure as the installation you can update the Send-Event package.

1.2.6 Offline install

To perform an offline installation, you need to take the following steps.

- Create the kompira-extra package in an Internet-connected environment.
- Offline installation using the kompira-extra package.

Note: However, we have not been able to confirm that it works in all environments, so please let us know if there are any problems.

Create the kompira-extra package in an Internet-connected environment.

The creation of the kompira-extra package must be performed on a server that meets the following conditions.

- A server with the same configuration as the target for offline installation (at least the OS and version should match).
- A server with an Internet connection (if necessary, specify a proxy).

Note: For RHEL, please register a subscription if necessary.

Creating the kompira-extra package using install.sh

Run the install.sh included in the kompira package with the --extra option.

```
$ tar xzf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh --extra
[2021-11-04 20:56:38] ****:
↳ *****
[2021-11-04 20:56:38] ****: Kompira-1.6.3:
[2021-11-04 20:56:38] ****: Start: Install the Kompira
[2021-11-04 20:56:38] ****:
[2021-11-04 20:56:38] INFO:      SYSTEM                = CENT
[2021-11-04 20:56:38] INFO:      SYSTEM_NAME           = cent8
[2021-11-04 20:56:38] INFO:      SYSTEM_RELEASE        = CentOS Linux release 8.2.2004
↳ (Core)
[2021-11-04 20:56:38] INFO:      SYSTEM_RELEASEVER       = 8.2.2004
[2021-11-04 20:56:38] INFO:      PLATFORM_PYTHON        = /usr/libexec/platform-python
[2021-11-04 20:56:38] INFO:      PYTHON                 =
[2021-11-04 20:56:38] INFO:      SYSTEMD                = true
[2021-11-04 20:56:38] INFO:      TMPDIR                 = /root/kompira-1.6.3-bin/.tmp.
↳ install-20211104-2056.P3fx
[2021-11-04 20:56:38] INFO:      LOCALE_LANG            = ja_JP.UTF-8
[2021-11-04 20:56:38] INFO:      PATH                   = /usr/local/sbin:/usr/local/
↳ bin:/usr/sbin:/usr/bin:/root/bin
[2021-11-04 20:56:38] INFO:      HTTPS_MODE             = true
```

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```

[2021-11-04 20:56:38] INFO:    FORCE_MODE           = false
[2021-11-04 20:56:38] INFO:    BACKUP_MODE        = true
[2021-11-04 20:56:38] INFO:    BACKUP_PROCESS     = false
[2021-11-04 20:56:38] INFO:    INITDATA_MODE    = false
[2021-11-04 20:56:38] INFO:    INITFILE_MODE   = false
[2021-11-04 20:56:38] INFO:    OFFLINE_MODE    = false
[2021-11-04 20:56:38] INFO:    JOBMNGR_MODE    = false
[2021-11-04 20:56:38] INFO:    SENDEVT_MODE    = false
[2021-11-04 20:56:38] INFO:    PROXY_URL       =
[2021-11-04 20:56:38] INFO:    NO_PROXY        = localhost,127.0.0.1
[2021-11-04 20:56:38] INFO:    KOMPIRA_SERVER  = localhost
[2021-11-04 20:56:38] INFO:    DRY_RUN         = false
[2021-11-04 20:56:38] ****:  -----
↪ ---
...

opt/kompira/extra/1.6.3/cent8/wheelhouse/PyYAML-5.3.1-cp36-cp36m-linux_x86_64.whl
opt/kompira/extra/1.6.3/cent8/wheelhouse/pykerberos-1.2.1-cp36-cp36m-linux_x86_64.whl
opt/kompira/extra/1.6.3/cent8/wheelhouse/future-0.18.2-py3-none-any.whl
opt/kompira/extra/1.6.3/cent8/wheelhouse/PTable-0.9.2-py3-none-any.whl
[2021-11-04 21:08:58] ****:
[2021-11-04 21:08:58] ****: Finish: Install the Kompira (status=0)
[2021-11-04 21:08:58] ****: ↪
↪ *****

```

Check the kompira-extra package

If there are no problems, a package file starting with `kompira-extra-` will be generated in about 10-20 minutes, so check it.

```

# ls -lh kompira-extra-*.tar.gz
-rw-r--r--. 1 root root 290M Nov  4 21:08 kompira-extra-1.6.3.cent8.tar.gz

```

Offline installation using the kompira-extra package.

Prepare the kompira and kompira-extra packages

On the server where you want to perform the offline installation, place the kompira package and the kompira-extra package created above.

```

# ls -l kompira-*
-rw-r--r--. 1 root root 7555278 Nov  4 21:11 kompira-1.6.3-bin.tar.gz
-rw-r--r--. 1 root root 303772888 Nov  4 21:12 kompira-extra-1.6.3.cent8.tar.gz

```

Extract the kompira-extra package.

With root privileges, extract the kompira-extra package to the root directory.

```

# tar xzf kompira-extra-1.6.3.cent8.tar.gz -C /

```

Make sure that the various packages required for offline installation have been extracted under `/opt/kompira/extra/1.6.x/${OS}/`.

```
$ ls -l /opt/kompira/extra/1.6.3/*
total 40
drwxr-xr-x. 3 root root 24576 Nov  4 21:08 packages
drwxr-xr-x. 2 root root    6 Nov  4 20:57 pip
drwxr-xr-x. 2 root root  8192 Nov  4 21:08 wheelhouse
```

Run the kompira offline installation.

Extract the kompira package and run install.sh with the `--offline` option.

```
$ tar xzf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh --offline
[2021-11-04 21:14:37] ****:
→ *****
[2021-11-04 21:14:37] ****: Kompira-1.6.3:
[2021-11-04 21:14:37] ****: Start: Install the Kompira (offline-mode)
[2021-11-04 21:14:37] ****:
[2021-11-04 21:14:37] INFO:      SYSTEM                = CENT
[2021-11-04 21:14:37] INFO:      SYSTEM_NAME           = cent8
[2021-11-04 21:14:37] INFO:      SYSTEM_RELEASE        = CentOS Linux release 8.2.2004_
→ (Core)
[2021-11-04 21:14:37] INFO:      SYSTEM_RELEASEVER       = 8.2.2004
[2021-11-04 21:14:37] INFO:      PLATFORM_PYTHON      = /usr/libexec/platform-python
[2021-11-04 21:14:37] INFO:      PYTHON                =
[2021-11-04 21:14:37] INFO:      SYSTEMD              = true
[2021-11-04 21:14:37] INFO:      TMPDIR              = /root/kompira-1.6.3-bin/.tmp.
→ install-20211104-2114.7XV8
[2021-11-04 21:14:37] INFO:      LOCALE_LANG          = ja_JP.UTF-8
[2021-11-04 21:14:37] INFO:      PATH                = /usr/local/sbin:/usr/local/
→ bin:/usr/sbin:/usr/bin:/root/bin
[2021-11-04 21:14:37] INFO:      HTTPS_MODE          = true
[2021-11-04 21:14:37] INFO:      FORCE_MODE           = false
[2021-11-04 21:14:37] INFO:      BACKUP_MODE         = true
[2021-11-04 21:14:37] INFO:      BACKUP_PROCESS      = false
[2021-11-04 21:14:37] INFO:      INITDATA_MODE       = false
[2021-11-04 21:14:37] INFO:      INITFILE_MODE       = false
[2021-11-04 21:14:37] INFO:      OFFLINE_MODE        = true
[2021-11-04 21:14:37] INFO:      JOBMNGR_MODE        = false
[2021-11-04 21:14:37] INFO:      SENDEVT_MODE        = false
[2021-11-04 21:14:37] INFO:      PROXY_URL           =
[2021-11-04 21:14:37] INFO:      NO_PROXY            = localhost,127.0.0.1
[2021-11-04 21:14:37] INFO:      KOMPIRA_SERVER      = localhost
[2021-11-04 21:14:37] INFO:      DRY_RUN             = false
[2021-11-04 21:14:37] ****: -----
→ ---
...
[2021-11-04 21:15:25] ****: -----
→ ---
[2021-11-04 21:15:25] ****: Test access to kompira.
[2021-11-04 21:15:25] ****:
```

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```
[2021-11-04 21:15:26] INFO: Access succeeded: <div class="brand-version">1.6.3</div>
[2021-11-04 21:15:26] ****:
[2021-11-04 21:15:26] ****: Finish: Install the Kompira (offline-mode) (status=0)
[2021-11-04 21:15:26] ****:
→ *****
```

1.3 Kompira process management

The Kompira system has multiple processes working together. Kompira's process structure will be explained below.

1.3.1 Structure of Kompira processes

The Kompira system structure processes are as follows:

Kompira daemon (kompirad)

Kompira Daemon process for executing and managing job flow.

Kompira Job Manager is requested to execute remote command and receives the result.

Kompira Job Manager (kompira_jobmgrd)

This is a daemon process for executing the remote command requested from the Kompira daemon.

Kompira Job Manager will connect to the remote host with the protocol specified by the connection type and execute the command when receiving the remote command from the Kompira daemon. The command execution result will be sent to the Kompira daemon.

Other processes required for the Kompira system are Apache (httpd), PostgreSQL (postgresql), RabbitMQ (rabbitmq-server).

Each of these processes is set up by install.sh to start automatically at machine startup.

1.3.2 Starting / stopping the Kompira daemon and Checking the state

Please start and stop the Kompira daemon as root. The user running daemon will change to Kompira automatically after startup.

For RHEL / CentOS 7x / 8x

Start the Kompira daemon on RHEL / CentOS 7x / 8x by the following command.

```
# systemctl start kompirad
```

To abort, execute the following command.

```
# systemctl stop kompirad
```

With the systemctl status command you can check the status of the Kompira daemon.

```
$ systemctl status kompirad.service
* kompirad.service - Kompira-daemon
   Loaded: loaded (/usr/lib/systemd/system/kompirad.service; enabled; vendor preset:↵
   disabled)
   Active: active (running) since Thu 2018-07-05 16:33:02 JST; 2h 20min ago
   Process: 5277 ExecStartPre=/opt/kompira/bin/prestart_kompirad.sh (code=exited,↵
   status=0/SUCCESS)
   Main PID: 5368 (kompirad)
   CGroup: /system.slice/kompirad.service
           └─5368 /opt/kompira/bin/python3.6 /opt/kompira/bin/kompirad

Jul 05 16:32:32 kompira-install-test3.dev.fixpoint.co.jp systemd[1]: Starting Kompira-
↵ daemon...
Jul 05 16:33:02 kompira-install-test3.dev.fixpoint.co.jp systemd[1]: Started Kompira-
↵ daemon.
```

When it is started, the Active: section is as **active (running)**, and when it is aborted it displays as **inactive (dead)**.

1.3.3 Starting / stopping the Kompira daemon and Checking the status.

Please start and stop the Kompira daemon as root. User to run daemon will be change to kompira are automatically after startup.

For RHEL / CentOS 7x / 8x

Start the Kompira job manager on RHEL / CentOS 7x / 8x by the following command.

```
# systemctl start kompira_jobmgrd.service
```

To abort, execute the following command.

```
# systemctl stop kompira_jobmgrd.service
```

With the status command you can check the status of the Kompira job manager.

```
$ systemctl status kompira_jobmgrd.service
* kompira_jobmgrd.service - Kompira-jobmanager
   Loaded: loaded (/usr/lib/systemd/system/kompira_jobmgrd.service; enabled; vendor↵
   preset: disabled)
   Active: active (running) since Thu 2018-07-05 16:32:22 JST; 2h 25min ago
   Main PID: 5164 (kompira_jobmgr)
   CGroup: /system.slice/kompira_jobmgrd.service
           └─5164 /opt/kompira/bin/python3.6 /opt/kompira/bin/kompira_jobmgrd
             └─5197 /opt/kompira/bin/python3.6 /opt/kompira/bin/kompira_jobmgrd

Jul 05 16:32:22 kompira-install-test3.dev.fixpoint.co.jp systemd[1]: Started Kompira-
↵ jobmanager.
Jul 05 16:32:22 kompira-install-test3.dev.fixpoint.co.jp systemd[1]: Starting Kompira-
↵ jobmanager...
```

When it is started, the Active: section is as **active (running)**, and when it is aborted it displays as **inactive (dead)**.

1.3.4 Port List used by Kompira

On the server on which the Kompira package is installed, the following ports need to be open to access from outside.

Port number	Description
80/TCP	HTTP (it is unnecessary when accessing only HTTPS)
443/TCP	HTTPS (it is unnecessary when accessing only HTTP)
5671/TCP	AMQPS (not required if you do not allow AMQPS connections from external kompira_jobmgrd or kompira_sendvt)
5672/TCP	AMQP (not required if you do not allow AMQP connections from external kompira_jobmgrd or kompira_sendvt)

Otherwise, the port 5593/TCP is used in the loopback IF for the httpd server and the Kompira engine RPC.(No need to make it externally connectable)

When building a redundant configuration, it is necessary to be able to communicate using the following ports between each node (or between internal IFs when using internal IFs for heartbeat).

Port number	Description
2224/TCP	pcs (high-availability middleware)
4369/TCP	epmd (Erlang port mapper daemon)
5405/UDP	corosync (for heartbeat)
5432/TCP	PostgreSQL (for replication)
25672/TCP	RabbitMQ Server (for inter-node communication)

Changed in version 1.6.4: Rsyncd has been removed from the port number list because it is no longer used.

New in version 1.6.8: Added 5671/TCP to the port list to support AMQPS.

1.4 Node setting

Kompira allows you to run remote jobs on the following types of nodes.

- Local node
- SSH node
- Windows node
- Network device node

The connection type to be specified for each type of node and the settings required on the node side in advance differ.

For details on how to specify the connection type, see [Control variable](#).

1.4.1 Local node setting

There is one type of connection to Local nodes.

Connection type	Protocol	Note
local	Local execution	Runs jobs directly on the node where kompira_jobmgrd is running.

If a remote node is not explicitly specified in Kompira, the job is executed directly on the local node. The local node here is the node where the kompira_jobmgrd service is running.

New in version 1.6.6: Description of local node is added.

1.4.2 SSH node setting

There is one type of connection to SSH nodes.

Connection type	Protocol	Note
ssh	SSH	Only SSH v2 is supported.

When executing commands from Kompira to an SSH node, you should log in with ssh version 2. As for recent Linux, ssh login is ready by default so it is not necessary to configure. For details on how to enable ssh login on other nodes, refer to the manual of each operation system.

Note: Supported version of SSH is only v2. SSH v1 is not supported.

1.4.3 Windows node setting

For Windows nodes, there are four connection types to choose from.

Connection type	Protocol	Note
windows/https	WS-Man HTTPS	Requires the installation of an SSL certificate on the server side.
windows/https-ignore-validation	WS-Man HTTPS (ignore server certificate validation errors)	Self-signed certificates are available.
windows/http	WS-Man HTTP (with message encryption)	
windows/http-unencrypted	WS-Man HTTP (without message encryption)	(Deprecated) Requires server-side allow unencrypted.

Note: For compatibility, the traditional connection type winrs can also be used. However, in this case, the protocol used will be switched depending on whether or not a port number is specified. HTTPS will be used if the port number is 5986 or 443, and HTTP will be used if the port number is 5985 or 80. If the port number is omitted, an HTTPS connection will be attempted.

When executing commands from Kompira to the Windows node, WinRM setting is required on the Windows node. The supported version of WinRM is 1.1, 2.0, 3.0.

Enabling remote management of WinRM

In order to enable WinRM, please run Windows Command Prompt as Administrator and execute `winrm quickconfig` (or `winrm qc`). When you are prompted to select y/n, i.e. “Do you want to change [y / n]?” Please enter y. Note that this operation is not needed from the second time.

The following is an example of Windows 7, but the details of the contents displayed can be different depending on the version of Windows and the setting.

```
C:\>winrm quickconfig
...
Make these changes [y/n]? y
...
```

Changing WinRM connection settings

HTTPS connections are the most secure connection method, but require an SSL certificate to be installed on the Windows node. The detailed procedure is not shown here, but you can refer to the Microsoft support page for more information.

- <https://docs.microsoft.com/en-us/search/?terms=winrm%20https>

Although deprecated, if you want to make HTTP connections without message encryption, you need to allow unencrypted communication in WinRM. You can allow unencrypted communication by executing the following command from a command prompt run as administrator.

```
C:\> winrm set winrm/config/service @{AllowUnencrypted="true"}
```

HTTP connections with message encryption may be slower than those without message encryption. If slowdowns are an issue, consider using unencrypted communications with an understanding of the risks.

By default, WinRM allows only privileged users who belong to the Administrators group to connect. If you want to connect as an unprivileged user, you will need to do some additional configuration, try one of the following.

- Add the user to the “Remote Management Users” group.
- Execute the following command from a command prompt run as an administrator to give read and execute privileges to the user or one of the groups to which he or she belongs.

```
C:\> winrm configSDDL default
```

Changed in version 1.4.10: Since Kompira Ver.1.4.10 and later, NTLM authentication is supported by default, so BASIC authentication is no longer needed.

Changed in version 1.6.4: Since message encryption is now supported in WinRM for HTTP connections, allowing unencrypted communication is no longer required. In addition, allowing unencrypted communication is now deprecated.

Test job flow

Please create and run the following job flow in Kompira to see if you can execute commands to the Windows node.

```
[__host__ = '<IP address of Windows server>',  
__user__ = '<Username of Windows account>',  
__password__ = '<Password of Windows account>',  
__conntype__ = 'windows/http']  
-> ['ver']  
-> print($RESULT)
```

It is successful if the Windows version number is displayed on the console of the job flow process.

In WinRM 2.0 and later, TCP port 5985 is used by default, but in WinRM 1.1 such as Windows Server 2008, the port number used is 80. In that case, add the port number setting `__port__ = 80`.

If you cannot connect properly, make sure that the firewall allows TCP port 5985 (or 80) to pass through, and check whether the login account settings are correct or not.

1.4.4 Network device node setting

If you want to execute commands from Kompira to a network device node, you need to enable SSH or TELNET login beforehand, depending on the network device. For details on how to enable SSH or TELNET login for each device, please refer to the manual of each device.

New in version 1.6.4: Remote jobs with network device nodes are now supported.

List of supported devices

As of Kompira v1.6.4, remote jobs with the following network devices (connection protocols) are supported.

- Cisco IOS (SSH, TELNET)
- Cisco ASA (SSH)
- Yamaha (SSH, TELNET)
- Juniper ScreenOS (SSH)
- HP Procurve (SSH)

The following table shows the connection types that can be specified for each device and the devices whose operation was checked.

Network device	Connection type	Protocol	Devices confirmed to work	Note
Cisco IOS	cisco_ios/ssh	SSH	Cisco 892J, Cisco CSR1000V	Support for PUT/GET
	cisco_ios/telnet	TEL-NET	Cisco 892J, Cisco CSR1000V	Support for PUT/GET
Cisco ASA	cisco_asa/ssh	SSH	Cisco ASA5505	Support for PUT/GET
Yamaha	yamaha/ssh	SSH	Yamaha RTX1200	
	yamaha/telnet	TEL-NET	Yamaha RTX1200	
Juniper ScreenOS	juniper_screenos/ssh	SSH	Juniper SSG5	
HP ProCurve	hp_procurve/ssh	SSH	ProCurve 2510G	

Note: Other models than the above can be selected as node types, but we have not been able to confirm their operation.

Restrictions on network devices

Not all functions of Remote Job are supported in cooperation with network devices. Please note that there are some limitations as follows.

- The command job cannot determine the success or failure of a command. If the login is successful, \$STATUS will always be 0 regardless of the actual command success or failure. If error judgment is required, it is necessary to check whether the standard output contains error messages or not in the job flow.
- Standard error output is not supported. Internally it is the same as PTY mode (__use_pty__=true) and all output is taken as standard output.
- Specifying the shell or execution directory by control variables is not supported.
- Script jobs and reboot jobs are not supported.
- File transfer by PUT/GET is supported on some devices, but only single file transfer is possible. Wildcard specification and recursive file transfer are not supported.

Information on the devices tested

The following table shows the version information for each device that we have tested.

Cisco 892J:

```
Cisco IOS Software, C890 Software (C890-UNIVERSALK9-M), Version 15.0(1)M3, RELEASE
SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2010 by Cisco Systems, Inc.
Compiled Sun 18-Jul-10 08:34 by prod_rel_team
ROM: System Bootstrap, Version 12.4(22r)YB3, RELEASE SOFTWARE (fc1)
```

Cisco CSR1000V:

```
Cisco IOS XE Software, Version 03.11.00.S - Standard Support Release
Cisco IOS Software, CSR1000V Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 15.
  4(1)S, RELEASE SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2013 by Cisco Systems, Inc.
Compiled Tue 19-Nov-13 21:00 by mcpre
```

Cisco ASA5505:

```
Cisco Adaptive Security Appliance Software Version 8.4(4)3
Device Manager Version 6.4(9)
Compiled on Wed 11-Jul-12 10:25 by builders
System image file is "disk0:/asa844-3-k8.bin"
Config file at boot was "startup-config"
```

Yamaha RTX1200:

```
RTX1200 BootROM Ver.1.01
RTX1200 Rev.10.01.78 (Wed Nov 13 16:29:42 2019)
```

Juniper SSG5:

```
Product Name: SSG5-Serial
Serial Number: XXXXXXXXXXXXXXXX, Control Number: 00000000
Hardware Version: 0710(0)-(00), FPGA checksum: 00000000, VLAN1 IP (0.0.0.0)
Flash Type: Samsung
Software Version: 6.2.0r8-cu1.0, Type: Firewall+VPN
Feature: AV-K
Compiled by build_master at: Thu Nov 18 01:29:55 PST 2010
```

ProCurve 2510G:

```
Image stamp:    /sw/code/build/cod(cod11)
                Nov 17 2009 16:55:04
                Y.11.16
                43
Boot Image:     Primary
```

1.5 Kompira settings and log files

The following is an explanation of the directory and configuration files on the server that are standard to Kompira.

1.5.1 Kompira standard directories.

The following is a list of directories and configuration files on the server that Kompira uses as standard.

Path		Description
/opt/kompira/	bin/	Directory for Kompira executable file
	kompira.conf	Kompira configuration files
/var/log/kompira/		Directory for engine and job manager log files
/var/opt/kompira/		Directory of Kompira variable files
	kompira.lic	Kompira license
	html/	Online help's HTML file group
	repository/	Working directory for repository link
/etc/httpd/conf.d/	kompira.conf	Apache setting files

Deprecated since version 1.6.4: The /var/opt/kompira/upload directory has been deprecated because attachments are now stored on the database.

1.5.2 Kompira logs

Kompira's own log files are created by default under the following directory.

- /var/log/kompira/

Note: In a Windows environment, log files are created under the directory C:\Kompira\Log by default.

For each log file created, the standard log rotation settings and the contents to be recorded are as follows.

Log file	Log rotation settings	Contents
kompira.log	fixed (daily rotate 7)	Request related log output (output by httpd)
kompirad.log	fixed (daily rotate 7)	Kompira daemon log output
process.log	fixed (daily rotate unlimited)	Log output of Kompira job flow process
kompira_jobmgrd.log	kompira.conf (daily rotate 7)	Kompira Job Manager log output
kompira_sendevt.log	kompira.conf (1GB rotate 10)	Log output of Send-Event command
audit-*.log	logrotate (daily rotate 365)	Audit log output for various operations

- The log files are automatically rotated, and the old log files are saved with the date added to the file name.
- For the above log files, kompira_jobmgrd.log and kompira_sendevt.log the settings of rotation, such as interval and number of generations can be changed in /opt/kompira/kompira.conf.
- The audit-*.log is rotated by the logrotate service, and you can change its settings in /etc/logrotate.d/kompira_audit.

The various services that make up Kompira output their logs to the following directories. The standard log rotation settings for each service are also shown below.

Service	Log output directory	Log rotation settings	Note
httpd	/var/log/httpd/	logrotate (daily rotate 30)	
postgresql	/var/log/postgres/	logrotate (daily rotate 30)	
rabbitmq-server	/var/log/rabbitmq/	logrotate (weekly rotate 20)	
pacemaker (1.x)	/var/log/	logrotate (weekly rotate 99)	Only in cluster configuration (RHEL7 series)
pacemaker (2.x)	/var/log/pacemaker/	logrotate (weekly rotate 99)	Only in cluster configuration (RHEL8 series)
corosync	/var/log/cluster/	logrotate (daily rotate 31)	Only in cluster configuration
pcsd	/var/log/pcsd/	logrotate (weekly rotate 5)	Only in cluster configuration

New in version 1.6.3: An audit log has been added.

Changed in version 1.6.8: In Windows environments, log files are now created by default in C:\Kompira\Log.

1.5.3 Kompira configuration files

The setting items in /opt/kompira/kompira.conf are as follows.

Section name	Item name	Default value	Contents
kompira	site_id	1	Not used in this version
logging	Log output related settings		
	loglevel	INFO	Setting the log level (DEBUG, INFO, WARNING, ERROR, CRITICAL)
	logdir	/var/log/kompira	Directory of log files
	logbackup	kompirad: 7 kompira_jobmngprd: 7 kompira_sendvt: 10	Number of generations of log backup
	logmaxsz	kompirad: 0 kompira_jobmngprd: 0 kompira_sendvt: 1024*1024*1024	Maximum log file size (in bytes) Set to 0 to rotate daily
amqp-connection	RabbitMQ connection information related settings		
	server	localhost	Connection host name
	port	(5671 or 5672)	Connection port number
	user	(guest or kompira)	Connection user name
	password	(guest or kompira)	Connection password
	ssl	(true or false)	Enabling to connect with SSL or not
	ssl_verify	false	Whether to validate server certificates with SSL

continues on next page

Table 2 – continued from previous page

Section name	Item name	Default value	Contents
	ssl_cacertfile		CA certificate file for validating server certificates during SSL connection
	ssl_certfile		Certificate file for SSL connection
	ssl_keyfile		Private key file for SSL connection
	heartbeat_interval	10	Heartbeat interval (in seconds)
	max_retry	3	Maximum number of attempts to reconnect at disconnection
	retry_interval	30	Interval (in seconds) to reconnect at disconnection
agent	Settings related to job manager operation		
	name	default	Name of job manager
	pool_size	8	Number of concurrent process workers (1..80)
	disable_cache	false	Disable remote connection cache
	cache_duration	300	Remote connection cache expiration date (in seconds)
event	Settings of Send-Event		
	channel	/system/channels/Alert	Path on Kompira for event transmission channel

Note that in a Windows environment, the default value changes as follows.

- logdir: C:\Kompira\Log

Note: The remote connection cache is a function that speeds up the processing of successive remote command execution on the same node and under the same account by reusing the remote connection during remote command execution.

However, the remote connection cache will not be used for WinRS connections regardless of the disable_cache setting, because the speedup effect is not available.

Changed in version 1.6.8: The default value of logdir has been changed to C:\Kompira\Log under Windows.

Changed in version 1.6.8: The default value for user is now guest or kompira. If localhost or 127.0.0.1 is specified as the hostname to connect to, the value is guest; otherwise, the value is kompira.

Changed in version 1.6.8: When password is not specified, the default value is now the same string as user.

Changed in version 1.6.8: The default value of ssl has been changed to true or false. When ssl is not specified, it is false if server is localhost, otherwise it is true.

Changed in version 1.6.8: The default value of port has been changed to 5671 or 5672. If port is not specified, 5671 if ssl is true, 5672 if false.

New in version 1.6.8: New configuration items ssl_verify, ssl_cacertfile, ssl_certfile, and ssl_keyfile have been added.

New in version 1.6.9.post4: The pool_size is now limited from 1 to 80.

1.5.4 Kompira image files

The images displayed in the browser window are located on the Kompira server at the following locations.

- /var/opt/kompira/html/kompira/img/

The image files located here are as follows. You can change the appearance of the screen by directly replacing the image files.

File name	Purpose	Size	Description
favicon.svg	Favicon (SVG)	16x16	This icon is used for browser tabs and favorite icons when registered.
favicon.ico	Favicon (ICO)	16x16	Same as above (for use with browsers that do not support SVG format)
brand-logo.svg	Brand logo image	40x40	The logo image will be displayed in the upper left corner of the menu bar.
login-logo.svg	Log-in logo image	128x128	The logo is displayed in the center of the login and logout screens.
console-loading.gif	Console loading image	20x20	Shown in the console while the process is active on the process details screen.

Note: Size is shown as the number of pixels for reference when displayed on a typical resolution display.

1.6 Data backup of Kompira

How to back up and restore data stored on Kompira.

The definitions of job flow and device information created on Kompira will be stored in the database. These data sets can be exported and imported as a file in json format.

1.6.1 Export of Kompira objects

By executing the `export_data` command with the following format, specified data of Kompira file system will be dumped in json format.

```
/opt/kompira/bin/manage.py export_data [options] <path>...
```

For example, to export all data under /home/guest created by Kompira to a file, execute the following command.

```
$ /opt/kompira/bin/manage.py export_data /home/guest > guest.json
```

Alternatively, by executing the `export_dir` command, you can dump the data below the path of the Kompira file system specified by the argument as a YAML file on a per-object basis.

```
/opt/kompira/bin/manage.py export_dir [options] <path>...
```

Note that for objects of the following types, only the data in the fields they represent will be output as a file, and the remaining fields will be output as `<object name>` with property information.

Type name	Representative field	File format
Jobflow	source	text
ScriptJob	source	text
Library	sourceText	text
Template	template	text
Text	text	text
Wiki	wikitext	text
Environment	environment	YAML

New in version 1.6.7: The `export_dir` command has been changed to output the data in the attachment field as a separate file.

1.6.2 Import of Kompira objects

You can import data with the exported file using the `import_data` command. The format of the `import_data` command is as follows.

```
/opt/kompira/bin/manage.py import_data [options] <filename>...
```

For example, to import the file `guest.json` exporting the `/home/guest` directory, execute the following command:

```
$ /opt/kompira/bin/manage.py import_data guest.json
[2014-07-25 12:34:49,576] INFO: import data: start...
[2014-07-25 12:34:49,676] INFO: home/guest: import is skipped: "/home/guest" already
↳exists.
[2014-07-25 12:34:49,710] INFO: home/guest/a: import is skipped: "/home/guest/a" already
↳exists.
[2014-07-25 12:34:49,743] INFO: home/guest/b: import is skipped: "/home/guest/b" already
↳exists.
[2014-07-25 12:34:49,743] INFO: import data: finished (created=0, updated=0, skipped=3,
↳error=0)
```

If the imported json file contains an object of a path that already exists, the import of that object will be skipped. In the above case, all three files to be imported were skipped.

You can overwrite by using the `overwrite-mode` option.

```
$ /opt/kompira/bin/manage.py import_data --overwrite-mode guest.json
[2014-07-25 12:39:15,685] INFO: import data: start...
[2014-07-25 12:39:15,821] INFO: import object: imported "home/guest" to "/home/guest"
↳ (updated)
[2014-07-25 12:39:15,904] INFO: import object: imported "home/guest/a" to "/home/guest/a"
↳ (updated)
[2014-07-25 12:39:15,971] INFO: import object: imported "home/guest/b" to "/home/guest/b"
↳ (updated)
[2014-07-25 12:39:15,991] INFO: import fields: /home/guest: []
[2014-07-25 12:39:16,015] INFO: import fields: /home/guest/a: ['wikitext']
[2014-07-25 12:39:16,046] INFO: import fields: /home/guest/b: ['wikitext']
[2014-07-25 12:39:16,046] INFO: import data: finished (created=0, updated=3, skipped=0,
↳error=0)
```

Files dumped with the `export_dir` command can be imported using the `import_dir` command.

```
/opt/kompira/bin/manage.py import_dir [options] <dirname>...
```

1.6.3 Backup

The Kompira backup procedure.

Kompira will use data from the paths listed in *Kompira standard directories* on the server, in addition to those in the database. When backing up Kompira data, in addition to backing up the Kompira objects with the `export_data` command, you should also back up the files on the server if necessary.

This is an example of backing up the Kompira object and license files.

```
$ mkdir -p /tmp/kompira_backup
$ cd /tmp/kompira_backup
$ /opt/kompira/bin/manage.py export_data / --virtual-mode > backup.json
$ cp /var/opt/kompira/kompira.lic ./
$ cd /tmp
$ tar zcf kompira_backup.tar.gz ./kompira_backup
```

1.6.4 export_data options

The `export_data` command has the following options:

Options	Description
<code>--directory=DIRECTORY</code>	Specify the directory as the starting point of the exported path. (Default is '/')
<code>--virtual-mode</code>	This also outputs data contained in the virtual file system.
<code>--owner-mode</code>	This also outputs the exported user object owned by that user and the group object belonging to that user.
<code>--zip-mode</code>	Output in ZIP format.
<code>--without-attachments</code>	Do not output attachment data.
<code>-h, --help</code>	Print help message.

New in version 1.6.7: The `--zip-mode` and `--without-attachments` options have been added.

1.6.5 export_dir options

The `export_dir` command has the following options:

Options	Description
<code>--directory=DIRECTORY</code>	Specify the directory as the starting point of the exported path. (Default is '/')
<code>--property-mode</code>	Attributes such as 'display_name' are also output.
<code>--datetime-mode</code>	The 'created' and 'updated' are also output.
<code>--current=CURRENT_DIR</code>	Specify the output directory.
<code>--without-attachments</code>	Do not output attachment data.
<code>--inline-attachments</code>	Include attachment data in the YAML file and output it.
<code>--linesep=LINESEP</code>	Change the newline codes when exporting model data. LINESEP can be any of <code>os_linesep</code> , <code>lf</code> , <code>crlf</code> or <code>no_change</code> . <code>os_linesep</code> changes the newline codes based on the OS standard. <code>lf</code> changes to <code>\n</code> , <code>crlf</code> changes to <code>\r\n</code> , and <code>no_change</code> preserves original newline codes. Default is <code>os_linesep</code> .

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Options	Description
<code>-h, --help</code>	Print help message.

New in version 1.6.7: The `--without-attachments` and `--inline-attachments` options have been added.

New in version 1.6.9: The `--linesep` option has been added.

Note: `--linesep` only affects *text-format* files.

1.6.6 import_data options

The `import_data` command has the following options:

Options	Description
<code>--user=USER</code>	Set the owner of the data to be imported to USER (specify user ID).
<code>--directory=ORIGIN-DIR</code>	Specify the directory as the starting point of the import destination. (Default is '/')
<code>--overwrite-mode</code>	Overwrite existing objects if any.
<code>--owner-mode</code>	Set the owner of the data to be imported to the export owner.
<code>--update-config-mode</code>	Also overwrites the configuration data of Config type objects. (The <code>--overwrite-mode</code> option must also be specified at the same time.)
<code>--now-updated-mode</code>	Sets the current time as the 'updated' of the object.
<code>-h, --help</code>	Print help message.

New in version 1.6.7: The `--update-config-mode` option has been added.

1.6.7 import_dir options

The `import_dir` command has the following options:

Options	Description
<code>--user=USER</code>	Set the owner of the data to be imported to USER (specify user ID).
<code>--directory=ORIGIN-DIR</code>	Specify the directory as the starting point of the import destination. (Default is '/')
<code>--overwrite-mode</code>	Overwrite existing objects if any.
<code>--owner-mode</code>	Set the owner of the data to be imported to the export owner.
<code>--update-config-mode</code>	Also overwrites the configuration data of Config type objects. (The <code>--overwrite-mode</code> option must also be specified at the same time.)
<code>--now-updated-mode</code>	Sets the current time as the 'updated' of the object.
<code>--linesep=LINESEP</code>	Change the newline codes when importing model data. LINESEP can be any of <code>os_linesep</code> , <code>lf</code> , <code>crlf</code> or <code>no_change</code> . <code>os_linesep</code> changes the newline codes based on the OS standard. <code>lf</code> changes to <code>\n</code> , <code>crlf</code> changes to <code>\r\n</code> , and <code>no_change</code> preserves original newline codes. Default is <code>crlf</code> .
<code>-h, --help</code>	Print help message.

New in version 1.6.7: The `--update-config-mode` option has been added.

New in version 1.6.9: The `--linesep` option has been added.

Note: `--linesep` only affects *text-format* files.

1.7 Kompira License

You can check the license status of Kompira using the `license_info` command. The format of the `license_info` command is as follows.

```
/opt/kompira/bin/manage.py license_info
```

The following is an example of when a license is registered.

```
$ /opt/kompira/bin/manage.py license_info
*** Kompira License Information ***
License ID:      KP-REGLM0-00000000001
Edition:         REGL
Hardware ID:     NODE:000C29FB949E
Expire date:     2015-12-31
The number of registered nodes: 0 / 100
The number of registered jobflows:      2 / 100
The number of registered scripts:       0 / 100
Licensee:        fixpoint,inc.
Signature:       dwyWvG9eKbnGxcpWfVr1H0wSybLkGL7UqB2E6d5f0jYapfTx/AABJ66W3sRpK0byk+9Y724
                  NuEZ9Rh90ySU8f2GRsIyujuVrgPloajokbdZrPFIqOlyvLkak8MAWcGJxiioPHPNd2Tv2BN
                  Osq6bs5ZfJlCReEJhYyngnXjeLBM=
```

If the license is not registered, the temporary license information will be printed.

```
$ /opt/kompira/bin/manage.py license_info
*** Kompira License Information ***
License ID:      KP-TEMP-00000000000
Edition:         temporary
Hardware ID:     NODE:000C29FB949E
Expire date:     2015-01-22
The number of registered nodes: 0 / 100
The number of registered jobflows:      2 / 100
The number of registered scripts:       0 / 100
Licensee:
Signature:       None

Kompira is running with temporary license.
```

The license file path is `/var/opt/kompira/kompira.lic`.

You can place or update the license file in the above path using the `license_update` command.

The format of the `license_update` command is as follows.

```
/opt/kompira/bin/manage.py license_update <LICENSE_FILE>
```

The `license_update` command has the following options:

Options	Description
--no-backup	Does not make a backup of the license file.
--force	Force renewal if the license file validation fails.

New in version 1.6.2: `license_update` command

See also:

License Management: You can also check and register licenses from the browser.

1.8 Private key management

1.8.1 changing the private key

To change the private key used to encrypt the password field, run the command `change_secretkey` with root privileges. By running the command, all password data stored encrypted in the database will be re-encrypted and stored again with the new private key.

The `change_secretkey` command is of the following format

```
# /opt/kompira/bin/manage.py change_secretkey [options] <new_secretkey>
```

The options are as follows

Options	Description
--no-backup	Does not back up the keys before the change.
--force	Continue with re-encryption even if there is password data that failed to be re-encrypted along the way.

Note: The secret key string is stored in `/var/opt/kompira/.secret_key`.

Note: Restart the `httpd` and `kompirad` services after running `change_secretkey`. In a redundant configuration, execute `change_secretkey` on the active side before switching to the standby side.

1.9 High Availability (HA) Management

Kompira can be operated on two servers with active-standby redundant configuration using Pacemaker / corosync. The following is an explanation of its installation, state check, failover, etc.

1.9.1 Introduction

Pacemaker monitors the resources (applications) necessary for Kompira and failover when an error is detected for the redundancy.

The list of resources Pacemaker monitors is as follows.

httpd, kompirad, kompira_jobmgrd

This is a necessary process for Kompira and can only run on an active server.

RabbitMQ

RabbitMQ is also a necessary process for Kompira. A process on the active server is a ‘Master’, and a process on the standby server is a ‘Slave’.

IPaddr2

A resource for managing virtual IP addresses.

PostgreSQL

This is a PostgreSQL database process. A process on the active server is Master, and a process on the standby server is Slave. PostgreSQL replication is configured so the data on the primary server and the data on the secondary server are synchronized.

1.9.2 Installation

When building a redundant configuration of Kompira, after installing Kompira on each of the two servers, set up the redundant configuration on the primary server and then the secondary server.

Two servers require two network interfaces. Depending on the OS version, the network interface name may be eth0, eth1, ..., or ens192, ens224,

From the following, we call the primary server (ha-kompira1), and the secondary server (ha-kompira2), and each server has network interfaces eth0, and eth1. eth0 is connected to the service provisioning network and eth1 is used for heartbeat so that two servers are connected by an independent network.

When the redundant configuration is established, the primary server is in the active state and the secondary server is in the standby state.

To build a redundant configuration of Kompira, use `setup_cluster.sh` included in the package. In the following, the procedure for installing redundant Kompira on 2 servers after OS installation is explained.

Note: `setup_cluster.sh` downloads various middleware from the outside like `install.sh`. Please run it while you have an Internet connection available.

Setting of the primary server

After installing the Kompira package, set up the primary server by running `setup_cluster.sh` with the `--primary` option.

When executing `setup_cluster.sh`, specify the following information as an argument.

- Heartbeat network device name
- The virtual IP address (VIP) assigned to the cluster and its subnet mask prefix size

For example, to specify eth1 as the heartbeat network device, 192.168.0.100 as the virtual IP address and 24 as the subnet mask prefix size, execute the following commands.

```
$ tar xzf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh
# ./setup_cluster.sh --primary --heartbeat-device eth1 192.168.0.100/24
```

Note: Internally, each node in the redundant configuration needs to be able to resolve names, so it registers aliases such as ha-kompira1 (primary machine) and ha-kompira2 (secondary machine) in /etc/hosts. setup_cluster.sh does not change the hostname of the server.

Setting of the secondary server

After installing the Kompira package, set up the secondary server by executing setup_cluster.sh with the --secondary option.

When executing setup_cluster.sh, specify the following information as an argument. It is not necessary to specify a virtual IP address.

- Heartbeat network device name

Heartbeat network device name

```
$ tar xzf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh
# ./setup_cluster.sh --secondary --heartbeat-device eth1
```

Note: For example, to specify eth1 as the heartbeat network device, execute the following commands.

Status check

When the installation of the primary server and the secondary server are completed, please access the following URL from a Web browser and confirm that the login screen is displayed.

```
http://192.168.0.100/
```

The URL is the virtual IP address that was set when installing the primary server. This URL will be maintained even if the primary machine fails and a failover occurs.

Also, to check the status of each resource in the redundant configuration, use the crm_mon command on the primary server or the secondary server.

```
# crm_mon -A1
Cluster Summary:
* Stack: corosync
* Current DC: ha-kompira1 (version 2.1.0-8.el8-7c3f660707) - partition with quorum
* Last updated: Wed Sep  8 22:21:02 2021
* Last change:  Wed Sep  8 22:19:56 2021 by hacluster via crmd on ha-kompira1
* 2 nodes configured
* 9 resource instances configured
```

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```

Node List:
* Online: [ ha-kompira1 ha-kompira2 ]

Active Resources:
* Resource Group: webserver:
* res_memcached      (systemd:memcached):      Started ha-kompira1
* res_kompirad       (systemd:kompirad):       Started ha-kompira1
* res_kompira_jobmgrd (systemd:kompira_jobmgrd): Started ha-kompira1
* res_httpd (ocf::heartbeat:apache):          Started ha-kompira1
* res_vip   (ocf::heartbeat:IPaddr2):         Started ha-kompira1
* Clone Set: res_pgsql-clone [res_pgsql] (promotable):
* Masters: [ ha-kompira1 ]
* Slaves: [ ha-kompira2 ]
* Clone Set: res_rabbitmq-clone [res_rabbitmq]:
* Started: [ ha-kompira1 ha-kompira2 ]

Node Attributes:
* Node: ha-kompira1:
* master-res_pgsql           : 1001
* rmq-node-attr-last-known-res_rabbitmq : rabbit@ha-kompira1
* rmq-node-attr-res_rabbitmq   : rabbit@ha-kompira1
* Node: ha-kompira2:
* master-res_pgsql           : 1000
* rmq-node-attr-last-known-res_rabbitmq : rabbit@ha-kompira2
* rmq-node-attr-res_rabbitmq   : rabbit@ha-kompira2

```

Here is the points to check in the output of the `crm_mon` command.

- **Resource Group**

Only resources that are running on the active machine are printed. Everything is normal if “Started <host name of active machine>” is printed.

- **Clone Set**

Resources running on both servers are printed. In the case of Promotable resources, it is normal if the host name of the active machine is displayed in Masters and the host name of the standby machine is displayed in Slaves.

- **Node Attributes**

Detailed status of the PostgreSQL process is printed. If replication has been performed correctly, it prints in the `res_pgsql-data-status` line as 1001 on the active server and 1000 on the standby server.

License Registration

In a redundant configuration, you will need to register license files for both active and standby servers.

Please follow the procedure in [Kompira License](#) and register the license file for each server.

1.9.3 Update

First, here are some points to keep in mind when updating the redundant configuration.

- Before updating, please make sure that both the active and standby systems are working properly. If only one system is working properly, the update may not be possible.
- Please make sure that there is no abnormality in each step, and that the update has not failed.
- In any of the update procedures, jobs running on the active system will be terminated. Please note that the operation of the terminated jobs will not be resumed by starting or switching the system after the update.
- Please note that there may be version-specific precautions regarding the update procedure. Please check the release notes beforehand.
- The following single-system stop update procedure may not work in environments that used the old erlang / rabbitmq-server.
- rabbitmq-server only updates minor versions +1 at a time for compatibility. You may need to update multiple times to get up to the latest version.
- rabbitmq-server may add new features when the minor version is updated. If some features are not enabled, you may not be able to update next time. After updating, please enable all features with the `rabbitmqctl enable_feature_flag all` command.
- Please note that the upgrade of PostgreSQL is a special procedure based on the both-system stop update procedure.

When updating a redundant configuration, there are two main update procedures. Depending on the procedure, you can choose a method that involves switching Master/Slave or a method that does not involve switching. The following is a brief description of the procedure for your reference.

Update procedure with both systems stopped (without failover)

1. Stop the standby system. (`pcs cluster stop`)
2. Stop the active system. (`pcs cluster stop -force`) (*) The running jobs will be killed here.
3. Update the active system. (`./install.sh`) (*) The auto-startup job will start.
4. Update the standby system. (`./install.sh`)
5. Enable rabbitmq-server features (`rabbitmqctl enable_feature_flag all`) (*) If rabbitmq-server has had a minor update.

Instead of failover occurring, both systems will be stopped, resulting in a longer period of time when jobs are stopped.

Warning: Please note that if the `--skip-cluster-start` option of `install.sh` is specified in step 3 for updating both systems stop and in step 2 for updating one system stop, the redundant configuration settings may not be updated correctly.

Update procedure with single systems stopped (with failover)

1. Stop the standby system. (pcs cluster stop)
2. Update the standby system. (./install.sh)
3. Stop the active system. (pcs cluster stop) (*) At this point, failover occurs and the updated standby system becomes active. Jobs that were running on the old active system will be terminated and auto-startup jobs will be started on the new active system.
4. Update the old active system. (./install.sh)
5. Enable rabbitmq-server features (rabbitmqctl enable_feature_flag all) (*) If rabbitmq-server has had a minor update.

It involves failover, but one system is still running, so the period of time when jobs are stopped is shorter.

However, if there is a compatibility problem, such as when updating from an old erlang / rabbitmq-server, the single-system stop update cannot be performed. In this case, the following warning will be displayed at the end of install.sh, and the automatic cluster restart process will be skipped.

```
[2023-02-03 12:00:00] WARN: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2023-02-03 12:00:00] WARN:
[2023-02-03 12:00:00] WARN: FULL STOP UPGRADES ARE REQUIRED! (For version compatibility)
[2023-02-03 12:00:00] WARN:
[2023-02-03 12:00:00] WARN:   erlang: R16B -> 23.3.4.11
[2023-02-03 12:00:00] WARN:   rabbitmq-server: 3.3.5 -> 3.10.0
[2023-02-03 12:00:00] WARN:
[2023-02-03 12:00:00] WARN: - Automatic cluster start was skipped.
[2023-02-03 12:00:00] WARN: - Please stop both systems and upgrade each one.
[2023-02-03 12:00:00] WARN: - Then start the clusters in order with the following↪
↪ command.
[2023-02-03 12:00:00] WARN:
[2023-02-03 12:00:00] WARN:       # pcs cluster start
[2023-02-03 12:00:00] WARN:
[2023-02-03 12:00:00] WARN: - At that time, start the cluster first on the node that↪
↪ was active before the upgrade.
[2023-02-03 12:00:00] WARN:
[2023-02-03 12:00:00] WARN: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
```

In this case, please switch to the both-system stop update procedure. After the update, use the pcs cluster start command to restart the redundant configuration sequentially, starting with the active system

Procedure for updating with PostgreSQL upgrade with both systems stopped

When upgrading PostgreSQL in a redundant configuration, this is a dedicated procedure based on a both-system outage update. Specify the version of PostgreSQL you wish to upgrade in steps 3 and 4 as follows.

1. Stop the standby system. (pcs cluster stop)
2. Stop the active system. (pcs cluster stop -force) (*) The running jobs will be killed here.
3. Update the active system. (./install.sh --postgresql-version=17)
4. Update the standby system. (./install.sh --postgresql-version=17)
5. Restart the active system. (pcs cluster stop)

6. Restart the standby system with sync_master.sh. (/opt/kompira/bin/sync_master.sh --force)

Warning: Be sure to specify the same major version in steps 3 and 4.

The following warning appears at the end of install.sh in steps 3 and 4, and the automatic cluster restart process is also skipped.

```
[2024-10-29 12:00:00] WARN: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2024-10-29 12:00:00] WARN:
[2024-10-29 12:00:00] WARN: FULL STOP UPGRADES ARE REQUIRED! (For version compatibility)
[2024-10-29 12:00:00] WARN:
[2024-10-29 12:00:00] WARN:   postgresql: 12.17 -> 17.0
[2024-10-29 12:00:00] WARN:
[2024-10-29 12:00:00] WARN:   - Automatic cluster start was skipped.
[2024-10-29 12:00:00] WARN:   - Please stop both systems and upgrade each one.
[2024-10-29 12:00:00] WARN:   - First, start the cluster with the following command on_
↪ the node that was active before the upgrade.
[2024-10-29 12:00:00] WARN:
[2024-10-29 12:00:00] WARN:       # pcs cluster start
[2024-10-29 12:00:00] WARN:
[2024-10-29 12:00:00] WARN:   - Next, start the cluster with the following command on the_
↪ node that was standby before the upgrade.
[2024-10-29 12:00:00] WARN:
[2024-10-29 12:00:00] WARN:       # /opt/kompira/bin/sync_master.sh --force
[2024-10-29 12:00:00] WARN:
[2024-10-29 12:00:00] WARN: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
```

After this, in step 5, restart the active system with pcs cluster start as in the basic procedure. At this time, confirm that all resources in the active system are started normally by using pcs status or crm_mon command, for example.

Finally, restart the standby system with sync_master.sh as step 6. At this time, add the --force option to force the active system to synchronize its data.

Changed in version 1.6.6: pcs cluster start is now automatically executed after install.sh is run in redundant configuration. The update procedure for redundant configurations has been changed accordingly.

Changed in version 1.6.8: If the single-system stop update cannot be performed, a warning will be displayed and pcs cluster start will be skipped.

Changed in version 1.6.8.post2: In a redundant configuration, rabbitmq-server will now only go up by +1 minor version.

New in version 1.6.8.post2: A procedure to enable rabbitmq-server features has been added.

New in version 1.6.10: Add the procedure for updating with PostgreSQL upgrade with both systems stopped.

1.9.4 HA stop and start

How to stop and start Kompira operating in a HA:

First of all, use the `crm_mon` command to see which of the two servers is acting as active. In the resource part of the `crm_mon` command result the active server shows, “Started” and “Masters”.

The following explanation assumes that `ha-kompira1` is in the active state.

In principle, to stop servers, stop the standby server first and then stop the active server, to start servers, start the active server first and then start the standby server second.

This is because if the active server is stopped first, the standby server judges that an error has occurred in the active server and a failover process will be performed. If it fails over by mistake, refer to [Failover and fail back behavior](#).

Stop HA configuration

First, stop the Pacemaker process on the secondary server (`ha-kompira2`).

```
# pcs cluster stop
Stopping Cluster (pacemaker)...
Stopping Cluster (corosync)...
```

After confirming that the service has stopped, do the same thing on the primary server (`ha-kompira1`). The `--force` option is required to stop the last one of the HA configuration.

```
# pcs cluster stop --force
Stopping Cluster (pacemaker)...
Stopping Cluster (corosync)...
```

This stops monitoring resources by Pacemaker/corosync. Please note that the `crm_mon` command can not be executed when the pacemaker process is stopped.

To not only stop the process but to also shut down the server OS, the above process is not needed. However, please shut down the standby server first and then the active server.

Start HA configuration

To start up, follow the procedure opposite to stop. First, start the Pacemaker process on the primary server (`ha-kompira1`).

```
# pcs cluster start
Starting Cluster...
```

Note: In a Pacemaker (1.x) environment such as RHEL7, the following message will be displayed when executing `pcs cluster start`.

```
# pcs cluster start
Starting Cluster (corosync)...
Starting Cluster (pacemaker)...
```

When the pacemaker process started up, the resources registered in pacemaker will start sequentially. Execute the `crm_mon` command and wait until all resources are started.

When the resources were started, start the Pacemaker process on the secondary server (`ha-kompira2`).

```
# pcs cluster start
Starting Cluster...
```

This completes start up of the HA configuration.

When you boot server OS not only starting processes, the above processing is not needed. The Pacemaker service is set to auto start up.

Please start the active server first and after confirming startup is completed, then start the standby server.

1.9.5 Failover and fail back behavior

If any failure occurs on the active server, the failover will be automatically performed and the standby server will be promoted to the active status.

Below is the `crm_mon` command result on `ha-kompira2` after shutting down of `ha-kompira1` which was in the active state.

```
# crm_mon -A1
Cluster Summary:
* Stack: corosync
* Current DC: ha-kompira2 (version 2.1.0-8.el8-7c3f660707) - partition with quorum
* Last updated: Wed Sep  8 22:27:37 2021
* Last change: Wed Sep  8 22:27:09 2021 by root via crm_attribute on ha-kompira2
* 2 nodes configured
* 9 resource instances configured

Node List:
* Online: [ ha-kompira2 ]
* OFFLINE: [ ha-kompira1 ]

Active Resources:
* Resource Group: webserver:
  * res_memcached      (systemd:memcached):      Started ha-kompira2
  * res_kompirad       (systemd:kompirad):        Started ha-kompira2
  * res_kompira_jobmgrd (systemd:kompira_jobmgrd):      Started ha-kompira2
  * res_httpd (ocf::heartbeat:apache):          Started ha-kompira2
  * res_vip (ocf::heartbeat:IPaddr2):            Started ha-kompira2
* Clone Set: res_psql-clone [res_psql] (promotable):
  * Masters: [ ha-kompira2 ]
* Clone Set: res_rabbitmq-clone [res_rabbitmq]:
  * Started: [ ha-kompira2 ]

Node Attributes:
* Node: ha-kompira2:
  * master-res_psql : 1001
  * rmq-node-attr-last-known-res_rabbitmq : rabbit@ha-kompira2
  * rmq-node-attr-res_rabbitmq : rabbit@ha-kompira2
```

You can see `ha-kompira1` is OFFLINE, and each of the resources are running on `ha-kompira2`.

In the following, the procedures when `ha-kompira1` is recoverable, and unrecoverable separately will be explained.

When the server is recoverable

Here is the procedure when the ha-kompira1 can be started normally.

When you have started ha-kompira1, the status will be as follows

```
# crm_mon -A1
Cluster Summary:
* Stack: corosync
* Current DC: ha-kompira2 (version 2.1.0-8.el8-7c3f660707) - partition with quorum
* Last updated: Wed Sep  8 22:35:16 2021
* Last change:  Wed Sep  8 22:34:57 2021 by root via crm_attribute on ha-kompira2
* 2 nodes configured
* 9 resource instances configured

Node List:
* Online: [ ha-kompira1 ha-kompira2 ]

Active Resources:
* Resource Group: webserver:
  * res_memcached      (systemd:memcached):      Started ha-kompira2
  * res_kompirad       (systemd:kompirad):       Started ha-kompira2
  * res_kompira_jobmgrd (systemd:kompira_jobmgrd):      Started ha-kompira2
  * res_httpd (ocf::heartbeat:apache):          Started ha-kompira2
  * res_vip   (ocf::heartbeat:IPaddr2):         Started ha-kompira2
* Clone Set: res_pgsql-clone [res_pgsql] (promotable):
  * Masters: [ ha-kompira2 ]
  * Slaves:  [ ha-kompira1 ]
* Clone Set: res_rabbitmq-clone [res_rabbitmq]:
  * Started: [ ha-kompira1 ha-kompira2 ]

Node Attributes:
* Node: ha-kompira1:
  * master-res_pgsql      : -1
  * rmq-node-attr-last-known-res_rabbitmq : rabbit@ha-kompira1
  * rmq-node-attr-res_rabbitmq : rabbit@ha-kompira1
* Node: ha-kompira2:
  * master-res_pgsql      : 1001
  * rmq-node-attr-last-known-res_rabbitmq : rabbit@ha-kompira2
  * rmq-node-attr-res_rabbitmq : rabbit@ha-kompira2
```

In ha-kompira1, the database is not synchronized correctly and it is not in a normal state as a standby server.

In order to complete the setup as a standby server, use sync_master.sh in the kompira package on the standby server. sync_master.sh will copy the database of the active server to the standby server, sets up replication, and starts the database process.

```
# /opt/kompira/bin/sync_master.sh
[2023-08-03 18:19:46] ****:
*****
[2023-08-03 18:19:46] ****: Kompira-1.6.8.post3:
[2023-08-03 18:19:46] ****: Start: Sync with the Master
...
[2023-08-03 18:19:49] INFO: Waiting for the resources to stabilize.
[2023-08-03 18:19:49] INFO: nodes[2]: ha-kompira1 ha-kompira2 (local=ha-kompira1)
```

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```
[2023-08-03 18:19:51] INFO: Display state of resources.
* Resource Group: webserver:
* res_memcached      (systemd:memcached):      Started ha-kompira2
* res_kompirad       (systemd:kompirad):        Started ha-kompira2
* res_kompira_jobmgrd (systemd:kompira_jobmgrd):        Started ha-kompira2
* res_httpd (ocf::heartbeat:apache):           Started ha-kompira2
* res_vip   (ocf::heartbeat:IPaddr2):          Started ha-kompira2
* Clone Set: res_pgsql-clone [res_pgsql] (promotable):
* Masters: [ ha-kompira2 ]
* Slaves: [ ha-kompira1 ]
* Clone Set: res_rabbitmq-clone [res_rabbitmq]:
* Started: [ ha-kompira1 ha-kompira2 ]

[2023-08-03 18:19:51] *****
[2023-08-03 18:19:51] *****: Finish: Sync with the Master (status=0)
[2023-08-03 18:19:51] *****:
*****
```

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Cluster Summary:

```
* Stack: corosync
* Current DC: ha-kompira2 (version 2.1.0-8.el8-7c3f660707) - partition with quorum
* Last updated: Thu Sep  9 00:35:55 2021
* Last change:  Thu Sep  9 00:30:55 2021 by root via crm_attribute on ha-kompira2
* 2 nodes configured
* 9 resource instances configured
```

Node List:

```
* Online: [ ha-kompira1 ha-kompira2 ]
```

Active Resources:

```
* Resource Group: webserver:
* res_memcached      (systemd:memcached):      Started ha-kompira2
* res_kompirad       (systemd:kompirad):        Started ha-kompira2
* res_kompira_jobmgrd (systemd:kompira_jobmgrd):      Started ha-kompira2
* res_httpd (ocf::heartbeat:apache):           Started ha-kompira2
* res_vip   (ocf::heartbeat:IPaddr2):          Started ha-kompira2
* Clone Set: res_pgsql-clone [res_pgsql] (promotable):
* Masters: [ ha-kompira2 ]
* Slaves: [ ha-kompira1 ]
* Clone Set: res_rabbitmq-clone [res_rabbitmq]:
* Started: [ ha-kompira1 ha-kompira2 ]
```

Node Attributes:

```
* Node: ha-kompira1:
* master-res_pgsql      : 1000
* rmq-node-attr-last-known-res_rabbitmq : rabbit@ha-kompira1
* rmq-node-attr-res_rabbitmq : rabbit@ha-kompira1
* Node: ha-kompira2:
* master-res_pgsql      : 1001
* rmq-node-attr-last-known-res_rabbitmq : rabbit@ha-kompira2
* rmq-node-attr-res_rabbitmq : rabbit@ha-kompira2
```

When the server is unrecoverable

This is the procedure when you need to shutdown the server and replace failing hardware, prepare the server with OS installed and set it as a standby state.

In a HA configuration, it is necessary to register a license file on each of the active server and the standby server. Execute `install.sh`, then use the `license_info` command to check the hardware ID and register the license file.

```
$ tar xzf kompira-<version>-bin.tar.gz
$ cd kompira-<version>-bin
# ./install.sh

$ cp kompira_KP-EVALM100-00000000001.lic /var/opt/kompira/kompira.lic
$ cd /var/opt/kompira
$ chown apache:apache kompira.lic
$ /opt/kompira/bin/manage.py license_info

# ./setup_cluster.sh --primary --slave-mode
```


The above command is an example of setting up ha-kompira1 in a standby state.

In a HA configuration, it is necessary to register a license file on each of the active servers and standby servers, so you will need to register the license file before running `setup_cluster.sh`.

When you run `setup_cluster.sh` to add ha-kompira2 instead of ha-kompira1, use the `--secondary` option instead of the `--primary` option.

When the process of `setup_cluster.sh` is completed, please refer to [Status check](#) to know how to check the status.

See also:

[Kompira License](#)

1.9.6 setup_cluster.sh Options

Below is a list of instructions on how to `setup_cluster.sh`.

Options	Default value	Description
<code>--primary</code>	true (specified)	Start setup as a primary
<code>--secondary</code>	false (not specified)	Start setup as secondary
<code>--heartbeat-device=DEVICE</code>		Specify the network device for heartbeat.
<code>--master-mode</code>		Setup as an active state.
<code>--slave-mode</code>		Set up as a standby state.
<code>--without-vip</code>		Setup without VIP configuration. (You will need to setup LB with ACT/SBY monitoring separately.)
<code>--without-jobmanager</code>		Setup without job manager configuration.
<code>--hostname-prefix=PREFIX_NAME</code>	ha-kompira	Specify the host name prefix.
<code>--heartbeat-netaddr=NETWORK_ADDRESS</code>	192.168.99.0	Specify the network address to be set for the heartbeat interface.
<code>--manual</code>		Setup parameters manually.
<code>--manual-heartbeat</code>		Manually configure the network for heartbeat. You will need to specify <code>--heartbeat-primary</code> and <code>--heartbeat-secondary</code> and ignore <code>--heartbeat-netaddr</code> . Heartbeat runs in unicast mode.
<code>--heartbeat-primary=NETWORK_ADDRESS</code>		Specify the primary IP address.
<code>--heartbeat-secondary=NETWORK_ADDRESS</code>		Specify the IP address of the secondary.
<code>--cluster-name=NAME</code>		Specify the cluster name (up to 15 characters).

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Options	Default value	Description
<code>--cluster-device=DEVICE</code>		Specify the network device to be assigned the VIP.
<code>--token=TOKEN</code>	30000	Specify token timeout (milliseconds).
<code>--consensus=CONSENSUS</code>		Specify consensus timeout (milliseconds).
<code>--proxy=PROXY</code>		Specify the proxy server in the following format. [user:passwd@]proxy.server:port
<code>--noproxy=HOSTS</code>		Specify the hosts to be excluded from the proxy in a comma-separated list.
<code>--offline</code>		Setup in offline mode.
<code>--dry-run</code>		Runs in dry run mode. It only checks the parameters and does not perform the actual setup.
<code>--help</code>		Print help message.

Changed in version 1.6.7: The default value of the `--token` option has been changed to 30000.

1.9.7 sync_master.sh options

Run `sync_master.sh` on the node where you want to synchronize data with the active system. Executing `sync_master.sh` copies the database of the active system to its own node and restarts the cluster as a standby system. Since `sync_master.sh` is used to recover a standby system that has been down for some reason, it clears the failure history recorded by pacemaker so that the cluster can be restarted.

The `sync_master.sh` is of the following format

```
# /opt/kompira/bin/sync_master.sh [options]
```

The options are as follows

Options	Description
<code>--force</code>	Forcibly copy the data of the active system even if data remains.
<code>--no-save-datadir</code>	The data directory before data synchronization with the active system is deleted without saving.

`sync_master.sh` attempts to synchronize data with the active system using the appropriate data, if any, remaining on the executed node. If data synchronization with the active system is achieved, the cluster can be restarted as a standby system without the need to copy data. If data synchronization cannot be confirmed, the cluster will automatically start copying data from the active system and then restart the cluster as a standby system.

Running `sync_master.sh` with the `--force` option will force the cluster to copy data from the active system even if data remains. This may improve behavior in cases where data synchronization decisions are not made properly.

`sync_master.sh` will save the existing database cluster before starting to copy data from the active system. Specifically, it renames the data directory, for example `/var/lib/pgsql/<pgver>/data` to `/var/lib/pgsql/<pgver>/data.old`. If the data copy succeeds, the saved `data.old` will be deleted automatically. If the data copy fails, the saved `/var/lib/pgsql/<pgver>/data.old` will be reverted to its original name `/var/lib/pgsql/<pgver>/data`.

Note that because of this process, you will need the combined capacity of the saved data and the synchronized data during data copying. If `sync_master.sh` is run with the `--no-save-datadir` option, data synchronization will be started after deletion without this saving, thus reducing the required free space. Note, however, that you will not be able to undo a failed synchronization.

Changed in version 1.6.10: The `--force` and `--no-save-datadir` options have been added.

1.10 Audit log management

1.10.1 Introduction

When a user performs various operations on Kompira, it logs information such as the type of operation, whether it was permitted or not, and whether it was succeeded or not.

Operations covered by the audit log

The audit log records browser operations, operations using APIs, and operations using management commands on the server.

On the other hand, the following will not be recorded in the audit log.

- Data manipulation and process manipulation by job flow operation.
- Operations outside the Kompira system (such as direct data manipulation using DB management commands).
- Access to static content.

Operation level and logging level

Whether or not an operation to be recorded is actually recorded in the audit log depends on the “operation level value” calculated from the type and result of the operation, and the “logging level value” which is a configuration item. When the calculated operation level value is greater than or equal to the logging level value of the setting item, the entry will be output to the audit log.

Conditions for recording audit logs: Operation level value \geq Logging level value

The operation level value is calculated from several items in the operation. Each item has its own set of operation level criteria, and the maximum value is the final operation level value. Usually, this value is between 1 and 3. See [Details of audit log items](#) for the default value of the operation level threshold for each item.

For example, “Edited an existing JobFlow object in the browser (allowed and successful)” would result in the following per-item operation level criteria values being applied, with a final operation level value of 2.

Item	Value	Operation level (reference value)
interface	"web"	1
class	"object"	1
type	"update"	2
permit	"allowed"	1
result	"succeeded"	1

The default logging level value is 2. See [Configuration file](#) for more information.

1.10.2 Audit log file

Destination of audit log

The audit log file will be created in the following directory.

```
/var/log/kompira/
```

The name of the log file to be created will be as follows.

```
audit-`${USERNAME}$.log
```

Here, the `\${USERNAME}` part is the user name on the operating system that executed the process that processed the operation. For example, if you perform the operation in a browser, the Apache service on the server is doing the actual processing, and the `\${USERNAME}` part will be `apache`. Note that this is not the same as the user name you use to log in to Kompira in your browser.

The audit log file is not rotated by Kompira itself, but is configured at installation time to be rotated by a standard OS service.

The audit log file is created with a umask value of `027`. The owner of the log file will be the same as `\${USERNAME}`, groups will have their write permissions masked, and other users will have their full access permissions masked.

File format of audit log

The audit log is a UTF-8 encoded text file that outputs one entry as one line in JSON format.

Items recorded in audit log

The items that are recorded in one entry of the audit log are shown below.

Item	Name	Type	Description
Operation level	<code>level</code>	Integer	Operation level value
Operation started time	<code>started</code>	Date-time	The date and time the operation was started.
Operation finished time	<code>finished</code>	Date-time	The date and time the operation was finished.
Execution information	<code>exec</code>	Dictionary	Information on the execution Linux process (dictionary format)
Operation user	<code>user</code>	String	The name of the Kompira user who performed the operation.
Operation interface	<code>interface</code>	String	Indicates the interface, such as whether it is operated by a browser or by management commands.
Operation class	<code>class</code>	String	Indicates the classification of session operations, object operations, etc.
Operation target	<code>target_path</code>	String	Object path (during non-session operations)
	<code>target_type</code>	String	Type object (during object operations)
Operation type	<code>type</code>	String	Indicates the type of operation, such as “reference” or “delete”.
Operation permit	<code>permit</code>	String	Indicates whether the operation has been “allowed” or “denied”.
Operation result	<code>result</code>	String	Indicates whether the operation “succeeded” or “failed”.
Reasons for result	<code>reason</code>	String	Indicates the cause of the failure (if known).
Detail information	<code>detail</code>	Dictionary	Detailed information about the operation (in a different dictionary format for each operation)

Sample of audit log

The following is a sample audit log file `/var/log/kompira/audit-apache.log` from a browser operation. The log is output as one entry and one line, but here it is formatted for easy understanding.

```
{
  "level": 3,
  "started": "2021-10-05T15:51:31.403016+09:00",
  "finished": "2021-10-05T15:51:31.452097+09:00",
  "exec": {
    "pid": 1286192,
    "name": "/usr/sbin/httpd",
    "user": "apache",
    "remote": "10.10.0.110"
  },
  "user": "root",
  "interface": "web",
  "class": "session",
  "target_path": null,
  "target_type": null,
  "type": "login",
  "permit": "allowed",
  "result": "succeeded",
  "reason": null,
  "detail": {
    "next_page": "/"
  }
}
{
  "level": 2,
  "started": "2021-10-05T15:51:43.447941+09:00",
  "finished": "2021-10-05T15:51:43.486984+09:00",
  "exec": {
    "pid": 1285426,
    "name": "/usr/sbin/httpd",
    "user": "apache",
    "remote": "10.10.0.110"
  },
  "user": "root",
  "interface": "web",
  "class": "object",
  "target_path": "/config/license",
  "target_type": "/system/types/License",
  "type": "read",
  "permit": "allowed",
  "result": "succeeded",
  "reason": null,
  "detail": {
    "http_method": "GET",
    "http_status": 200
  }
}
```

1.10.3 Details of audit log items

This section provides details about the items that are recorded in the audit log. In the table in the following sections, “operation level” indicates the default operation level reference value.

Operation level (level)

The operation level calculated based on the type of operation, result, etc. is shown as a numerical value. When this operation level value is greater than or equal to the logging level value of the setting item, the entry will be output to the audit log.

Operation date and time (started, finished)

The item `started` indicates the start date and time of the operation, and the item `finished` indicates the end date and time of the operation. These are recorded in ISO8601 format in local time, as shown below.

"2021-10-01T11:45:08.977356+09:00"

Execution information (exec)

The following information is recorded in the dictionary that indicates execution information.

Item	Name	Type	Description
Process id of execution	<code>exec["pid"]</code>	Integer	Process id on the Kompira server.
Process name of execution	<code>exec["name"]</code>	String	Process name on the Kompira server.
User name of execution	<code>exec["user"]</code>	String	User name of the execution process on the Kompira server.
Remote address	<code>exec["remote"]</code>	String	IP address of the operation source. (during browser operation)

Operation user (user)

Record the name of the Kompira user who performed the operation. If the operation was performed by logging in to Kompira in a browser, this will be the login user name. If the operation was performed using management command on the server console, it will be an empty string because it is not accompanied by Kompira authentication.

Operation interface (interface)

Record the classification of what interface was used to perform the operation.

Value	Operation level	Description
"web"	1	Operation by web browser.
"api"	1	Operation by REST-API.
"mng"	2	Operation by management commands (e.g. <code>manage.py</code>).

Operation class (class)

Indicates the classification of what kind of operation was performed.

Value	Operation level	Description
"session"	3	Session operations (login, logout)
"user"	3	User information operations (adding and deleting users, changing passwords, etc.)
"group"	3	Group information operations
"object"	1	Object operations
"task"	1	Task operations
"incident"	1	Incident operations
"process"	1	Process operations
"schedule"	1	Schedule operations
"packages"	1	System packages information operations

Operation target (target_path, target_type)

Indicates what was manipulated and its specific target.

If the operation class is other than `session`, the operation target can be identified by its path. The path is recorded as an entry `target_path` as follows.

"/system/user/id_1"

Additionally, in the case of object operations, the path of the type object is recorded in the entry `target_type`.

"/system/types/Directory"

Operation type (type)

It records the type of the operation that was performed.

Value	Operation level	Example of operations
"login"	3	logged in to kompira
"logout"	3	Logged out of kompira
"create"	3	Create a new object
"rename"	3	Rename object
"copy"	3	Copy objects
"move"	3	Move objects
"export"	3	Export data
"import"	3	Import data
"execute"	3	Execute job flows and script jobs.
"suspend"	3	Suspend the process
"resume"	3	Resume the process
"terminate"	3	Terminate the process
"read"	1	Display the content of an object.
"list"	1	Display a list of objects.
"search"	1	Search for objects.
"new"	1	Edit a new object (before create).
"edit"	1	Edit an existing object (before update).
"confirm"	1	Confirm object operation (before delete).
"update"	2	Update object
"clear"	2	Erase messages from a channel. Clear status of management area.
"recv"	2	Receive a message from a channel.
"send"	2	Send a message to a channel.
"delete"	3	Delete object

Some operation types are only used for specific operation class. For example, login and logout are only used when the operation class is `session`.

Although an operation type may be used in multiple operation classes, it is not possible to set different operation level criteria values for each operation class.

Operation result (permit, result)

As a result of the operation, its allowed or denied and succeeded or failed will be recorded.

The item `permit` indicates whether the operation is allowed or not. For example, in object operations, the operation is allowed or denied depending on the permissions set.

Value	Operation level	Description
"allowed"	1	Operation allowed.
"denied"	3	Operation denied.

The item `result` indicates whether the operation was succeeded or not.

Value	Operation level	Description
"succeeded"	1	Operation succeeded.
"failed"	1	Operation failed.

Detail information (detail)

Additional detail information for each type of operation is recorded in a dictionary format.

(*) However, please note that the detail information may be adjusted even after the release of the audit log feature.

Login

Item	Description
next_page	Pages to which you will be redirected after logging in.
invalid_password	Invalid password. (in case of authentication error)

REST-API

Item	Description
invalid_token	Invalid API token. (in case of authentication error)

Export

Item	Description
export_format	Export format. ('json' or 'dir')
export_options	Options specified during export.
export_paths	The path to export.
export_counters	Counter information for export results.

Import

Item	Description
import_format	Import format. ('json' or 'dir')
import_options	Options specified during import.
import_sources	Imported file names.
import_counters	Counter information for import results.

Search for objects

Item	Description
search_params	Search parameters

Create a new object

Item	Description
create_name	Name of the new object to be created.
create_type	The path of the type object of the new object to be created.

Execute job flows and script jobs

Item	Description
execute_pid	Process ID that was executed.
execute_params	Parameters specified at execute.
execute_form	Path of the form used for execution (if executed from a form object).
execute_table	Path of the table used for execution (if executed from a table object).

Rename object

Item	Description
rename_to	Name to be changed.

Copy objects

Item	Description
copy_objects	List of objects to be copied.
copy_rename	Name of the object specified when copying.

Move objects

Item	Description
move_objects	List of objects to be moved.
move_rename	Name of the object specified when moving.

Delete object

Item	Description
delete_objects	List of deleted paths or object IDs.
delete_file	File name of the deleted attachment.

Send a message to a channel

Item	Description
send_form	Path of the form used for send (if send from a form object).

Management command: compile_jobflow / compile_library

Item	Description
compile_paths	List of paths specified as compile targets.
compile_result	Compilation result (count information)

Management command: license_info / license_update

Item	Description
license_id	License ID
license_path	The name of the license file you installed (for license_update)

Management command: process

Item	Description
process_query	Search query for process objects.
process_count	Number of processes searched.
process_listed	Number of processes displayed.
process_deleted	Number of processes deleted.
process_terminated	Number of processes terminated.
process_suspended	Number of processes suspended.
process_resumed	Number of processes resumed.

Other detailed information

Item	Description
http_method	Method name of the HTTP request.
http_status	Status code of the HTTP response.
target_attr	Attribute name of the operation target.
target_index	Index value of the operation target
bulk_deleted	Detail information for bulk deletion.

1.10.4 Configuration file

You can configure settings related to the audit log in the following file.

```
/opt/kompira/kompira_audit.yaml
```

Configuration file format

The configuration file `kompira_audit.yaml` is written in YAML format. The whole thing is a dictionary structure, and the following configuration items are required.

Name	Type	Description
logging_level	Integer	Logging level value for audit log.
operation_levels	Dictionary	Operation level reference value table for each operation.
target_levels	Array	Operation level reference value table for each operation target in object manipulation, etc.

Auto reloading of configuration file

When the audit log configuration file is updated on the server, it will be automatically reloaded at the timing of the next audit log recording. There is no need to restart the service.

Default configuration file

```
#-----
# kompira_audit.yaml
#
# Configuration file to control audit log output.
#-----
#
# logging_level: recording level value
#
# If the calculated operation level value is less than the recording
# level value, no audit log will be recorded.
#
logging_level: 2
#
```

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```
# operation_levels: basic operation level table
#
# Table of operation level reference values for each operation.
# The operation level value for an operation is the maximum of
# several operation level criteria values.
#
operation_levels:
interface:
    web: 1
    api: 1
    mng: 2
class:
    session: 3
    user: 3
    group: 3
    object: 1
    task: 1
    incident: 1
    process: 1
    schedule: 1
    packages: 1
type:
    login: 3
    logout: 3
    create: 3
    rename: 3
    copy: 3
    move: 3
    export: 3
    import: 3
    execute: 3
    suspend: 3
    resume: 3
    terminate: 3
    read: 1
    list: 1
    search: 1
    edit: 1
    confirm: 1
    update: 2
    clear: 2
    recv: 2
    send: 2
    delete: 3
permit:
    allowed: 1
    denied: 3
result:
    succeeded: 1
    failed: 1
#
```

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```
# target_levels: operation level table for object operation
#
# Operation level reference value to be applied to each target
# during object manipulation.
#
target_levels:
  - {path: '/config/*', type: null, level: 2}
  - {path: '/system/*', type: '/system/types/Config', level: 2}
```

1.11 System packages management

Information about the Python and web packages installed in the Kompira environment can be viewed below. For each package type, you can see information about the installed package version and license.

Path	Description
/system/packages/PIP	Information about the Python packages managed by PIP in the Kompira environment.
/system/packages/Web	Information about packages for the web that are managed as static content in the Kompira environment.

Note: System package information is automatically collected and updated when kompivad is started after installing or updating Kompira.

1.11.1 Manage command for packages information

You can use the following commands on the Kompira server to manage packages information.

```
$ /opt/kompira/bin/manage.py packages_info [options...]
```

Show packages information

If the option is omitted or the `--show` option is specified, packages information that has already been collected will be listed in the console.

```
$ /opt/kompira/bin/manage.py packages_info --show
```

An example of the package information listing is shown below.

Type	Name	Installed	Latest	License
pip	APScheduler	3.6.3	3.8.1	MIT License
pip	Creoleparser	0.7.5	None	MIT License
pip	Django	3.0.5	3.2.8	BSD License
pip	Genshi	0.7.5	None	BSD License

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pip	GitPython	3.1.18	None	BSD License	
:	:	:	:	:	:

Collect packages information

If the `--collect` option is specified, it will collect information about the installed packages. However, only the `root` or `kompira` user on the Kompira server can do this.

```
$ /opt/kompira/bin/manage.py packages_info --collect
```

At this time, an Internet connection is required to collect the latest version information for each package. If a proxy connection is required, specify it with the `--proxy` option (or the `https_proxy` environment variable).

If you don't want to collect the latest version information, for example because you don't have an Internet connection, you can additionally specify the `--no-collect-latest` option. Alternatively, you can specify the `--collect-latest` option to explicitly collect the latest version information.

Note: Note that the collected packages information will be stored in the `/var/opt/kompira/packages/` directory on the server.

Update packages information

If the `--update` option is specified, the system packages information object (of type Wiki) on Kompira will be updated based on the collected packages information. However, only the `root` or `kompira` user on the Kompira server can do this.

```
$ /opt/kompira/bin/manage.py packages_info --update
```

If the `--update` and `--collect` options are used together, the system package information object will be updated following the collection of package information.

1.12 SSL Certificate Management

Kompira uses the following certificates for SSL connections.

- CA certificate for signing the following SSL certificates
- Server certificate for AMQPS connections (used by `rabbitmq-server`)
- Client certificate for AMQPS connection (used by `kompira_jobmgrd` and `kompira_sendvt`)

Note: The descriptions in this section are for cases where the Kompira server has been configured to perform SSL certificate verification. For example, if you have added the `--amqps-verify` option to `install.sh` during installation. If SSL certificate verification is not enabled, the “SSL certificate verification” described in this section will not be performed.

1.12.1 Location of Certificate Files

The SSL certificate used by Kompira is located in the following directory.

Path	Description
<code>/opt/kompira/ssl/ca-source/</code>	Directory where CA certificate files for signing SSL certificates are located.
<code>/opt/kompira/ssl/certs/</code>	Directory where SSL certificate files used for SSL connections and CA certificate files used to verify SSL certificates are located.

The certificate files to be located in these directories are described below. Note that each certificate file also contains a CSR file and a private key file with `.csr` and `.key` extensions in the same location.

1.12.2 `/opt/kompira/ssl/ca-source/`

Locate the CA certificate file for signing SSL certificates in `/opt/kompira/ssl/ca-source/`.

`kompira-local-ca.crt`

The CA certificate that signs the SSL certificate created on this Kompira server.

This CA certificate is automatically created when Kompira is installed.

`kompira-other-ca.crt`

This is a copy of `kompira-local-ca.crt` from the opposing Kompira server in a clustered environment. Copy it by scp from the opposite Kompira server with the `ssl_utils.sh get-other-ca` command described below, or by some other means.

Kompira does not use this CA certificate directly, but uses `kompira-bundle-ca.crt`, a bundle of CA certificates described below, to perform SSL verification.

1.12.3 `/opt/kompira/ssl/certs/`

Locate the SSL certificate file used for the SSL connection and the CA certificate file used for verification in `/opt/kompira/ssl/certs/`.

`kompira-bundle-ca.crt`

This is a single file containing all CA certificates located in `/opt/kompira/ssl/ca-source/`. It is usually created automatically, but can be updated with the `ssl_utils.sh update-bundle-ca` command described below.

The `rabbitmq-server` on the Kompira server is configured to use this CA certificate to validate client SSL certificates. This means that only clients with SSL certificates signed by one of the included CA certificates will be able to connect. Note that clients with SSL certificates signed by CA certificates generated by other Kompira servers cannot connect to this Kompira server.

`kompira_jobmgrd` and `kompira_sendvt` are configured to use this CA certificate for server SSL certificate validation (this can also be specified in `kompira.conf`). This means that SSL connections can only be made to servers with SSL certificates signed by one of the included CA certificates. Note that on nodes where `kompira_jobmgrd` or `kompira_sendvt` is installed independently, this CA certificate must be copied in advance. Please refer to the `ssl_utils.sh client-setup` command for instructions.

kompira-bundle-ca.crt contains only kompira-local-ca.crt for that server when Kompira is installed.

When setting up a clustered environment, it is recommended to update kompira-bundle-ca.crt on the two servers by retrieving the mutually opposed kompira-local-ca.crt. That way, a client with an SSL certificate signed by either CA certificate will be able to make SSL connections to either server. For example, when sending an event with kompira_sendevt to a VIP address, it is not known in advance which server will actually be connected to. Note that the client must have a kompira-bundle-ca.crt that contains the two CA certificates. See [Manage CA certificates in a clustered environment](#) for details.

amqp-server.crt

SSL certificate to be used by the AMQP server side (rabbitmq-server). It is signed by kompira-local-ca.crt. This certificate is automatically created when Kompira is installed.

amqp-client-kompira.crt

SSL certificate used by AMQP clients (kompira_jobmgrd, kompira_sendevt). It is signed by kompira-local-ca.crt. This certificate is automatically created when Kompira is installed.

Note that on nodes where kompira_jobmgrd or kompira_sendevt is installed independently, this SSL certificate must be copied in advance. Please refer to the `ssl_utils.sh client-setup` command for instructions.

1.12.4 Script for SSL Certificate Management

The `ssl_utils.sh` script can be used to manage SSL certificate creation, etc.

```
# /opt/kompira/bin/ssl_utils.sh command [options]
```

The `ssl_utils.sh` script must be run as root.

Setting up a server side SSL environment

```
# /opt/kompira/bin/ssl_utils.sh server-setup
```

Creates CA and SSL certificates for use on the Kompira server. Internally, the following processes are performed.

- Create local CA certificate
- Update bundled CA certificate
- Create SSL certificate (for AMQP server)
- Create SSL certificate (for AMQP client)

All certificates are created with an expiration date of 10000 days.

This process is automatically performed when installing Kompira with `intall.sh` and is not normally used.

Setting up a client side SSL environment

```
# /opt/kompira/bin/ssl_utils.sh client-setup kompira-server
```

For `kompira_jobmgrd` or `kompira_sendvt` installed on a different node from the Kompira server to make SSL connections CA and SSL certificates must be obtained from the Kompira server. This command obtains the necessary certificates from the Kompira server specified in the command line argument `kompira-server` using the `scp` command. It is automatically executed when the `-jobmgrd` or `-sendvt` option is added to `install.sh`, so it is not normally used.

When this command is executed, you will need to enter the password for the root account on the Kompira server in order to transfer files internally using the `scp` command. Enter the password when prompted as shown below.

```
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: Start copying the SSL/CA certificates from the kompira_
↪ server with scp.
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: PLEASE ENTER THE PASSWORD OF THE REMOTE KOMPIRA SERVER (
↪ <kompira-server>) FOR SCP.
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] VERBOSE: run: scp -q -p -o StrictHostKeyChecking=no -o_
↪ UserKnownHostsFile=/dev/null root@<kompira-server>:/opt/kompira/ssl/certs/{kompira-
↪ bundle-ca.crt,amqp-client-kompira{.crt,.key}} /opt/kompira/ssl/certs/
root@<kompira-server>'s password:
```

If for some reason you cannot transfer files using the `scp` command, copy the following files on the Kompira server to the same directory by any other feasible means.

- `/opt/kompira/ssl/certs/kompira-bundle-ca.crt`
- `/opt/kompira/ssl/certs/amqp-client-kompira.crt`
- `/opt/kompira/ssl/certs/amqp-client-kompira.key`

If you copied them manually, set a group of these files to `kompira` so that they can be accessed by `kompira_jobmgrd`.

```
# chown :kompira /opt/kompira/ssl/certs/*
```

Also note that if `kompira_sendvt` is used with SSL connections, the user executing it must have access to these files. Adjust the executing user or adjust the permissions on these files as necessary.

Note: If you have installed `kompira_sendvt` in a Windows environment, locate the certificate files obtained from the Kompira server in the `C:\Kompira\SSL\Certs` directory. See [Installation on Windows](#) for details.

Manage CA certificates

Update bundled CA certificate

```
# /opt/kompira/bin/ssl_utils.sh update-bundle-ca
```

Combine the CA certificates located in `/opt/kompira/ssl/ca-source/` into a single CA certificate, `kompira-bundle-ca.crt`. The `ssl_utils.sh server-setup` or `ssl_utils.sh get-other-ca` commands, it is handled internally and is not normally used.

Create local CA certificate

```
# /opt/kompira/bin/ssl_utils.sh create-local-ca
```

Create a local CA certificate `kompira-local-ca.crt`. The following file will be created in the directory `/opt/kompira/ssl/ca-source/`.

- `kompira-local-ca.key` : Private key file (RSA-key 2048 bit)
- `kompira-local-ca.crt` : CA certificate file

The CA certificate is valid for 10000 days.

When you run the `ssl_utils.sh server-setup` command, it is handled internally, so you will not normally use it.

Manage CA certificates in a clustered environment

Obtain CA certificate of another node (scp)

```
# /opt/kompira/bin/ssl_utils.sh get-other-ca [other-server]
```

Obtains the CA certificate `kompira-local-ca.crt` from the Kompira server specified by the command line argument `other-server`. Save the obtained CA certificate as `kompira-other-ca.crt`, and then update the bundle CA certificate.

When this command is executed, you will need to enter the password for the root account on the Kompira server in order to transfer files internally using the `scp` command. Enter the password when prompted as shown below.

```
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: Start copying the SSL/CA certificates from the other kompira_
↪ server with scp..
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: PLEASE ENTER THE PASSWORD OF THE OTHER KOMPIRA SERVER (
↪ <other-server>) FOR SCP..
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] INFO: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
↪ !!!!!!!!!!!!!!!
[2023-01-16 18:34:12] INFO:
[2023-01-16 18:34:12] VERBOSE: run: scp -q -p -o StrictHostKeyChecking=no -o_
↪ UserKnownHostsFile=/dev/null root@<other-server>:/opt/kompira/ssl/ca-source/kompira-
↪ local-ca.crt /opt/kompira/ssl/ca-source/kompira-other-ca.crt
root@<other-server>'s password:
```

If for some reason you are unable to transfer the file using the `scp` command, copy `/opt/kompira/ssl/ca-source/kompira-local-ca.crt` on the opposite Kompira server as `/opt/kompira/ssl/ca-source/kompira-other-ca.crt` on this server by any other feasible means. Then, update the bundle CA certificate with the `ssl_utils.sh update-bundle-ca` command.

Create SSL certificate

```
# /opt/kompira/bin/ssl_utils.sh create-cert certname subject
```

Creates a new SSL certificate. The following file is created in the directory `/opt/kompira/ssl/certs/` based on the name specified in the option `certname`.

- `<certname>.key` : Private key file (RSA-key 2048 bit)
- `<certname>.csr` : CSR file
- `<certname>.crt` : SSL certificate file

The subject of the certificate is set to the value specified in the option `subject`, and the validity period is 10000 days. This SSL certificate file is signed by `kompira-local-ca.crt`.

Certificates for AMQP servers and AMQP clients are automatically created when you run the `ssl_utils.sh server-setup` command.

OPERATION GUIDE

Author

Kompira development team

2.1 Introduction

In this manual, information about using Kompira's functions through the web user interface (WebUI) provided by Kompira, will be explained.

2.2 Basic operations

2.2.1 Login and logout

You can access the login screen of Kompira by accessing the following URL.

`https://<Hostname or ipaddress of Kompira server>/`

Please enter your user name and password to login to the Kompira login screen.

For a list of available default users, refer to: *User management*.

When you log in, your logged in user name will appear in the upper right hand corner of the screen. Click on the user name and a drop-down menu will appear, from which you can log out by selecting "Logout".

Note: The login information will be saved in the browser's cookies. Login information cookies expire after 2 weeks. So after the expiry date, you will need to log in again.

Note: If the *System Settings* maximum number of login attempts is set, then after a certain number of failed login attempts, the account will be locked and the target user will not be able to login from the same IP address thereafter. If an account lock period is set, the account lock will be automatically released after a certain period of time from the last failed login attempt, and the user will be able to log in again. Users with administrative privileges, such as root, can also manually unlock a locked user from the locked user's details screen. An ordinary user can also log in from another IP address that has not been locked and unlock the account from his/her own user details screen.

2.2.2 Menu operations

When logged in, you can navigate to Home, File System, Task List, Incident List, *Process Management*, *Scheduler*, *Settings* and Help from the menu at the top of the screen.

The logo image and the “Kompira” notation on the left side of the menu are links to the Home page, which takes the user to the page of the object (usually a directory) that has been set as Home for each user.

The menu “File System” is a shortcut to several typical directories and their child objects.

2.2.3 Keyboard operations

Kompira also allows keyboard operation of some of the functions that correspond to each page you are viewing. Common keyboard operations are listed below.

Key bindings	Operation	Note
?	Display the help	Display a list of keyboard shortcuts in a dialog.
/	Focus on search box	If the search box is present.
~	Go to home object	
^	Go to parent directory	
Ctrl-Left	Go to previous page	If the object has multiple page views.
Ctrl-Right	Go to next page	If the object has multiple page views.
Alt-E	Edit object	If the object is editable in the object detail screen.
Alt-S	Save object	If the object’s edit screen is open.

Note: Some key bindings such as Alt-E may differ from actual key operations such as Alt-Shift-E depending on the OS or browser.

New in version 1.6.6: Added description of keyboard operations.

2.3 Kompira file system

Kompira defined Information, such as job flow definitions and node information, are centrally managed on the Kompira file system as Kompira objects.

Below, we explain the settings and values not dependent on Kompira object type.

2.3.1 Names of object

The name of the Kompira object can be freely named within the following rules.

- You can use alphabetical and numerical characters, as well as underscores (“_”), and Japanese characters.
- The first character must be a number
- It is case-sensitive
- Object name length must be within 128 characters
- Absolute path length must be within 1024 characters

2.3.2 Object Properties

All Kompira objects have properties, and the object owner or root users can edit each item of the property.

Here is the list of items that can be set in the properties.

Field	Description
Display name	Name used to display the object. (It is different from the object name)
Description	A description of the object.
Owner	Owner of the object
User permissions	Access permission list given to users.
Group permission	The permission list given to the group.

In the section on user permissions and group permissions, you can set access permissions for each user and group.

If you want to set common access permissions for all users, it is a good idea to use the other group to which all users belong.

If the target of property editing is a directory or a table, the “Apply changes to descendant objects” checkbox will appear on the property edit screen for the Owner, User Permissions, and Group Permissions items, respectively. By checking these checkboxes and saving the changes, the corresponding property settings will be reflected in the descendant objects.

Note: Properties can be edited only by the owner of the object or root users, regardless of the permission setting. A user with writing permission can edit the contents of an object, but be aware that properties cannot be edited.

Note: Note that if a directory contains many descendant objects, applying property changes to the descendant objects may take a long time to complete.

2.3.3 Object permissions

All Kompira objects have permission settings.

Here is a list of access permission types that the Kompira objects have.

Permission type	Description
Read	Grants the capability to read the contents of the object. An attempt to move to the path of an unauthorized object will result in an error.
Write	Grants the capability to edit the contents of the object. If you do not have writing permission on a directory or table object, you can not add new objects.
Execute	Grants the capability to execute objects. It is a permission type valid only for executable objects (job flow and script job).

For root users, all access is allowed, even if they are not explicitly specified.

Object permission settings can be edited from [Object Properties](#).

Note: When adding an object to a directory or table object, permission settings are not inherited.

2.4 Kompira object

There are various kinds of objects created on the Kompira file system, such as job flow and node information. These are specified by the type object on the Kompira file system. For predefined type objects, you can refer to the list in `/system/types`.

In the current version, the type objects shown below are defined as standard.

Type name	Description
TypeObject	An object for defining type objects. When you create a type object, you can create an object of the type you created.
Directory	An object that can store multiple objects.
License	An object for registering a license file. This is a special object used in the system, it will not be created anew.
Virtual	Object for defining virtual objects. Process list (<code>/process</code>) and task list (<code>/task</code>) are defined as virtual objects. This is not used in general.
Jobflow	An object that can write and execute job flow.
Channel	An object with a queue that can store messages. It can be used for sending and receiving messages.
Wiki	An object that can create Creole format Wiki pages.
ScriptJob	An object that can write and execute scripts.
Environment	An object that can store environment information in key-value format.
Template	An object that can store template text used in tasks.
Table	An object that can store multiple objects of the same type.
Realm	An object for defining the area managed by the job manager. This will be created under the management area list object, and this will not be created under the normal directory or table.
AttachedFile	An object that can save arbitrary files.
NodeInfo	An object that can store information for specifying a node, such as server IP address or SSH port number.
AccountInfo	An object that can store account information for remote login.
Repository	An object that defines information for linking with the version control system.
MailChannel	A channel that can receive email from the IMAP server.
Form	An object that can create a user input form.
Config	An object that can create a setting form.
Library	An object that defines a Python library that can be called from a job flow.
MailTemplate	An object that can store the template text used for sending mail.
Text	An object that holds text information such as plain text and HTML text.
SystemInfo	An object that provides Kompira system information.
NodeType	An object that defines the connection peer information available for remote jobs.
CustomStyle	An object that sets the color scheme and other settings for the screen displayed by the browser.
OAuth2Provider	This object defines the service provider information for OAuth2 authentication.
SmtptServer	This object defines the SMTP server information to be used when sending mail.
LdapServer	This object defines the LDAP server information to be used when linking login users to LDAP.

Each type object defines its own field and its type. For details on what fields are defined, please refer to: [Built-in objects](#)

In the following we will introduce some typical Kompira objects and explain how to use them.

2.4.1 Directory

A directory is a Kompira object that can contain several different types of objects. When you open the Directory Objects page, you will see a list of objects stored in that directory.

If there are a large number of stored objects, they will be displayed over multiple pages. Use the paginate buttons located in the upper right corner of the object list to navigate to the previous or next page, or to the first or last page. The menu to the left of the paginate button allows you to change the number of objects displayed per page (page size).

The sort order of the list view can be changed by clicking on the header row of the object list where the column names are displayed. Clicking the same column again toggles between ascending and descending order.

For the sort order of object listings and page size, their default values can be set for each directory object. Select “Edit this directory” from the menu button located in the upper right corner of the object list to go to the edit directory screen, where you can save your settings.

From the directory object, you can do the following operations. These operations can be performed from the buttons located in the upper left corner of the object list and from the “More actions” menu. They can also be operated from the context menu that appears by right-clicking on the object list.

Operation	Description
Create New	Create an object. When creating, you need to specify a type object.
Brows	Move to the page of the stored object.
Edit	Edit the contents of the object.
Change name	Change the name of the object. If the display name of the property is the same as the object name, the display name will be also be changed at the same time.
Move	Move the object.
Copy	Copy the object to another directory.
Delete	Delete the object.
Export	Export the selected object. When an object is not selected, all objects under the directory will be exported.
Import	Import the object into the selected directory from the file. When the directory is not selected, the object will be imported under the current directory.
Property	Edit the properties of the object.
Search	Searches for descendant objects under a directory.

In addition to the common key operations, the following key operations are supported on the detailed screen of directory objects.

Key bindings	Operation
n	Create new object
#	Select type object
j	Move cursor to next object
k	Move cursor to previous object
Space	Toggle the object selection
a	Toggle selection of all objects
Delete	Delete objects
F2	Rename object
c	Copy objects
m	Move objects
p	Edit property

New in version 1.6.6: Key operation description added.

Create new object

New objects can be created in the directory screen.

- In the “Type” column on the bottom line, select the type of object you wish to create.
- Enter the name of the object you wish to create in the input form in the “Name” column on the bottom line.
- Click the button with the “+” sign to the right of the form in which you have entered the name, and you will be taken to the editing screen corresponding to the type you have selected.
- Enter the necessary information on the edit screen and click the “Save” button to create the object.

Note that for some types, such as directory type, a new object is created without moving to the edit screen.

Viewing and editing object

Clicking on a link of an object listed in the directory screen, or selecting one of the objects and pressing enter or choosing “Open” from the menu, will take you to the page (detail screen) of that object.

You can also select an object and choose “Edit” from the menu to go directly to the object’s editing page.

Rename object

You can rename an object by selecting one and choosing “Rename” from the menu. An input form will appear above the “Name” column of the selected row, with the current name of the object entered. The name can be changed by entering a new name and pressing enter. Alternatively, the ESC key can be used to cancel.

Moving and copying objects

Select one or more objects and choose “Move” or “Copy” from the menu to move or copy the selected objects. A dialog box will appear to select the move or copy destination. Select the desired location and press the “Move” or “Copy” button.

Note that if only one object is selected, the name form in the dialog will be inputtable, and you can also specify a new name for the move or copy destination.

Note: Please note that copying operations with a very large number of target objects may take a long time to complete.

Delete objects

Select one or more objects and choose “Delete” from the menu to delete the selected objects. A dialog box will appear asking you to confirm that you really want to delete the object, so choose “Delete” or “Cancel”.

Editing object properties

Select one or more objects and choose “Properties” from the menu to edit the properties of the selected objects.

If only one object is selected, you will be taken to the edit properties screen for that object. Edit the properties you want to change and then click the “Save” button to update the properties of that object.

Selecting the Properties menu with two or more multiple objects selected will bring up the Edit Properties dialog. In this dialog, you can change the owner and user permissions, group permissions, and items with “Apply Changes” checked can be applied to the selected objects at once. Note that if the selected objects include directories or tables, the property changes will not be reflected in their descendant objects.

Importing objects

You can import exported JSON files into Kompira by selecting “Import” from the menu. A dialog will appear, select the file you want to import, and then click the “Import” button to start the import process. At this time, you can also specify whether or not the import will overwrite existing objects.

Note that if no objects are selected in the directory screen, the import will be performed in that directory. If a directory or table is selected, the import will be performed in the selected directory or table.

When an object that cannot be imported is selected, or when two or more objects are selected, it cannot be imported.

Importing objects can only be done by the owner of the directory or root users.

Note: Note that if the JSON file to be imported is large or contains a very large number of objects, the import process may take a long time or require a lot of memory.

Exporting objects

You can export the data of a Kompira object as a JSON file by selecting “Export” from the menu. In the dialog that appears, press the “Export” button to start the export process. When the export file is ready, a system dialog will appear asking you where you want to save the file. At this time, you can also specify whether to include virtual objects in the export target. Check this box if you wish to include virtual objects such as process information, users, groups, etc. Translated with www.DeepL.com/Translator (free version)

Exporting objects can only be done by the owner of the directory or root users.

Note: Note that if the number of objects to be exported is very large, or if the size of the included field data is huge, the export process may take a long time or require a lot of memory.

Searching for objects

Enter a search key in the search box at the upper right of the directory listing screen and click the search button to go to the search result listing screen.

If you prefix the search key with #, the search will be performed using the display name of the type. For example, specifying #JobFlow as the search key will search for objects of type JobFlow. Similarly, @ will search by owner. For example, a search key of @guest will search for objects owned by the guest user. If the first character is not # or @, the search key will search for objects whose display name contains the specified string. If you want to search for display names that start with # or @, you can do so by adding a backslash, like \# or \@.

If more than one type of search key is specified at the same time, the search will be performed using AND conditions. Multiple search keys are generally separated by whitespace, but consecutive display names are treated as a single display name including whitespace. For example, typing `some display name @root #directory` will return a display name that contains the string `some display name` and is owned by the user `root`. For example, typing `some display name @root #directory` will search for objects with a display name containing the string `some display name` and whose owner is the user `root` and whose type is `directory`.

If you specify multiple search keys of the same type, the last one will be used.

2.4.2 Table

A table is a Kompira object that can store multiple objects like a directory. However, it differs from the directory in that only one type of object can be stored.

When creating a table object, first select the type object and the fields in that type object. In the created table object, in addition to the information displayed in the directory object, the field information selected at the time of creation will be displayed.

By using the table object you can view all bundled fields of stored objects.

The table object detail screen supports the same key operations as the directory object. However, type object selection by `#` is not available.

Searching for objects

In the detailed view of the table object, you can search for objects contained within the table. You will need to select the object's property or field as the search target in order to begin searching.

In order to search objects by properties, you can choose `abspath`, `display_name`, and `owner`.

You can select from the fields defined in the type object associated with the table as the search targets. However, the following fields cannot be selected as search targets.

- **Any field of the following types**
 - Password, Array<Password>, Dictionary<Password>
- Fields set as hidden with the field modifier (`invisible=true`)

How objects are narrowed down based on the value (search value) entered into the search box depends on the selected search target. If a property is chosen as the search target, the search will be conducted as follows.

- **abspath (Absolute path)**
 - Objects with the search value contained in their path will be retrieved.
- **display_name (Display name)**
 - Objects with the search value contained in their display name will be retrieved.
- **owner (Object owner)**
 - Objects whose owner's name matches the search value will be retrieved.

If a field is selected as the search target, the object will be retrieved when the field value matches the search criteria. In this case, for each selected *field type*, the input format and search criteria for the search value are as follows.

- **String, Enum, Text, LargeText, IPAddress, EMail, URL**
 - Input format: Any string
 - Search criteria: Search value matches a portion of the field value.

- **Binary**
 - Input format: Hexadecimal value
 - Search criteria: Search value matches a portion of the field value.
- **Integer**
 - Input format: Integer value
 - Search criteria: Field value matches the search value.
- **Float**
 - Input format: Float value
 - Search criteria: Field value matches the search value.
- **Boolean**
 - **Input format:**
 - * True: True, true, 1
 - * False: False, false, 0
 - Search criteria: Field value True, False matches with the search values of (True, False).
- **Object**
 - Input format: Object Path
 - Search criteria: The path of the field value (object) matches the search value.
- **Datetime**
 - **Input format(1): Datetime format parseable by the `datetime()` function like the following.**
 - * YYYY-mm-dd HH:MM:SS
 - * YYYY-mm-dd HH:MM:SS.mmmmmmm
 - **Search criteria(1)**
 - * [When specified in seconds] Field value is within a 1-second range from the search value. i.e: (YYYY-mm-dd HH:MM:SS.000000 .. YYYY-mm-dd HH:MM:SS.999999)
 - * [When specified in microseconds] Field value matches the search value
 - Input format(2): Date format parseable by the `date()`, such as YYYY-mm-dd.
 - Search criteria(2): Field value matches the search value.
 - **Input format(3): Time format parseable by the `time()` function like the following.**
 - * HH:MM:SS
 - * HH:MM:SS.mmmmmmm
 - **Search criteria(3)**
 - * [When specified in seconds] Time part of the field value is within a 1-second range from the search value. i.e: (HH:MM:SS.000000 .. HH:MM:SS.999999).
 - * [When specified in microseconds] Time part of the field value matches the search value.
- **Date**
 - Input format: Date format parseable by the `date()`, such as YYYY-mm-dd.
 - Search criteria: Field value matches the search value.

- **Time**
 - **Input format:** Time format parseable by the *time()* function like the following.
 - * HH:MM:SS
 - * HH:MM:SS.mmmmmmm
 - **Search criteria**
 - * [When specified in seconds] Field value is within a 1-second range from the search value. i.e: (HH:MM:SS.000000 .. HH:MM:SS.999999).
 - * [When specified in microseconds] Field value matches the search value
- **File**
 - Input format: File name
 - Search criteria: The filename of the field value (file) matches the search value.
- **Array<T>**
 - The search process depends on *type T* .
 - If there is at least one element in the array data that meets the search criteria, that object will be retrieved.
- **Dictionary<T>**
 - The search process depends on *type T* . In the dictionary data, the keys are not subject to search, only the values are considered as search targets.
 - If there is at least one element in the dictionary data that meets the search criteria, that object will be retrieved.

New in version 1.6.9: The table detail screen now supports searching for Float, DateTime, Date, and Time fields.

New in version 1.6.9.post1: The table detail screen now supports searching for Binary, Boolean, Integer, and Object fields.

2.4.3 Job flow

The job flow can be described and executed from the job flow object. For details on syntax of the job flow, refer to: *Kompira Tutorial* . For details on the job flow language, refer to: *Kompira Jobflow Language Reference*

In addition to the common key operations, the following key operations are supported on the job flow object detail screen.

Key bindings	Operation
Alt-X	Job flow execution

Job flow execution

When you write and save the job flow, the execution button of the job flow becomes effective. When you press the execute button, the job flow starts and the process details screen will be displayed.

Note: If there is a syntax error in the job flow or the Kompira engine is stopped, the execution button of the job flow will be invalid.

Specifying parameters

If parameters are defined for a job flow, you can specify the value of each parameter by entering it on the screen when executing the job flow. For parameters for which default values are defined, the default values are entered in the input fields when the job flow screen is displayed. The input fields for parameters for which no default values have been defined are empty. However, if there are empty parameters, the job flow cannot be executed, so be sure to enter all parameters before executing the job flow.

The parameter entry field can be a value or an expression in the job flow notation. This means, for example, that if you want to give a string for a parameter, you must enclose it in quotation marks.

When displaying the job flow screen, you can also specify job flow parameters in the URL parameter in the form “parameter-name=expression”. For example, if a job flow named /root/test_jobflow has parameters named foo and bar defined, and you want to specify a number and a string, the URL would look like this

```
https://<kompira-server>/root/test_jobflow?foo=100&bar="hello"
```

Note that the parameter part must be URL-encoded, and depending on the characters used, it may be written as %XX (where XX is the hexadecimal code of the character set). For example, if you want to give foo the expression 50+50 and bar a string containing the symbol “#hashtag”, the URL should look like this

```
https://<kompira-server>/root/test_jobflow?foo=50%2b50&bar="%23hashtag"
```

Specifying options

The following options can be selected to run a job flow.

Option name	Contents
Step mode	This mode is used when debugging a job flow. Before the command is executed, the job flow is paused and the contents of the execution command can be confirmed.
Checkpoint mode	Checkpoint mode is a mode for saving the execution status of job flow. If the Kompira server stopped abnormally during job flow execution, the job flow process can be resumed from the saved checkpoint status.
Monitoring mode	Specify the execution monitoring mode of the job flow. When the job flow is completed or abnormally stopped, a mail is sent to the mail address of the user who executed the job flow.

2.4.4 Script job

When you create a script job, you can run scripts written in languages such as Bash, Perl, Ruby, Python on a remote server.

In addition to the common key operations, the following key operations are supported on the script job object detail screen.

Key bindings	Operation
Alt-X	Script job execution

Script edit

Pressing the Edit button will take you to the script edit screen. Write a script to execute it in the text area of the source.

When running a script on a Unix type OS such as Linux, please write (shebang) as the top line of the script.

Example

```
#!/bin/bash
echo hello
```

When executing a script on a Windows OS, you need to specify an extension. Please specify the following extensions according to the type of script.

Script	Extension
Batch file	bat
VBScript	vbs
JScript	js
PowerShell script	ps1

How to execute a script

When you press the execute button, the script's execution will be started and the process details screen is displayed. When the script is completed, the results of the exit status, standard output, and standard error output are printed on the console.

Command parameters can be entered in the text field to the right of the execute button. Multiple command arguments can be passed by separating them with spaces.

For the execution node specify the remote server on which the script is executed. If not specified, the script is executed on the local server on which the job manager is running.

For the execution account, specify the user's credential when logging in to the remote server.

New in version 1.4.0: The function to execute script jobs directly from the browser has been added.

2.4.5 Mail channel

A mail channel is an object that works with an external IMAP4/POP3 server to receive mail from a job flow. As shown below, the message receiving function of JobFlow can be used for the created mail channel object to receive and process mail. (The following example assumes reception from a mail channel created in /home/guest/test_mchan.)

```
</home/guest/test_mchan> ->
[mail = mail_parse($RESULT)] ->
print('Received mail:', mail['Subject'])
```

How to set up mail channels

On the mail channel object edit screen, set the following items and save them.

Setting items	Contents
Server name	Set the host name or IP address of the IMAP4/POP3 server to connect to.
Protocol	Set either IMAP4 or POP3 as the protocol for receiving mail.
SSL	Check this box if you wish to use SSL for communication.
Port number	Sets the port number of the IMAP server. If not specified, the default port number is used.
Mailbox	Sets the mailbox to receive. The default is “INBOX”.
User name	Set the user name to connect to the IMAP4/POP3 server.
Password	Set the password for connecting to the IMAP4/POP3 server.
Interval	Specify the interval to check for new messages to the IMAP4/POP3 server in minutes.
Timeout	Specify the connection timeout to the IMAP4/POP3 server in seconds.
Use OAuth2	Check this box if you wish to authenticate using OAuth2. In this case, a password is not required.
OAuth2 provider	Select the OAuth2 service provider; required if OAuth2 authentication is used.
Disabled	Disables connections to IMAP4/POP3 servers.
Log size	Specify the maximum size of the log. If the maximum size is exceeded, the oldest log messages are deleted first.

Connection test

Click the “Test Connection” button to the right of the server name to connect to the configured IMAP4/POP3 server, authenticate with a user name and password, and check the mailbox.

Setup procedure when using OAuth2 authentication

To connect using OAuth2 authentication, set the user name, select the OAuth2 provider that supports the mail service you are connecting to, and check Use OAuth2.

Then, click the “Start authorization” button displayed to the right of OAuth2 use to start the approval flow. The OAuth2 provider’s authentication screen will appear in a separate window. After logging in with the user name you have set, confirm the contents and click the Approve button. If the redirection fails and the window displays “Cannot access this site,” copy the URL displayed in the address bar portion of the window, paste it into the dialog box for entering the redirection URL displayed on the original Kompira screen, and click the “Submit” button. Kompira uses the authorization code contained in the redirect URL entered to obtain an access token.

If the token is successfully obtained, a new token expiration date will appear on the mail channel screen.

If you have changed the provider's settings, for example, click the "Clear Token" button to clear the token stored inside Kompira, and then re-create the token by performing the "Start Authorization" again.

Note: With a refresh token, an expired access token is automatically refreshed and its expiration date extended when sending/receiving mail or performing a connection test. Refresh tokens generally have a longer expiration time than access tokens, but if a refresh token expires, token refresh will fail. In that case, please "Start Authentication" to obtain the token again. Since the refresh token is also updated upon refresh, regular mail sending/receiving and connection tests can be performed to prevent the refresh token from expiring.

Note: The user must register the Kompira application with the OAuth2 provider and define an OAuth2 provider type object based on the configuration information there. Please refer to the technical documentation of each OAuth2 provider for information on how to register your application.

2.4.6 SMTP server

The SMTP server is an object that defines information about the SMTP server to be used when sending mail.

How to set up an SMTP server

On the edit screen of the SMTP server object, set each of the following items and save them.

Setting items	Contents
Host name	Set the host name or IP address of the SMTP server to be followed.
Port number	Sets the port number of the SMTP server. If not specified, the default port number is used.
User name	Sets the user name when connecting to an SMTP server that requires authentication.
Password	Sets the password when connecting to an SMTP server that requires authentication.
Timeout	Specifies the connection timeout to the SMTP server in seconds.
Use TLS	Check this box if you want to connect to the SMTP server using TLS.
Use SSL	Check this box if you want to connect to the SMTP server using SSL.
Use OAuth2	Check this box if you wish to authenticate using OAuth2. In this case, a password is not required.
OAuth2 provider	Select the OAuth2 service provider; required if OAuth2 authentication is used.

Click the "Connection Test" button to check the connection to the SMTP server. It also confirms user authentication if a user name and password have been set.

The procedure for setting up OAuth2 authentication is the same as for the mail channel. (*Setup procedure when using OAuth2 authentication*)

2.4.7 LDAP Server

The LDAP server is an object that defines the LDAP server and configuration information for linking Kompira login accounts with LDAP. Specify the LDAP server object to be federated in the LDAP Server (ldapServer) field of the system configuration.

How to set up an LDAP server

On the edit screen of the SMTP server object, set each of the following items and save them.

Setting items	Contents
Server URL	Specify the URL of the LDAP server. (Example: <code>ldap://ldap.example.com</code>)
Timeout	Specifies the connection timeout to the LDAP server.
Use STARTTLS	Set if STARTTLS is used to connect to the LDAP server.
Fallback Login	Set to allow login with the password of the most recent login in case of LDAP login failure.
Session Expiration	Specify the session expiration time in hours when logging in as an LDAP user.
Bind DN	Specifies the bind DN to the LDAP server. If empty, anonymous bindings are used.
Bind Password	Specify the password for binding to the LDAP server.
User Search DN	Specifies the DN on which the user search will be based.
User Search Scope	Specify the scope from the base point of the user search among BASE, ONELEVEL, and SUBTREE.
User Search Attribute	Specifies which of the attributes of the object to which the user search is directed contains the user name.
Target Users	Specify a list of user names to be linked to LDAP.
Required Group DN	Specify the DN of the group to which the user to be linked to LDAP belongs.
Group Search DN	Specifies the DN on which the group search will be based.
Group Search Scope	Specify the scope of the search target from the base point of the group search among BASE, ONELEVEL, and SUBTREE.
Group Search Class	Specifies the class (objectClass) to filter from among the objects in the group search.
Group Type	Specifies the type of group to be searched for in the group search.
Mirror Groups	Specify the group name that reflects the LDAP group to which the LDAP user belongs to the Kompira group.
User Data (First Name)	Specify the corresponding LDAP user attribute if you want the “name” of the user object to reflect LDAP values.
User Data (Last Name)	Specify the corresponding LDAP user attribute if you want the “last name” of the user object to reflect LDAP values.
User Data (Email)	Specify the corresponding LDAP user attribute when reflecting LDAP values in the “Email” user object.

Click the “Test Connection” button to check the connection to the LDAP server.

Note: After the first successful login as an LDAP user, a new LDAP user is created in the Kompira user list (/config/user). The created LDAP user will remain in the Kompira user list even if it is deleted from the LDAP server, so you can delete it if necessary.

Note: The session validity period setting only affects users logged in via LDAP. When logged in as a local user, the system default session validity period (2 weeks = 336 hours) always applies. Also, if the session expiration time is set to 0, the session will be destroyed when the browser is closed. If set to empty, the default session validity period will

be applied.

Note: If a group search DN or user data (first_name, last_name, email) is specified, the corresponding fields of the user object (groups, first_name, last_name, email) will be overwritten with the latest values from the LDAP server each time the LDAP user logs in. Note that even if you rewrite the values of these fields separately, they will be overwritten by the LDAP server values each time you log in. However, if you have set a non-LDAP group in the group field of the user object, that value will be preserved.

2.4.8 Form

A form is an object that allows you to create a user input form. The functions that a form can perform depend on the type of object set as the submission object.

- If a channel type object is set as the submission object, the message entered in the form can be sent to that channel.
- If a job flow type object is set as the submission object, then the job flow can be executed with the parameters entered in the form.

In addition to the common key operations, the following key operations are supported on the form object detail screen.

Key bindings	Operation	Note
Alt-S	Send	If the submission object is a channel type.
	Execute	If the submission object is a job flow type.

How to set up a form

On the form object edit screen, set each of the following items and save them.

Setting items	Contents
Submit object	Set up a channel type or job flow type object to be submitted from this form.
Type fields	Sets the structure of the data to be submitted in the submission object.

Entering submission data

The form object detail screen displays the entry fields (form) for the data to be submitted to the submission object. Each field is an input interface according to its field type that you have defined, allowing you to enter values such as numbers or strings. Note that while expressions could be given in job flow parameters as shown in [Specifying parameters](#), only values can be entered in forms, but not expressions.

When displaying the screen of a form object, you can also specify submitted data in the form “field-name=value” in the URL parameter. For example, if a form object named /root/test_form defines an Integer type field named foo and a String type field named bar, and you want to specify a number and a string, the URL would look like this

```
https://<kompira-server>/root/test_form?foo=100&bar=hello
```

Unlike the parameter specification that gives an expression in a job flow, there is no need to enclose the string in quotation marks because the value is specified according to the type.

Send message

If a channel type object is set as the submission object, a “Send” button will appear below the input form.

Enter a value in the form and press the send button, and the entered value will be sent to the channel object set as the submission object as dictionary type data.

Run job flow

If a job flow type object is set as the submission object, an “Run” button will appear below the input form.

Enter a value in the form and pressing the run button executes the job flow object set in the submitted object with the entered value as a parameter.

2.4.9 Repository

It is possible to synchronize the Kompira directory and the repository on the distributed version control system (DVCS) by creating repository objects. You can import objects from the remote repository into the specified Kompira directory, or conversely save the created Kompira objects on the remote repository. This enables version control of Kompira’s job flow and script jobs. It also makes it easy to share job flows across multiple Kompira.

How to set up repository

On the repository object edit screen, set the following items and save them.

Setting items	Contents
URL	Specify the URL of the remote repository.
Repository type	Specify the type of remote repository. (In the current version, only git or mercurial can be selected.)
Port number	Specify this when the port number of the repository server is different from the default.
User name	Specify the user name of the account accessing the remote repository.
Password	Specify the password for the account that will access the remote repository.
Directory	Specify the directory object of Kompira to be synchronized.
Update config data	If checked, the configuration data of the Config type object will also be overwritten when pulled from the remote repository.

Note: Remote repository must be created in advance.

New in version 1.6.7: The setting item “Update config data” has been added.

Initialization

Initialize a local repository on the Kompira server and import the contents of the repository into the Kompira directory. When the Initialize button is clicked, the following process is performed.

- Clones the remote repository and initializes it as a local repository.
- Imports the contents of the local repository into the Kompira directory.

The initialize button is enabled when the required repository configuration items are entered on the edit screen.

Push

Commits the changes in the Kompira directory to the specified branch and pushes them to the remote repository. When the Push button is clicked, the following process is performed.

- Switches the local repository to the selected branch.
- Exports the Kompira directory to the local repository in directory format.
- Commits the changes in the local repository with the commit message entered.
- Pushes to the remote repository.

When committing the changes, the full name and email address of the user logged into Kompira are recorded as author. However, if the first name and last name are not specified, the logged in {username} is used, and if the email address is not specified, {username}@{hostname} is used.

After initialization, the push button will be enabled.

Changed in version 1.6.9.post4: The Kompira login user is now recorded as the author of the commit during push operation.

Pull

Pulls the remote repository and imports the contents of the specified branch into the Kompira directory with overwrite. When the Pull button is clicked, the following process is performed.

- Pulls from the remote repository.
- Switches the local repository to the selected branch.
- Import the contents of the local repository into the Kompira directory with overwrite.

If “Update config data” is checked when importing to the Kompira directory, the configuration data of Config type objects are also overwritten.

After initialization, the pull button will be enabled.

2.5 Process Management

We will explain the process for managing the execution state of job flows and script jobs.

A process is created when a job flow and a script job are executed. For details on starting execution, please refer to: *Job flow* and *Script job*

2.5.1 Process list

On the process list screen, you can check the list of processes that are being executed or were executed in the past.

By default, processes with process statuses NEW (New), READY (Executable), RUNNING (Running), WAITING (Waiting for Input or Command Completion) are displayed with [Running Process] selected.

When process status is DONE (completed) or ABORTED (abnormal termination), the process has already ended. If you want to check these, please select [All processes].

For processes that have already been executed, you can delete them from the list screen.

Note: Normal users can view only the processes that they themselves executed. Root users can view all processes.

2.5.2 Process details

On the process details screen, you can check and control the execution status of processes.

Button operations and displayed tabs in the process details screen are described in the next and subsequent sections.

In addition to the common key operations, the following key operations are supported on the process detail screen.

Key bindings	Operation	Note
F6	Terminate processes	A confirmation dialog will appear.
F7	Suspend processes	Not supported for script jobs.
F8	Resume processes	Not supported for script jobs.
CTRL - [Switch to previous tab	
CTRL -]	Switch to next tab	
a	Toggle text selection	Can be operated in the console tab or the result tab.

New in version 1.6.6: Key operations are now available on the process detail screen.

Terminate

Stop execution of the process. Terminated processes will show an ABORTED (abnormal termination) status and cannot be restarted.

If there is a child process running, the status of the child process will also be ABORTED (abnormal termination).

Suspend

Temporarily suspend execution of the process.

If there is a child process running, the child process will also be paused.

Resume

Resume the suspended process.

If there is a stopped child process, the child process also restarts.

Console

Output shown during process execution.

In the case of a job flow, messages of print statement, execution result of a remote command, a stack trace at error, etc. are displayed.

For script jobs, the exit status of the script, standard output, and standard error output are displayed.

Note: The maximum console buffer size is limited to 64 KB. Please note that if there is output of 64 KB or more, only the first 64 KB message can be printed.

Job flow / Script

The job flow and script executed will be displayed.

In the case of a job flow, the line currently being executed is also displayed.

Result

The contents of the result \$RESULT at the end of the process will be displayed in JSON format.

Child processes

You can check the list of child processes on the screen that is displayed only when the job flow is executed.

A child process is created when you execute a job flow that creates a child process using fork or pfor syntax.

Settings

This screen is displayed only when a job flow is executed, and allows you to check the settings of the process. You can also change the settings when it is stopped.

What you can see or change here are the options for job flow execution shown in *Job flow execution*.

2.5.3 Process operation by management command

On kompira server, you can use the management command `/opt/kompira/bin/manage.py process [options. . .]` to perform the following operations on Kompira processes.

- Display process list
- Display process count
- Delete processes
- Terminate processes

- Suspend processes
- Resume processes

At this time, you can specify the conditions for filtering the processes to be operated on.

- The status of the process.
- The job flow that the process is executing.
- Whether the process was started by a schedule.
- Whether the invoker object is a specified process or not.
- The user who executed the process.
- Started datetime and finished datetime.
- The elapsed time during which the process is running.
- A string included in the console output.

Process operation options

The following options specify the operations to be performed on the Kompira process.

Option	Description
-L, --list	Displays a list of processes. By default, it shows the processes in the active state.
-C, --count	Displays the number of processes. By default, it displays the number of processes in all states.
-D, --delete	Deletes processes. Processes in the active state will be excluded.
-T, --terminate	Terminates processes. Processes that have already been terminated will excluded.
-S, --suspend	Suspends processes. Processes that have already been terminated or have been suspended are excluded.
-R, --resume	Resumes processes. Processes that have already been terminated or have not been suspended will be excluded.

Only one of the options specifying the operation can be specified, and if more than one is specified, the last option will be applied. If none of the above options are specified, a list of processes will be displayed.

Note: Please note that when a large number of processes are to be processed, the load on memory, CPU, and other resources may increase.

When an operation involving a change in process information (delete, terminate, suspend, resume) is specified, a confirmation (yes/no input) will be given to actually apply the control. If you want to apply the control without any confirmation, specify the -y option. If you want to check the behavior without applying the control, use the --dry-run option.

Option	Description
-y, --noinput	Apply operation without confirmation.
--dry-run	It does not actually apply the change.

Process filtering options

The following options allow you to specify conditions for filtering the Kompira processes to be operated on.

Option	Description
<code>-i PID, --pid PID</code>	processes whose process ID is PID (more than one can be specified)
<code>-a, --all</code>	processes whose with any status.
<code>--active</code>	processes in active state (NEW, READY, RUNNING, or WAITING)
<code>--finish</code>	processes in finished state (ABORTED or DONE)
<code>--status {NEW,READY,RUNNING,WAITING,ABORTED,DONE}</code>	processes in the specified state (more than one can be specified)
<code>--suspended</code>	processes in suspended state
<code>--not-suspended</code>	processes not in suspended state
<code>--parent PARENT</code>	processes whose parent process ID is PARENT (more than one can be specified)
<code>--anyones-child</code>	processes whose with an arbitrary parent process.
<code>--min-children MIN_CHILDREN</code>	Processes whose with equal or more than MIN_CHILDREN child processes.
<code>--job JOB</code>	processes whose job flow at the start matches JOB in the regular expression.
<code>--current-job CURRENT_JOB</code>	processes whose running job flow matches CURRENT_JOB with a regular expression.
<code>--scheduled</code>	Processes started by the schedule.
<code>--not-scheduled</code>	Processes started by other than the schedule.
<code>--scheduler-id SCHEDULER_ID</code>	Processes started by the schedule whose ID is SCHEDULER_ID (more than one can be specified)
<code>--scheduler-name SCHEDULER_NAME</code>	Processes started by the schedule whose name matches SCHEDULER_NAME in a regular expression.
<code>--invoked</code>	Processes executed in a manner in which the invoker object is recorded.
<code>--not-invoked</code>	Processes executed in a way that does not record the invoker object.
<code>--invoker INVOKER</code>	Processes whose invoker object is INVOKER (abspath; more than one can be specified).
<code>--invoker-type INVOKER_TYPE</code>	Processes whose invoker object has type INVOKER_TYPE (abspath; more than one can be specified).
<code>--user USER</code>	Processes whose executing user name matches USER (more than one can be specified)
<code>--started-since STARTED_SINCE</code>	processes whose start date and time is since STARTED_SINCE.
<code>--started-before STARTED_BEFORE</code>	Processes whose start date and time is before STARTED_BEFORE.
<code>--finished-since FINISHED_SINCE</code>	processes whose finish date and time is since FINISHED_SINCE.
<code>--finished-before FINISHED_BEFORE</code>	Processes whose finish date and time is before FINISHED_BEFORE.
<code>--elapsed-more ELAPSED_MORE</code>	processes whose elapsed time is longer than or equal to ELAPSED_MORE (in seconds).
<code>--elapsed-less ELAPSED_LESS</code>	Processes whose elapsed time is shorter than ELAPSED_LESS (in seconds).
<code>--console CONSOLE</code>	Processes that include CONSOLE in their console output.

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Option	Description
<code>--head HEAD</code>	The first HEAD of the filtered results will be operated.
<code>--tail TAIL</code>	The last TAIL of the filtered results will be operated.
<code>-r, --reverse</code>	Reverse the sort order.
<code>--order ORDER</code>	The sort order is specified by ORDER.

- If you specify multiple filtering options that can be specified more than once, they will be filtered as OR conditions.
- If you specify multiple filtering options of different types, they will be filtered as AND conditions.
- The optional date and time can be specified in a format that is recognized by the `datetime()` built-in function of the job flow.

Other options

Option	Description
<code>--format {table,json,export}</code>	The format for listing processes.
<code>--datetime-format DATETIME_FORMAT</code>	The format for displaying date and time.

2.6 Scheduler

By adding the job flow and script job created on Kompira in the scheduler, you can run the job periodically.

Here is the list of items that can be set with the scheduler.

Field	Default value	Description
Schedule name	Nil	Name of schedule
Description	Nil	A description about the schedule
User		User who runs the job
Job		Job run by the scheduler
Year	*	Scheduled year (4 digit number)
Month	*	Scheduled month (1-12)
Date	*	Scheduled date (1-31)
ISO week number	*	Scheduled week number (1-53) Week number defined in ISO 8601
Day or day number	*	Day of the week (0 (Monday) - 6 (Sunday), or mon, tue, wed, thu, fri, sat, sun)
Hour	*	Scheduled hour (0-23)
Minute	*	Scheduled minute (0-59)
Disable schedule	false (unchecked)	If true (checked), it will not run job

2.6.1 Date and time setting field format

The date and time setting field can be used the same format as Unix cron as follows.

Format	Field	Description
*	All	Run on each value
*/a	All	Run every (a).
a-b	All	Run every (a-b)
a-b/c	All	Run every (a-b) and (c).
xth y	Day	Run at the (x)th y (day) of the month.
last x	Day	Run on the last (x) day of the month.
last	Day	Run on the last day of the month.
x,y,z	All	Run with condition x, y or z (any combination of the above formats can be used)

Note: In the above format, be careful not to put a space next to ‘,’, ‘/’, ‘-’.

Example 1: Run at 0:00 on the first Monday and last Friday of December every year:

```
Month: 12
Day: 1st mon,last fri
```

Example 2: Run at 12:30 of 15th-20th in April and August 2012:

```
Year: 2012
Month: 4,8
Day: 15-20
Hour: 12
Minute: 30
```

Example 3: Run every hour on weekdays:

```
Day of week: mon-fri
Hour: *
```

Example 4: Run at 0:00 on January 1st every year:

```
Year: *
```

2.7 Settings

Below is an explanation of various settings that you can set from the “Settings” tab at the top of the Kompira screen.

2.7.1 User management

You can check the list of users registered on Kompira.

Here is the list of initial users.

User name	Password	Description
guest	guest	Guest user
root	root	root user
admin	admin	Administrative user. All objects are accessible regardless of access permission settings. By default it is a disabled user.

The name of the user can be freely named within the following rules.

- You can use alphabetical and numerical characters, as well as underscores (“_”).
- The first character must be a number
- It is case-sensitive
- User name must be no longer than 30 characters.

When creating a new user, /home/<username> directory is created automatically as the home directory.

General users can only edit their own user information. However, it cannot change its own group or valid fields. Only root users can edit all users information.

Here is the list of items that can be set for each user.

Field	Description
User name	Name used to identify users in the system
Surname	User’s surname
Name	User’s first name
Email	User’s email address
Group	Group user belongs to.
Active	If false (unchecked), it will not allow user login
LDAP User	If true (checked), represents an LDAP user
Home	The page that displays first when the user logs in
Environment variable	Environment variable object automatically loaded when running a job flow

Note: Guest, root, and admin users can not be deleted. Nor can it delete itself.

Note: The Group, Enabled, and LDAP User fields can only be modified by privileged users. However, the LDAP user fields for built-in users (admin, root, guest) cannot be modified. Also, LDAP user passwords cannot be changed (if necessary, please change the password on the LDAP server side).

Account Unlocking

When an account is locked, a list of the IP addresses from which the account was accessed is displayed with a warning message at the bottom of the locked user's information display screen. The user's account can be unlocked by clicking the "Unlock" button displayed along with the warning message.

It is also possible to unlock the device by logging in to the Kompira server at the terminal and executing the following administrative commands

`axes_reset` removes all account locks at once.

```
/opt/kompira/bin/manage.py axes_reset
```

`axes_reset_ip` unlocks the account from the specified IP address.

```
/opt/kompira/bin/manage.py axes_reset_ip [ip ...]
```

`axes_reset_username` unlocks the account for the specified user.

```
/opt/kompira/bin/manage.py axes_reset_username [username ...]
```

You can also run the `axes_list_attempts` command to see a list of failed login attempts. (The corresponding history will be deleted when the lock is released.)

```
/opt/kompira/bin/manage.py axes_list_attempts
```

2.7.2 Group management

You can check the list of groups registered on Kompira.

Here is the initial group list.

Group name	Description
other	All users on Kompira belong to other
wheel	Users with root privilege belong to wheel.

The name of the group can be freely named within the following rules.

- You can use alphabetical and numerical characters, as well as underscores ("_").
- The first character must be a number
- It is case-sensitive
- Group name must be no longer than 30 characters.

Group information can only be edited by root users.

Note:

- You can not delete other and wheel groups.
 - As mentioned above, to be able to see what group other users belong to can be done regardless of their settings. That means that user settings belonging to the other group are ignored.
-

2.7.3 Management area setting

A management area is a network area managed by each job manager.

When using multiple job managers in Kompira, Each Job Manager can specify the area, such as the job manager A will access 192.168.1.x and the Job Manager B will access 192.168.2.x.

Here is the list of items that can be set for each management area.

Field	Description
Display name	Specify the display name of the management area
Description	Describe the management area
Disable	Set this to temporarily disable the target management area
Range	Specify the range of the management area by IP address or host name. You can specify more than one, and wildcard (*) can also be used.

Only root users can edit the management area information.

By default, there is a management area named default that has its range set to '*'. In this case, all remote commands are executed by the job manager of the default management area.

If you use Kompira with only one job manager, or if you do not need to set a management area for each job manager, you do not need to change the management area setting.

Job manager status check

In the management area setting screen, you can check the operation status of the job manager registered in each management area.

The following items are displayed as job manager status.

Value	Description
Host name	Name of the host on which the job manager is running
Process ID	The process ID of the job manager process (kompira_jobmgrd)
Version	Job Manager's Kompira Version
Status	Job manager's operating status ('Active' or 'Down')

When the status is [active], the job manager can communicate with Kompira, and remote command can be executed.

2.7.4 System Settings

On the system setting screen, you can configure the entire Kompira system.

Here is the list of setting items.

Item name (Key name)	Description
Server URL (serverUrl)	URL of Kompira server
Administrator email address (adminEmail)	Set the mail address of the administrator of the Kompira server. It is used as the default 'from' address when sending mail.

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Item name (Key name)	Description
Successful email template (doneMailTemplate)	The email template used when the job flow completed normally.
Unsuccessful email template (abortMailTemplate)	The email template used when the job flow completed unsuccessfully.
SMTP Server (smtpServer)	Select the SMTP server for sending e-mail. If abbreviated, the SMTP server on localhost is used.
LDAP Server (ldapServer)	Select the LDAP server to be used for LDAP federation. If omitted, LDAP linking is not performed.
Login failure limit (loginFailureLimit)	Locks the account if the specified number of consecutive login attempts fail. If the value is set to a value less than or equal to 0 or empty, the account is not locked.
Account lockout time (accountLockoutTime)	Specify the period of time, in minutes, to lock the account. The lock will be automatically released after the specified period of time. If the value is set to a value less than or equal to 0 or empty, the account lock will not be automatically released.
Show command enabled (showCommandEnabled)	Check if you want the console to display information about the command or job to be executed when executing a command or script by an executing job, when starting a session block, and when executing a reboot job.
Show command format (showCommandFormat)	Specifies the format for displaying information about the command or job to be executed.
Show stdout enabled (showStdoutEnabled)	Check to display standard output from command execution on the console.
Show stdout filter (showStdoutFilter)	Sets how much of the standard output is displayed on the console when it is allowed.
Show stderr enabled (showStderrEnabled)	Check to display standard error output from command execution on the console.
Show stderr filter (showStderrFilter)	Sets how much of the standard error output is displayed on the console when it is allowed.

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Item name (Key name)	Description
Show session enabled (showSessionEnabled)	Check if you want the console to display output received while the session is executing.
Show session filter (showSessionFilter)	Sets how much of the session is displayed on the console when it is allowed.
Hide password while editing (hidePasswordWhileEditing)	If checked, the password set in the password field cannot be displayed when editing an object. The newly entered password can be displayed by clicking on the eye icon until the object is saved.
Custom style (customStyle)	Select a custom style with settings such as the color scheme of the screen displayed in the browser. This makes it easier to distinguish between multiple Kompira servers.
Brand tag (brandTag)	You can set a string of brand tag that will be displayed following the brand name notation in the upper left corner of the menu bar. If a brand tag is specified, it will appear between [and] with a space after the brand name.

Note: Since the system setting (/system/config) is a setting type object (*Config*), it can refer to the data dictionary of setting's dictionary data from the job flow with key name.

Note: When password hiding mode is enabled, editing an object containing a password dictionary (Dictionary<Password>) or password array (Array<Password>) field from multiple locations simultaneously does not guarantee that the value will always be reflected if the password is later saved unchanged.

New in version 1.6.8: Login failure limit (loginFailureLimit), account lockout time (accountLockoutTime) and hide password while editing (hidePasswordWhileEditing) have been added.

Changed in version 1.6.8: The default value of show command enabled (showCommandEnabled) has been changed to false.

Show command format

Specifies the display format for command display as a string. The item name can be enclosed in {} to embed the information at the time of execution and display it on the console. The default values for the command display format are as follows.

```
[{username}@{hostname}]{sudomark} {command}
```

The following items can be specified in the command display format. If you specify an item name that is not specified, it will be ignored.

Item name	Description
now	Current date and time
jobtype	Job type (one of “COMMAND”, “SCRIPT”, “SESSION”, “REBOOT”)
conntype	Connection type specified by control variable (“ssh”, “windows/http”, etc.)
hostname	Remote host name or IP address specified in the control variable (“localhost” if local)
port	Port number specified in the control variable (”” if not specified)
username	User name for remote access specified in the control variable (“kompira” if local)
sudomark	Usually \$, or # if <code>__sudo__=true</code> .
command	A string indicating the command line, which varies for each job type. Detailed formatting for each job type cannot be specified.

Of these, the item `command` is expanded as follows for each job type.

- For command execution (jobtype=“COMMAND”)
 - Entire command line specified for the job to be executed
- For script job execution (jobtype=“SCRIPT”)
 - `{script_job.abstractmethod}. {script_jop["ext"]} {args}`
 - where `script_job` refers to the script job object passed to the executing job and `args` refers to the parameters passed to the executing job.
- For session block (jobtype=“SESSION”)
 - `<SESSION: {session_id}>`
- for reboot job (jobtype=“REBOOT”)
 - `reboot`

The same format as Python3’s `str.format()` can be used for the command display format. If an error occurs due to an incorrect format, the default format will be used.

console display filter

The standard output display filter, standard error output display filter, and session display filter allow you to set filter conditions for console display in a common format.”

Depending on the format set, there are several types of filters, with different behaviors, such as whether or not the output is displayed on the console when it is obtained.”

If the filter is empty, an unlimited number of entries will be displayed.

- All obtained output is displayed on the console.

If you set the filter in the format `<number><unit>`, only the specified amount will be displayed. For example, `10L` will display only the first 10 lines.

- From the start of the job up to the specified quantity is displayed on the console, after which it is suppressed and no longer displayed.
- `<number>` can be specified as an integer.
- `<unit>` is optional and can be one of the following It is case-insensitive.
 - If `L` or `LINES` is specified, count by lines. If the output is binary, the count is separated by `0x0A`.
 - If the unit is omitted, the number of characters is counted. If the output is binary, it is counted in bytes.
 - If an undefined unit is specified, count in characters or bytes.

- If <number> is 0 (or a negative value), it will not be displayed at all.
- If you get more than one character of output after the specified quantity is reached, you will get a one-time ``...`` and a new line will be printed to the console.

2.7.5 Startup job flow

In the startup directory (/system/startup), you can set a startup job flow that starts automatically when the Kompira server starts up.

2.7.6 License Management

You can check the Kompira license

Here is the list of items that can be checked on the license management screen.

Field	Description
License ID	Unique ID of license file
Edition	License type
Hardware ID	Kompira server's Hardware unique ID
Expiration date	License expiration date
Number of registered nodes	The number of nodes that have been connected from the job flow Select Reset to delete connection history
Number of job flows	Number of job flows registered as objects
Number of scripts	Number of script jobs registered as objects
User	licensed user
signature	License file signature

The number of registered nodes, the number of job flows, and the number of scripts are displayed together with the maximum number according to the license.

If the license file is not registered, Kompira will operate using a temporary license. You can use a temporary license for up to one week after Kompira installation.

License of registration

Press the edit button on the right side of the license management screen to go to the license file upload screen.

Select the license file by pressing "Select file", and press the "Save" button to register the license.

Note: The license file is saved in /var/opt/kompira/kompira.lic. By placing the license file directly in the above path, you can register the license without accessing the license management screen.

2.8 Troubleshooting

A list of errors, causes and ways to troubleshoot them when you operate Kompira via a browser.

2.8.1 “The number of Jobflows has exceeded the limit”, “The number of ScriptJobs has exceeded the limit”

The number of job flows and script job objects that can be created are controlled by the Kompira license.

If you attempt to create an object beyond the limit set by the license, an error message will be displayed and the creation of the object will fail.

Please check the available object numbers from the license management page.

2.8.2 “Kompira engine has stopped”

When the kompirad process has stopped this message is displayed.

Please check the log file under /var/log/kompira and start the kompirad process.

See also:

Starting / stopping the Kompira daemon and Checking the state, Kompira logs

2.8.3 Database connection error

This message is displayed when the database cannot be connected to.

You can check the status of the database process and restart it by the following commands.

```
# systemctl status postgresql-<pgver>.service
# systemctl restart postgresql-<pgver>.service
```

Note: Replace <pgver> with the version of PostgreSQL you have installed.

2.8.4 Internal error

This will be displayed when an unexpected error occurs inside Kompira.

Check the logs under /var/log/kompira and then please contact us at support@kompira.jp

2.8.5 kompira_dump.sh Information collection and support inquiries

In order to solve any problems you are having on Kompira, it may be necessary to check various information sources such as various log files and setting files.

Run /opt/kompira/bin/kompira_dump.sh as root on the Kompira server and this will automatically collect useful information to solve the problem. In addition, since the database dump is included, the file size can be large. Please make sure there is enough free space to run the script.

```

$ sudo /opt/kompira/bin/kompira_dump.sh
2014-11-18 15:18:52 # mkdir /home/ec2-user/kompira_dump-20141118-151852
###
### kompira_dump ver 1.0.0
### dump started: 2014-11-18 15:18:52
###
===== system =====
2014-11-18 15:18:52 # mkdir /home/ec2-user/kompira_dump-20141118-151852/system
2014-11-18 15:18:52 # cp -a /etc/os-release /etc/system-release ./
2014-11-18 15:18:52 # printenv
2014-11-18 15:18:52 # who -aH
:
:
:
===== kompira =====
2014-11-18 15:19:09 # mkdir /home/ec2-user/kompira_dump-20141118-151852/kompira
2014-11-18 15:19:09 # /opt/kompira/bin/kompirad --version
2014-11-18 15:19:09 # /opt/kompira/bin/manage.py license_info
2014-11-18 15:19:10 # /opt/kompira/bin/manage.py dumpdata -a
2014-11-18 15:19:16 # cp -a /opt/kompira/kompira.conf ./
2014-11-18 15:19:16 # cp -a /var/opt/kompira/kompira.lic ./
2014-11-18 15:19:16 # tar -cf - /var/log/kompira
tar: Removing leading `/' from member names
----- kompira -----
###
### dump finished: 2014-11-18 15:19:16
###
compressing...
/home/ec2-user/kompira_dump-20141118-151852.tar.gz

```

In the last line you will see a file that summarizes the collection results (kompira_dump-20141118-151852.tar.gz in the example above). Please attach this file along with a description of the problem and email it to: support@kompira.jp

Please note that this .tar.gz file is not encrypted, so please treat it according to your security policy.

Information not collected

kompira_dump.sh does not collect confidential information such as the following.

- Account password information set in Kompira server

Information collected

kompira_dump.sh collects the following information.

- **System information**
 - Process information (ps, top, etc.)
 - Service information (service, chkconfig, etc.)
 - Installed package information (yum, rpm, pip etc)
 - Kernel information (sysctl, lsmod, /proc/{ version,*info,*stat }, etc.)
 - Log files (/var/log/{ dmesg,messages } etc)

- **Network information**
 - Interface information (ip link, ip addr, ip route, etc.)
 - Firewall information (iptables -L etc)
 - Network status (netstat, traceroute, etc.)
- **Information on Apache**
 - Service state (service httpd status, etc.)
 - Log files (/var/log/httpd/)
 - Configuration files (/etc/httpd)
- **Information on RabbitMQ**
 - Service status (service rabbitmq-server status)
 - Log files (/var/log/rabbitmq/)
- **Information on PostgreSQL**
 - Service status (service postgresql-<pgver> status)
 - Log files (/var/lib/pgsql/<pgver>/data/{pg_log,pgstartup.log})
- **Information on Kompira**
 - Version (kompirad -version)
 - License information (manage.py license_info, etc.)
 - Database dump (manage.py dumpdata -a)
 - Configuration file (/opt/kompira/kompira.conf)
 - Log files (/var/log/kompira/)

Note: Please note that because it contains a Kompira database dump, **node information and account / password information stored on Kompira objects and job flows are included.**

KOMPIRA TUTORIAL

Author

Kompira development team

3.1 Introduction

In this tutorial, the language used by Kompira to describe the job flow will be introduced.

For specifications of the Kompira standard object, refer to *Kompira Standard Library*. Alternatively, *Kompira Jobflow Language Reference* can also be used and contains more accurate definitions of the terminology.

This tutorial is not an exhaustive guide describing all the functions of Kompira. However, if you have a simple job flow then by reading this tutorial you will likely be able to understand and learn about Kompira's main functions, usage and special features.

3.2 Initiate the job flow

3.2.1 Hello World

The first job flow is simple. It is to display “Hello World” on the console.

```
print("Hello World")
```

When you run this job flow, you should see the following output in the console.

```
Hello World
```

Note: If there is a syntax error in the job flow, you will not be able to run it even when you save it. If the Run button has not been pressed, correct the error in the job flow and save it again.

In Kompira's job flow language, **job** represents a singular process in a typical execution.

In the above example, `print()` is one of the **built-in jobs** of the job flow, and outputs the character string given as an argument in the parentheses to the console. For details, see *print*.

3.2.2 How to write a comment

In the job flow, anything written from a hash tag # until the end of the line becomes a comment. A comment can be written at the beginning of a line, or even after a job. However, hash tags appearing in the middle of character strings will be excluded.

```
# This would be recognised as a comment in a job flow
print("# This would NOT be a comment.") # This would be a comment
```

3.2.3 Execute the command

By writing the command you want to execute between [] these parenthesis as a character string, it becomes an **execution job** that can be executed as a command.

Note: If put inside [] parenthesis, the character string will be interpreted as a command. If the variable which is in the character string is substituted, it is possible to re-write what is in between those parenthesis to change the command. Variable substitution will be explained later in further detail.

The following is an example of how the command will be shown.

```
['whoami'] ->
print($RESULT)
```

If you run this job flow, the `whoami` command will be executed and as a result, the standard output will show in the console as a `print()` job. Usually it will show in the console as shown below.

```
[localhost] local: whoami

kompira
```

Note: Unless otherwise specified, as a result of executing the `whoami` command, the command will be executed on a host run by the job manager on the `kompira` account and it will display as `kompira`.

A character string beginning with `[localhost] local:` indicates which command was executed on which node. When the command is executed remotely, it will be displayed as `[<Host name>] run: <command>` or `[<IP Address>] run: <command>`.

3.2.4 \$RESULT

`$RESULT` contains the execution result of the previous job. It is a special variable (status variable). The result of the command `whoami` will be stored in the character string “`kompira`”.

Note: The format of the value stored in `$RESULT` depends on the type of job. For command jobs, the standard output is stored as a character string, but depending on the job it may be written numerically or alphabetically.

3.2.5 Linking jobs together

The arrow `->` between jobs means that if the previous job was successful, subsequent jobs are to be executed. Therefore, you can run jobs in order by connecting jobs with a `->` command.

If the job fails (even if the execution status of the command returns as anything other than 0), use the double arrow `=>` to continue to the next process. The execution status of the previous command can be referred to by the `$STATUS` status variable.

The arrow linking these jobs is called *Connectors*, and there are 4 kinds in the job flow.

3.3 Use a variable

3.3.1 Variable definition

Variables can be defined using the syntax `{<variable definition> | <job>}`. `<Variable definition>` is written in the form `variable name = value (or expression)`. Multiple variable definitions can be described by separating them with a comma.

```
{ x = 'what do you get if you multiply six by nine?', y = 6 * 9 |
  print(x) -> print(y) }
```

In this case, the variable `x` is initialized with the string `'what do you get if you multiply six by nine?'`. And the variable `y` is replaced with `6 * 9`. It is initialized with the calculation result of the expression. You can write a job that refers to that variable, separated by a vertical bar `|` after the variable definition.

When you execute the above job flow, it will be displayed on the console as follows.

```
what do you get if you multiply six by nine?
54
```

3.3.2 Identifier

Characters written alphabetically as words or phrases in Unicode can be used for identifiers, variable names and so on. Japanese kanji, hiragana and English characters and underscores can be used (symbols other than underscores cannot be). However, you can not use the numbers `[0-9]` at the beginning of the identifier.

Therefore, the following character strings can be used as identifiers.

```
x, foo123, RESULT, __reserved_variable__
```

The following character strings can not be used as an identifier.

```
1st, foo-bar, @id, #hash
```

In addition, the following words are used as keywords and therefore cannot be used as variable names.

and	break	case	choice
continue	elif	else	false
for	fork	if	in
not	null	or	pfor
then	true	while	

3.3.3 Scope

The valid range (scope) of the variable is the range enclosed in { } parenthesis. Variables that are not defined within the scope can not be referenced, so the following job flow will result in an error during execution.

```
{ x = 'hello' |      # Scope of variable x is ...
  print(x) }        # ... up to here.
-> print(x)          # This is outside the scope.
```

It is possible to nest scopes as follows.

```
{ x = 'outer', y = 999 |
  print(x) -> print(y)
  -> { x = 'inner' |
    print(x) -> print(y) }
  -> print(x) -> print(y)
}
```

Execution of this job flow leads to the following, the scopes of `x = 'inner'` are the 3rd to 4th lines, and the 5th line reveals the outer scope.

```
outer
999
inner
999
outer
999
```

That is, the scoping rules of variables in the job flow are the same as in C and Java.

3.3.4 Assigning Variables

To change the value of the defined variable, substitute the variable as follows `[variable = value (or equation)]`.

```
{ x = 'outer', y = 'foo' |
  print(x) -> print(y) ->
  { x = '1st' |
    print(x)
    -> [x = '2nd'] -> print(x)
    -> [x = '3rd'] -> print(x)
    -> [y = 'bar']
    -> [z = 'baz'] }
  -> print(x) -> print(y) }
-> print(z)
```

When the scope is nested, the inner most scope is assigned to what was once the outer most scope, taking on its variable definition as well as its original location.

If you assign a value to an undefined variable, the variable is newly defined as the **outermost scope (job flow scope)** and set to that value. In the above example, since the variable `z` which is assigned a value in line 8 is undefined at that point, it is newly defined in the outermost scope and is displayed in line 10.

The outermost scope is not explicitly surrounded by {}, but you should imagine that there is a scope enclosing the entire job flow.

The execution result of the above job flow is as follows.

```

outer
foo
1st
2nd
3rd
outer
bar
baz

```

Note: Status variables such as \$RESULT and \$STATUS are internally set values by Kompira and as such, status variables cannot be assigned values in the job flow.

3.3.5 Array and Dictionary

Array

If you want to keep multiple values at once, use an array or dictionary. An array is described by separating multiple values or expressions with commas in square brackets as follows [expression, ...]. To access array elements, you can define them using square brackets using an index that starts with 0. You can also rewrite array elements with [value >> array element].

```

[arr = [1, true, 'foo' ,['nested', 'array']]] ->
print(arr[1]) ->                               # get array elements
[false >> arr[1]] ->                           # set array elements
[arr = arr + ['added']] ->                     # add array elements
print(arr[3][1]) ->                           # get nested array elements
print(arr)                                     # print() can print array

```

When this job flow is executed, it executes as follows.

```

true
array
[1, false, 'foo', ['nested', 'array'], 'added']

```

If a negative value is specified as an index, elements are accessed from the back of the array.

```
[arr = [1, true, 'foo']] -> print(arr[-1])
```

The execution result of this job flow is as follows.

```
foo
```

Dictionary

The dictionary describes `{identifier = expression, ...}` with a comma in the brackets delimiting multiple `identifier = value`. Access to dictionary elements is possible by specifying dot notation or by placing an identifier in square brackets. Also, rewriting dictionary elements is possible by changing it to `[value >> dictionary element]`.

```
[dic = {foo=1, bar=true, baz={a=123, b=456}}] ->
print(dic.foo) ->                # get dictionary elements (dot notation)
[false >> dic.bar] ->             # set dictionary elements
print(dic['bar']) ->             # get dictionary elements (square bracket notation)
[[1,2,3] >> dic.arr] ->          # add dictionary elements
print(dic.baz.a) ->              # get nested dictionary elements
[777 >> dic.baz.a] ->            # set nested dictionary elements
[999 >> dic['baz']['b']] ->      # set nested dictionary elements
print(dic)                       # print() can print dictionary
```

When this job flow is executed, it executes as follows.

```
1
false
123
{foo=1, bar=false, baz={a=777, b=999}, arr=[1, 2, 3]}
```

3.3.6 Template character string

In the job flow, you can expand the value of a variable in a character string. If there is a placeholder consisting of `$` and an identifier in the string as shown below, that part can be replaced with the variable value indicated by the identifier.

```
[service = 'http', port = 80] ->
print('Port $port is used by $service')
```

When this job flow is executed, it executes as follows.

```
Port 80 is used by http
```

In place of `$identifier`, placeholders can also be written with the notation `${identifier}`. So when identifiers are not delimited in strings, please use `${identifier}` instead.

```
[w=640, h=480] ->
print("width=${w}px, height=${h}px")
```

You can also expand the value contained in the following dictionary by writing `%` after the string. In that case, write a placeholder of `%` and an identifier in the string.

```
print('Port %port is used by %service' % {service = 'http', port = 80})
```

The dictionary that follows `%` is ok to be a variable, such as shown below.

```
[ctx = {service = 'http', port = 80}] ->
print('Port %port is used by %service' % ctx)
```

In any of the notations, if the variable or dictionary element specified by the placeholder is undefined, it remains in the string as is, including `$` and `%`.

3.3.7 Parameters

The job flow can receive parameters at the time of execution.

You can define a variable as a parameter with the notation `|variable name|` enclosing the variable name at the beginning of the job flow with vertical bars. You can also define default values for parameters by writing `|variable name = value (or expression) |`. Please note that parameters that do not have default values need to specify values (can not be omitted) when executing the job flow.

In the following job flow, we define two parameters `command` and `wait`, and `wait` has a default value of 10.

```
| command |
| wait = 10 |

print('Execute the command "$command" after $wait seconds.') ->
["sleep $wait"] ->
[command] ->
print($RESULT)
```

Note: Parameters are evaluated in order from top to bottom, at the start of the job flow's execution. Therefore, you can also use expressions that refer to the values of the parameters that appeared earlier.

3.4 Remotely run commands

The next step is to try executing the command on a different host, from the host where the job manager is running next.

3.4.1 Specified by the control variable

Firstly, this is how to designate hosts and accounts to execute commands with control variables.

```
[__host__ = '<Hostname or IP-Address>',
 __user__ = '<Username>',
 __password__ = '<Password>']
-> ['hostname'] -> print($RESULT)
-> ['whoami'] -> print($RESULT)
-> ['echo Hello World'] -> print($RESULT)
```

Note: Please re-write your `<host name>`, `<user name>` and `<password>`.

`__host__`, `__user__` and `__password__` are the **reserved variables** in Kompira and these variables are the host name (or IP address), user name, and password. After setting the password, you can execute it using the host and user name you want to process subsequent remotes on.

If successful, the execution results should be displayed as follows

```
<Hostname>
<Username>
Hello World
```

If the host name is incorrect, or the user name or password are incorrect, the job flow fails and processing is aborted.

3.4.2 Node information and account information settings

If you create a node information object and an account information object on the Kompira file system, you can designate them from the job flow as the target server for command execution.

Suppose now that you create a node information object `test_node` and an account information object, `test_account` and that the host name, user name, and password information are set appropriately. Then, you can describe the command from the job flow in the same directory concisely as follows by using the control variable `__node__` for specifying the node information object, and `__account__` for specifying the account information object.

```
[__node__ = ./test_node, __account__ = ./test_account]
-> ['hostname'] -> print($RESULT)
-> ['whoami'] -> print($RESULT)
-> ['echo Hello World'] -> print($RESULT)
```

Note: Referencing to a Kompira object from the job flow can be done by describing it as relative path or absolute path. In the above example, we specify the objects in the same directory starting with `./`, but you can specify the path starting with `../` or `/` relative to the parent directory or root directory.

You can also omit the `__account__` specification if you have set a default account for `test_node`.

```
[__node__ = ./test_node]
-> ['hostname'] -> print($RESULT)
-> ['whoami'] -> print($RESULT)
```

In addition, you can specify the control variable as a parameter of the job flow, so you can also create a job flow that specifies the controlled node at run time.

```
|__node__ = ./test_node|
-> ['hostname'] -> print($RESULT)
```

3.4.3 Execution by sudo

If root privilege is required for command execution, set the control variable `__sudo__` to `true` and set the settings to sudo mode.

```
|__node__ = ./test_node|
-> ['whoami'] -> print($RESULT)
-> [__sudo__ = true]
-> ['whoami'] -> print($RESULT)
```

When this job flow is executed, it is displayed on the console as follows:

```
<Username>
root
```

Warning: In order to execute the command correctly in sudo mode, the user must be registered in the sudoers file. Otherwise, processing will fail (abort) when executing the remote command in sudo mode. For details, refer to the manual `sudoers(5)`.

Note: When executing a command execution job that does not specify a host in sudo mode, you need to register the user of the server (usually the server on which Kompira is installed) that is running the job manager in the sudoers file. In addition, it is necessary to add a setting to invalidate the requiretty flag to the sudoers file as follows:

```
Defaults:kompira    !requiretty
```

3.5 Manipulating Jobs with Control Structures

3.5.1 Conditional branch

To branch processing according to the execution result of the previous job or the contents of the variable, use an `if` block or `case` block.

If block

If you use an `if` block, you can branch the process according to the result of the conditional expression.

```
['echo $$RANDOM'] ->
[x = int($RESULT)] ->
{ if x % 2 == 0 |
  then: print('$x is an even number')
  else: print('$x is an odd number')
}
```

In the above, the `then` clause is executed if the remainder of the variable `x` divided by 2 equals 0, otherwise the `else` clause is executed. `['Echo $$ RANDOM']` shows the environment variable `RANDOM` that returns a random number and `[x = int($RESULT)]` converts the result string to an integer `x`.

In addition to `true` / `false`, if you wish to further branch processing use the `elif` clause.

```
{ if x % 3 == 0 and x % 5 == 0 |
  then: print('FizzBuzz')
  elif x % 3 == 0: print('Fizz')
  elif x % 5 == 0: print('Buzz')
  else: print(x)
}
```

Alternatively, you can omit the `else` clause, or you can omit the `then` keyword.

```
[command] =>
{ if $STATUS != 0 | print('An error occurred: ' + $ERROR) }
```

In the example above, if you execute the command indicated by the contents of the `command` variable and the value of the `$STATUS` status is not 0, the `print` job will print the standard error output (`$ERROR`).

Case block

A conditional branch with a case block can be written as

```
['cat /etc/redhat-release'] ->
{ case $RESULT |
  'CentOS*release 7.*': print("This is CentOS")
  'Red Hat*release 7.*': print("This is Red Hat")
  else: print("CentOS/Red Hat 7.x is required")
}
```

In this example, a conditional branch is made to determine the type of the OS with the contents of the file `/etc/redhat-release`, and the pattern string may contain `*` or `?` for which Unix wildcard patterns can be used.

The mapping of strings in the case block is done sequentially from the first pattern and only the job flow series following the first matched pattern is executed.

If none of the patterns match, the following will appear:

- If the `else` clause is included, the job flow sequence is executed.
- If the `else` clause is not included, the whole case block will fail(`$STATUS` is set to 1).

Note: Note that unlike the `if` block, the `else` clause is omitted in the case block, and the entire block fails if you do not match any of the conditions. If you do not do anything in the case block and not even an error occurs, try writing `else: []` and a skip job in the else clause.

3.5.2 Repetition

Repetition uses the `for` block or the `while` block.

for blocking

Some objects that Kompira can handle include complex data such as arrays and dictionaries or child elements such as directories. Use a `for` block if you want to perform the same processing on child elements (values and objects) contained in an object. The `for` block should be expressed as below

```
{ for <loop variable> in <object containing child elements> | job... }
```

For example, in the `in` clause, you can refer to the list of objects in the directory by writing a `<directoryprefix> ::`.

```
{ for t in /system/types | print(t) }
```

In this example, all the objects in the `/system/types` directory are referenced one by one with the loop variable `t` and are output to the console by the `print()` job. If you pass a Kompira object to the `print()` job, its absolute path is output to the console and the result is as follows.

```
/system/types/TypeObject
/system/types/Directory
/system/types/License
/system/types/Virtual
/system/types/Jobflow
```

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```
/system/types/Channel
:
```

In the `in` clause it is also possible to write a direct array as follows.

```
{ sum = 0 |
  { for i in [1,2,3,4,5,6,7,8,9,10] |
    [sum = sum + i]
  } ->
  print('The total of 1 to 10 is ${sum}.')
}
```

This job flow calculates and outputs the total value, from numbers 1 to 10.

```
The total of 1 to 10 is 55.
```

Also, if you write a dictionary following the `in` clause, you can refer to the list of identifiers contained in that dictionary sequentially.

```
[dic = {a=10, b=20, c=30}] ->
{ for k in dic |
  print("$k = ${$k}" % dic)
}
```

When this job flow is executed, it is displayed on the console as follows:

```
a = 10
b = 20
c = 30
```

Note: Before template expansion with `%`, In `/${$k}`, The `$k` part is replaced by the identifier of the dictionary. Therefore, each time it repeats, it expands to `%a`, `%b`, `%c` and that is the value of each element of the dictionary `dic`. The template is expanded and displayed as `10`, `20`, `30`.

While block

If you want to iterate through the job while satisfying certain conditions, use the `while` block instead. The syntax of the `while` block is as follows.

```
{ while <expression> | job... }
```

For example, an “Euclidean algorithm” which finds the greatest common divisor of two given numbers, is an algorithm that iterates until the remainder becomes 0, but when it is described using a `while` block, shows as follows

```
|x = 165|
|y = 105|
[m = x, n = y] ->
{ while n != 0 |
  [r = m % n] ->
  print("The remainder of $m and $n is $r.") ->
}
```

(continues on next page)

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```
[m = n, n = r]
} ->
print("The greatest common divisor of $x and $y is $m.")
```

In this while block, n is n while n is not 0, n for m, m for n and the job of substituting (and displaying) the remainder of n is repeated. When executed, it displays as follows.

```
The remainder of 165 and 105 is 60.
The remainder of 105 and 60 is 45.
The remainder of 60 and 45 is 15.
The remainder of 45 and 15 is 0.
The greatest common divisor of 165 and 105 is 15.
```

3.5.3 Calling a job

Calling a job flow

To call another job flow from one job flow, use the following syntax.

```
[<Jobflow object>]
```

Here is an example of creating a job called “sub job” and calling it. First, define the sub job as follows, under the appropriate directory.

```
print("This is subjob.") ->
return("Succeeded.")
```

The return job terminates the sub job and returns the result to the calling job.

Next, create a main job that calls this sub job under the same directory.

```
print("Call the subjob.")
-> [./SubJob]           # call the subjob
-> print($RESULT)       # return the result of subjob
```

Note that “./” is added to the beginning of the string at the point of specifying the call of the “sub job”. This indicates that “sub job” is defined in the same directory as the directory in which the current job flow is defined.

The execution result of the sub job can be received as \$RESULT. When the above main job is executed, it is displayed as follows.

```
Call the subjob.
This is subjob.
Succeeded.
```

Passing parameters to job flows

When invoking a job flow, you can also pass parameters using the following syntax:

```
[<Jobflow object> : <parameter list> ... ]
```

First, extend the sub job and add the parameters as follows.

```
|parameter1 = 'Hello'|
|parameter2 = 'World'|

print("This is subjob.")
-> print(parameter1)
-> print(parameter2)
-> return("Succeeded.")
```

In this state, if you execute the main job as it is, the following will be displayed. Since no parameters are specified at the time of invocation, you can see that the default parameters defined on the sub job side are used.

```
Call the subjob.
This is subjob.
Hello
World
Succeeded.
```

To pass parameters to this sub job and call it, extend the main job as follows. When calling a sub job, you can write values following : so that you can pass them to the sub job as parameter values.

```
print("Call the subjob with parameter.")
-> [./SubJob: 'HELLO', 'WORLD']
-> print($RESULT)
```

When you do this, the result is as follows.

```
Call the subjob with parameter.
This is subjob.
HELLO
WORLD
Succeeded.
```

It is also possible to specify the parameter name defined on the side of the called job flow and pass the parameter value. This is convenient when you want to specify only some parameters.

```
[./SubJob: parameter2='WORLD']
```

Note: Please be aware that specifying a parameter name that is not defined on the called side, or trying to pass more parameter values than defined, will result in an error.

Execution of a script job

If you want to create more complicated jobs, it would be better to combine existing scripting languages such as bash, perl, ruby, python, etc. than to use the Kompira job flow language. By creating a script job on the Kompira file system, it becomes possible to call these script language programs from the job flow.

Let's look at an example of writing a script job using a shell script and calling it from a job flow. First, save a simple shell script as shown below as a script job.

```
#!/bin/sh
echo Hello world from shell script
```

For scripts to be executed in a Unix environment, please describe the shebang line beginning with `#!` on the first line appropriately. For scripts running on a Windows environment, you will need to specify the extension (eg bat/vbs/ps1) appropriately.

If you save this script job as “sample_script”, the job flow for executing this script job is as follows.

```
print('Execute the ScriptJob') ->
[./SampleScript] ->
print($RESULT)
```

If you do not specify `__node__` or `__host__`, this script will be executed after being transferred to the machine on which the job manager is running. The output of the execution result is stored in `$RESULT` like the execution result of the remote command.

Note: The script is transferred to the host specified at runtime as a temporary file and deleted after it is executed.

Parameters can also be passed to script jobs. The script job side receives parameters as command line arguments.

On the caller side of the script, pass parameters as keyword-less arguments as follows.

```
[./SampleScript: 'parameter1', 'parameter2']
```

3.6 Manipulating objects

3.6.1 Referencing objects

Information handled by Kompira, such as job flow and environment variable definitions, are managed as a **Kompira object** in a unified manner on the Kompira file system. These objects can then be accessed from the job flow by specifying a path like a Unix file system.

In previous examples, references to Kompira objects were specified by relative paths. In this case, the path of the object is specified based on the directory in which the job flow being executed is defined.

For example, if the running job is `/some/path/jobflow`, referencing the object with the relative path `/subdir/object` will result in `/some/path/subdir/object` being accessed.

Also, referring to the relative path `../object` will access `/some/object`. Relative paths starting with `../` refer to objects in parent directories.

Of course you can also reference the object directly as an absolute path like `/some/path/object`.

Warning: Do not forget to add `./`, `../` or `/` to the beginning of Kompira object references. Kompira recognizes a character string beginning with `./`, `../` or `/` as a **path identification**, otherwise it recognizes it as an identifier of a variable.

If you want to concatenate paths and reference objects, use the `path()` built-in function. For example, when preparing a job flow for “resource information acquisition” for each type of node, if you want to execute the job flow by designating the node and the node type, you can refer to the job flow by assembling the path.

```
|node|
|node_type = 'Linux'|
|job_name = 'GetResourceInfo'|
[job = path(./DefinitionsByNodeType, node_type, job_name)] ->
[job: node]
```

Here, if the default argument is passed to the `path()` function as it is, refer to the job flow named `./node definition/Linux/resource information acquisition` by using the variable `job` and `node` as a parameter.

3.6.2 Browse and update properties

Each Kompira object has a “property” defined in the system. For example, properties are the name and path of the object, creation date and time, and so on. For details on the properties of Kompira objects, see [Properties](#).

To refer to the properties of a Kompira object, use the dot notation `object.property name`. In the following job flow, it lists the Kompira objects in the directory which was the parameter `dir` and its properties ‘Owner (owner)’, ‘Updated date (update)’, ‘Type name (type_name)’, ‘Display name (display_name)’ is displayed by dot notation.

```
| dir = / |
{ for obj in dir |
  [attr = {
    owner = obj.owner,
    updated = obj.updated,
    type = obj.type_name,
    name = obj.display_name
  }] ->
  print("%owner %updated <%type> %name" % attr)
}
```

To update the property value of a Kompira object, use the output job `[value >> object.properties]`.

```
["Description of the Object" >> obj.description]
```

Note: However, please note that some of the properties can not be updated from the job flow and some are not writable. See [Properties](#) for details.

3.6.3 Referencing and updating fields

Each Kompira object has a “field” defined for each type. You can see what fields are defined for each type defined in the system by looking at the definition information of each type under `/system/types/`.

Fields of Kompira objects can be referenced by `object['field_name']` or `object.field_name`.

Note: Please note that the property of the object can also be accessed by dot notation. You can also define a field with the same name as the property, but dot notation refers to the property value in preference.

For example, in the node information object, fields such as “host name (hostname)” and “IP address (ipaddr)” are defined. To refer to these values in the job flow, you write as follows.

```
|node = ./node|
print(node['hostname'], node.ipaddr)
```

Since values of fields can be referenced like dictionaries, template expansion with % is also possible.

```
|node = ./node|
print('%hostname: %ipaddr' % node)
```

Also, to update the field value of the Kompira object, use the notation `[value >> object['field_name']]` or `[value >> object.field_name]` in the output job. For example, to update the “Wiki text” field (‘wikitext’) of Wiki page type, write as follows.

```
['= Sample Wiki\n' >> ./wiki['wikitext']]
```

You can also write the result of an expression in an output job, so you can modify the referenced field value and rewrite it as follows.

```
|wiki = ./wiki|
|types = /system/types|
['= Type list\n' >> wiki.wikitext] ->
{ for type in types |
    [wiki.wikitext + "*" $type: (" + type.description + ")\n" >> wiki.wikitext]
}
```

In the example above, we create a wiki page that lists the system standard type objects in `/system/types`, listing their paths and descriptions.

3.6.4 Calling methods

Some Kompira objects have methods. To invoke a method on an object we use the following syntax:

```
[ <object> . <method name> : <parameter list> ... ]
```

For example, to add an object, the directory type object has a method called `add`. The `add` method is called by specifying three parameters `name`, `type_obj`, and `data`. In the following example, create an environment variable type (`/system/types/Environment`) object with the name ‘ENV’ in the same directory as the job flow and put the `{k1 = 'value1', k2 = 'value2'}` as given.

```
[./add: 'ENV', /system/types/Environment, {
    environment={k1='value1', k2='value2'}
}]
```

Here, the relative path identification `./` refers to the Kompira object indicating the directory to where this job flow resides. You can also pass object references as variables, so you can write:

```
[dir = ./, type=/system/types/Environment] ->
[dir.add: 'ENV', type, {environment={k1='value1', k2='value2'}}]
```

In the parameter string, you can pass a value by specifying the parameter name.

```
[dir = ./, type=/system/types/Environment] ->
[dir.add: 'ENV', type_obj=type, data={environment={k1='value1', k2='value2'}}]
```

3.7 Waiting for an event

Job synchronization and event waiting processing can be described in the job flow using the channel.

3.7.1 Transmission of messages

To send a message to the created channel, use the `send` method. A new channel can be created as `"/home/guest/test channel"`.

The job flow for sending a message to a channel is as follows.

```
[/home/guest/TestChannel.send: 'Hello']
-> print('Sent a message.')
```

Next, define the job flow to receive messages from the channel as follows.

```
</home/guest/TestChannel>
-> [mesg = $RESULT]
-> print('Message "$mesg" was received.')
```

Please execute the above job flow. It is deemed successful if a message is output to the process console of the job flow execution on the receiving side as follows.

```
Message "Hello" was received.
```

If you execute the sender job flow more than once, messages will be accumulated on that channel by that amount. Every time the receiver's job flow is executed, it extracts one message from that channel and outputs it. If the message on the channel is empty, the receiving job flow waits until a new message arrives.

Note: Using the `kompira_sendevt` command you can send arbitrary information to the channel from an external system. For example, by transmitting alert information from the monitoring system to the channel, it is possible to process the procedure at the time of failure by the job flow. For information on how to use the `kompira_sendevt` command, see [Coordination with other systems](#).

3.7.2 About event jobs

A job enclosed by < and > is called an event job. Event jobs can be used in combination in the job flow in the same way as other jobs.

The format of an event job is as follows.

```
< <object> : <parameter list> ... >
```

For object names, specify objects of channel type (and similar type: mail channel type etc). Other events that specify an object that can not be queued, result in a runtime error.

3.7.3 Specify a timeout for message retrieval

Wait for the arrival of the message from the channel, specify the parameter `timeout` for the event job to time out and continue the process if it does not arrive within the fixed time.

```
print('Wait for a message from channel.')
-> <./TestChannel: timeout=10>
=> { if $STATUS==0 |
    then: [mesg=$RESULT]
        -> print('Message "$mesg" was received.')
    else: print('Timeout occurred.') }
```

Note that if the message does not arrive within the number of seconds specified by `timeout`, the event job will fail, so be aware that `=>` binds the next job.

Note: If a channel is deleted while awaiting arrival from a message, the event job fails and sets `$STATUS` to -1. The mail channel also sets `$STATUS` to -1 when the `detect_error=true` parameter is passed to the event job, if the mail fetch fails or if the disable flag is set.

3.7.4 Selective reception from multiple channels

It is also possible to wait for the arrival of messages from multiple channels by using the `choice` block. In this case, the processing of the channel on which the message arrived earlier continues.

Example of choice block usage:

```
print('Wait for message from channel1 and channel2.')
-> { choice |
    <./Channel1> -> [mesg=$RESULT]
        -> print('Message "$mesg" was received from Channel1.')
    <./Channel2> -> [mesg=$RESULT]
        -> print('Message "$mesg" was received from Channel2.')
}
-> print('OK')
```


3.8 Access externally

3.8.1 Send mail

To send the mail, use the built-in `mailto` job.

```
[subject = 'Test mail',
 body = 'Send a test mail.']
-> mailto(to='taro@example.com', from='hanako@example.com',
         subject=subject, body=body)
-> print('Sent a mail.')
```

Arguments of the `mailto` job include `to` (destination mail address), `from` (source mail address), `subject` (mail title), `body` (mail body text).

When sending mail to multiple addresses, pass the list of mail address strings to the `to` argument as follows.

```
mailto(to=['taro@example.com', 'jiro@example.com'], from='hanako@example.com',
       subject=subject, body=body)
```

Note: When sending mail, Kompira connects to the specified SMTP server to send the mail. If mail cannot be sent successfully, please check if the settings of the specified `SmtpServer` type object are correct, as well as the settings and logs on the SMTP server side.

3.8.2 HTTP Access

For HTTP access to web servers etc., use the built-in `urlopen` job. Simply passing URL only to `urlopen()` will result in GET access.

```
|url = 'http://www.kompira.jp'|
urlopen(url)
=> [status = $STATUS, result = $RESULT]
-> { if status != 0 |
then:
    print('HTTP access failed.')
elif result.code != 200:
    print('HTTP status code is %code.' % result)
else:
    print(result.body)
}
```

The result of successful access with `urlopen()` is returned in the dictionary. `code` contains the HTTP status code, and `body` contains the contents of the response.

As Kompira at version 1.5.0 does not have the function to parse HTML, we create a simple script job like the following, `html_parse`. This script extracts the part specified by the parameter as text from the HTML passed to standard input.

```
#!/usr/bin/python
import sys;
from lxml import html;
if __name__ == '__main__':
```

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```
doc = html.fromstring(sys.stdin.read().decode("utf-8"))
for e in doc.xpath(sys.argv[1]):
    print html.tostring(e, method="text", encoding="utf-8")
```

`urlopen()` can also pass POST access by passing dictionary data to parameter data. As an example, consider a job flow of checking the product vendor from the first half (OUI) of the MAC address assigned to the network interface. OUI is managed by the organization called IEEE, (see weblink <http://standards.ieee.org/develop/regauth/oui/public.html>). There is a form on this page, so that OUI is entered in the entry field named `x`. Also, since CGI called `/cgi-bin/ouisearch` is executed when searching, you need to POST access to pass OUI as data `x` to that CGI as data `.`

```
|oui = '00-00-00'|
urlopen('http://standards.ieee.org/cgi-bin/ouisearch', data={x=oui})
-> [./html_parse << $RESULT.body: '//pre']
-> print($RESULT)
```

Since there is a result in the `<pre>` tag on the search result page, we pass the parameter `//pre` to the `html_parse` script to extract it. This parameter is specified by the syntax for specifying part of an XML document called XPath.

By executing this job flow, you can see that vendor information can be acquired from an external web page as follows.

```
[localhost] local: (/tmp/tmpxaL7DG //pre) < /tmp/tmpktOTMU
```

OUI/MA-L company_id	Organization Organization Address
00-00-00 (hex)	XEROX CORPORATION
0000000 (base 16)	XEROX CORPORATION
	M/S 105-50C
	800 PHILLIPS ROAD
	WEBSTER NY 14580
	UNITED STATES

3.9 Controlling processes

When a job flow is executed, it is managed in Kompira as a process execution unit until the end of the job flow, and the process will sequentially execute the jobs described in the job flow sequentially.

3.9.1 Process Termination

If there are no more jobs to continue, such as reaching the end of the job flow, or if you join the job using `->` when the executed command fails, the process will automatically finish.

Otherwise, you can use an `exit` job or `abort` job to explicitly terminate a running process.

exit

To terminate a running process, use the built-in `exit` job. If you call `exit()` without specifying arguments, the process terminates normally immediately.

```
exit()
```

You can also specify the exit status code with the argument of the `exit` job. In the following example, after executing the command specified by the parameter `command`, the standard error output and standard output are displayed regardless of the result (success / failure), and then the command execution result is processed as a status code.

```
|command|
[command]
=> [status=$STATUS, stderr=$ERROR, stdout=$RESULT]
-> { if stderr | print(stderr) }
-> { if stdout | print(stdout) }
-> exit(status)
```

Please note the difference between `exit` and `return`. For example, calling the `exit` job at a sub job called from the main job will terminate the running process (control will not be returned to the main job and will end immediately). On the other hand, if you call the `return` job at a sub job, control is returned to the main job rather than terminating the process, and processing continues immediately after the execution job that invoked the sub job.

However, if the caller does not exist, for example, if you call the `return` job from the job flow you pressed by pressing the “execute button” directly, the job will be terminated at that point and the process will terminate.

abort

You can abnormally end a running process by calling the built-in `abort` job, for example, when the job can not be continued. In the example below, when accessing the URL specified by the parameter with `urlopen`, if the HTTP access fails or if the HTTP status code is not 200, abnormally terminate (`abort`) the process.

```
|url|
urlopen(url)
=> [result = $RESULT, status = $STATUS]
-> { if status != 0 | abort('HTTP access failed.') }
-> { if result.code != 200 | abort('HTTP status code is %code.' % result) }
-> return(result.body)
```

The `abort()` job is almost identical to `exit(status=1)` because it automatically terminates the process with an exit status code set to 1.

3.9.2 Child Process Activation

Kompira’s concurrent behavior of multiple processes can be used in a job flow by starting a “child process”.

A child process is a copy of a parent process (that is, a process that started a child process) at the time of activation, local variables and special variables have the same value, but since it can not share or reference between processes, Please note that it is not possible to rewrite the variables of the parent process from the process (the same is true for the reverse direction).

fork

It is possible to start multiple child processes at once using the `fork` block. Below is an example of a job flow that causes the execution results of the sub job “processing A” to be processed in parallel with the sub jobs “processing B” and “processing C”, respectively.

```
[./ProcessA] -> [result = $RESULT] ->
{ fork |
  [./ProcessB: result] -> print('ProcessB is finished.')
  [./ProcessC: result] -> print('ProcessC is finished.')
} -> print('All child processes have terminated.')
```

There are places where jobs are not connected by connectors in the `fork` block, but this is a “job flow expression” delimiter, and in the above example they are two job flow expressions. When these two job flow expression parts operate in parallel as child processes and their execution is completed, the job of the parent process continues to be output to the console “all the child processes have ended”.

When starting a child process in the job flow, the child process started is displayed on the “child process list” tab of the process details screen of that process. Conversely, please be aware that child processes are not displayed on the “process list” screen.

pfor

By using the `pfor` block instead of the `for` block, iterations can be executed as a parallel process all at once.

For example, if you want to manage the managed nodes in the “node list” and want to execute the same job “configuration information collection” on all managed nodes, you can write as follows using the `for` block (Assume that the configuration information collection specifies the node to be processed with parameters).

```
|job = ./CollectConfigurationInformation|
{ for node in ./NodeList |
  [job: node]
} -> print("Processing of all nodes has ended.")
```

If this “configuration information gathering” job is submitting a command which takes time to process to the remote node, this process is “waiting” more often. As a result, the load is low, but it will take a long time to finish processing for all nodes.

If you use `pfor` instead of `for` then you will invoke the child process on each node and execute the ‘gather configuration information’ job for that child process. Then, processing can be executed in parallel by another node even if it is in the “waiting state” due to the processing on a certain node, so it is possible to shorten the processing time by increasing the job execution efficiency as a whole.

```
|job = ./CollectConfigurationInformation|
{ pfor node in ./NodeList |
  [job: node]
} -> print("Processing of all nodes has ended.")
```

3.9.3 Detaching from the parent process

The parent process that started the child process using `fork` or `pfor` will wait for all child processes to finish, so the parent process will not be able to run the new job during that time. However, there are cases where you want to continue processing on the parent process side without waiting for the child process to finish. In that case we can deal with it by detaching it from the parent process using `detach()`.

detach

For example, you often want to execute the same job flow each time you receive a message from a channel. In the following, every time a message is received, it is called by passing a message as a parameter to the job flow “message processing”.

```
|chan = /system/channels/Alert|
|proc = ./MessageProcessing|
{ while true |
  <chan>
  -> [msg = $RESULT]
  -> [proc: msg]
}
```

If there is no relevance between multiple messages received from the channel, by simultaneously executing the message processing, when the messages arrive consecutively, the processing efficiency of the whole can be improved. To that end, it is necessary to operate the job flow that receives the message and “message processing” as a separate process. This is “message processing” in a child process using “*fork*”.

```
|chan = /system/channels/Alert|
|proc = ./MessageProcessing|
{ while true |
  <chan>
  -> [msg = $RESULT]
  -> { fork | [proc: msg] }
}
```

However, since the parent process waits until the “message processing” job is completed, even if a new message arrives during message processing, it can not be processed at the same time. So we use a `detach()` built-in job on the child process to separate the child process from the parent process.

```
|chan = /system/channels/Alert|
|proc = ./MessageProcessing|
{ while true |
  <chan>
  -> [msg = $RESULT]
  -> { fork | detach() -> [proc: msg] }
}
```

By detaching child process using `detach()`, the parent process will have no child processes to wait for processing completion, so the next job can be continued at that point. That is, the next message is received from the channel, and a new “message processing” can be activated even if “Message processing” started earlier is not completed yet.

The child process becomes a normal process instead of a child process by using `detach()` and it will be displayed on the ‘Process List’ screen instead of the ‘Child Process List’ of the parent process.

By combining `fork` and `pfor` with `detach()`, you can easily write somewhat complicated parallel processing in this way.

KOMPIRA JOBFLOW LANGUAGE REFERENCE

Author

Kompira development team

4.1 Introduction

This document explains the tokens and syntax and meanings of the job flow language. A description of built-in functions and embedded jobs can be found in *Kompira Standard Library*.

4.1.1 Syntax Notation

In this document, the syntax is shown using extended BNF. Extended BNF uses symbols such as “*” representing zero or more repetitions, “+” representing one or more repetitions, “?” Representing an optional element, in addition to normal BNF. The parentheses “(” and “)” are also used to group multiple elements together.

4.2 Lexical structure

This chapter specifies the lexical structure of the job flow language. The program text of the job flow language is written in Unicode. The text is delimited by vocabulary units called tokens by Kompira’s lexical analyzer.

Note: The maximum number of characters that can be written as program text for a job flow is 65536.

4.2.1 Comment

Comments begin with a hash character (#) that is not included in a string literal, and end at the end of the line. Comments are skipped by the lexical analyzer.

4.2.2 Blanks

Newline characters, spaces, tabs, and form feeds are treated as blanks. Whitespace is skipped by the lexical analyzer.

4.2.3 Identifiers

The identifier (IDENTIFIER) is defined by the following regular expression.

```
IDENTIFIER = [^\W0-9]\w*
```

\w matches any Unicode word character. This includes letters, numbers, and underscores that can be part of a word in any language. \W means [^\w]. The length of the identifier is unlimited. Identifiers are case-sensitive.

Keywords

The following character sequences are reserved as keywords and can not be used as identifiers.

and	break	case	choice
continue	elif	else	false
for	fork	if	in
not	null	or	pfor
session	then	true	try
while			

Reserved identifier Class

Identifiers of the form `__*` are reserved in the system for control variables and have special meanings. Since it is possible that unexpected behavior of the job flow may occur, it is better to avoid users using these names as identifiers.

Special identifiers

An identifier starting with `$` is a special identifier used for special variables as defined below.

```
SPECIAL_IDENTIFIER = "$" IDENTIFIER
```

4.2.4 Object Path

The object path points to the location of the object on the Kompira file system. It is defined as follows:

```
OBJECT_PATH = RELATIVE_PATH  
              | ("/" | RELATIVE_PATH) PATH_ELEMENT* LAST_PATH_ELEMENT  
RELATIVE_PATH = "./" | "../"  
PATH_ELEMENT = RELATIVE_PATH | IDENTIFIER "/"  
LAST_PATH_ELEMENT = RELATIVE_PATH | IDENTIFIER
```

Note: Although a single `/` is also treated as an object path, it is not included in `OBJECT_PATH` as a token, because it is indistinguishable from the division operator `/` in terms of lexical analysis.

4.2.5 Literal

A literal is a source code representation of values of type String, Binary, Integer, Float, Boolean, Null, and Pattern.

String literal (STRING)

A string literal consists of zero or more characters enclosed in single quotation marks (') or double quotation marks (")

```
""           # empty string
'''         # "
'\''        # '
"This is a string" # String containing 16 characters.
```

It can also be surrounded by corresponding triple quotes or double quotes. In this case, you can write non-escaped newlines and quotes.

```
'''         # '
"""String containing
line feed code""" # String containing line feed code
```

Within a string literal, you can use escape sequences to represent certain non-expressable characters, such as newline characters and tab characters.

The list of escape sequences is shown below.

Escape sequence	Meaning
\	backslash()
'	Single quotations (')
"	double quotations(")
a	ASCII terminal bell (BEL)
b	ASCII backspace (BS)
f	ASCII form feed (FF)
n	ASCII line feed (LF)
r	ASCII return (CR)
t	ASCII horizontal tab (TAB)
v	ASCII vertical tab (VT)
ooo	Characters with octal <i>ooo</i>
xhh	Characters with hexadecimal value <i>hh</i>

Binary literal (BINARY)

A binary literal consists of zero or more characters enclosed in single quotation marks (') or double quotation marks (") with the prefix sign b.

```
b""         # empty binary
b'''        # "
b'\''       # '
b"This is a string" # binary containing 16 bytes.
```

Unlike string literals, you cannot use multi-line descriptions with a corresponding triplet of quotation marks. Nor can you include non-ASCII characters such as Japanese. Escape sequences can be used in the same way as string literals.

Integer literal (INTEGER)

Integer literals can be expressed in decimal. It is described by the following lexical definition.

```
INTEGER      = NONZERO_DIGIT DIGIT* | "0"  
DIGIT        = [0-9]  
NONZERO_DIGIT = [1-9]
```

Floating-point literal (FLOAT)

A floating-point literal is a representation of a floating-point number consisting of mantissa and exponential parts consisting of integer and decimal parts. It is described by a lexical definition.

```
FLOAT        = DIGIT+ "." DIGIT* ( [eE] [+-]? DIGIT+ )?  
DIGIT        = [0-9]
```

An example is shown below:

```
3.1415926  
0.5e-3      # 0.0005  
12.3e+2     # 1230.0  
9.E5        # 900000.0
```

Boolean literal (BOOLEAN)

A boolean literal has two boolean expressions of true (true) and false (false).

```
BOOLEAN = "true" | "false"
```

Null literal (NULL)

A null literal is a value indicating that there is no value, and it is written as null.

```
NULL = "null"
```

Pattern literal (PATTERN)

After the characters a pattern literal makes up, ('e' 'g' or 'r' making a pattern), more than 0 characters are surrounded with a single quotation mark (') or double quotation marks (") (pattern string). The 'i' which indicates a mode at the end is sometimes added as an option.

```
r"(From|Subject): "      # regular expression pattern  
g'*.txt'                 # glob pattern  
e'kompira'i              # case-insensitive exact match pattern  
r"windows(95|nt|2000)"i  # case-insensitive regular expression pattern
```

Within a pattern character string, the escape sequence is invalid and it is handled as it is. String substitution by \${identifier} is valid.

4.2.6 Symbols

Symbols are classified as operator symbol (OPERATOR), connector symbol (COMBINATOR), and delimiter.

Operators

The following tokens are operators:

+	-	*	/	%			
<	>	<=	>=	==	!=	=~	!~

Connectors

The following tokens are connectors:

->	=>	->>	=>>
----	----	-----	-----

Delimiter

The following tokens are delimiters:

()	{	}	[]		,	.	=	>>	<<	?	??
---	---	---	---	---	---	--	---	---	---	----	----	---	----

4.3 Value and type

Kompira's job flow language can handle various values (data) such as integers, character strings and dates.

4.3.1 Primitive types

Primitive type is a generic name of basic data types of Kompira's job flow language, which are four types: integer type, character type, boolean type, and null type. Values of primitive types are never shared with values of other primitive types.

Integer type (Integer)

The integer type handles types of values representing integers such as 0, 1, 1000, -9999. The integer type of Kompira is not limited in scope (as far as memory allows).

Note: Since the range of the Integer type field of the Kompira object is limited, writing data outside the range from the job flow to the Integer type field will result in a runtime error.

String type (String)

String type is a type for string values like “kompira” or “today is sunny”. Each element of the string is a letter. There is no character type in Kompira’s job flow language. A single character is represented as a string with only one element. Each character is expressed internally as Unicode.

If you write the value of a string representing an integer, such as “123” or “-999”, into an integer field, it will be implicitly converted to the corresponding integer value.

When the value of the string type is converted to Boolean type, the empty string (“”) corresponds to false, and the other string corresponds to true. Therefore, be aware that the string “false” corresponds to Boolean true.

The string type data has the following methods:

String.format(*args, **kwargs) : String

Perform a string formatting operation. The string on which this method is called can contain literal text or replacement fields delimited by braces {}. Each replacement field contains either the numeric index of a positional argument, or the name of a keyword argument. Returns a copy of the string where each replacement field is replaced with the string value of the corresponding argument.

String.join(list) : String

Return a string which is the concatenation of the strings in list. The separator between elements is the string providing this method.

String.find(sub[, start[, end]]) : Integer

Return the lowest index in the string where substring sub is found within the slice s[start:end]. Optional arguments start and end are interpreted as in slice notation. Return -1 if sub is not found.

String.rfind(sub[, start[, end]]) : Integer

Return the highest index in the string where substring sub is found, such that sub is contained within s[start:end]. Optional arguments start and end are interpreted as in slice notation. Return -1 on failure.

String.startswith(prefix[, start[, end]]) : Boolean

Return true if string starts with the prefix, otherwise return false. prefix can also be a tuple of prefixes to look for. With optional start, test string beginning at that position. With optional end, stop comparing string at that position.

String.encode([encoding]) : Binary

Converts the string to a byte string encoded with the specified encoding. If encoding is not specified, the string is encoded as ‘utf-8’.

String.endswith(prefix[, start[, end]]) : Boolean

Return true if the string ends with the specified suffix, otherwise return false. suffix can also be a tuple of suffixes to look for. With optional start, test beginning at that position. With optional end, stop comparing at that position.

String.lower() : String

Return a copy of the string with all the cased characters converted to lowercase.

String.upper() : String

Return a copy of the string with all the cased characters converted to uppercase.

String.replace(old, new[, count]) : String

Return a copy of the string with all occurrences of substring old replaced by new. If the optional argument count is given, only the first count occurrences are replaced.

String.split([sep[, maxsplit]]) : Array<String>

Return a list of the words in the string, using sep as the delimiter string. If maxsplit is given, at most maxsplit splits are done.

`String.rsplit([sep[, maxsplit]])` : **Array<String>**

Return a list of the words in the string, using sep as the delimiter string. If maxsplit is given, at most maxsplit splits are done, the rightmost ones.

`String.splitlines([keepends])` : **Array<String>**

Return a list of the lines in the string, breaking at line boundaries.

`String.strip([chars])` : **String**

Return a copy of the string with the leading and trailing characters removed. The chars argument is a string specifying the set of characters to be removed.

Binary type (Binary)

A binary type is a type whose value is a sequence of bytes. A sequence of bytes is similar to a string of characters, but the units of a sequence of bytes are not characters, but rather byte values (8-bit integers between 0 and 255).

The binary type data has the following methods:

`Binary.decode([encoding])` : **String**

A byte sequence is interpreted with the encoding specified by the encoding and converted into a string. If the encoding is omitted, it will be interpreted as 'utf-8'.

`Binary.hex()` : **String**

Converts each byte value in a string of bytes into a string of 2-digit hexadecimal notations.

Floating-point type (Float)

A floating-point type is a type that takes a floating point number as a value.

Boolean (Boolean)

Boolean type is a type that takes two values of truth - 1. value true (true) and 2. false (false)

Null type (Null)

A null type is a type that has only null values.

Pattern type (Pattern)

A pattern type is a type of a value that represents a pattern for matching with a character string. There are three types of patterns: 'r' (regular expression pattern), 'g' (glob pattern), 'e' (perfect match pattern). Also, you can combine capitalized and lowercase non-discriminating mode ('i') as pattern matching mode.

The regular expression pattern conforms to the regular expression of the re module of the programming language Python.

In the glob pattern, you can use Unix shell-style wildcards and correspond to the following special characters.

Pattern	Meaning
*	Matches everything
?	Matches any single character
[seq]	Matches any character in seq
[!seq]	Matches any character not in seq

Exact match patterns also allow match comparisons with non-string values.

Pattern type data has the following methods:

Pattern.match(s) : *Boolean* | *Dictionary*

Attempts to match the string s with the pattern. If a match is true, or if the pattern is a regular expression pattern, it returns a dictionary containing matched information. If it does not match, it returns false. If a non-string is passed to s in the regular expression or glob pattern, false is returned.

The dictionary data returned when the regular expression pattern matches includes the following entries

Key	Meaning
group	String matched with regular expression
groups	List containing strings of all subgroups
groupdict	Named group dictionary
start	Start position of match
end	End position of match

Changed in version 1.6.8.post1: If a non-string is passed to the match(s) method in a regular expression pattern or glob pattern, it will now return false.

4.3.2 Complex data type

A complex data type is a generic name of data types that can hold multiple elements of other types, and there are three types: array, dictionary and lazy evaluation array.

Array type (Array)

Array type data is a data structure in which elements are arranged in one dimension, and elements can be accessed with an integer index. If the length of the array is n, the index is 0, 1, ..., n - 1. Element i of array can be referenced by a[i]. If index i is negative, a[i] refers to element n + i.

If you access elements outside the range of the array, a run-time error occurs. Also, arrays can not be extended.

The array type data has the following methods:

Array.add_item(value)

Add data value to the end of array a.

Array.del_item(index)

Delete the element a[index] of the array a.

Array.pop_item([index])

Delete the element a[index] of the array a. If index is not specified, the last element is deleted.

Dictionary type (Dictionary)

Dictionary type data is a data structure that allows elements to access elements associated with any type of key except for complex data types. Elements associated with key *k* of dictionary *d* can be referenced by *d[k]*. If the key *k* is a string type value and it is a character string satisfying the lexical requirement of the identifier (IDENTIFIER), it can be referred to as *d.k*.

If you attempt to refer to an element with a key that is not included in the dictionary, it will result in an execution error. You can add new keys and elements by writing job (described later).

Dictionary type data has the following methods:

Dictionary.del_item(key)

Delete element *d[key]* of dictionary *d*.

Dictionary.get_item(key[, default])

Get the element *d[key]* of dictionary *d*. If element *d[key]* does not exist, it returns default. The default value of default is null.

Dictionary.pop_item(key[, default])

Delete element *d[key]* of dictionary *d*. If element *d[key]* does not exist, it returns default. If default is not given and the element *d[key]* does not exist, an error occurs.

Dictionary.get_keys()

Return a copy of the dictionary *d* list of keys.

Lazy evaluation array type (LazyArray)

Data of the lazy evaluation array type has a data structure similar to that of the array type, allowing access to elements by integer index. However, as the name suggests, the content of the data is determined only when it is actually accessed.

The lazy evaluation array type is used as a result type to indicate the result of an object find, for example. Therefore, it is not possible to directly describe data of the lazy evaluation array type in a job flow.

Even if a lazy evaluation array type is returned as a result of an object find, at that point, it only contains the specified search conditions and so on. It is called lazy evaluation because it works by querying the database with those search criteria when it is actually accessed. Note that this means that a lazy-evaluation array type may give different results depending on when you access its data.

Below is a brief description of how the internal behavior differs from that of ordinary array types.

If you pass a lazy evaluation array type to the `length()` builtin, it queries the database for the number of objects that match the current search criteria and returns them. Also, when accessing elements of the lazy evaluation array type by integer index, the database is queried and the objects are returned one at a time for each access.

Because of these characteristics, if we use `length()` to get the number of items and access them by integer index in a loop process by the number of items, the number of times the database is queried will increase according to the number of items.

```
[found = /root.find()] ->
{ for i in length(found) |
  [obj = found[i]] ->
  ...
}
```

Lazy evaluation array types can also be iterated over in a for block (or pfor block). In this case, at the start of the block, the database is queried for objects that match the search criteria, and the objects are expanded in memory one at a time and passed to processing inside the block.

The number of queries to the database can be reduced by iterating through the for block instead of iterating through the integer index.

```
[found = /root.find()] ->
{ for obj in found |
    ...
}
```

Inside the “for” block, the field values of the object can be updated or the object can be deleted.

The lazy evaluation array type can be combined with an array type (or lazy evaluation array type) with the + operator. In this case, the database is queried for all objects that match the search criteria at that time. The combined value will also be a regular array type, with all elements in memory. Note that the larger the number of objects involved in such a query, the longer the processing time and memory usage will increase.

Because of its features, the lazy evaluation array type can be used to add or remove elements using the `add_item`, `del_item`, `pop_item` methods.

The lazy evaluation array type data has the following methods:

LazyArray.delete()

All corresponding objects are deleted when this method is called. This method returns the number of objects deleted.

New in version 1.6.8: The lazy evaluation array type has been added.

4.3.3 Opaque data type

The opaque data type is a generic term for data types whose internal structure of data is hidden. Also, since it does not have a corresponding data constructor, it can not directly generate data by notation in the source code of the job flow program like a complex data type.

Object type (Object)

The value of the object type represents a reference to the object on the Kompira file system. The string representation of the value of the object type is the absolute path of that object. The property `p` of the object `o` can be accessed with `op`, and the field `f` can be accessed with the notation `o[f]`. If there is no property name or method name with the same name as the field `f`, the field can be referenced with the notation of `o.f`.

Kompira’s object have fields and methods defined by a type object (TypeObject). For details, refer to the Kompira Object Reference (*Kompira Standard Library*)

File type (File)

The value of the file type represents the file data attached to the object with the file type field.

The following fields are defined in the file type value.

Field name	
name	Attachment (file) name
data	Attached file data
size	Data size (read only)
url	Download URL (read only)

It is possible to write a value to a file type field (i.e., create a file from a job flow) by passing dictionary data with name and data as keys to an update job as follows

```
[{'name': 'binary.txt', 'data': b'\xde\xad\xbe\xef \xca\xfe'} >> ./some_obj['attached1']]
```

Basically, data is binary data, but it can also be a string, as shown below.

```
[{'name': 'some.txt', 'data': 'Hello'} >> ./some_obj['attached1']]
```

In this case, the data will be encoded as UTF-8 and written to the file as binary data.

It is also possible to update only the name or data of an existing file, as shown below.

```
['update.txt' >> ./some_obj['attached1']['name']] -> # Update the file name to
↪ "update.txt"
['new text' >> ./some_obj['attached1']['data']]      # Update the file data to "new_
↪ text"
```

To delete a file by a job flow, pass a null value to the update job as follows

```
[null >> ./some_obj['attached1']]
```

Date and time data (Datetime)

A datetime value represents data that contains both the date and the time.

Date-time type values have the following read-only properties:

Datetime.year : *Integer*

Year

Datetime.month : *Integer*

Month (values from 1 to 12)

Datetime.day : *Integer*

Day (value from 1 to the number of days in the given month and year)

Datetime.hour : *Integer*

Time (value from 0 to 23)

Datetime.minute : *Integer*

Minute (value from 0 to 59)

Datetime.second : *Integer*

Seconds (values from 0 to 59)

Datetime.weekday : *Integer*

With Monday as 0, Sunday as 6, a value representing the day of the week as an integer

Datetime.date : *Date*

Date portion of datetime type data

Datetime.time : *Time*

Time portion of datetime type data

Datetime data has the following methods:

Datetime.format(dt_fmt) : String

Converts the date / time data to a character string in the format specified by dt_fmt. Format specification of this format conforms to C language strftime() function.

An example is shown below:

```
[dt = now()] -> print(dt.format('%Y-%m-%d %H:%M:%S'))
```

Datetime.isoformat() : String

Return a string representing the date and time in ISO 8601 format, *YYYY-MM-DDTHH:mm:ssZ*. The time zone is always UTC and has a suffix of Z.

Date data (Date)

A date value represents date data.

Date type values have the following read-only properties:

Date.year : Integer

Year

Date.month : Integer

Month (values from 1 to 12)

Date.day : Integer

Day (value from 1 to the number of days in the given month and year)

Date.weekday : Integer

With Monday as 0, Sunday as 6, a value representing the day of the week as an integer

Date data has the following methods:

Date.format(dt_fmt) : String

Converts the date data to a character string in the format specified by dt_fmt. Format specification of this format conforms to C language strftime() function.

Time data (Time)

A time value represents time data.

Time type values have the following read-only properties:

Time.hour : Integer

Time (value from 0 to 23)

Time.minute : Integer

Minute (value from 0 to 59)

Time.second : Integer

Seconds (values from 0 to 59)

Time data has the following methods:

Time.format(dt_fmt) : String

Converts the time data to a character string in the format specified by dt_fmt. Format specification of this format conforms to C language strftime() function.

Elapsed time type (Timedelta)

The value of elapsed time type data represents the difference between date and time type values. Addition and subtraction are possible between the date-time type value and the elapsed time type value. Also, the difference between date and time type values will be elapsed time type.

The elapsed time value has the following read-only properties:

`Timedelta.days` : *Integer*

Days

`Timedelta.seconds` : *Integer*

Seconds

`Timedelta.microseconds` : *Integer*

Microseconds

`Timedelta.total_seconds` : *Float*

The total number of seconds contained in the duration.

4.4 Variables

A variable is a name given to a storage area that holds a value. Variables in the Kompira job flow language can hold values of any type.

Note: Variables are not shared between child processes generated by fork and pfor blocks, or between parent processes and child processes, even if they have the same scope. However, it is possible to reference (read) the variable of the scope of the parent process from the child process when the child process is generated.

4.4.1 Local variables

Local variables are introduced by job flow parameters, assignment jobs. Local variables have different scopes depending on the position on the source code where the variables are introduced.

Job Flow Scope

A job flow scope is a scope that can be referred to from any subsequent job following the job in which the variable is introduced. The job flow parameter has a job flow scope. Also, if an undefined variable is newly introduced by an assignment job, that variable has a job flow scope.

Job flow scope variables are hidden if variables of the same name are redefined in inner block scope.

Block scope

Block scope is a scope that can only be referenced from within that block. Variables defined by simple blocks and loop variables introduced by `for` and `pfor` blocks have block scope.

4.4.2 Environment variable

Deprecated since version 1.6: Environment variables have been deprecated in version 1.6.0. Use the `$ENV` state variable instead.

4.4.3 Special variable

A special variable is a variable with special meaning defined in advance by the system.

Status variable

A status variable is a reserved variable for temporarily storing of execution results such as remote jobs, status codes, etc., and starts with `$`. These variables are those whose values are set automatically by the Kompira engine and can not be explicitly assigned in the job flow.

There are the following types of status variables:

Variable name	Meaning
<code>\$RESULT</code>	Job execution result (standard output)
<code>\$STATUS</code>	Job execution status
<code>\$ERROR</code>	Job execution error message (standard error output)
<code>\$DEBUG</code>	Debug information
<code>\$ENV</code>	Environment variable dictionary

Note: The character code of the execution result of the job is automatically determined and converted into an appropriate character string. If conversion to a character string fails, job execution is regarded as failed and an error is returned.

The `$ENV` state variable contains a dictionary of environment variable fields in an environment variable type (Environment) object set by the JobFlow user.

Control variable

The control variable is a variable for specifying the host name, login name, etc. when executing the remote job, and it is a variable in the form of two consecutive underscores (`_`) appended before and after, such as `__*__`. It is a variable.

The control variable can be defined as a local variable or it can be set as an environment variable.

There are the following types of control variables:

Variable name	Meaning
<code>__realm__</code>	Specify the management area to execute the remote command
<code>__host__</code>	Specify the execution host name of the remote command

continues on next page

Table 1 – continued from previous page

Variable name	Meaning
<code>__conntype__</code>	Specify the host's connection type of remote command execution. (See Node setting for the connection types that can be specified)
<code>__user__</code>	Specify the execution user name of the remote command
<code>__password__</code>	Specify a password
<code>__node__</code>	Specify the node information object to execute the remote command
<code>__account__</code>	Specify the account information object necessary for executing the remote command
<code>__sudo__</code>	When executing in sudo mode, set it to true
<code>__dir__</code>	Specify the execution directory of the remote command
<code>__port__</code>	Specify ssh port number
<code>__keyfile__</code>	Specify ssh key file path
<code>__passphrase__</code>	Specify the passphrase of the ssh key file (it can be omitted if there is no passphrase or same as <code>__password__</code>)
<code>__timeout__</code>	Specify the number of seconds before the remote command times out
<code>__proxy__</code>	Specify the proxy host when connecting to the execution host
<code>__shell__</code>	Specify the shell to use when executing the remote command (default: <code>"/bin/bash"</code>)
<code>__use_shell__</code>	Set to false if shell is not used when executing remote command
<code>__use_pty__</code>	Set to true to use PTY when executing remote command
<code>__use_cache__</code>	Set to false if the remote connection cache is not used
<code>__raw_stdout__</code>	Set to true to receive standard output as binary
<code>__raw_stderr__</code>	Set to true to receive standard error output as binary
<code>__encoding__</code>	Specifies the encoding of standard input/output (default: <code>"utf-8"</code>).
<code>__winrs_auth_type__</code>	Specify the authentication method of WinRS connection from <code>"ntlm"</code> (default) and <code>"credssp"</code> .
<code>__winrs_scheme__</code>	Specify the scheme of WinRS connection from <code>"https"</code> (default) and <code>"http"</code> .
<code>__winrs_use_tls1_0__</code>	Set to true to use TLS 1.0 when performing CredSSP authentication with a WinRS connection. (For environments where TLS 1.2 can not be used, such as Windows Server 2008)

Deprecated since version 1.4: The control variable `__via__` has been removed in version 1.4.0. Use `__proxy__` instead.

New in version 1.6.0: The control variables `__raw_stdout__`, `__raw_stderr__` have been added.

New in version 1.6.2.post6: The control variable `__use_cache__` has been added.

Changed in version 1.6.4: The control variable `__conntype__` has been extended to allow the specification of network devices.

Changed in version 1.6.4: The value of the control variable `__conntype__` to specify a Windows device has been changed.

New in version 1.6.8.post2: The control variable `__encoding__` has been added (available since 1.6.0).

Note: For WinRS connections, the remote connection cache is always not used, regardless of the setting of `__use_cache__`.

Note: If the directory string specified by `__dir__` contains shell metacharacters such as `(and)` and `"and"` etc., it must be properly escaped as follows:

```
[__dir__ = 'somedir\\(foo\\)']
```

Note: `__dir__` can't be specified when `__sudo__=true` and `__use_shell__=false`.

Note: If you do not specify `__timeout__` or set a value of 0, timeout does not occur when executing remote command. The operation when `__timeout__` is set to a negative value is undefined.

Changed in version 1.4.9.

In winrs mode, as long as the remote command being executed continues to output, it does not time out. In other words, it will time out if there is no output for the number of seconds specified by `__timeout__`.

Changed in version 1.5.4.post5.

Even when there is command output in winrs mode, it now timeouts in seconds specified by `__timeout__`.

Note: Changed in version 1.4.8.post6.

For remote command execution in winrs mode, the smaller value of the value specified by `__timeout__` and the value set by `MaxTimeoutms` from WinRM is applied.

Changed in version 1.5.4.post5.

In command execution in winrs mode, the timeout specification by `__timeout__` is now prioritized over `MaxTimeoutms`.

4.5 Expression

Expressions in the job flow program are evaluated during the execution of the job flow and have some value as a result.

4.5.1 Atomic formula

An atomic expression is the basic unit that constitutes an expression. Identifiers, object paths, literals are included in atomic expressions. Also, the format enclosed in parentheses is also grammatically classified as an atomic expression.

```
atomic_expression ::= IDENTIFIER | OBJECT_PATH | SPECIAL_IDENTIFIER
                  | literal
                  | parenth_form
                  | array_expression
                  | dict_expression
```

Identifier (IDENTIFIER)

An identifier as an atomic expression represents a variable name. When evaluating the variable name, it returns the value bound to that variable name under the execution environment at the time of evaluation.

Object Path

The object path returns the value of the Kompira object pointed to by that path.

If the object does not exist, a run-time error occurs.

Special identifiers

The special identifier represents a status variable after job execution. At the start of the job flow, \$STATUS is initialized to 0 and \$RESULT and \$ERROR are initialized to the empty string (""), respectively.

Literal

Literals are strings, binary, integers, floating-point numbers, booleans, and nulls.

```
literal ::= STRING | BINARY | INTEGER | FLOAT | BOOLEAN | NULL
```

When evaluating a literal, it becomes the value indicated by that literal.

In the case of a string literal, the variable prefixed by \$ in that string is expanded. The following rules will be observed:

- A \$identifier is a replacement placeholder specification and corresponds to mapping to the key “identifier”. By default, the “identifier” part must contain Kompira’s identifier. If a character that can not be used as an identifier appears after \$, specification of the placeholder name ends.
- \${identifier} is the same as \$identifier. It is a necessary writing method if the placeholder name is followed by a character string that can be used as an identifier and you do not want to treat it as part of the placeholder name.

For example, if you execute the following job flow, “Hello Kompira” will be output to the console.

```
[name = 'Kompira']  
-> print('Hello $name')
```

Parentheses format

The parenthesis format evaluates the enclosed expression and returns its value.

```
parenth_form ::= "(" expression ")"
```

Array expression

Array expressions are a comma-separated list of expressions enclosed in square brackets. It is also possible to omit the sequence of expressions.

```
array_expression ::= "[" expression_list? "]"
expression_list  ::= expression ("," expression_list)*
```

When evaluating an array expression, it returns the data of the newly created array type as a value. Each element of the array is evaluated from left to right.

Dictionary expression

A dictionary expression is a comma-separated sequence of key-value pairs enclosed in curly brackets. It is possible to omit the list of pairs. If the pair is connected with an equal sign, the key must be an identifier. If the key is duplicated, it will report an error at the time of compilation. If it is bound by a colon, the key can describe arbitrary expressions. In this case key duplication is not checked.

```
dict_expression ::= "{" ( binding_list | key_val_list )? "}"
binding_list    ::= binding ("," binding_list)*
binding         ::= IDENTIFIER "=" expression
key_val_list    ::= key_val ("," key_val_list)*
key_val         ::= expression ":" expression
```

When evaluating a dictionary expression, it returns the newly created dictionary type data as a value. Given a set of comma-delimited key-value pairs, the expression will be evaluated from left to right to define the dictionary's entry. Giving a duplicate key, results in a syntax error.

4.5.2 Postfix expressions

Postfix expressions have the highest connectivity among expressions.

```
postfix_expression ::= attribute_reference
                  | subscript_reference
                  | function_call
                  | atomic_expression
```

Attribute reference

Attribute references are formats in which the postfix expression has a dot followed by an identifier.

```
attribute_reference ::= postfix_expression "." IDENTIFIER
```

The evaluation result of the postfix expression must be an object type. The value specified by the identifier of the object of the post evaluation result is the value of the evaluation result. If the specified attribute does not exist, it becomes the field value of the object with the identifier string as the key. If no such field exists, a runtime error will result.

Subscript Reference

A postfix expression followed by an expression enclosed in square brackets represents an expression that retrieves an element from fields or arrays of objects, and dictionary data.

```
subscript_reference ::= postfix_expression "[" expression "]"
```

The evaluation result of the postfix expression must be one of either object type, dictionary type, or array type.

If there is no element corresponding to the key or index, a runtime error will occur.

Function calls

Function calls call functions of objects defined by built-in functions, library type objects, and methods of objects with a list of arguments. The argument list consists of an expression list followed by a binding list (keyword argument list), each of which can be empty.

```
function_call ::= postfix_expression "(" argument_list? ")"
argument_list ::= expression_list ("," "*" atomic_expression)?
                ("," binding_list)? ("," "*" atomic_expression)?
                | binding_list ("," "*" atomic_expression)?
                | "*" atomic_expression ("," binding_list)?
                ("," "*" atomic_expression)?
                | "*" atomic_expression
```

If the syntax `*atomic_expression` appears in the function call, `atomic_expression` must evaluate to an array. Elements from this array are treated as if they were additional positional arguments.

If the syntax `**atomic_expression` appears in the function call, `atomic_expression` must evaluate to a dictionary, the contents of which are treated as additional keyword arguments.

Each element of the argument list is evaluated before the function call.

4.5.3 Operator expression

Unary operator

Unary operators show as `+` and `-`. Since the unary operator is a right join, `+x` has the same meaning as `+(-x)`.

```
unary_expression ::= postfix_expression
                  | ( "+" | "-" ) unary_expression
```

The unary `-` operator inverts the sign of the numeric value to be argument.

The unary `+` operator does not change numeric arguments.

Multiplication and division operator

The multiplicative operator has `*`, `/`, and `%`. All of them have the same priority and become a left join.

```
multiplicative_expression ::= unary_expression
                             | multiplicative_expression "*" unary_expression
                             | multiplicative_expression "/" unary_expression
                             | multiplicative_expression "%" unary_expression
```

The `*` operation is the product of the arguments. If either argument is a character string or an array and one is an integer, it is the value obtained by repeating the number of strings and arrays by that number. For example, the expression `'foo' * 3` evaluates to `'foofoofoo'`.

The `/` operation is the quotient between the arguments. If division by zero occurs, an error occurs.

The `%` operation is the remainder when dividing the first argument by the second argument when the two arguments are integers. If the first argument is a character string and the second argument is a dictionary, it returns the result of replacing the template string.

Arithmetic operators

Arithmetic operators include `+` and `-`. All of them have the same priority and become a left join.

```
additive_expression ::= multiplicative_expression
                       | additive_expression "+" multiplicative_expression
                       | additive_expression "-" multiplicative_expression
```

The `+` operation returns the value obtained by adding the argument. If both arguments are a string or an array, it returns the concatenated value.

The `-` operation returns the subtracted value between the arguments.

Comparison operators

The comparison operators are `<`, `>`, `==`, `>=`, `<=`, `!=`, `=~` and `!~`. All of them have the same priority and become a left join.

```
comparison_expression ::= additive_expression
                       | comparison_expression "<" additive_expression
                       | comparison_expression ">" additive_expression
                       | comparison_expression "==" additive_expression
                       | comparison_expression ">=" additive_expression
                       | comparison_expression "<=" additive_expression
                       | comparison_expression "!=" additive_expression
                       | comparison_expression "=~" additive_expression
                       | comparison_expression "!~" additive_expression
```

The result of the comparison is Boolean value true or false. You can chain any number of comparisons. For example, `x < y <= z` is equivalent to `x < y` and `y <= z`. However, in this case, `y` is evaluated only once for the former. Also, `x < y <= z` and `(x < y) <= z` have different meanings. The latter compares the Boolean value of `z` with the result of evaluating `x < y`.

The meaning of comparison between values of the same type depends on type.

- For integer-by-integer comparisons, an arithmetic comparison is made.
- In comparison between character strings, a dictionary comparison is performed.
- In comparison between arrays, a dictionary comparison is performed using the comparison result of each corresponding element.
- Comparison between dictionaries is defined only for equivalence judgment. They are only equivalent when the keys are in the same order and the corresponding elements of the key and value are equal.

`x != y` is equivalent to not (`x == y`).

`==~` makes similar comparisons. The meaning depends on type.

- In comparisons between pattern and character strings, comparison by pattern matching is performed.
- In comparison between character strings and other types, comparison is performed by converting values other than character strings into character strings.
- In comparing arrays, similarities between corresponding elements are compared.
- A comparison between dictionaries ignores differences in the order of keys and compares the values corresponding to each key in a similar manner.
- Except for the above, it has the same result as the equivalent comparison by normal `==`.

`x !~ y` is equivalent to not (`x ==~ y`).

Inclusion operators

Inclusion operators are expressed as `in` or `not in`. They all have the same priority and become a left join.

```
membership_expression ::= comparison_expression
                        | membership_expression "in" membership_expression
                        | membership_expression "not" "in" membership_expression
```

Inclusive operations `x in y` returns true if the value `x` is included as an element of `y`, and false if it is not included. `x not in y` is the same as not (`x in y`).

If `y` is a value other than an array type, the judgment as to whether it is an element or not is as follows:

- If `x` and `y` are both strings, they are regarded as elements if `x` is a substring of `y`.
- If `y` is a dictionary type value, it is considered an element if `x` is included in the key set of `y`.
- If `y` is a directory/table type object, it is regarded as an element if `x` is a child object of `y`.

Logical operators

Logical operators include not, and, and or. When a boolean value is required as a result of a logical operation context or expression, false, null, 0, an empty string (`""`), an empty array (`[]`), and an empty dictionary (`{}`) are all interpreted as false. Any other value is interpreted as true.

```
logical_not_expression ::= membership_expression
                        | "not" membership_expression
logical_and_expression ::= logical_not_expression
```

```
logical_or_expression ::= | logical_and_expression "and" logical_not_expression  
                       | logical_and_expression  
expression           ::= | logical_or_expression "or" logical_and_expression  
                       | logical_or_expression
```

The operator “not” is true if the argument is false, if the argument is true, then “not” is false.

The expressions x and y evaluate the expressions x and y respectively, and return the evaluation result of x if x is false. Otherwise it returns the evaluation result of y.

The expression x or y evaluates the expression x and y respectively, and returns the evaluation result of x if x is true. Otherwise it returns the evaluation result of y.

4.6 A job

A job instructs execution of a command, waiting for an event, or a control such as repetition or conditional branching. The syntax of a job is as follows:

```
job ::= skip_job  
      | execution_job  
      | assignment_job  
      | update_job  
      | event_job  
      | builtin_job  
      | control_job  
      | block_job
```

4.6.1 Skip Job

Skip job does nothing but set \$STATUS to 0.

```
skip_job ::= "[" "]"
```

4.6.2 Execution job

An execution job performs different processing depending on the value type of the result of evaluating the expression.

```
execution_job ::= "[" expression ("<<" expression)? (":" argument_list)? "]"
```

If the result of evaluating the first expression is a character string, the execution job interprets the character string as a command on the remote server or on the local server according to the control context and executes it. If there is a second expression following the symbol <<, the evaluation result of that expression is regarded as a character string and passed to the standard input of the command.

If the result of evaluating the first expression is a job flow object, call that job flow object. If there is an argument list, the value obtained by evaluating the expression of the argument in the list is the parameter of the job flow.

If the result of evaluating the first expression is a script object, that script will be executed on the remote server or on the local server. If there is a second expression following the symbol <<, the evaluation result of that expression is

regarded as a character string and passed to the standard input at the time of script execution. If there is an argument list, the value evaluating the expression of the argument in the list is the command line argument of the script.

If the result of evaluating the first expression is a method of Kompira objects, call its method with argument list as a parameter.

If the result of evaluating the first expression is a library object function, call that function with the argument list as a parameter.

Warning: The length of the command string, the size of the script and script command line arguments is limited to 112 KB. If this limit is exceeded, the job execution will fail and set \$STATUS to -1.

4.6.3 Assignment jobs

Assignment jobs assign the evaluation result of the right side of the = expression to a variable.

```
assignment_job ::= "[" binding_list "]"
```

If the variable is undefined, a variable with job flow scope is newly defined and initialized with the evaluated value.

4.6.4 Update jobs

An update job evaluates the first expression and updates the contents of variables, objects, and fields as a result of evaluating the target expression against the value of the result.

```
update_job      ::= "[" expression ">>" target_expression "]"
target_expression ::= IDENTIFIER | OBJECT_PATH
                  | target_expression "." IDENTIFIER
                  | target_expression "[" expression "]"
```

4.6.5 Event jobs

The event job evaluates the first expression and waits according to its type.

```
event_job ::= "<" expression (("?" | "??") expression)? (":" argument_list)? ">"
           | "<" ">"
```

When the result of evaluating the first expression is a channel object or a task object, the event job waits for the event of that object. Received objects are stored in \$RESULT.

```
<./ChannelObject> ->
[message = $RESULT]
```

If you pass a process object, wait until the process ends. In this case, \$RESULT stores process objects.

If you pass a list whose elements are channels, tasks, or process objects, wait for the event of one of the objects. \$RESULT stores a list with two elements described below. The first element of the list is the object where the event occurred, the second element is the received object.

```
# ./ChannelTable is a Table object that contains Channel objects.  
<./ChannelTable.children> ->  
[chan = $RESULT[0], message = $RESULT[1]]
```

If ? is followed by an expression (guard expression), it becomes an event job with a guard. In this case, we will only receive a message if the result of evaluating the guard expression matches the object at the top of the message queue of the channel. It is the same in the case of ??, but checks whether objects match in order from the top of the message queue, and if they match, discards the previous object and receives the matched object. When waiting for a process object, the guard specification is simply ignored.

If there is an argument list, timeout is specified. If the value of the first expression is a datetime type, the date and time to time out is specified, and in the case of an integer type, the number of seconds until the timeout is specified. If it times out, \$STATUS is set to 1.

Passing the keyword argument `peek_mode=true` as a parameter changes the handling of received messages and the structure of the result. If `peek_mode=true` is specified in an event job for a channel object, when a message is received, the first message in the message queue of the target channel is referenced (without deleting it) and a list [msgid, message] containing the ID value identifying the message in the target channel object and the message body is returned to \$RESULT. Since the message has not been removed from the channel at this time, the same message will be retrieved when the event job is executed again. When a message is no longer needed to be retrieved from the channel, such as when a message has been processed, the message can be deleted by calling `Channel.delete_message()` with the message ID.

```
[chan = ./ChannelObject] ->  
<chan: peek_mode=true> ->  
[msgid = $RESULT[0], message = $RESULT[1]] ->  
...  
[chan.delete_message: msgid]
```

`peek_mode` can also be used in conjunction with guard expressions. ? followed by a guard expression and matched at the top of the message queue, returns a list of [msgid, message] for that message. ?? followed by a guard expression and matched in the middle of the message queue, it removes the message from the message queue from the beginning to one before the message and returns a list of [msgid, message] of the matched messages.

Note that `peek_mode` can also be used in conjunction with event jobs on lists, but the structure of the resulting results is a bit more complex.

```
<[chanA, chanB, chanC]: peek_mode=true> ->  
[chan = $RESULT[0], msgid = $RESULT[1][0], message = $RESULT[1][1]]
```

The “received object” portion of the result of an event job on a list is a list of [msgid, message], which is created by `peek_mode`.

If `peek_mode=true` is specified in an event job for a process object, a list [pid, process] containing the process ID and process object is returned to \$RESULT. This ensures that the structure of the result will be the same, even if the list contains mixed channels and processes when invoking an event job that specifies a list.

Passing the keyword argument `detect_error=true` as a parameter to an event job for a mail channel will set \$STATUS to -1 and immediately terminate the event wait if mail fetching fails due to misconfiguration, mail server failure, or if the mail channel is disabled. (Passing `detect_error` to any event job parameter other than mail channel is simply ignored.)

If it is empty expression <>, the event is always fired, so the job flow will continue executing immediately.

Changed in version 1.6.6: The keyword argument `detect_error` has been added.

Changed in version 1.6.7: The keyword argument `peek_mode` has been added.

4.6.6 Built-in jobs

Embedded jobs are called Kompira's built-in jobs.

```
builtin_job ::= IDENTIFIER "(" argument_list? ")"
```

If there is an argument list, the expression is evaluated from the beginning in order of the list, and the result is passed as a parameter of the built-in job.

For a list and details of the embedded jobs provided by Kompira, see *Kompira Standard Library*.

4.6.7 Control jobs

There are two control jobs, break and continue.

```
control_job ::= "continue" | "break"
```

Control jobs can only be used inside while blocks and for blocks. If you use it elsewhere, it will result in a compile-time error.

Continue

Continue transfers control to the beginning of the next iteration of the while/for block.

Break

Break aborts the iteration of the while/for block, and transfers control to the block after it.

4.6.8 Block jobs

A block job creates a new block scope.

```
block_job ::= simple_block  
           | if_block  
           | for_block  
           | while_block  
           | case_block  
           | choice_block  
           | fork_block  
           | pfor_block  
           | session_block  
           | try_block
```

Simple block

If a simple block has a variable declaration, the local variable holding the block scope is newly defined, and then a job flow expression in the block is executed accordingly. If the variable declaration is omitted, simply execute the job flow expression in the block.

```
simple_block ::= "{" (binding_list "|")? jobflow_expression "}"
```

if Block

The if block evaluates the first conditional expression and branches processing depending on the result. If the conditional expression is omitted, the value of \$RESULT which is the execution result of the immediately preceding job is used.

```
if_block    ::= "{" "if" expression? "|" jobflow_expression "}"  
            | "{" "if" expression? "|" then_clause elif_clause* else_clause? "}"  
then_clause ::= "then" ":" jobflow_expression  
elif_clause ::= "elif" expression ":" jobflow_expression  
else_clause ::= "else" ":" jobflow_expression
```

In the first form of an if block, the job flow expression in the block is executed only if the conditional expression is true.

In the second form of an if block, if the first conditional expression is true, the jobflow expression in the then clause is executed. In the case of false, the conditional expression of the next elif clause is evaluated, and if the value is true, the job flow expression of the elif clause is executed. When every conditional expression is false, and if there is a last else clause, the job flow expression of the else clause is executed.

Case block

The case block evaluates the first expression and attempts to match that value with the value evaluated for the pattern expression of each case clause. If the matching is successful, execute the job flow of the corresponding case clause. If multiple pattern expressions of case clause are described in comma-separated form, if matching with any one pattern is regarded as a success, the job flow of that section is executed.

If the first expression is omitted, the value of \$RESULT (which is the execution result of the previous job) is used.

```
case_block  ::= "{" "case" expression? "|" case_clause+ else_clause? "}"  
case_clause ::= expression_list ":" jobflow_expression
```

The case clause is followed by a pattern expression followed by a colon (:), which is a delimiter, and a job flow expression to be executed when it matches the pattern. If the result of evaluating the pattern expression is a pattern object, matching based on that pattern object is attempted. If the evaluation result of the pattern expression is a character string, it is treated as a case-sensitive Glob pattern. Otherwise, we will do a simple == comparison by matching.

Patterns are tried in order from the beginning of the case clause. If no pattern matches, if there is an else clause, the job flow expression is executed. If there is no else clause, matching is considered to have failed and \$STATUS is set to 1.

for block

A for block is used to iterate over elements within an object that contains multiple elements, such as lists, directories, and tables.

```
for_block ::= "{" "for" IDENTIFIER "in" expression "|" jobflow_expression "}"
```

Expressions are evaluated only the first time when the for block is executed. The evaluation result of the expression must be a repeatable object or an integer value, otherwise an execution error will occur. Each element of the object is assigned to a local variable indicated by an identifier (IDENTIFIER). If the evaluation result of the expression is an integer value N, the local variable iterates in the range 0 to N-1. However, it does not iterate if N is 0 or negative. Since this local variable has the scope of the for block, it can not be referenced after leaving the for block.

When the break job is executed in the job flow expression, the loop is terminated. When the continue job is executed, the subsequent processing of the job flow expression is skipped and the loop is terminated.

\$STATUS at the end of the for block is always set to 0.

While block

The while block evaluates the expression iteratively, and if it is true, it executes the job flow expression. If the expression is false, the while block ends the iteration.

```
while_block ::= "{" "while" expression "|" jobflow_expression "}"
```

When the break job is executed in the job flow expression, the loop is terminated. When the continue job is executed, skip the subsequent processing of the job flow expression and return to evaluating the expression.

\$STATUS at the end of the while block is always set to 0.

Choice block

The choice block waits for multiple event jobs, and when one becomes executable, it executes the job flow expression following that event job.

```
choice_block      ::= "{" "choice" "|" eventflow_expression+ "}"
eventflow_expression ::= event_job ("->" | "=>" | "->>" | "=>>") jobflow_expression
```

If multiple event jobs can be executed at the same time, the event job closest to the top takes precedence.

Fork block

The fork block starts executing the job flow expression as a child process.

```
fork_block ::= "{" "fork" "|" jobflow_expression+ "}"
```

The fork block waits until all child processes that has not been detach() have completed execution. \$RESULT is set to the list of child processes. At the end of the fork block, \$RESULT is set to the list of all child processes created in the fork block, and \$STATUS is set to the number of child processes terminate abnormally. If all child processes terminate

normally, \$STATUS is set to 0.

If the process generated by the fork block exceeds the limit of the number of processes, the fork block waits for execution until the other process complete execution and it falls within the process limit.

Pfor block

The pfor block creates a child process and performs concurrent processing on elements in an object including multiple elements such as lists, directories, and tables.

```
pfor_block ::= "{" "pfor" IDENTIFIER "in" expression "|" jobflow_expression "}"
```

Expressions are evaluated only during the first time when executing the pfor block. The evaluation result of the expression must be a repeatable object, otherwise it will result in an execution error. A child process is created for each element of the object and the corresponding element in each child process is assigned to a local variable identified by an identifier (IDENTIFIER), and execution of the child process is started. If the evaluation result of the expression is an integer value N, execution of the child process is started for each of the local variables from 0 to N-1. However, if N is 0 or negative, the child process is not executed.

The pfor block waits until all child processes that has not been detach() have completed execution. \$RESULT is set to the list of child processes. At the end of the pfor block, \$RESULT is set to the list of all child processes created in the pfor block, and \$STATUS is set to the number of child processes terminate abnormally. If all child processes terminate normally, \$STATUS is set to 0.

If the process generated by the pfor block exceeds the limit of the number of processes, the pfor block waits for execution until the other processes are executed and it is within the processing limit.

Session block

The session block starts a session with the remote server.

```
session_block ::= "{" "session" IDENTIFIER "|" jobflow_expression "}"
```

When a session block is executed, it first starts a session with the remote server specified by the control variable. The session channel for interaction with the remote server in the session is assigned to the local variable indicated by the identifier (IDENTIFIER). When sending (send) a character string to this session channel, a character string is sent to the remote server side. In addition, in order to obtain output from the remote server side, data is acquired from the session channel using the event job. The output from the remote server is stored in the session channel as a line-by-line message. Therefore, reading messages from the session channel is one line at a time.

Exiting the session block ends the session, and the session channel is closed. After that, transmission to the session channel will result in an error. Reading messages from the session channel also results in an error. (However, messages output from the remote server before closing the session can be read)

Calling break in a session block closes the session and ends the block.

When the session block ends normally, \$STATUS is set to 0. In addition, the session channel is stored in \$RESULT. Unread data is stored in the data attribute of the session channel. (Each line of the message is concatenated and becomes one character string data)

If the session fails to start, the session block is terminated without being executed in the session block, and \$STATUS is set to non-0. In addition, \$ERROR contains a message indicating the cause of the error.

Note: You can execute a command job within a session block, but you can not start another session anew.

The following shows an example of a job flow program that executes interactive processing by executing the su command.

```
[__host__ = 'server.exmaple.com', __user__ = 'testuser', __password__ = 'password',
__use_pty__ = true    # su command require PTY.
] ->
# log in to server.example.com and start session.
{ session s |
    [s.send: 'LANG=C su\n'] ->                # execute su command
    <s ?? 'Password: '> ->                    # wait for password prompt
    [s.send: 'root_password\n'] ->            # send root's password
    <s ?? g'*]# '> ->                        # wait for root user prompt
    [s.send: 'service httpd restart\n'] ->    # restart the httpd service
    <s ?? g'*]# '> ->                        # wait for root user prompt
    [s.send: 'exit\n']                        # exit from root
} ->
print('OK')
```

Try block

The try block catches the abnormal termination that occurred while executing the job flow in the block, and continues the processing.

```
try_block ::=  "{" "try" "|" jobflow_expression "}"
```

If the job flow enclosed by the try block ends normally, the try block sets \$STATUS to 0, and if it ends abnormally, sets \$STATUS to 1. It also stores debugging information in \$DEBUG.

If exit is called while executing the job flow in the try block, the job flow always ends. Also, if the execution of the job flow is cancelled by the user while executing the job flow in the try block, the job flow will terminate execution.

4.7 Job flow expressions

A job flow expression is an expression that combines jobs with connectors.

```
jobflow_expression ::=  jobflow_expression "->" job
                       | jobflow_expression "=>" job
                       | jobflow_expression "->>" job
                       | jobflow_expression "=>>" job
```

4.7.1 Connectors

There are multiple types of connectors, and whether job flow processing continues or not when the job fails is different. Below is a list of connectors, the behaviour they exhibit when the job fails and the value of the status variable, when processing is continued.

Connectors	Command abnormal termination	Remote login failed
->	Forced termination	Forced termination
=>	Processing continuation \$STATUS >= 1 \$RESULT = (stdout) \$ERROR = (empty)	Forced termination
->>	Forced termination	Processing continuation \$STATUS = -1 \$RESULT = (empty) \$ERROR = (error message)
=>>	Processing continuation \$STATUS >= 1 \$RESULT = (stdout) \$ERROR = (empty)	Processing continuation \$STATUS = -1 \$RESULT = (empty) \$ERROR = (error message)

If the execution status of the remote command is anything other than 0, it begins to operate as per “Command abnormal termination” in the above table. At this time, the value of the execution status of the remote command is the value of \$STATUS.

If remote access times out, or if the IP address, user name, password, etc. specified in the job flow are incorrect, the failure will be as per “Remote login failure” in the above table.

Note: When a remote command is executed to a Windows node, the execution status is normally a signed 32-bit value, but Kompira treats it as an unsigned 32-bit value.

Note: The maximum number of jobs that can be combined in a single job flow expression is 4096. Inside a block is counted separately, so for example, the following job flow expression would have 6 jobs.

```
x -> y -> { if true | a -> b -> c } -> z -> v -> w
```

Changed in version 1.5.4.post5: When remote login fails, \$ERROR contains a message indicating the cause of the error.

4.8 Job flow Program

A job flow program consists of zero or more parameter declarations followed by job flow expressions. If the job flow expression is empty, execution of the job flow program can be skipped.

```
jobflow_program ::= (parameter_declaration)* jobflow_expression?
```

4.8.1 Parameter declaration

The parameter declaration takes the following form:

```
parameter_declaration ::= "|" IDENTIFIER ("=" expression)? "|"
```

In the parameter declaration, if there is a form of `parameter_declaration = expression`, the job flow has default parameters. For parameters with default values, if the corresponding parameter is omitted during the job flow call, the value of the parameter will be replaced with the default value. The default parameter expression is evaluated for each job flow invocation.

KOMPIRA STANDARD LIBRARY

Author

Kompira development team

In this library reference manual, the Kompira Standard library will be explained.

5.1 Built-in functions / jobs

Kompira's jobs are predefined as built-in jobs and built-in functions.

Embedded jobs are divided into two types: local embedded jobs not run via the job manager and remote embedded jobs executed by the job manager.

5.1.1 Local embedded jobs

Local embedded jobs are executable jobs even if the job manager is not running.

self()

Re-executes its own job flow from the beginning. When re-executing, the parameters of the job flow are not changed. Also, in the case of a job flow whose multiplicity is specified, re-executes with the lock held.

print([*message*[, *args*, ...]])

Outputs a message string to the console and carries out a line feed.

When multiple arguments are given, multiple message strings are separated by space characters and output. If you omit all arguments, only newlines are used.

sleep(*timeout*)

Sleeps the process for the number of seconds specified by the timeout. If the timeout is a datetime type, it will sleep until that date and time.

exit([*status*=0[, *result*="", *error*=""]])

Finishes the process. You can also specify an exit status code with status. Specify the execution result at process termination with result. You can also specify an error message with error.

return([*result*="", *status*=0[, *error*=""]])

Returns control to the caller of the job flow. Specifies the execution result with result. You can also specify an exit status code with status. You can also specify an error message with error.

abort([*message*])

It outputs a message to the console and abnormally ends the job. The end status code is set to 1.

assert(*value*[, *message*])

It verifies that *value* is true, otherwise it outputs a message to the console and abnormally ends.

detach()

Separates the running process of the child process from the parent process. This allows the parent process to proceed further without waiting for the child process to finish.

suspend()

Pauses a running process.

urlopen(*url*[, ...*options*])

The options can be *user*, *password*, *data*, *params*, *files*, *timeout*, *encode*, *http_method*, *verify*, *quiet*, *headers*, *cookies*, *charset*, *binary*, *proxies*.

It sends a HTTP request to the url specified by the argument and gets the result.

When user and password are specified, access by basic authentication is performed.

For data, you can specify the data to send with a POST request as a dictionary type. Transmission data is encoded in the method specified by the encode argument.

Passing a dictionary to params expands it as a URL query string. For example, if you call as follows, the URL actually accessed is `http://example.com?key1=value1&key2=value2`.

```
urlopen(url='http://example.com', params={key1='value1', key2='value2'})
```

You can pass files to upload to files. The file can be specified in either a dictionary with the fields name and data, a list of file names and contents, a filename on the Kompira server, or an attachment field.

```
files={file={name='filename', data='content'}}
files={file=['filename', 'content']}
files={file="/tmp/filename.xls"}
files={file=../attached_file.attached1}
```

In this case, specify the dictionary key (“file” in the above) to be sent to “files” according to the name of the file field of the destination form. For file fields that accept multiple files, you can also pass field names and files side-by-side in list format.

```
files=[['file', {name='filename1', data='content1'}],
       ['file', {name='filename2', data='content2'}]]
```

In this case, please also specify the inner field name and file in the list. When files are specified, they are encoded in multipart/form-data format.

For timeout, specify the time until timeout in seconds.

For encode, “json” can be specified as the encoding type. When the data specified and encoded is in “json”, application/json is automatically set in the Content-Type: header of the HTTP request. If the encode argument is omitted, the transmitted data is encoded in application/x-www-form-urlencoded format. If files are specified, specifying “json” for encoding will result in an error.

For http_method, specify the method of HTTP request from ‘GET’, ‘POST’, ‘PUT’, ‘DELETE’, ‘HEAD’. If the http_method is omitted, it is POST method if data or files are specified, and GET method if not specified.

When verify is set to true, a SSL certificate check is performed when the specified URL is https accessed. If an illegal SSL certificate is detected, the urlopen job will generate an error. The default value of verify is false.

If quiet is set to true, when the verify option is true, suppress warning messages displayed when accessing https.

For headers, you can pass the header information set in the HTTP request as a dictionary type value.

In cookies, pass the cookie passed to the server as a dictionary type value.

For charset, you can specify the character code you expect as a response.

If you need to send an HTTP request via a proxy server, you pass the proxy server URL dictionary to the proxies parameter for the following example. :

```
[proxies = {'http': 'http://10.10.1.10:3128', 'https': 'http://10.10.1.10:1080'}] ->
urlopen('http://www.kompira.jp', proxies=proxies)
```

Whether or not the acquired content is binary is determined by Content-Type. When Content-Type starts with image | audio | video, or when octet | binary is included, it is judged to be binary. However, if binary is set to true, content is treated as binary regardless of the Content-Type.

This built-in job returns a dictionary type value with the following elements:

Field name	Meaning
url	Response URL
code	Resulting status code
version	HTTP version (If HTTP 1.1, it will be 11)
text	Content of the response (The response body was decoded into text based on the encoding information, but in the case of binary content it will be empty)
content	Content of the response (body of the response as it is binary)
body	Content of the response (When it judges that the content is binary, it becomes the same value as content, and when judging it is text it will be the same value as text)
encoding	Encoding information
headers	Header information (dictionary type) included in the response
cookies	The cookie value (dictionary type) passed from the server
history	When there is a redirect, its history information (list type)
binary	True value of whether it is binary content

mailto(*to, from, subject, body*[, ...*options*])

The options can be *cc*, *bcc*, *reply_to*, *html_content*, *attach_files*, *parents*, *headers*, *charset*, *reply_to_all*, *inline_content*, *placeholder*, *as_string*, *smtp_server*.

Send mail.

For *to*, specify the destination mail address as a character string. If you want to send to multiple addresses, specify it in the list with the destination mail address as an element. For *from*, specify the mail address of the sender. For *subject*, specify the character string of the mail subject. For *body*, specify the character string of the mail body. For *cc* and *bcc*, specify Cc / Bcc destination email addresses respectively. If you want to specify multiple addresses, pass them in a list. For *reply_to*, specify the reply mail address.

When *html_content* is specified, mail of HTML format (text / html) is sent. If *html_content* is omitted or null is specified, mail with body in text format (text / plain) will be sent. If both *body* and *html_content* are null, the mailto job will fail. In *attach_files*, you can pass a list of file objects or file objects to attach to the mail.

If you pass a parent message (dictionary as a result of mail_parse) to *parents*, a reply mail will be sent for that message. At this time, the mail headers In-Reply-To: and References: are properly set. In addition, the address set in Reply-To: or From: of the parent message (if set) is set as the destination. If you want to refer to more than one parent message, please pass it as a list. When *reply_to_all* is set to true when replying to mail with parents, it sets "To:" of parent message as handling "Reply to all" and inherits the destination specified by Cc:.

Passing a dictionary to headers, adds each key of the dictionary as a header item to the mail header.

For charset, you can specify the character code of sending mail. default is UTF-8.

If inline_content is set to true, inline expansion of the attached file occurs. At this time, the MIME mixed subtype of the mail body is “related” and the Content-Disposition header of each attachment is “inline”. In addition, “%{Content-ID#num}” (the num part is the index of the attachment specified by `attache_files`) or “%{Content-ID:filename}” in the body of the body (body, `html_content`) File name of the file) and the specified placeholder, will be replaced with the Content-ID automatically appended to each attachment (with ‘<’ and ‘>’ removed at both ends). For example, if you attach one image file with `attach_files` and include the description ‘’ in `html_content`, The image file attached to is now displayed inline.

If `as_string` is set to true, instead of actually sending the mail, it converts the entire message including the mail header into a string. The resulting string can be referenced with `$RESULT`.

When an SMTP server type object is passed to `smtp_server`, the SMTP server is used to send mail. If the argument is omitted, the SMTP server specified in the system configuration is used; if null is passed, mail is sent using the SMTP server running on localhost (the server on which Kompira is installed), regardless of the system configuration.

The User-Agent header of the mail sent by the mailto job is “Kompira ver X.XX”. The “X.XX” part contains the version number of Kompira.

Note: If from is omitted, the sender’s e-mail address is determined with the next priority.

- (1) process owner’s e-mail address
 - (2) administrator e-mail address of `/system/config`
 - (3) `webmaster@localhost`
-

Changed in version 1.6.10: A `mailto()` error now occurs if the to, cc, or bcc in the address list specified to `mailto()` is in an invalid (not RFC 2822 compliant) format.

download(*from_file*, *to_path*)

Download the file in the attached file field (fields of File, Array<File>, and Dictionary<File> types) to the specified path.

For *from_file*, specify the download source attachment field object. For *to_path*, specify the file path of the download destination. The download destination is the file system on the server on which the job manager is running. If the downloaded file path points to a directory, the file name is the file name of the attached file.

The following, downloads the file attached to the attached field of the Kompira object `/root/Package` to the local `/tmp` directory. :

```
download(from_file=/root/Package.attached, to_path='/tmp/')
```

upload(*from_path*, *to_object*, *to_field*[, *to_subscript*])

Upload the file specified in the attached file field (fields of File, Array<File>, Dictionary<File> types). The result returns the file name of the attached file.

For *from_path*, specify the file path of the download source. For *to_object*, specify the Kompira object to which you want to attach, and specify the attachment field name of the attached Kompira object with *to_field*. If the attachment field is an array (Array<File>) or a dictionary (Dictionary<File>), you can specify the array index or dictionary key in *to_subscript*. If *to_subscript* is omitted, the array will add the file and the dictionary will treat the file name is treated as a key in the dictionary.

The following uploads the locally placed file `/tmp/foo.tar.gz` to the attached field of the `/root/Package` object. :

```
upload(from_path='/tmp/foo.tar.gz', to_object=/root/Package, to_field='attached')
```

5.1.2 Remotely embedded job

Remote embedded jobs are built-in jobs that run through the Job Manager. If the job manager is not running, execution waits until the job manager is started.

In remote embedded jobs, the connection information of the remote host is referenced from the control variable.

put(*local_path*, *remote_path*) : *Array<String>*

Transfer the file from the host on which the job manager is running to the remote host. The result will return a list of destination file paths.

For *local_path*, specify the source file path. It is also possible to transfer multiple files using wildcards. If *local_path* is specified as a relative path, it is relative to the directory in which the job manager is running (usually the root directory).

For *remote_path*, specify the directory path or file path of the transfer destination. If *remote_path* is specified as a relative path, it is relative to the login user's home directory or relative to the path specified by the `__dir__` control variable.

Note: If the filename of the file to be transferred contains characters that are not available at the destination, the entire transfer process fails and an error is returned to the user. If the destination is Windows, `/ : * ? < > | `` are not available in the file name, so an error is returned if the file name contains these characters. Note that if some files fail to be transferred during the transfer of multiple files (e.g., by directory), the entire transfer process will fail, but the files that were transferred earlier will remain at the destination.

get(*remote_path*, *local_path*) : *Array<String>*

Transfer the file from the remote host to the host on which the job manager is running. The result will return a list of destination file paths.

For *remote_path*, specify the source file path. It is also possible to transfer multiple files using wildcards.

For *local_path*, specify the file path or directory path of the transfer destination (job manager side).

Warning: File transfers to and from Windows may fail if the file name contains the caret character `^`.

reboot([*wait=120*])

Restarts the remote host.

In *wait*, specify the maximum time (in seconds) to wait for the remote host to restart.

The reboot job can only be run by users who run `sudo` jobs.

5.1.3 Built-in functions

Built-in functions are functions that can be used as Kompira expressions.

In addition to describing it in an expression, it can also be used alone as with embedded jobs. When used alone, the result is inserted in \$RESULT.

The right side of the colon (:) indicates the type of result returned by the function.

now() : *Datetime*

Return the current local date and time.

current() : *Process*

Retrieves its own process object currently executing.

channel() : *Channel*

Create an on-memory channel object for sending and receiving data between multiple processes.

datetime(*dt_str_or_date*[, *dt_fmt_or_time*, *zone*]) : *Datetime*

It converts the character string specified by *dt_str_or_date* into date and time data. It is also possible to specify a format string with *dt_fmt_or_time*. By passing date type data to *dt_str_or_date* and passing time type data to *dt_fmt_or_time*, you can configure date and time type data combined. The option parameter *zone* specifies a time zone.

The format conforms to C language `strptime()` function. An example is shown below:

```
[dt = datetime('2015-1-1 10:30:05', '%Y-%m-%d %H:%M:%S', 'Asia/Tokyo')] ->
print(dt) ->
[dt2 = datetime(dt.date, dt.time)] ->
print(dt2)
```

Note: If *dt_fmt* is omitted, the format of the date string will be converted as ISO 8601 format as shown below.
YYYY-MM-DD[T]hh:mm(:ss(.mmmmmm))?(*[Z]*)[+|-]hh(:)?mm)?

You can use T or blank separator for date and time. Specifying seconds, microseconds, and time zones is optional.

If *zone* is omitted, the local time zone is assumed to be specified.

date(*date_str*[, *dt_fmt*]) : *Date*

It converts the character string specified by *date_str* into date data. It is also possible to specify a format string with *dt_fmt*.

The format conforms to C language `strptime()` function.

time(*time_str*[, *dt_fmt*]) : *Time*

It converts the character string specified by *time_str* into time data. It is also possible to specify a format string with *dt_fmt*.

The format conforms to C language `strptime()` function.

timedelta(*days=0*, *hours=0*, *minutes=0*, *seconds=0*, *microseconds=0*) : *Timedelta*

Creates data showing elapsed time. Values of *timedelta* type and *datetime* type can be added or subtracted.

int(*x=0*) : *Integer*

Converts the string given by argument *x* to integer type.

float(*x=0.0*) : *Float*

Return a floating point number constructed from a number or string *x*.

pattern(*pattern*, *typ='r'*, *mode=''*) : *Pattern*

Creates a pattern object given by the string *pattern*. *typ* represents the type of pattern, you can specify either 'r' (regular expression pattern), 'g' (glob pattern), 'e' (exact match pattern). If 'i' is specified for *mode*, pattern matching is not case sensitive.

path(*str_or_obj*[, *args, ...*]) : *Object*

Returns the actual Kompira object from the character string *str_or_obj* representing the path name. *str_or_obj* can be an array of strings. When an array or multiple arguments are given, each element is combined and interpreted as a path name.

The following example enumerates the objects directly under the root directory. An example of use:

```
{ for p in path('/') | print(p) }
```

If a relative path is specified for *str_or_obj*, it refers to the Kompira object relative to the directory where this job flow resides. The following example displays the path of the directory where this job flow resides.

Example usage:

```
print(path('.'))
```

You can also specify a Kompira object for *str_or_obj*. The following example enumerates Kompira objects at the same level as the object contained in the parent directory of the Kompira object specified by parameter 'dir', that is, the object specified by 'dir'.

Example usage:

```
|dir = /home/guest|
{ for sibling in path(dir, '..') | print(sibling) }
```

user(*user*) : *User*

Returns a User object with the user name *user*. Giving an integer value to *user* returns a User object with that value as user ID. Giving User object returns it as is.

group(*group*) : *Group*

Returns a Group object with the group name, *group*. Giving an integer value to *group* returns a Group object with that value as the group ID. Giving a Group object will return it as is.

string(*obj*) : *String*

Converts object *obj* to a string.

bytes([*b*[, *encoding='utf-8'*]]) : *Binary*

If *b* is an integer value, this generates a binary (sequence of bytes) of length *b* with each byte value of 0. If *b* is a string, produces a binary encoded with the encoding specified in *encoding*. If *b* is an array of integers from 0-255, it generates the corresponding binary. If *b* is binary, return its value as is.

type(*obj*) : *String*

Returns the type name of the object *obj*.

decode(*data*[, *encoding='utf-8'*]) : *String*

Decodes the binary data, *data* into a character string with the character code system specified by *encoding*.

encode(*message*[, *encoding='utf-8'*]) : *Binary*

Encodes the string *message* into binary data with the encoding system specified by *encoding*.

length(obj) : Integer

Gets the length of the array passed in obj.

has_key(obj, key) : Boolean

Checks whether dictionary data and objects passed by obj are field accessible with the specified key, key.

json_parse(data[, strict=false]) : any

Converts a string serialized in JSON format into an object of Kompira.

Example usage:

```
[str = '[1,2,3,true,"foo","bar"]']
-> [obj = json_parse(str)]
-> { for elem in obj | print(elem) }
```

If strict is true, an error will occur if the control character is included in the string. If strict is false, then control characters will be allowed inside strings. Control characters in this context are those with character codes in the 0–31 range, including ‘\t’, ‘\n’, ‘\r’ and ‘\0’

New in version 1.6.2.post3: Added the strict parameter.

json_dump(obj[, ensure_ascii=true, indent=null]) : String

Convert Kompira’s object to a serialized string in JSON format.

If ensure_ascii is true, all input non-ASCII characters will be escaped in the output. If ensure_ascii is false, these characters will be output as-is.

If indent is a non-negative integer or string, then JSON array elements and dictionary elements will be pretty-printed with that indent level. An indent level of 0, negative, or “” will only insert newlines.

New in version 1.6.2.post3: Added the ensure_ascii and indent parameters.

mail_parse(data) : Dictionary

Converts MIME formatted string to Kompira’s dictionary object.

In addition to the header information of the mail, you can access the file name with the ‘Filename’ key in the body of the mail with the ‘Body’ key. (If the attached file does not exist, ‘Filename’ key is null)

The body of the mail is encoded in utf-8 format only when Content-Type is text/plain and it is not an attached file.

If the Content-Type is multipart, the ‘Is-Multipart’ key becomes true and the element of the ‘Body’ key becomes an array of Kompira dictionary objects.

iprange(address) : Array<String>

Converts CIDR notation network address to IP network object.

Example usage:

```
{ for ip in iprange('192.168.0.1/24') |
  [__host__ = ip] ->
  ['hostname'] ->> []
}
```

Warning: The embedded job iprange() will be removed in the near future.

5.2 Kompira objects

Various data handled by Kompira is stored as a Kompira object on the Kompira file system with directory structure. Kompira objects have unique fields and methods for each type, and can be operated from the job flow.

5.2.1 Field type

The types that can be used in fields of Kompira object are as follows. The right side of the colon (:) indicates the type of data when referring to the field from the job flow.

String : *String*

Represents a field of a string.

Binary : *Binary*

Represents a field of the binary, entered in hexadecimal notation.

Integer : *Integer*

Represents an integer field. Values other than integers can not be entered. If it is not entered, it will be null value.

Float : *Float*

Represents a floating point number field. If an integer is entered, it is converted to a floating point number. If not entered, a null value is returned.

Boolean : *Boolean*

Represents a boolean field. It is displayed as a check box on the form, corresponding to true when checked and false when unchecked.

Enum : *String*

Represents a choice field. The list of choices is specified by the field qualifier.

Text : *String*

Represents a text field.

LargeText : *String*

Represents a larger text field.

Password : *String*

Represents a password field. The string is hidden when displaying the field.

File : *File*

Represents an attachment field. You can upload and download attached files.

Object : *Object*

Represents a Kompira object field. You can choose Kompira objects from choices. By specifying the field qualifier, it is also possible to restrict choices to objects of a specific type or to objects under a specific directory.

Datetime : *Datetime*

Represents a date / time field. The format of the date and time information to enter is as follows.

Format	Example
%Y-%m-%d %H:%M:%S	2006-10-25 14:30:59
%Y-%m-%d %H:%M	2006-10-25 14:30
%Y-%m-%d	2006-10-25
%m/%d/%Y %H:%M:%S	10/25/2006 14:30:59
%m/%d/%Y %H:%M	10/25/2006 14:30
%m/%d/%Y	10/25/2006
%m/%d/%y %H:%M:%S	10/25/06 14:30:59
%m/%d/%y %H:%M	10/25/06 14:30
%m/%d/%y	10/25/06

Date : *Date*

Represents a date field.

Time : *Time*

Represents a time field.

IPAddress : *String*

Represents an IP address field. It corresponds to input of IPv4 address format.

Email : *String*

Represents a mail address field.

URL : *String*

Represents a URL field.

Array<T> : *Array*

Represents an array field whose type of elements is T. You can enter multiple elements of type T. (Array is synonymous with Array<String> field.)

The only types that can be specified for the type variable T are String, Binary, Integer, Float, Boolean, Enum, Password, Object, Datetime, Date, Time, IPAddress, EMail, and URL.

Dictionary<T> : *Dictionary*

Represents a dictionary field. Multiple keys and values can be entered. The type of the value is T. (Dictionary is synonymous with Dictionary<String> field.)

New in version 1.6.0: Binary, Float, Array<T>, and Dictionary<T> fields have been added newly.

5.2.2 Field qualifier

Field qualifiers add more control and constraints on field display to field types. The field qualifier is described in the form of a JSON object as shown below.

```
{ "<qualifier1>" : <value1>, "<qualifier2>" : <value2>, ... }
```

The following types of field qualifiers exist.

The right side of the colon (:) indicates the type described by each field qualifier.

default : **any**

- Target fields: any

Specify the default value for the field.

The default value must be written in the format corresponding to the *field types*.

For example, a String type must be enclosed in double quotes, while an Integer type must be written as a not fractional number.

E.g.

```
{ "default": "string data" }
{ "default": 123456 }
```

DateTime, Date, and Time types default values must be written in string format so that Kompira can parse them by using `datetime()`, `date()`, and `time()`.

E.g.

```
{ "default": "2023-05-12 23:21:45" }
{ "default": "2023-09-26" }
{ "default": "17:43:01" }
```

It is also possible to specify default values for `Array<T>` and `Dictionary<T>` types. For `Array<T>`, comma-separated items must be enclosed by square brackets, and for `Dictionary<T>`, key:value pairs must be enclosed by curly braces.

E.g.

```
{ "default": [value1, value2, ...] }
{ "default": {"key1": value1, "key2": value2, ...} }
```

In this case, It is necessary to write the default values of each element of an array or dictionary according to its *type T*. Default values that are not compatible with field's types will be invalid and unusable.

Note: `File`, `Array<File>`, and `Dictionary<File>` types do not support default values.

invisible : *Boolean*

- Target fields: any

Hides fields from forms and views.

help_text : *String*

- Target fields: any

Describes the field. If this qualifier is specified, the text specified when editing the object is displayed.

object : *String* | *Array* | *Dictionary*

directory : *String* | *Array* | *Dictionary*

- Target fields: Object

Refines the choices in an object type field.

With the qualifier “object”, if you specify the path of a type object, the objects of that type will be displayed as choices. Also, if you specify the path of a directory or table, the child objects of that object will be displayed as choices. The following is an example of using a job flow type object as a choice.

```
{ "object" : "/system/types/Jobflow" }
```

With the qualifier “directory”, if you specify the path of a directory or table, its descendant objects are displayed as choices. The following is an example of using all objects under /user as a choice.

```
{ "directory" : "/user" }
```

If you specify a path with “~” or “~(username)” at the beginning, that part will be expanded to the user’s home directory. If the user name is omitted, the user who is logged in becomes the target.

```
{ "object" : "~" }  
{ "directory" : "~" }
```

These qualifiers allow you to specify multiple objects in an array format.

```
{ "object" : ["~", "/user"] }  
{ "directory" : ["~", "/user"] }
```

If multiple directory or type objects are specified, an OR condition will be applied to each one. When a directory and a type object are specified, an AND condition is applied.

By combining the qualifier “object” with the qualifier “directory”, it is possible to select an object of a specific type under a certain directory, etc.

E.g.

```
{ "object" : "/system/types/NodeInfo", "directory" : "~" }
```

If you specify a object that does not exist or does not have read permission, it will be disabled. If you do not specify any valid path, the choice will be empty. This means that you have narrowed down your search to criteria that do not match any of the above.

E.g.

```
{ "object" : "/invalid_path" }  
{ "directory" : "/invalid_path" }
```

If null is specified, then no filtering will be done. This is equivalent to not specifying a qualifier.

E.g.

```
{ "object" : null }  
{ "directory" : null }
```

If you want to switch the criteria for narrowing down the choices in this field depending on the status of other objects, instead of keeping it fixed, there are several ways to do so, as shown below.

If you want to switch the criteria for narrowing down the choices in this field based on the objects recorded in the Object type field of another object, you can specify the field name as [reference_field] followed by the path notation as follows.

E.g.

```
{ "object" : "/foo/bar/SomeObject[reference_field]" }  
{ "directory" : "/foo/bar/SomeObject[reference_field]" }
```

In this case, the field named reference_field is called the “reference field”.

The object recorded in the reference field will be applied as this qualifier “object” or “directory”. Note, however, that if no directory, table or type object is recorded in the reference field, it will not be valid as an object to be specified as a qualifier.

If you want to refer to an Object type field as a configuration item of a Config type object, you need to add the attribute name `.data` to the path of the Config type object.

E.g.

```
{ "object" : "/foo/bar/SomeConfig.data[reference_field]" }
{ "directory" : "/foo/bar/SomeConfig.data[reference_field]" }
```

If you want to switch the narrowing choices in this field depending on the selection of another Object type field in the same object, you can specify the field name as `[$depend_field]` instead of the path notation as follows.

E.g.

```
{ "object" : "[$depend_field]" }
{ "directory" : "[$depend_field]" }
```

In this case, the field named `depend_field` is called the “dependent field”.

The object selected in the dependent field will be applied as this qualifier “object” or “directory”. In the editing window, selecting a dependent field will reset the selection at that point as the choices for this field will be switched.

Note, however, that if the object selected in the dependent field is not a directory, table or type object, it is not a valid object to specify as a qualifier. It is recommended to specify a field qualifier that limits the type on the dependent field side as well.

Also, when the object selected in the dependent field has an Object type field, you can specify the object recorded in that field as the reference field.

E.g.

```
{ "object" : "[$depend_field][reference_field]" }
{ "directory" : "[$depend_field][reference_field]" }
```

The object recorded in the reference field of another object selected in the dependency field will be applied as this qualifier “object” or “directory”. Note, however, that as above, if no directory, table or type object is recorded in the reference field, it will not be valid as an object to be specified as a qualifier.

Depending on the selection of another Enum or Object type field, you can also choose another way to switch the refinement choices in this field.

E.g.

```
{
  "object" : {
    "switch" : "[$depend_field]",
    "case" : {
      "Directory": ["/system/types/Directory", "/system/types/Table"],
      "Jobflow": "/system/types/Jobflow",
      "*": null
    }
  }
}
```

In this form, a “switch” part and a “case” part are required. The “switch” part is written in the same way as the dependent or reference fields described above. The “case” part is in the form of a dictionary, which can contain multiple pairs of patterns as keys and values as qualifier to be applied if a match is found. The “case” part is a dictionary, with the pattern as the key and the qualifier as the value to be applied if a match is found. In this case, the values of the dependent or reference fields described in the “switch” part are used to evaluate whether

the pattern described in the key of the “case” part matches, starting from the top. If any pattern is matched, the corresponding value will be applied as this qualifier.

If none of the patterns match, it will be disabled as this qualifier and the choices in this field will be empty unless a valid refinement is specified with another qualifier. In the example above, the optional matching pattern “*” is specified at the end of the “case” section to prevent it from being invalidated.

By default, the pattern part can be written with the glob pattern, which is case-sensitive. The pattern type can be specified in “case_pattern_type” as “exact”, “glob”, or “regex”. If “case_ignorecase” is set to true, the pattern will be case-insensitive.

E.g.

```
{
  "object" : {
    "switch" : "$[depend_field]",
    "case" : {
      "[0-9a-f]+\.\bin": ...
    },
    "case_pattern_type": "regex",
    "case_ignorecase": true
  }
}
```

Note that when writing the regex pattern as a field qualifier in JSON format, the escape character \\ should be \\\\.

filter : *Dictionary*

- Target fields: Object

In the object type field, narrow down the choices. In addition to filtering by the “object” and “directory” qualifiers, the filtering conditions specified here will be applied. The filtering condition can be specified as a parameter of *Directory.find()* method in dictionary form.

E.g.

```
{
  "directory" : "/user",
  "filter" : {
    "type_object" : "/system/types/TypeObject",
    "abspath__contains" : "kompira"
  }
}
```

Note that if the type object is specified with the qualifier “object” and the type object is also specified with “type_object” in the qualifier “filter”, the condition will be applied as an OR condition.

Note, however, if you specify a type object with “type_object” in the “filter” qualifier, the home directory will not be expanded with “~” or “~(username)”.

order_by : *String*

- Target fields: Object

Specifies the sort order for object type fields. The sort order can be specified by attribute names (abspath, display_name, etc.) common to general objects. If you specify “-” at the beginning, such as “-abspath”, the sort result will be in reverse order.

E.g.

```
{ "object" : "/system/types/NodeInfo", "order_by" : "abspath" }
```

If omitted, the sort order set for the directory specified by the qualifier “object” or “directory” will be applied. However, the behavior when multiple directories are specified is undefined, so please specify it explicitly with the qualifier “order_by”.

Specifying the sort order by field value is not supported. Also, if an invalid sort order is specified, it will be ignored.

no_empty : *Boolean*

- Target fields: Object

Does not allow empty choices on the input form of Object type field.

E.g.

```
{ "object" : "/system/types/TypeObject", "no_empty" : true }
```

enum : *Array* | *String* | *Dictionary*

- Target fields: Enum

In the Enum type field, specifies a list of character strings to be selected.

Example

```
{ "enum" : ["Server", "Switch", "Router"] }
```

If you want to separate the stored data from the display name, you can specify it as follows by using the pair [“<data>”, “<display name>”]. :

```
{ "enum" : [ ["SV", "Server"], ["SW", "Switch"], ["RT", "Router"] ] }
```

If you want to switch the choices in this field depending on the status of other objects, instead of keeping them fixed, there are several ways to do so.

If you want to switch a value recorded in an Array or Dictionary type field of another object as a choice for this field, you can specify it as a *reference field* as follows.

E.g.

```
{ "enum" : "/foo/bar/SomeObject[reference_field]" }
```

The value recorded in the reference field will be applied as this qualifier “enum”. If the reference field is an array, it will remain as an option. If the reference field is a dictionary, the key of each element will be the data and the value will be the display name.

However, if you specify an object that does not exist or does not have read permission, and if the object does not have the specified reference field, the choice will be empty.

If you want to reference an Array or Dictionary type field as a configuration item of a Config type object, you need to add the attribute name `.data` to the path of the Config type object.

E.g.

```
{ "enum" : "/foo/bar/SomeConfig.data[reference_field]" }
```

If the object selected for another Object type field in the same object has an Array or Dictionary type field, you can specify the reference field along with the *dependent field* as follows.

E.g.

```
{ "enum" : "$[depend_field][reference_field]" }
```

Based on the value recorded in the reference field held by another object selected in the dependent field, the choices in this field will be switched. In the editing screen, when you select a dependent field, the selection at that point will be reset once in order to switch the choices for this field.

Depending on the selection of another Enum or Object type field, you can also choose another way to switch the choices for this field.

E.g.

```
{
  "enum" : {
    "switch" : "$[depend_field]",
    "case" : {
      "Server": ["Server-A", "Server-B", "Server-C"],
      "Switch": ["Switch-A", "Switch-B", "Switch-C"],
      "Router": ["Router-A", "Router-B", "Router-C"],
      "*": ["Unknown"]
    }
  }
}
```

In this form, a “switch” part and a “case” part are required. The “switch” part is written in the same way as the dependent or reference fields described above. The “case” part is in the form of a dictionary, which can contain multiple pairs of patterns as keys and values as qualifier to be applied if a match is found. The “case” part is a dictionary, with the pattern as the key and the qualifier as the value to be applied if a match is found. In this case, the values of the dependent or reference fields described in the “switch” part are used to evaluate whether the pattern described in the key of the “case” part matches, starting from the top. If any pattern is matched, the corresponding value will be applied as this qualifier.

If none of the patterns match, it will be invalid as this qualifier and the choices in this field will be empty. In the example above, the “case” section is terminated with an optional matching pattern “*” to prevent it from being invalidated.

By default, the pattern part can be written as a glob pattern, and the pattern type can be specified by *case_pattern_type* as well as the object field qualifier.

pattern : *String*

- Target fields: String

In the String type field, specify a pattern with a regular expression.

min_length : *Integer*

- Target fields: String

In the String type field, specify minimum and/or maximum length.

max_length : *Integer*

- Target fields: String

In the String type field, specify minimum and/or maximum length.

strip : *Boolean*

- Target fields: String, Text, LargeText, Password

Removes whitespace characters from both ends of the input string. The default value is false.

key_strip : *Boolean*

- Target fields: Dictionary<T>

In the Dictionary<T> type fields, removes whitespace from both ends of the input key string. The default value is false.

min_value : *Integer*

- Target fields: Integer, Float

In the Integer and Float type field, specifies minimum value.

max_value : *Integer*

- Target fields: Integer, Float

In the Integer and Float type field, specifies maximum value.

file_accept : *String* | *Array*

- Target fields: File

In the File type field, specifies a selectable file types.

E.g.

```
{ "file_accept" : ".xls" }
```

When more than one file type is specified, it is specified by a list.

E.g.

```
{ "file_accept" : [".png", ".jpg"] }
```

schemes : *String* | *Array*

- Target fields: URL

Specify the acceptable schemes in the input form for URL type fields as a string or a list of strings. Defaults to http, https, ftp, ftps.

E.g.

```
{ "schemes": "https" }  
  
{ "schemes": ["ldap", "ldaps"] }
```

Note that the scheme string specified in the schemes modifier should be specified in lowercase, since the scheme string contained in the URL entered in the URL type field is automatically converted to lowercase and saved.

Note: The Array<T> and Dictionary<T> fields allow you to specify a qualifier for the element *type T* . However, the default modifier is only applied to the entire array or dictionary.

New in version 1.5.1: New field qualifiers: pattern, min_length, max_length, min_value, max_value, file_accept have been added.

New in version 1.6.2.post5: New field qualifiers: strip and key_strip have been added.

New in version 1.6.4: New field qualifiers: filter and order_by have been added.

New in version 1.6.4: Dependency and reference fields can now be specified with the object, directory or enum qualifiers.

New in version 1.6.4: For object, directory or enum qualifiers, “switch” and “case” now allow you to specify which qualifier to apply depending on the pattern.

Changed in version 1.6.4: The sort order set for objects specified with the object or directory qualifiers is now applied.

New in version 1.6.8: New field qualifiers: schemes has been added.

New in version 1.6.9: It is now possible to specify default values for the Array<T> and Dictionary<T> types.

5.2.3 Properties

Kompira objects provide the following properties.

Object.id : *Integer*

The value of the ID of the object. The object ID is a unique integer value that is automatically assigned when the object is created. It can not be updated.

Object.abstractmethod : *String*

The absolute path value of the object. It can not be updated.

Object.name : *String*

The value of the object name. The format of the character string that can be used for the object name is the same as the identifier in the Kompira job flow language. You can not create objects with the same name in the same directory.

Object.description : *String*

A character string that describes the object.

Object.display_name : *String*

The display name of the object. The display name string has no format restriction unlike object names.

Object.field_names : *Array<String>*

A list of field names that the object has. It is a list type value. It can not be updated.

Object.owner : *User*

The owning user of the object. It is a user object.

Object.created : *Datetime*

The creation date and time of the object. It will be a date and time type value. It can not be updated.

Object.updated : *Datetime*

The update date and time of the object. It will be a date and time type value. It can not be updated. Object.updated is not updated in situations where only fields with the field qualifier set to invisible=true are updated.

Object.parent_object : *Object*

The parent object of the object, i.e. the directory (or table) object. It can not be updated.

Object.children : *LazyArray<Object>*

Returns search results that are a list of child objects of the object. If the object has no child objects, such as if it is not a table or directory, the result will be empty. It can not be updated.

Object.type_object : *TypeObject*

The type object of the object. It can not be updated.

`Object.type_name` : *String*

The type name of the object. It can not be updated.

`Object.user_permissions` : *Dictionary*<*Permission*>

User permission information. It is a dictionary type object with key as writable, readable, executable as the key.

`Object.group_permissions` : *Dictionary*<*Permission*>

Group permission information. It is a dictionary type object with writable, readable, executable and priority keys

Changed in version 1.6.8: Property children is changed to LazyArray type.

Changed in version 1.6.9: Object.updated is no longer updated in situations where only invisible fields are updated.

5.2.4 Method

Kompira objects provide the following methods.

`Object.delete()`

Deletes the object.

`Object.update([key1=val1, key2=val2, ...])`

Updates the values of the fields key1, key2, ... of the object to val1, val2,

`Object.rename(name)`

Change the name of the object to name.

5.3 Built-in objects

This section describes standard type objects pre-built in Kompira.

An object of Kompira has a type indicated by a type object. For example, a job flow object has a job flow type and a directory object has a directory type. In Kompira, types such as job flow type and directory type are also defined as objects, so they also have types of type objects. I.e. the type of the type object is a type object.

Kompira's objects have fields and methods specific to that type.

5.3.1 Type Object (TypeObject)

The *type object* type defines the fields and methods of Kompira objects belonging to that type. By defining a new type object, the user can freely add the type of Kompira object.

Note: When modifying a type object, such as adding a field to an existing type or deleting an unnecessary field, Kompira processes it according to the following rules.

- Fields deleted by the changed type object are ignored and become inaccessible.
 - Newly added fields of the new type object are automatically initialized with null values.
-

Field

In the type object type, the following fields are defined.

`TypeObject.extend` : *String*

- Display name: Extend module

Specifies Python extension module paths referenced by type objects. The default is `kompira.extends`.

To extend the behavior and view of type objects, create extension model modules `models.py` and extension view modules `views.py` as Python modules and place them under the path specified here.

`TypeObject.fieldNames` : *Array*

- Display name: Field names

Specifies an array of field names of objects of this type as an array. The rules for strings that can be used in field names are the same as the job flow language identifier.

`TypeObject.fieldDisplayNames` : *Array*

- Display name: Field display names

Specifies the list of field display names of objects of this type as an array. An arbitrary character string can be used for the field display name. The order of array elements must correspond to the columns of field names.

`TypeObject.fieldTypes` : *Array*

- Display name: Field types

Specifies an array of field types of objects of this type as an array. The order of array elements must correspond to the columns of field names.

Method

Methods specific to type object types are not specifically defined.

5.3.2 Directory (Directory)

Directory type specifies the type of directory object. You can have several different types of Kompira objects under a directory object. This allows Kompira objects to have a hierarchical structure as well as Unix file systems.

Field

In the directory type, the following fields are defined.

`Directory.orderBy` : *String*

- Display name: Sort order

Specifies the order in which objects are displayed in this directory.

`Directory.pageSize` : *Integer*

- Display name: Page size
- Minimum value: 10
- Maximum value: 1000

- Default value: 25

Specifies the number of objects to be displayed in this directory.

Method

The following methods are defined in the directory type.

Directory.add(name, type_obj[, data, overwrite]) : *Object*

Under the directory, add a *type_obj* type Kompira object with the name specified by *name*. Dictionary type data can be passed to *data*, so that you can initialize the field value of the object. If the dictionary passed to the *data* parameter includes a field, the field data will be inserted in the database with the given values. However, If the *data* parameter is omitted or specified as *data=null*, field data will not be inserted in the database.

When it comes to fields that do not have existing records, the object's details screen or job flow will reference the default value of that field. In that case, *Directory.find()* will not allow filtering by field value.

If you pass *true* to the *overwrite* argument, even if an object of the same name exists under the directory, it does not cause an error and updates the object. Lastly, *\$RESULT* contains the newly created object.

New in version 1.6.9: Default values behavior has been implemented for objects of types *Array<T>* and *Dictionary<T>*.

Directory.move(obj[, name])

Moves the object specified by *obj* under the directory. If *name* is specified, the name of the object to be moved is changed to *name*.

Directory.copy(obj[, name]) : *Object*

Duplicates the object specified by *obj* under the directory. If *name* is specified, the name of the duplicated object is changed to *name*. If *obj* is a directory or table, child objects are recursively duplicated. *\$RESULT* stores newly created objects.

Directory.has_child(name) : *Boolean*

Returns *true* if the child object specified by *name* exists under the directory, *false* if it does not exist.

Directory.find(params) : *LazyArray<Object>*

Returns search results for objects under a directory that match the filtering criteria specified in *params*. To filter by attribute of the objects, you can specify filters *<attribute-name> = <value>* in *params*.

For example, if you want to get a list of type objects, specified as shown below.

```
[result = /.find(type_object=/system/types/TypeObject)]
```

Although the above is filtering by exact matching, detailed filtering conditions can be specified by describing the attribute name followed by a lookup as follows.

For example, you can filter objects that contain *kompira* in the path.

```
[result = /.find(abspace__contains='kompira')]
```

The lookup types and filtering method is as follows.

Lookup	Filtering method
exact, iexact	The attribute exactly matches the specified value.
contains, icontains	The attribute contains the specified value.
startswith, istartswith	The attribute starts with the specified value.
endswith, iendswith	The attribute ends with the specified value.”
regex, iregex	The attribute matches the specified regular expression.
gt, gte	The attribute is greater than specified value (gt). The attribute is greater than or equal to the value specified (gte).
lt, lte	The attribute is less than specified value (lt). The attribute is less than or equal to the value specified (lte).
in	The attribute is included in the specified values.

In filtering others than virtual objects by attribute value, the lookup that can be specified depends on attribute.

Attribute	Specifiable Lookup
owner	exact, in
abspath	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
display_name	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
description	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
created	exact, gt, gte, lt, lte
updated	exact, gt, gte, lt, lte
type_object	exact, in
parent_object	exact, in

In filtering virtual objects by attribute value, the lookup that can be specified depends on the data type of the attribute.

Type of the attribute	Specifiable Lookup
String	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
Integer	exact, gt, gte, lt, lte
Datetime	exact, gt, gte, lt, lte
Object	exact
User	exact
Boolean	exact

If lookup is not specified, exact is applied.”

If type objects are specified by type_object attribute filtering, you can also specify filtering conditions by field value. When filtering by field value, use params as `fields = {<field-name> = <value>}` or `fields = {<field-name>__<lookup> = <value>}`.

An error occurs if you specify filtering by field value when type object is not specified.

For example, if you want to get a list of jobflows that contain `urlopen` in its source code, specified as shown below.

```
[result = /.find(type_object=/system/types/Jobflow, fields={source__contains=
→ 'urlopen'})]]
```

The available lookups for filtering by field are shown below.

Type of field	Specifiable Lookup
String	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex, in, range
Integer	exact, isnull, gt, gte, lt, lte, in, range
Boolean	exact
Datetime	exact, isnull, gt, gte, lt, lte, range
Object	exact, isnull
File	(same as string)
Array	(same as string)
Dictionary	(same as string)

`exact` is applied when lookup is not specified.

By default, the `find` method returns the resulting object list in the order set for the directory. If you want to specify the order explicitly, you can specify `order_by=<attribute-name>` in params. In the following example, they are sorted in ascending order by creation date and time.

```
[result = /.find(order_by='created')]
```

The following attributes can be used to specify the order by `order_by`.

Attribute	Order applied
<code>id</code>	Order by object ID
<code>owner</code>	Order by user ID of the object's owner
<code>abspath</code>	Order by absolute path of the object
<code>display_name</code>	Order by display name of the object
<code>description</code>	Order by description of the object
<code>created</code>	Order by creation date and time of the object (oldest first)
<code>updated</code>	Order by update date and time of the object (oldest first)
<code>type_object</code>	Order by type object's ID
<code>parent_object</code>	Order by parent object's ID

If you want to reverse the order, prefix it with `-`. In the following example, they are sorted in descending order by update date and time.

```
[result = /.find(order_by='-updated')]
```

Multiple sort orders can be specified by separating them with commas. If the values of the previously specified attributes are the same, they will be sorted in the order of the values of the later specified attributes.

```
[result = /.find(order_by='type_object,created')]
```

If the type object is specified by `type_object` attribute filtering, you can also specify the sort order by field value. To sort by field value, use `order_by=field:<field name>` in params. If you want to reverse the order by field value, use `order_by=-field:<field-name>`.

```
[result = /.find(type_object=/system/types/Wiki, order_by='field:wikitext')]
```

Specifying sort order by field value will basically sort by the value indicated by the field's type, i.e., numeric or string. However, File type fields are sorted by file name.

Fields that can be sorted by `order_by` are fields of any type except Password / Array<T> / Dictionary<T>. If you specify a field of type Password / Array<T> / Dictionary<T> that does not support sorting in `order_by`, an error will result.

You can specify order by multiple fields separated by commas. If the values of the first field specified are the same, they will be ordered by the value of the field specified later.

```
[result = /.find(type_object=/system/types/Wiki, order_by='field:style,  
↪field:wikitext')]
```

You can also specify a combination of fields and attributes to specify the sort order.

```
[result = /.find(type_object=/system/types/Wiki, order_by='field:style,created')]
```

By default, the `find` method returns a list of all objects that match the condition, but in some cases, this may be unwieldy due to the large number of objects involved. If you want to limit the maximum number of objects to retrieve, you can specify `limit=<number>` in params. The following example will return at most the first 10 objects.

```
[result = /.find(limit=10)]
```

If you want to specify the first position of the object to be retrieved, you can specify it in params with `offset=<first position>`. The first position is specified starting from 0. The following example returns up to 10 objects, starting at position 11.

```
[result = /.find(offset=10, limit=10)]
```

Even if the specified first position is larger than the actual number of objects, no error will occur, resulting in an empty list.

New in version 1.6.6post1: `Parent_object` can now be specified in object attribute filtering. `Description` and `parent_object` attributes can now be specified in `order_by`.

Changed in version 1.6.8: Changed the result of `find()` method to `LazyArray` type.

Changed in version 1.6.9.post4: The `find()` method can now specify multiple sort orders by field value.

Changed in version 1.6.10: An error occurs when `order_by` is specified for a field of type Password / Array<T> / Dictionary<T> that does not support sorting in the `find()` method.

Directory.glob(pattern) : *LazyArray<Object>*

Returns search results for objects under the directory that match the filtering criteria specified in `pattern`. To filter by patterns of the objects, you can specify as shown below.

```
"<object name>"
```

For example, you can filter objects that contain `kompira` in the path.

```
[result = /.glob("kompira*")]
```

In addition to the object name, it is possible to specify the following elements.

- Path
- Object
- Owner
- Attribute filtering
- Field value filtering

If a path is specified, the object under that path is returned. The pattern is described in the following format.

```
"<path>/<object name>"
```

You can specify `/*` and `/**` as the path. Each matches a single-tiered directory and a directory of any depth.

For example, if you want to get a list of objects whose name begin with `kompira` and that contain `user` in path, specified as shown below.

```
[result = /.glob("/**/user/**/kompira*")]
```

If a type object is specified, the object whose type is specified type object is returned. The pattern is described in the following format.

```
"<object name>.<type object>"
```

For example, if you want to get a list of jobflows, specified as shown below.

```
[result = /.glob("*.Jobflow")]
```

If a owner is specified, the owner's object is returned. The pattern is described in the following format.

```
"<object name>@<owner>"
```

For example, if you want to get a list of root's objects, specified as shown below.

```
[result = /.glob("*@root")]
```

If a attribute filtering is specified, matched object is returned. The pattern is described in the following format.

```
"<object name>(<attribute name>=<value>)" or "<object name>(<attribute name>_  
↪<lookup>=<value>)"
```

Refer to the `find` method for a list of lookups that can be specified for attribute values.

For example, if you want to get a list object whose display name contains `kompira`, specified as shown below.

```
[result = /.glob("(display_name__contains='kompira')")]
```

If a field value filtering is specified, matched object is returned. The pattern is described in the following format.

```
"<object name>[<field name>=<value>]" or "<object name>[<field name>_  
↪<lookup>=<value>]"
```

Refer to the find method for a list of lookups that can be specified for field values.

For example, if you want to get a list of jobflows that contain `urlopen` in its source code, specified as shown below.

```
[result = /.glob("[source__contains='urlopen']")]
```

These can also be specified in combination. The pattern when all specified is as follows.

```
"<path>/<object name>.<type object>@<owner>(<attribute filtering>)[<field value_<br/>↪filtering>]"
```

For example, if you want to get a list of object like below, specified as shown below.

- Objects under `/user/app`
- It owned by `root`.
- Its name starts with `Kompira`.
- Jobflow
- <Its display name contains *Kompira*.
- Its multiplicity is 1 or less.

```
[result =  
/.glob("/user/app/**/kompira*.Jobflow  
@root(display_name__contains='kompira')[multiplicity__lt=1]")]
```

Changed in version 1.6.8: Changed the result of `glob()` method to `LazyArray` type.

5.3.3 License

`License type` defines objects that manage Kompira's license file.

Field

A unique field is not defined for the license type.

Method

There are no specific methods defined for the license type.

Properties

The license type object provides the following properties.

`License.node_count` : *Integer*

The number of nodes currently in use.

5.3.4 Virtual Object (Virtual)

Virtual object type specifies an implementation module for defining special objects of Kompira, such as processes and incidents.

Field

In the virtual object type, the following fields are defined:

Virtual.virtual : *String*

- Display name: Implementation module

Specifies the path of the Python implementation module of the special object.

Method

Methods specific to virtual object types are not specifically defined.

5.3.5 Job flow (Jobflow)

The **job flow type** specifies the type of job flow object.

Field

In the job flow type, the following fields are defined.

Jobflow.source : *LargeText*

- Display name: Source

The source code string of the job flow.

Jobflow.code : *LargeText*

- Display name: Code
- Invisible field

The intermediate code character string, as the result of compiling the source of the job flow, is stored. It can not be edited from the browser.

Jobflow.parameters : *Dictionary*

- Display name: Parameters
- Invisible field

The intermediate code character string, resulting from compiling the default value of the parameters of the job flow, is stored as a parameter dictionary. Since it is invisible, it can not be edited from the browser.

Jobflow.executable : *Boolean*

- Display name: Executable
- Invisible field

If the job flow can be executed, it is true. If the job flow can not be executed because of a compile error or the like, false is stored. It can not be edited from the browser.

`Jobflow.errors` : *Dictionary*

- Display name: Errors
- Invisible field

An error message at compile time is stored in a dictionary with the line number of the corresponding source code as a key. It can not be edited from the browser.

`Jobflow.compilerVersion` : *String*

- Display name: Compiler version
- Invisible field

Contains the version string of the compiler used to compile the job flow. It can not be edited from the browser.

`Jobflow.multiplicity` : *Integer*

- Display name: Multiplicity

Sets the multiplicity of the job flow. If a job flow process that exceeds the number of multiplicity invokes this job flow at the same time, that process is kept waiting until another process completes this job flow call. If the multiplicity is set to a value less than or equal to 0, the multiplicity is interpreted as unlimited.

`Jobflow.defaultCheckpointMode` : *Boolean*

- Display name: Default Checkpoint mode

Specifies the default checkpoint mode for the job flow.

`Jobflow.defaultMonitoringMode` : *Enum*

- Display name: Default Monitoring mode
- Enum choices: "NOTHING" | "MAIL" | "ABORT_MAIL"

Specifies the default monitoring mode of the job flow.

`Jobflow.compiledDatetime` : *Datetime*

- Display name: Compiled Datetime
- Invisible field

The compiled datetime of the job flow is stored. It can not be edited from the browser.

Note: If you call a job flow with multiplicity specified, the job flow process acquires the lock. When returning from the job flow call or the job flow ends, the lock is released. Locks can be acquired recursively. Therefore, even if recursively calling a job flow with specified multiplicity, execution of that process will not block.

Multiplicity When another job flow is called at the end in the specified job flow, the acquired lock is released.

Method

Methods specific to the job flow type are not specifically defined.

5.3.6 Channel (Channel)

Channel type specifies the type of channel object. Using channel objects, it is possible to synchronously send and receive messages between different job flow processes.

By specifying an action, you can specify what to do when a message is received.

Field

In the channel type, the following fields are defined.

`Channel.message_queue` : **Array<Binary>**

- Display name: Message queue
- Invisible field

The queue in which messages sent to the channel are stored. It can not be edited from the browser.

`Channel.event_queue` : **Array<Binary>**

- Display name: Event queue
- Invisible field

A queue that stores events waiting to receive messages on a channel. It can not be edited from the browser.

`Channel.action_type` : **Enum**

- Display name: Action type
- Enum choices: "NoAction" | "ExecuteJobflow"
- Default value: "NoAction"

Specifies the type of action to take when the channel receives a message.

Action type	Action behavior
NoAction	Nothing as an action.
ExecuteJobflow	Execute the job flow specified in the action target.

`Channel.action_target` : **Object**

- Display name: Action target
- Choices by object: Depends on the field action_type

Specify the action target to be processed according to the action type. If the action type is ExecuteJobflow, it specifies a job flow to be executed. The job flow is executed with the owner of the channel object as the user, passing the received message as the first parameter.

Warning: The job flow specified when the action type is ExecuteJobflow must have at least one parameter, and if there is a second or subsequent parameter, a default value definition is required.

Changed in version 1.6.6: The fields `action_type` and `action_target` have been added.

Method

The channel type has the following methods defined.

Channel.send(*message*)

Sends the message, 'message' to the channel.

Channel.pop_message(*index=0*) : any

Retrieves a message of the specified index (or first if omitted) from the channel's message queue. The retrieved message is deleted from the message queue.

If a negative value is specified for the index, the position from the end is specified. If an index at which no message exists is specified, a runtime error occurs (unlike an event job, it does not wait for receipt of a message).

Channel.peek_message(*index=0*) : Array

References a message of the specified index (or first if omitted) from the channel's message queue. The referenced message is not deleted from the message queue but remains.

The result is a list, where the first element contains the ID of the referenced message and the second element contains the referenced message itself. This is the same structure as the result when `peek_mode=true` is specified in *Event jobs*.

If a negative value is specified for the index, the position from the end is specified. If an index at which no message exists is specified, a runtime error occurs (unlike an event job, it does not wait for receipt of a message).

The message ID is an ID that identifies a separate message for each channel and is used in the `delete_message()` method described below. Note that the message ID is not system unique, since the same message ID may be used for different channel objects.

Channel.delete_message(msgid*)**

Deletes the message corresponding to the specified message ID from the channel's message queue. Multiple message IDs can be specified.

If a message ID that does not exist is specified, a runtime error occurs.

Channel.clear_messages()

Empties the channel's message queue.

Changed in version 1.6.7: New methods `pop_message`, `peek_message`, `delete_message` and `clear_messages` have been added.

Properties

The channel type object provides the following properties.

Channel.message_count : Integer

Indicates the number of messages accumulated in the message queue.

Channel.event_count : Integer

Indicates the number of events accumulated in the event queue.

5.3.7 Wiki page (Wiki)

The **Wiki page type** specifies the type of wiki page object. Kompira's Wiki page object supports Wiki Creole / Markdown / Textile notation.

Field

In the Wiki page type, the following fields are defined.

Wiki.**wikitext** : *LargeText*

- Display name: Wiki text

Stores the text of the wiki page.

Wiki.**style** : *Enum*

- Display name: Wiki style
- Enum choices: "Creole" | "Markdown" | "Textile"
- Default value: "Creole"

Select wiki page notation from Creole, Markdown and/or Textile.

Method

Methods specific to Wiki page type are not specifically defined.

5.3.8 ScriptJob

The **script job type** specifies the type of script job object.

Field

In the script job type, the following fields are defined.

ScriptJob.**source** : *LargeText*

- Display name: Source

Stores the source text of the script.

ScriptJob.**ext** : *String*

- Display name: Extension

Sets the extension of the script. When executing a script on a Windows server, you need to set the extension of the script appropriately.

ScriptJob.**multiplicity** : *Integer*

- Display name: Multiplicity

Sets the multiplicity of the script job. If a job flow process that exceeds the number of multiplicity invokes this script job at the same time, that process will wait until another process completes this script job invocation. If the multiplicity is set to a value less than or equal to 0, the multiplicity is interpreted as unlimited.

Method

Methods specific to script job types are not specifically defined.

5.3.9 Environment Variables (Environment)

The *environment variable type* specifies the type of the environment variable object. If an environment variable object is specified in the environment variable section of the user's configuration, when the user executes the job flow, an environment variable dictionary is stored in \$ENV so that each value in the dictionary can be referenced from the job flow.

Field

For environment variable type, the following fields are defined.

`Environment.environment` : *Dictionary*

- Display name: Environment

Stores the environment variable dictionary.

Method

Methods specific to environment variable types are not specifically defined.

5.3.10 Template

The *template type* specifies the type of the template object.

Field

In the template type, the following fields are defined.

`Template.template` : *LargeText*

- Display name: Template

Stores the template string.

Method

Methods specific to template type are not specifically defined.

Deprecated since version 1.4.7: Changed since version 1.4.7: Please use text type object instead.

5.3.11 Table

Table type specifies the type of table object. A table object, like a directory object, can have multiple child objects. However, the type of the child object is fixed.

Field

For table type, the following fields are defined.

Table.typeObject : *Object*

- Display name: Type object
- Choices by object: TypeObject
- No empty field

Specifies the type of the child object to be stored in this table.

Table.relatedObject : *Object*

- Display name: Related object
- Choices by object: Jobflow | Form

Specifies the job flow and form that can be executed from the menu of this table. You can now run job flows and forms on selected objects from the table list. In the case of job flow execution, the selected object list is passed to the first parameter of the job flow. For form execution, the object list selected is passed to the objects parameter.

Table.displayList : *Array*

- Display name: Display fields

Specifies an array of field names of child objects to be displayed in the view of the table.

Table.orderBy : *String*

- Display name: Sort order

Specifies the order in which objects are displayed in this table.

Table.pageSize : *Integer*

- Display name: Page size
- Minimum value: 10
- Maximum value: 1000
- Default value: 25

Specifies the number of objects to be displayed in this table.

Method

The table type method is the same as the *Method* provided by the directory type. However, the `type_obj` parameter can be omitted in the add method, and the find method does not require the type object to be identified.

Table.add(*name* [, *type_obj*, *data*, *overwrite*]) : *Object*

Adds a Kompira object of the type specified in the object type field of the table with the name specified by name under the table. Dictionary type data can be passed to data, so that you can initialize the field value of the object. If you pass true to the overwrite argument, even if an object of the same name exists under the table, it does not cause an error and updates the object.

Table.find(*params*) : *LazyArray<Object>*

Returns search results for objects under the table that match the filtering criteria specified in params. Basically, it is the same as the *Directory.find()* method, but it does not require the `type_object` attribute filtering to identify the type object, even when filtering by field value or sorting by field value is specified.

Changed in version 1.6.8: Changed the result of find() method to LazyArray type.

5.3.12 Management Area (Realm)

The *management area type* specifies the type of management area object. By defining the management area objects, you can manage managed networks separately for each job manager.

Field

In the management area type, the following fields are defined.

Realm.range : *Array*

- Display name: Range

Specifies the target range of the network address that this management area has jurisdiction.

Realm.disabled : *Boolean*

- Display name: Disabled

If this value is set to true, the management area setting is invalidated.

Method

Methods specific to the controlling area type are not specifically defined.

5.3.13 AttachedFile

Attachment type specifies the type of attachment object.

Field

In the attached file type, the following fields are defined.

`AttachedFile.attached1` : *File*

- Display name: Attached file 1

The field containing the first attachment object.

`AttachedFile.attached2` : *File*

- Display name: Attached file 2

The field where the second attachment object is stored.

`AttachedFile.attached3` : *File*

- Display name: Attached file 3

The third attachment object field is stored.

Method

Methods specific to attachment type are not specifically defined.

5.3.14 Node information (NodeInfo)

Node information type specifies the type of node information object. By specifying the node information object as the `__node__` control variable in the job flow, you can specify the target node to execute the command.

Field

In the node information type, the following fields are defined.

`NodeInfo.nodetype` : *Object*

- Display name: Node type
- Choices by object: NodeType

Select the type of node defined in Kompira.

`NodeInfo.conntype` : *Enum*

- Display name: Connection type
- Enum choices: Depends on the field `NodeType.conntypes` of the object selected in field `nodetype`

Select the connection type of the node. The connection type that can be specified will change depending on the node type selected above. See *Node setting* for details.

`NodeInfo.hostname` : *String*

- Display name: Hostname

Specifies the host name of the node.

`NodeInfo.ipaddr` : *IPAddress*

- Display name: IP address

Specifies the IP address of the node.

`NodeInfo.port` : *Integer*

- Display name: Port number
- Minimum value: 0
- Maximum value: 65535

Specifies the port number of the node. If not specified, the default port number corresponding to the connection type is used.

`NodeInfo.shell` : *String*

- Display name: Shell

Specifies the shell to be used for remote connection. If not specified, `/bin/bash` is used as the default.

`NodeInfo.use_shell` : *Boolean*

- Display name: Use shell
- Default value: false

Set to false if you do not want to use the shell when connecting remotely. When connecting to a device that does not have a shell, such as network equipment, it is a good idea to set it to false. The default is false.

`NodeInfo.proxy` : *Object*

- Display name: Proxy
- Choices by object: `NodeInfo`

When connecting via SSH via a steppingstone server, specify the node information object to be the platform server. It is used only when connecting with SSH.

`NodeInfo.account` : *Object*

- Display name: Account
- Choices by object: `AccountInfo`

Specifies account information to be used for remote connection. If explicitly specifying the `__account__` control variable of the job flow, that will take precedence.

New in version 1.6.4: The node type field has been added.

Changed in version 1.6.4: The connection type field now switches between different options depending on the node type.

Method

Methods specific to node information type are not specifically defined.

5.3.15 Account information (AccountInfo)

Account information type specifies the type of account information object. By setting the account information object to the `__account__` control variable in the job flow, you can specify account information to be used for remote connection.

Field

In the account information type, the following fields are defined.

AccountInfo.user : *String*

- Display name: Username

Sets the user name of the account.

AccountInfo.password : *Password*

- Display name: Password

Sets the password for the account. If an SSH key file with passphrase is set, it is also used as a passphrase.

AccountInfo.keyfile : *File*

- Display name: SSH key file

When logging in using the SSH key file, attach the key file.

AccountInfo.passphrase : *Password*

- Display name: SSH key passphrase

This is the passphrase you specify for SSH keys with passphrase. If you do not have a passphrase or if it is the same as a password, you can omit it.

Method

Methods specific to account information type are not specifically defined.

5.3.16 Repository (Repository)

The *repository type* specifies the type of repository object. Using the repository object, you can link with an external VCS repository, you can synchronize data such as pushing data of Kompira's directory to repository, or pull data on repository to the Kompira directory.

Field

In the repository type, the following fields are defined.

Repository.url : *URL*

- Display name: URL

Sets the URL of the repository to be synchronized.

Repository.repositoryType : *Enum*

- Display name: Repository type
- Enum choices: "git" | "mercurial"

Specify the repository type. In the current version, only 'git' and 'mercurial' are supported. The default is 'git'.

Repository.port : *Integer*

- Display name: Port number
- Minimum value: 0
- Maximum value: 65535

Specifies the port number to connect to the external repository. If not specified, the default port number is used.

Repository.username : *String*

- Display name: Username

Specify the user name when connecting to the repository.

Repository.password : *Password*

- Display name: Password

Specify the password when connecting to the repository.

Repository.directory : *Object*

- Display name: Directory
- Choices by object: Directory

Specify the Kompira directory to be synchronized.

Repository.updateConfig : *Boolean*

- Display name: Update config data

When pulling object data from an external repository, the configuration data of Config type objects are also overwritten.

Repository.log : *LargeText*

- Display name: Log
- Invisible field

The log at the time of synchronous execution is stored.

New in version 1.6.7: The field updateConfig has been added.

Method

Methods specific to repository types are not specifically defined.

5.3.17 Mail channel (MailChannel)

Mail channel type specifies the type of mail channel object that imports mail from IMAP4 / POP3 server into the channel.

When a job flow is waiting to receive mail from the mail channel, or when an action with some action is set for the mail channel, the mail channel starts polling to receive mail from the configured IMAP4/POP3 server.

When mail is received from the IMAP4/POP3 server during polling, the following action is taken.

- If there is more than one job flow waiting for the mail channel, the received mail is passed to the job flow that has been waiting the longest and that job flow continues processing.
- If the above does not apply and an action has been set for the mail channel, the action will be initiated based on the received mail.
- If none of the above apply when the mail is received, the received mail is stored in the message queue of the mail channel.

The target mail to receive (all mails or unread mails) and whether to delete the received mail can be specified in the receive mode.

If there is no target mail to be received in the mailbox, mail is fetched again from the IMAP4/POP3 server after the time set in `checkInterval` has elapsed. However, if there is no job flow waiting for the mail channel and no action is set for the mail channel, the polling process for receiving mail is suspended.

Field

In the mail channel type, the following fields are defined.

MailChannel.message_queue : *Array<Binary>*

- Display name: Message queue
- Invisible field

The queue in which the message sent to the mail channel is stored. It can not be edited from the browser.

MailChannel.event_queue : *Array<Binary>*

- Display name: Event queue
- Invisible field

A queue that stores events waiting to receive messages on the mail channel. It can not be edited from the browser.

MailChannel.serverName : *String*

- Display name: Server name

Specifies the host name of the IMAP4/POP3 server. If set to empty, it will be treated as localhost.

MailChannel.protocol : *Enum*

- Display name: Protocol
- Enum choices: "IMAP4" | "POP3"

- Default value: "IMAP4"

Sets IMAP 4 or POP 3 as the mail reception protocol.

MailChannel.SSL : *Boolean*

- Display name: SSL

Set to true to communicate via SSL.

MailChannel.port : *Integer*

- Display name: Port number
- Minimum value: 0
- Maximum value: 65535

Set the port number of the IMAP server. If not specified, the default port number is used.

MailChannel.username : *String*

- Display name: Username

Set the user name to connect to the IMAP4 / POP3 server.

MailChannel.password : *Password*

- Display name: Password

Set the password for connecting to the IMAP4 / POP3 server.

MailChannel.timeout : *Integer*

- Display name: Timeout
- Minimum value: 0
- Default value: 60

Specify the connection timeout for IMAP4 / POP3 server in seconds. The default is 60 seconds. When it is empty or set to 0, it becomes the default value. Negative values are not allowed.

MailChannel.use_oauth2 : *Boolean*

- Display name: Use OAuth2

Check this box if you wish to authenticate using OAuth2. In this case, a password is not required.

MailChannel.oauth2_provider : *Object*

- Display name: OAuth2 provider
- Choices by object: OAuth2Provider

Select the OAuth2 service provider; required if OAuth2 authentication is used.

MailChannel.refresh_token : *Password*

- Display name: Refresh token
- Invisible field

Stores the refresh token obtained through OAuth2 authentication. It is a hidden field and cannot be edited from the browser.

`MailChannel.access_token` : *Password*

- Display name: Access token
- Invisible field

Stores the access token obtained through OAuth2 authentication. It is a hidden field and cannot be edited from the browser.

`MailChannel.token_expires_at` : *Datetime*

- Display name: Token expires at
- Invisible field

Stores expiration date of the access token obtained through OAuth2 authentication. It is a hidden field and cannot be edited from the browser.

`MailChannel.mailbox` : *String*

- Display name: Mailbox
- Default value: "INBOX"

Set up the mailbox to receive. The default is "INBOX". For the POP3 protocol, mailbox settings are ignored.

Warning: You can not set the Japanese mailbox name.

`MailChannel.receive_mode` : *Enum*

- Display name: Receive mode
- Enum choices: Depends on the field protocol

Specifies the behavior of the mail channel when it receives mail.

Receive Mode	Behavior when receiving mail
ReceiveAllAndDelete	Receive all mail, and delete received mail.
ReceiveUnseenAndSetSeen	Receive unread mail, and mark received mail as read.

The default receive mode is ReceiveAllAndDelete.

Warning: ReceiveUnseenAndSetSeen cannot be specified when the protocol is POP3.

`MailChannel.checkInterval` : *Integer*

- Display name: Interval
- Minimum value: 0
- Default value: 10

Specify the interval for checking new messages for IMAP4 / POP3 server in minutes. The default is 10 minutes. When 0 is specified, it becomes the default value. Negative values are not allowed.

`MailChannel.action_type` : *Enum*

- Display name: Action type
- Enum choices: "NoAction" | "ExecuteJobflow"

- Default value: "NoAction"

Specifies the type of action to take when the mail channel receives a message.

Action type	Action behavior
NoAction	Nothing as an action.
ExecuteJobflow	Execute the job flow specified in the action target.

MailChannel.action_target : *Object*

- Display name: Action target
- Choices by object: Depends on the field action_type

Specify the action target to be processed according to the action type. If the action type is ExecuteJobflow, it specifies a job flow to be executed. The job flow is executed with the owner of the mail channel object as the user, passing the received message as the first parameter.

Warning: The job flow specified when the action type is ExecuteJobflow must have at least one parameter, and if there is a second or subsequent parameter, a default value definition is required.

MailChannel.log : *LargeText*

- Display name: Log
- Invisible field

Connection log of IMAP4 / POP3 server is stored.

MailChannel.logSize : *Integer*

- Display name: Log size
- Default value: 65536

Specify the maximum size of the log. If it exceeds the maximum size, it will be deleted from the old log message.

MailChannel.disabled : *Boolean*

- Display name: Disabled
- Default value: true

Disable the connection to IMAP4 / POP3 server.

Changed in version 1.6.6: Negative values for timeout and checkInterval are no longer allowed. The fields use_oauth2, oauth2_service_provider, refresh_token, access_token, and token_expires_at have been added. The field receive_mode have been added. The fields action_type and action_target have been added. The order of some fields has been changed.

Method

The mail channel type has the following methods defined.

`MailChannel.conn_check()`

Test the connection to the configured IMAP4/POP3 server (including authentication with user name and password, and mailbox confirmation). If the connection is successful, `$STATUS` is set to 0. If it fails, `$STATUS` is set to 1 and a string indicating the reason for the failure is set to `$ERROR`. The connection test is performed even when the disabled flag is set.

New in version 1.6.6: A `conn_check` method has been newly added.

5.3.18 Form

The `form` type specifies the type of the form object that provides a view of the user input form. The items of the input form can be freely defined by the user.

When the user submits the form, the information entered in the form is submitted as dictionary type data to the specified submission object. If the submitted object is a channel type, the data is placed in the message queue of that channel object. If the submitted object is a job flow, the dictionary data is expanded to the parameters of the job flow and execution starts.

Field

`Form.submitObject` : *Object*

- Display name: Submit object
- Choices by object: Jobflow | Channel
- No empty field

Specify the object to submit the data entered in the form.

`Form.fieldNames` : *Array*

- Display name: Field names

Specify the list of field names of the input form as an array. The rules for strings that can be used in field names are the same as the job flow language identifier.

`Form.fieldDisplayNames` : *Array*

- Display name: Field display names

Specify the list of field display names of the input form as an array. An arbitrary character string can be used for the field display name. The order of array elements must correspond to the columns of field names.

`Form.fieldTypes` : *Array*

- Display name: Field types

Specify the list of field types of the input form as an array. The order of array elements must correspond to the columns of field names.

Method

Methods specific to form types are not specifically defined.

5.3.19 Settings (Config)

The **configuration type** specifies the type of configuration object that provides a view of the configuration form. The items of the setting form can be freely defined by the user.

When the user saves the setting form, the information entered in the form is saved in the data property of the setting object as dictionary type data.

Note: To change the configuration information of a configuration object (the data property), you must have executable privileges for the object.

Field

Config.**fieldNames** : *Array*

- Display name: Field names

Specify the list of field names of the setting form as an array. The rules for strings that can be used in field names are the same as the job flow language identifier.

Config.**fieldDisplayNames** : *Array*

- Display name: Field display names

Specify the list of field display names of the setting form as an array. An arbitrary character string can be used for the field display name. The order of array elements must correspond to the columns of field names.

Config.**fieldTypes** : *Array*

- Display name: Field types

Specify the list of field types of the setting form as an array. The order of array elements must correspond to the columns of field names.

Properties

Configuration type objects provide the following properties.

Config.**data** : *Dictionary*

The value of the data dictionary entered in the setting form.

Method

Methods specific to configuration type are not specifically defined.

5.3.20 Library

The `library` type defines a library implemented in Python that can be called from the job flow.

Field

`Library.libraryType` : *Enum*

- Display name: Library type
- Enum choices: "source" | "safe_source" | "module"
- Default value: "source"

Specify how to define the library. If 'source' is selected, the string stored in the source text will be loaded as a Python module program. When 'safe_source' is selected, the string stored in the source text is loaded as a safe Python module program. If 'module' is selected, the character string specified in the module path is loaded as a module under `kompira.library` in the Kompira package. The default value is 'source'. This field can not be edited from the browser.

`Library.modulePath` : *String*

- Display name: Module path

Specify the module path of the Python library to be loaded. The field used when `libraryType` is 'module'. This field can not be edited from the browser.

`Library.sourceText` : *LargeText*

- Display name: Source text

Write Python source code.

`Library.document` : *LargeText*

- Display name: Document
- Invisible field

The document character string of Python module is stored. Error messages are stored at load error. This field can not be edited from the browser.

`Library.executable` : *Boolean*

- Display name: Executable
- Invisible field

It is true if the Python module is loaded correctly and can be called from the job flow. If loading fails, it is false. This field can not be edited from the browser.

Method

Methods specific to configuration type are not specifically defined.

Invocation example

For library objects, you can call the defined Python functions from the job flow. For example, define a `test_lib` object with the following Python program as source text.

Python Program

```
def split(s):
    return s.split()

def hello():
    print('Hello, world!')
```

The job flow calling the function defined in this library is as follows.

```
[str = 'foo bar baz']
-> [result = ./test_lib.split(s)]
-> [./test_lib.hello]
```

When the above job flow is executed, the result variable stores the list ['foo', 'bar', 'baz'] of split results. Also, "Hello, world!" Is output to the console of the job flow process.

Warning: When using property names (*Properties*) and method names (*Method*), which are pre-built in Kompira objects such as `display_name`, `update`, and `delete`, in Python function names defined in library objects they cannot be called the same thing.

5.3.21 MailTemplate

The `mail template` type specifies the type of the mail template object.

Field

In the mail template type, the following fields are defined.

`MailTemplate.subject` : *String*

- Display name: Subject

Stores the template character string that is the subject of the mail.

`MailTemplate.body` : *LargeText*

- Display name: Body

Stores the template character string that is the body of the mail.

Method

Methods specific to the mail template type are not specifically defined.

5.3.22 Text

Text type specifies the type of text object that holds plain text or HTML text.

The text object can display the render view rendered by the template engine by accessing `http://<Kompira server>/<text object>.render` from the browser.

Note: Jinja 2 is used for the template engine. For the notation of templates, see the [Jinja 2 document](#).

Templates can be imported and inherited by specifying the path of another text object with the ‘include’ and ‘extends’ tags.

Field

For text type, the following fields are defined.

Text.text : *LargeText*

- Display name: Text

Stores a text string.

Text.ext : *String*

- Display name: Extension

Specify extension for browser access to display render view. For example, if you specify “html” as the extension, you will see a render view when accessing `http://<Kompira server>/<text object path>.html` and `http://<Kompira server>/<text object path>` To access the normal view.

Note: `update`, `delete`, `rename`, and `property` cannot be set as an extension.

Text.contentType : *String*

- Display name: Content type

Specify the content type of the text. If the content type specification is omitted, the content type is guessed from the extension. Also, if you omit specifying the extension and specify only the content type, the render view is displayed instead of the normal view even if the browser is accessed without the extension.

Text.context : *Object*

- Display name: Context
- Choices by object: Environment

Specify the environment variable object as the context to pass to the template. From the template you can refer to the key value of the environment variable as a variable.

Method

The following methods are defined for the text type.

`Text.render()` : *String*

Gets the text rendered by the template engine.

Properties

The text type object provides the following properties.

`Text.content_type` : *String*

Indicates the estimated content type.

New in version 1.4.7: A new text type has been added.

5.3.23 SystemInfo

System information type defines objects that provide Kompira's system information.

Field

A unique field is not defined for the system information type.

Method

No specific method is defined for system information type.

Properties

The system information type object provides the following properties.

`SystemInfo.engine_started` : *Datetime*

Kompira Indicates the start date and time of the engine.

`SystemInfo.server_datetime` : *Datetime*

Indicates the current date and time of the Kompira server.

`SystemInfo.version` : *String*

Indicates the version number of Kompira.

New in version 1.4.8.post2: A new system information type has been added.

5.3.24 NodeType

The `NodeType` defines the connection peer information that Kompira can use for remote jobs. The `NodeType` type object you create will be displayed as one of the choices for the `nodetype` field in the `NodeInfo` type object edit screen. The `NodeType` type objects supported by Kompira are defined in `/system/nodetypes`.

Field

`NodeType.conntypes` : *Dictionary*

- Display name: Connection types

This node type defines the corresponding connection type. The connection type field of the node information object displays choices based on this field.

Method

There are no specific methods defined for the `NodeType` type.

New in version 1.6.4: A new `NodeType` type has been added.

5.3.25 CustomStyle

`CustomStyle` type defines the type of the custom style object that sets the color scheme and other settings for the screen displayed in the browser.

Field

`CustomStyle.mainBackColor` : *String*

- Display name: Main background color

Set the background color for areas other than the menu bar.

`CustomStyle.menuBarBackColor` : *String*

- Display name: Menu bar background color

Set the background color of the menu bar area.

`CustomStyle.menuBarTextColor` : *String*

- Display name: Menu bar text color

Set the text color of the menu bar area. The text will be slightly darker when the mouse is not hovering over it.

`CustomStyle.invertMode` : *Boolean*

- Display name: Invert mode

When checked, the entire screen, including the menu bar, is inverted.

Note: For color information such as background and text color, you can specify Web Colors as strings. You can specify `#000000`, `rgb(255,255,255)`, `blue`, and so on.

Method

No specific method is defined for CustomStyle type.

New in version 1.6.6: A new CustomStyle type has been added.

5.3.26 OAuth2Provider

`OAuth2Provider` type defines the service provider configuration information used for OAuth2 authentication. To use OAuth2 authentication, you must register Kompira as an application with the service provider in advance and create an OAuth2 service provider type object based on the registration information.

Field

`OAuth2Provider.client_id` : *String*

- Display name: Client ID

Stores the client ID of the application registered with the service provider.

`OAuth2Provider.client_secret` : *Password*

- Display name: Client secret

Stores the client secret of the application registered with the service provider.

`OAuth2Provider.auth_endpoint` : *URL*

- Display name: Authorization endpoint

Specifies the service provider's authentication endpoint.

`OAuth2Provider.token_endpoint` : *URL*

- Display name: Token endpoint

Specifies the token endpoint of the service provider.

`OAuth2Provider.scope` : *Array*

- Display name: Scope

Specify the scopes of sending and receiving mail to allow access from Kompira. Scope names are defined uniquely for each service provider, so please refer to the service provider's documentation to specify the scope name required for sending and receiving mail.

`OAuth2Provider.redirect_url` : *URL*

- Display name: Redirect URL

Specify the URL to redirect to after the approval flow is completed. If empty, you will be redirected to your own Kompira server.

Method

There are no specific methods defined for the OAuth2Provider type.

New in version 1.6.6: OAuth2Provider type is newly added.

5.3.27 SmtplibServer

The **SMTP server type** defines the SMTP server configuration information available when sending mail from Kompira. The created SMTP server type object can be passed to the `smtp_server` parameter of the `mailto` built-in job to specify the SMTP server to be used when sending mail from the job flow.

Field

`SmtplibServer.hostname` : *String*

- Display name: Host name

Specifies the host name of the SMTP server. If set to empty, it will be treated as localhost.

`SmtplibServer.port` : *Integer*

- Display name: Port number
- Minimum value: 0
- Maximum value: 65535

Specifies the connection port number for the SMTP server. If set to empty, the connection is normally made on port 25, port 587 for TLS connections, or port 465 for SSL (SMTPS) connections.

`SmtplibServer.username` : *String*

- Display name: User name

If authentication is required for SMTP server connections, set the user name.

`SmtplibServer.password` : *Password*

- Display name: Password

If authentication is required for SMTP server connections, set a password.

`SmtplibServer.timeout` : *Integer*

- Display name: Timeout
- Minimum value: 0
- Default value: 60

Specifies the connection timeout to the SMTP server in seconds. An empty or 0 setting is the system's default timeout for TCP/IP connections. The default is 60 seconds. Negative values are not allowed.

`SmtplibServer.use_tls` : *Boolean*

- Display name: Use TLS

Check this box if you want to connect to the SMTP server using TLS.

`SmtplibServer.use_ssl` : *Boolean*

- Display name: Use SSL

Check this box if you wish to connect to the SMTP server using SSL (SMTPS). Cannot be used with TLS at the same time.

`SmtplibServer.use_oauth2` : *Boolean*

- Display name: Use OAuth2

Check this box if you wish to authenticate using OAuth2. In this case, a password is not required.

`SmtplibServer.oauth2_provider` : *Object*

- Display name: OAuth2 provider
- Choices by object: OAuth2Provider

Select the OAuth2 service provider; required if OAuth2 authentication is used.

`SmtplibServer.refresh_token` : *Password*

- Display name: Refresh token
- Invisible field

Stores the refresh token obtained through OAuth2 authentication. It is a hidden field and cannot be edited from the browser.

`SmtplibServer.access_token` : *Password*

- Display name: Access token
- Invisible field

Stores the access token obtained through OAuth2 authentication. It is a hidden field and cannot be edited from the browser.

`SmtplibServer.token_expires_at` : *Datetime*

- Display name: Token expires at
- Invisible field

Stores expiration date of the access token obtained through OAuth2 authentication. It is a hidden field and cannot be edited from the browser.

Method

`SmtplibServer.conn_check()`

Test the connection to the configured SMTP server. If the connection is successful, `$STATUS` is set to 0. If it fails, `$STATUS` is set to 1 and a string indicating the reason for the failure is set to `$ERROR`. If either the user name or password setting is empty, the connection to the SMTP server will be checked, but the user authentication will not be checked. This may cause an error when sending mail on SMTP servers that require a login.

New in version 1.6.6: SmtplibServer type is newly added.

5.3.28 LdapServer

LdapServer type defines the LDAP server configuration information used for LDAP federation of Kompira login accounts.

Field

LdapServer.server_url : *URL*

- Display name: Server URL
- Other field qualifier: {"schemes": ["ldap", "ldaps"]}

Specifies the connection URL to the LDAP server; either ldap or ldaps can be specified as the URL scheme.

LdapServer.timeout : *Integer*

- Display name: Timeout (in seconds)
- Default value: 10

Specifies the connection timeout to the LDAP server in seconds. If empty or set to -1, the system TCP connection timeout is used.

LdapServer.use_starttls : *Boolean*

- Display name: Use STARTTLS

Set if STARTTLS is used to connect to the LDAP server; this setting is ignored when connecting with ldaps.

LdapServer.fallback_login : *Boolean*

- Display name: Fallback Login

Set to allow login with the password of the most recent login in case of LDAP login failure. Note that in this case, even if the user is deleted on the LDAP side, if the user has logged in as an LDAP user once in the past, the user can continue to log in.

LdapServer.session_expiration : *Float*

- Display name: Session Expiration (in hours)
- Minimum value: 0
- Maximum value: 10000000
- Default value: 0

Specifies the session expiration time in hours when logged in as an LDAP user. If set to 0, the session will be discarded when the browser is closed. If empty, the validity period is the system default (2 weeks = 336 hours). The default is 0.

LdapServer.bind_dn : *String*

- Display name: Bind DN

Specifies the bind DN to the LDAP server. If empty, anonymous bindings are used.

LdapServer.bind_password : *Password*

- Display name: Bind Password

Specify the password for binding to the LDAP server.

LdapServer.user_search_dn : *String*

- Display name: User Search DN

Specifies the DN on which the user search will be based.

LdapServer.user_search_scope : *Enum*

- Display name: User Search Scope
- Enum choices: "BASE" | "ONELEVEL" | "SUBTREE"
- Default value: "SUBTREE"

Specify the scope from the base point of the user search among BASE, ONELEVEL, and SUBTREE: BASE for the object itself indicated by the user search DN, ONELEVEL for the object's immediate child objects, and SUBTREE for the object itself and all its descendant SUBTREE targets the object itself and all of its descendant objects.

LdapServer.user_search_attribute : *String*

- Display name: User Search Attribute
- Default value: "name"

Specifies which of the attributes of the object to which the user search will be directed that contain the user name. The attribute specified here will be used when searching for objects with the user name entered at login. Defaults to "name".

LdapServer.target_users : *Array*

- Display name: Target Users

Specify a list of user names to be linked to LDAP. If empty, all users included in the search target will be included.

LdapServer.required_group_dn : *Array*

- Display name: Required Group DN

Specify the DN of the group to which the user to be linked to LDAP belongs. If more than one is specified, the user must belong to one of the groups. If empty, all users included in the search target will be targeted.

LdapServer.group_search_dn : *String*

- Display name: Group Search DN

Specifies the DN on which to base the group search. If empty, LDAP groups are not reflected in Kompira groups.

LdapServer.group_search_scope : *Enum*

- Display name: Group Search Scope
- Enum choices: "BASE" | "ONELEVEL" | "SUBTREE"
- Default value: "SUBTREE"

Specify the scope of the search target from the base point of the group search among BASE, ONELEVEL, and SUBTREE: BASE for the object itself indicated by the user search DN, ONELEVEL for the object's immediate child objects, and SUBTREE for the object itself and all its descendant objects. SUBTREE is the object itself and all its descendant objects.

LdapServer.group_search_class : *String*

- Display name: Group Search Class
- Default value: "group"

Specifies the class (objectClass) to filter from among the objects in the group search. Default is “group”. If empty, all objects are targeted.

`LdapServer.group_type` : *Enum*

- Display name: Group Type
- Enum choices: "PosixGroup" | "GroupOfNames" | "NestedGroupOfNames" | "GroupOfUniqueNames" | "NestedGroupOfUniqueNames" | "ActiveDirectoryGroup" | "NestedActiveDirectoryGroup" | "OrganizationalRoleGroup" | "NestedOrganizationalRoleGroup"

Specifies the type of group to be searched for in the group search. The attribute name used to determine the members of the group will differ depending on the type. If you select a type that begins with *Nested*, the group will be included even if it contains other groups.

`LdapServer.mirror_groups` : *Array*

- Display name: Mirror Groups

Specify the group name that reflects the LDAP group to which the LDAP user belongs to the Kompira group. If empty, all groups will be reflected. If the group object is not registered in Kompira, it will be created automatically.

`LdapServer.user_data_first_name` : *String*

- Display name: User Data (First Name)
- Default value: "givenName"

Specifies the attribute of the LDAP user whose first name is stored if you want the last name of the LDAP user (first name) to be reflected in the Kompira user object.

`LdapServer.user_data_last_name` : *String*

- Display name: User Data (Last Name)
- Default value: "sn"

Specifies the attribute of the LDAP user whose last name is stored if the name (last name) of the LDAP user is to be reflected in the Kompira user object.

`LdapServer.user_data_email` : *String*

- Display name: User Data (Email)
- Default value: "mail"

Specifies the attribute of the LDAP user whose e-mail address is stored, if the e-mail address of the LDAP user is to be reflected in the Kompira user object.

Method

There are no specific methods defined for the `LdapServer` type.

New in version 1.6.8: `LdapServer` type is newly added.

5.4 Special objects

Unlike ordinary objects, special objects are built-in objects that are not specified by Kompira's type object. Each type has its own properties and methods. It does not have a field.

5.4.1 Process

An object representing process information at the time of executing a job flow.

Properties

The fields defined in the process object are as follows.

Process.checkpoint_mode : *Boolean*

True if the process is running in checkpointing mode, false otherwise. It is a writable property.

Process.children : *LazyArray<Process>*

Returns search results that are a list of child processes.

Process.console : *String*

A character string displayed on the console.

Process.current_job : *Object*

Stores job flow object or script job object currently being executed by the process. If you call another job flow from the job flow, the value of current_job is changed.

Process.elapsed_time : *Timedelta*

Represents the elapsed execution time of the process.

Process.error : *any*

The value of \$ERROR at the end of the process is stored.

Process.exit_status : *Integer*

The status code at the end of the process is stored.

Process.finished_time : *Datetime*

The date and time when the process ended.

Process.invoker : *Object*

When a process is started from the object, the corresponding object is stored.

How to invoke a process	Objects recorded in invoker
Startup Jobflow	Startup directory
Jobflow execution from a form.	Form object
Jobflow execution from a table.	Table object
Jobflow execution by channel action.	Channel object
Jobflow execution by mail channel action.	MailChannel object

In cases other than the above, such as when a jobflow is executed directly or invoked from the scheduler, null is stored.

Process.job : *Object*

Represents a job flow or script job object that started the process.

Process.monitoring_mode : *String*

A string representing the monitoring mode of the process. It is a writable property.

String	Monitoring Mode
NOTHING	A mail will not be sent.
MAIL	When the process is finished, a mail will be sent.
ABORT_MAIL	When the process is terminated abnormally (aborted), a mail will be sent.

Process.pid : *Integer*

Process ID.

Process.parent : *Object*

The job flow object of the parent process.

Process.result : *any*

The value of \$RESULT at the end of the process is stored.

Process.schedule : *Schedule*

When a process is started from the scheduler, the corresponding schedule object is stored.

Process.started_time : *Datetime*

The date and time when the process started running.

Process.status : *String*

A string representing the execution state of the process.

String	Execution Status
NEW	New (awaiting start)
READY	Executable
RUNNING	Running
WAITING	Waiting for input/command completion
ABORTED	Abnormal termination
DONE	Finished

Process.step_mode : *Boolean*

Set to true if the process is running in stepping mode, false otherwise. It is a writable property.

Process.suspended : *Boolean*

It is true if the process is suspended, false otherwise.

Process.user : *User*

The process execution user. Only for privileged users, you can change the executing user.

New in version 1.5.0.post1: A new monitoring_mode has been added.

New in version 1.6.6: A new property invoker has been added.

Changed in version 1.6.8: Property children is changed to LazyArray type.

Method

`Process.delete()`

Delete the process object.

5.4.2 Process list (/process)

The process list (/process) is an object that holds a list of process objects and is implemented as a virtual object (Virtual).

It is possible to iterate over each process object in ‘for’ and ‘pfor’ blocks as follows.

```
{ for p in /process |  
  print(p)  
}
```

Method

The following methods are defined in the process list.

`ProcessRoot.find([...params])` : *LazyArray*<*Process*>

Returns search results of processes in the process list that match the filtering criteria specified by params. The params can be used to specify filtering, similar to the *Directory.find()* method.

The attributes and lookup that can be specified are as follows.

Attribute	Specifiable Lookup
job	exact
user	exact
started_time	exact, gt, gte, lt, lte
finished_time	same as above
status	exact
schedule	exact
invoker	exact, isnull
parent	exact
current_job	exact
suspended	exact
lineno	exact, gt, gte, lt, lte
console	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex

New in version 1.6.3: A new find method has been added.

New in version 1.6.6: A new specifiable attribute invoker has been added.

Changed in version 1.6.8: Changed the result of find() method to LazyArray type.

5.4.3 Schedule

The schedule object represents the schedule registered in the scheduler of Kompira.

Properties

Schedule.day : *String*

Represents the day (1 to 31) on which the schedule is to be executed.

Schedule.day_of_week : *String*

Represents the day of the week or weekday number on which the schedule is to be executed. 0 (Monday) - 6 (Sunday), or mon, tue, wed, thu, fri, sat, sun.

Schedule.description : *String*

A character string describing the contents of the schedule is stored.

Schedule.disabled : *Boolean*

This field indicates invalidation of the schedule. It is true if the schedule is invalid, false if it is valid.

Schedule.hour : *String*

Represents the schedule execution (0 to 23).

Schedule.job : *Object*

Stores job flow or script job executed by schedule.

Schedule.minute : *String*

Represents the minute (0 to 59) to execute the schedule.

Schedule.month : *String*

Represents the month (1 to 12) for executing the schedule.

Schedule.name : *String*

A character string representing the name of the schedule.

Schedule.next_run_time : *Datetime*

If the schedule is valid, the date and time of the next execution will be stored. (Read Only)

Schedule.parameters : *Array<String>*

Strings of parameters passed to the job flow and script are allowed.

Schedule.user : *User*

Schedule user.

Schedule.week : *String*

Represents the ISO week number (1 to 53) for executing the schedule.

Schedule.year : *String*

Represents the year (4 digit number) for executing the schedule.

Note: For the fields that specify execution date and time of the above property, Date and time setting field format *Date and time setting field format* can be used.

Method

Schedule.delete()

Delete the schedule object.

5.4.4 Schedule list (/scheduler)

The schedule list (/scheduler) is an object that holds a list of schedule objects and is implemented as a virtual object (Virtual). By using the schedule list in for and pfor blocks, it is possible to process each schedule object iteratively.

Method

The following methods are defined in the schedule list.

SchedulerRoot.add(name, job[, parameters, datetime]) : *Schedule*

In the schedule list, add a schedule that has the name specified by name and executes the job flow or script job specified by job. You can specify as an option a parameter list given when executing job flow or script job as parameters argument. An optional datetime argument can be a date-time type value that indicates the job execution date and time.

SchedulerRoot.find([...params]) : *LazyArray<Schedule>*

Returns search results of schedules in the schedule list that match the filtering criteria specified by params. The params can be used to specify filtering, similar to the *Directory.find()* method.

The attributes and lookup that can be specified are as follows.

Attribute	Specifiable Lookup
name	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
description	same as above
user	exact
job	exact
year	exact, contains
month	exact, contains
day	exact, contains
week	exact, contains
day_of_week	exact, contains
hour	exact, contains
minute	exact, contains
disabled	exact, contains

New in version 1.6.3: A new find method has been added.

Changed in version 1.6.8: Changed the result of find() method to LazyArray type.

5.4.5 User

It is an object representing Kompira's user.

Properties

The properties defined in the user object are as follows.

User.username : *String*

Username

User.first_name : *String*

The user's first name.

User.last_name : *String*

The user's surname.

User.full_name : *String*

The user's full name.

User.mailbox : *String*

Represents an address in the following format.

```
username <email address>
```

User.email : *String*

This is the user's email address. It is a writable property.

User.environment : *Object (Environment)*

Environment variable object. It is a writable property.

User.home_directory : *Object (Directory)*

It is the user's home. It is a writable property.

User.groups : *Array<Group>*

Group list to which the user belongs.

User.is_active : *Boolean*

Indicates whether or not the user is a valid user.

User.is_ldap_user : *Boolean*

Indicates whether or not the user is an LDAP user.

User.enable_restapi : *Boolean*

Indicates whether to enable the REST API. It is a writable property.

User.auth_token : *String*

The user's authentication token. This is a read-only property. It is null when the REST API is invalid.

User.last_login : *Datetime*

The user's last login datetime.

New in version 1.6.3: The last_login property has been added.

New in version 1.6.8: The is_active and is_ldap_user properties have been added.

Method

There are no published methods.

5.4.6 User list (/config/user)

The user list (/config/user) is an object that holds a list of user objects and is implemented as a virtual object (Virtual).

Method

The following methods are defined in the user list.

`UserRoot.find([...params])` : *LazyArray<User>*

Returns search results of users in the user list that match the filtering criteria specified by params. The params can be used to specify filtering, similar to the *Directory.find()* method.

The attributes and lookup that can be specified are as follows.

Attribute	Specifiable Lookup
username	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
first_name	same as above
last_name	same as above
email	same as above
last_login	exact, gt, gte, lt, lte
is_active	exact
is_ldap_user	exact
home_directory	exact
environment	exact

New in version 1.6.3: A new find method has been added.

Changed in version 1.6.8: Changed the result of find() method to LazyArray type.

5.4.7 Group

This is an object representing a group of Kompira.

Properties

The properties defined in the group object are as follows.

`Group.name` : *String*

Group name

`Group.users` : *Array<User>*

List of users who belong to this group

`Group.is_ldap_group` : *Boolean*

Indicates whether or not this is an LDAP group.

New in version 1.6.3: The name and users properties have been added.

New in version 1.6.8: The is_ldap_group property has been added.

Method

There are no published methods.

5.4.8 Group (/config/group)

The groupd list (/config/group) is an object that holds a list of group objects and is implemented as a virtual object (Virtual).

Method

The following methods are defined in the group list.

`GroupRoot.find([...params])` : *LazyArray*<*Group*>

Returns search results of groups in the group list that match the filtering criteria specified by params. The params can be used to specify filtering, similar to the *Directory.find()* method.

The attributes and lookup that can be specified are as follows.

Attribute	Specifiable Lookup
name	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
is_ldap_group	exact

New in version 1.6.3: A new find method has been added.

Changed in version 1.6.8: Changed the result of find() method to LazyArray type.

COORDINATION WITH OTHER SYSTEMS

Author

Kompira development team

6.1 Introduction

This document will explain how to transfer data to other systems with Kompira, how to receive data from other systems and the required settings etc.

6.2 Sending events to Kompira

Event information can be sent to Kompira by using the `kompira_sendevt` command included in *Job manager package* and *Send-Event package*. This section explains the event transmission to Kompira using `kompira_sendevt`.

The `kompira_sendevt` script packs the `<keyword>=<value>` pair specified by the argument into a message and sends it to the Kompira server.

```
/opt/kompira/bin/kompira_sendevt [options] [<key1>=<value1> ...]
```

Be careful not to put a space on both sides of '=' connecting `key1` and `value1`. The job flow can refer to the received message as dictionary type data.

If no argument is specified, the standard input is sent as one key to the Kompira server.

To send a message with `kompira_sendevt` to a Kompira server that has SSL certificate verification enabled, such as by adding the `--amqps-verify` option during installation, you need an SSL certificate issued by that Kompira server. In this case, please note the following.

- You must have obtained an SSL certificate from the Kompira server in advance. See *SSL Certificate Management*.
- The user executing the `kompira_sendevt` command must be able to read the SSL certificate. Either run the `kompira_sendevt` command as a user with access to the certificate file, or adjust the permissions on the certificate file.

6.2.1 Sending events from Windows

By installing *Installation on Windows*, you can send events from Windows using the `kompira_sendvt` command, similar to as in Linux.

Note: Procedure: When installing *Installation on Windows*, the `kompira_sendvt` command will be installed in `C:\Kompira\Scripts\kompira_sendvt.exe`.

Also, the default log directory in Windows environment is `C:\Kompira\Log`, so please create it beforehand. If the log directory does not exist, a warning will be displayed when executing the `kompira_sendvt` command, and the log will be output on standard output.

Changed in version 1.6.8: The default log directory under Windows is now `C:\Kompira\Log`.

6.2.2 kompira_sendvt options

The `kompira_sendvt` command has the following options. Options specified on the command line take precedence over those specified in the configuration file.

Option	Description
<code>-c</code> , <code>--config=CONF</code>	Specify the configuration file(CONF is the configuration file path). By default, <code>/opt/kompira/kompira.conf</code> (<code>C:\Kompira\kompira.conf</code> in Windows environment) is loaded.
<code>-s</code> , <code>--server=SERVER</code>	Specify the IP address or server name of the Kompira server as the destination.
<code>-p</code> , <code>--port=PORT</code>	Specify the port number of the message queue of the destination Kompira server.
<code>--user=USER</code>	Destination Kompira specifies the user name of the message queue.
<code>--password=PASSWORD</code>	Destination Kompira specifies the user name of the message queue.
<code>--test-connection</code>	Tests the connection to the AMQP server. No data is sent.
<code>--ssl</code>	SSL is used to connect the message queue.
<code>--ssl-verify</code>	Validate the server certificate with SSL.
<code>--ssl-cacertfile=SSL_CACERTFILE</code>	Specify the certificate to be used to verify the server certificate with SSL.
<code>--ssl-certfile=SSL_CERTFILE</code>	Specify the certificate file for SSL connection.
<code>--ssl-keyfile=SSL_KEYFILE</code>	Specify the private key file for SSL connection.
<code>--channel=CHANNEL</code>	Specify the path on the Kompira file system of the channel to send the message.
<code>--site-id=SITE_ID</code>	Specify Kompira site ID.
<code>--max-retry=MAX_RETRY</code>	Specify the maximum number of times to send an event.
<code>--retry-interval=RETRY_INTERVAL</code>	Specify the interval between events (in seconds).
<code>--dry-run</code>	Does not actually transmit data but displays the transmission contents on the standard output.

Parameters related to AMQP connections that are not specified in the command line options are subject to the default values in the configuration file. For example, the user name and password will be `guest/guest` if the server name is `localhost`, and `kompira/kompira` otherwise. See *Kompira configuration files* for details.

Changed in version 1.6.8: When no configuration file is specified, `C:\Kompira\kompira.conf` is now applied in Windows environments.

New in version 1.6.8: New options `--test-connection`, `--ssl-verify`, `--ssl-cacertfile`, `--ssl-certfile`, and `--ssl-keyfile` have been added.

6.3 Receive e-mails on Kompira

How to use Kompira_sendvt to handle email contents received by the Kompira server in the job flow.

Note: If you are using an IMAP server, you can handle the contents of the email in the job flow by using the mail channel in alternative to the method described below. For details, see [MailChannel](#).

6.3.1 Setting up Linux

By writing the settings in the `/etc/aliases` file which is an alias for Sendmail, it is possible to specify execution of an arbitrary command for emails addressed to a specific account on the Kompira server.

The following is a setting for sending mail to `kompira_sendvt` when an email is sent to the `kompira` account on the kompira server.

```
kompira:    "|LANG=ja_JP.UTF-8 /opt/kompira/bin/kompira_sendvt --channel=/system/
↳ channels/Mail"
```

After writing the above in `/etc/aliases`, the setting is reflected by executing the following command.

```
% newaliases
```

Note: Depending on your system you may need to use `smrsh`. In that case, create a symbolic link of the `kompira_sendvt` command in the `smrsh` directory.

6.3.2 Kompira settings

`kompira_sendvt` can send values to arbitrary channels. Here is how to create a dedicated channel to receive mail called `/system/channels/Mail`.

The following is an example of a job flow in which mail contents are received and the contents are displayed.

```
</system/channels/Mail>
-> [mail = $RESULT]
-> mail_parse(mail)
-> [parsed_mail = $RESULT]
-> print(parsed_mail['Subject'])
-> print(parsed_mail['Body'])
```

By using Kompira's built-in job `mail_parse`, you can parse mail text in MIME format and handle values in dictionary format.

6.4 Coordinating with monitoring systems

Kompira can coordinate with external monitoring servers such as Zabbix and Nagios. By sending event information to the Kompira message queue (RabbitMQ) from the external system you want to link, you can receive the event from the job flow.

In this section, we will explain how to notify Kompira of occurrence of failure by using Zabbix as an example.

6.4.1 Confirming event transmission and receipt

How to prepare a script for sending event information to Kompira on the server running Zabbix. This section explains how to use `kompira_sendvt`.

1) Install the Kompira agent on the Zabbix server

According to the Kompira manual (*Send-Event package*), install Kompira's event sending package on the server on which Zabbix is running. (If you do not operate the job manager, startup settings of the job manager are unnecessary.)

2) Change of Configuration File

Rewrite the `/opt/kompira/kompira.conf` file on the Zabbix server side.

Specifically, set the IP address of the Kompira server or the host name in the `server` field of the `[amqp-connection]` section. Also make sure that the `channel` item in the `[event]` section is set to `/system/channels/Alert`.

3) Message notification confirmation

At this point, run `kompira_sendvt` to check that the event can be notified correctly to the Kompira server. On the Zabbix server side, execute the following command.

```
$ /opt/kompira/bin/kompira_sendvt test=hello
```

Next, log in to Kompira, refer to the page of `/system/channels/Alert` and check that the number of messages is increasing.

4) How to receive messages

Next, read the message that arrived at `/system/channels/Alert` from the job flow. Please define the following job flow and execute it.

```
</system/channels/Alert> -> [message = $RESULT] -> print(message.test)
```

If "hello" is displayed on the console, it was successful.

6.4.2 Zabbix Settings

Next, configure Zabbix.

Log in to Zabbix, create a new action from the "Set Action" menu and create a new operation of the action in it. The type of operation is a remote command.

For example, the contents of the remote command are as follows.

```
Zabbix server:python /opt/kompira/bin/kompira_sendvt status="{TRIGGER.STATUS}"
severity="{TRIGGER.NSEVERITY}" hostname="{HOSTNAME}"
trigger_name="{TRIGGER.NAME}" trigger_key="{TRIGGER.KEY}"
detail="{TRIGGER.KEY}: {ITEM.LASTVALUE}"
```

Here, we have set up to send dictionary data including the following key to Kompira.

Key name	Content (Value)
status	Trigger status
severity	Severity
hostname	Name of the host where the failure occurred
trigger_name	Trigger name
trigger_key	Trigger Key
detail	Event detailed information (combination of trigger key and event value)

After that, we will make settings so that the action registered here will be kicked, with the fault event as a trigger. For details, please refer to the Zabbix manual etc.

6.5 Coordinating with Redmine

As an example of coordination with an external ticketing system, we will explain how to issue tickets to Redmine from Kompira's job flow.

6.5.1 Redmine settings

1) Enable REST API

From "Administration" -> "Settings" -> "Authentication", save with "Enable Web service by REST" checked.

2) Create project

Select "New Project" from "Administration" -> "Project" and create the project "test".

3) Setting Priorities

Set the value to the priority of the ticket in "Administration" -> "Enumeration item". (Eg "high" "medium" "low")

Also, set one as the "default value".

(*) If you do not set the default value, the priority_id value is required when calling the API.

4) Create new user

Select "New User" from "Administration" -> "User" and create an arbitrary user.

Log in as the user you created and note the API access key on the "Personal Settings" page.

6.5.2 Issuing a ticket

In order to issue Redmine tickets, we convert the necessary information into json format data and send a POST request to the Redmine URL.

To do that, call dictionary type data to urlopen which is a built-in job of Kompira.

Specifically, you can issue a ticket to Redmine by describing the following job flow.

```
|redmine_server = '192.168.0.1'|
|redmine_key = '1234567890abcdef1234567890abcdef12345678'|
|ticket_title = 'Task from Kompira'|
|project_name = 'test'|

[url = 'http://$redmine_server/issues.json?format=json&key=$redmine_key']
```

(continues on next page)

(continued from previous page)

```
-> [ticket = {issue = {subject = ticket_title, project_id = project_name}}]
-> urlopen(url=url, data=ticket, timeout=60, encode='json')
```

For “redmine_key”, set the API access key confirmed in “4. Creating a user”.

In addition to the above, you can also include information such as ticket priority, description, person in charge and category.

You can also update / delete tickets, get list of ticket information, etc. For details, refer to the Redmine API specifications.

6.6 Receiving SNMP Traps

How to receive SNMP traps in Kompira’s job flow using Linux commands `snmptrapd` (8) and `snmptrap` (1).

6.6.1 Environment

	IP Address	OS
Kompira Server	192.168.213.100	CentOS 6.5
SNMP Agent Server	192.168.213.101	CentOS 6.5

6.6.2 Kompira Server Settings

Assume Kompira is installed on the Kompira server.

1) Install `snmptrapd`

```
$ yum install net-snmp
```

2) Edit `/etc/snmp/snmptrapd.conf`

Edit `snmptrapd.conf` to handle SNMP traps.

```
authCommunity      log,execute,net default
traphandle default  /opt/kompira/bin/kompira_sendvt --channel=/system/channels/
↳ snmptrap
```

Here default represents “all OIDs”.

3) Add job flow to Kompira

Create a “/system/channels/snmptrap” channel and create and execute a job flow that waits for data to this channel.

```
</system/channels/snmptrap> ->
print($RESULT)
```

4) Start `snmptrapd`

```
$ service snmptrapd start
```

6.6.3 Setting up the SNMP agent server

Install snmptrapd command

```
$ yum install net-snmp-utils
```

6.6.4 Transmission of SNMP trap

Execute the snmptrapd command on the SNMP agent server.

```
$ snmptrap -v 2c -c default 192.168.213.100 '' netSnmp.99999 netSnmp.99999.1 s "hello
↪world"
```

If the Kompira server can receive it correctly, the following log is displayed in /var/log/messages.

```
$ tail -f /var/log/messages
Dec 13 16:29:30 kompira-server snmptrapd[6110]: 2012-12-13 16:29:30 <UNKNOWN>
[UDP: [192.168.213.101]:56313->[192.168.213.100]]:#012DISMAN-EVENT-
↪MIB::sysUpTimeInstance = Timeticks: (590254) 1:38:22.54
#011SNMPv2-MIB::snmpTrapOID.0 = OID: NET-SNMP-MIB::netSnmp.99999#011NET-SNMP-
↪MIN::netSnmp.99999.1 = STRING: "hello world"
```

In addition, the following received results are displayed on the console of the job flow process that was running on Kompira.

```
<UNKNOWN>
UDP: [192.168.213.101]:56313->[192.168.213.100]
DISMAN-EVENT-MIB::sysUpTimeInstance 0:0:18:39.04
SNMPv2-MIB::snmpTrapOID.0 NET-SNMP-MIB::netSnmp.99999
NET-SNMP-MIB::netSnmp.99999.1 "hello world"
```


MONITORING KOMPIRA

Author

Kompira development team

7.1 Introduction

This document describes how to monitor the state of Kompira using a monitoring system such as Zabbix.

7.2 Monitoring using Zabbix

This document will explain how to acquire the number of Kompira's running processes and the number of incidents being handled in Zabbix.

There are various ways to monitor Zabbix, but here we will explain monitoring using Zabbix Agent's "UserParameter" function and monitoring method by "external script".

This document introduces the monitoring method using Zabbix 2.4.

7.2.1 Preperation

`kompira_jq.sh`

Whichever monitoring method you use, use the `kompira_jq.sh` script provided by Kompira.

For monitoring by "external script", execute `kompira_jq.sh` on the Zabbix server and on the Kompira server on which Zabbix Agent is installed for monitoring with, use "UserParameter".

Since `kompira_jq.sh` internally uses the `curl` and `jq` commands, please install the necessary packages on the Zabbix server or Kompira server according to the monitoring method so that these can be used.

In the CentOS environment, `jq` can be installed from the EPEL repository and in the AWS environment from the `amzn-main` repository.

Note: Since `kompira_jq.sh` that comes with Kompira 1.4.6 or later has become a version compatible with REST-API, it is incompatible with option specification method and older versions.

Kompira server's host settings

Since both monitoring methods access the Kompira server, it is necessary to register the Kompira server URL and REST API token as Zabbix “macros”.

On Zabbix, set the REST API token with the following macro names on the “Host Setting” → “Macro” settings screen of the Kompira server.

Macro	Value
{KOMPIRA_URL}	Kompira Server's URL
{KOMPIRA_TOKEN}	REST API token

7.2.2 Monitoring with UserParameter

This is the way Zabbix Agent gathers the value of the monitoring item by executing a preset command for the item specified from the Zabbix server.

Zabbix Agent settings

It is necessary to prepare UserParameter's setting files on the Kompira server where Zabbix Agent is installed. Please copy `userparameter_kompira.conf` to `/etc/zabbix/zabbix_agentd.d`

Please restart the Zabbix Agent when the setup file is ready.

```
$ sudo service zabbix-agent restart
Shutting down Zabbix agent:          [ OK ]
Starting Zabbix agent:               [ OK ]
```

Zabbix Server settings

For Zabbix Server, you need to set monitoring items using UserParameter, but you can immediately use standard monitoring items by importing `zbx_kompira_basic_templates.xml`.

A template named Template Kompira Server will be created, so apply this template to the Kompira server you want to monitor.

Monitoring items

The following monitoring items can be used as standard.

Name	Overview
Kompira active incidents	Number of active incidents
Kompira active processes	Number of active processes
Kompira active schedulers	Number of active schedules
Kompira active tasks	Number of active tasks
Kompira jobflows	Total number of job flows
Kompira license remain_days	Number of remaining days of license
Kompira objects	Total number of Kompira objects
Memory usage of kompirad process	Memory usage (kompirad)
Memory usage of kompira_jobmngd process	Memory usage (kompira_jobmngd)
Number of kompirad process	Number of processes (kompirad)
Number of kompira_jobmngd process	Number of processes (kompira_jobmngd)

7.2.3 Monitoring with external scripts

This is a method of collecting the value of the monitoring item by executing the external script on the Zabbix server.

First, please copy the script provided by Kompira `/opt/kompira/bin/kompira_jq.sh` to the directory where the external script on the Zabbix server is located. By default it is: `/usr/lib/zabbix/externalscripts`.

Number of processes

When monitoring the number of processes using the external script `kompira_jq.sh`, create the Item with the following settings:

Name	Kompira processes
Type	External check
Key	<code>kompira_jq.sh[-s,{ \$KOMPIRA_URL },-t,{ \$KOMPIRA_TOKEN },-ac,/process]</code>
Type of information	Numeric (unsigned)
Data type	Decimal

Number of incidents

To monitor the number of incidents using the external script `kompira_jq.sh`, create an Item with the following settings:

Name	Kompira incidents
Type	External check
Key	<code>kompira_jq.sh[-s,{ \$KOMPIRA_URL },-t,{ \$KOMPIRA_TOKEN },-ac,/incident]</code>
Type of information	Numeric (unsigned)
Data type	Decimal

KOMPIRA REST API REFERENCE

Author

Kompira development team

8.1 Introduction

This document describes how to use REST API.

8.2 Common Features

8.2.1 The end point

The end point of REST API is similar to that of the resource path of a regular Kompira object. That is, the root end point is displayed

```
http[s]://<hostname>/
```

as above.

In order to distinguish access from the browser and an API request, in the Accept header of the HTTP Request

```
Accept: application/json
```

must be included.

Alternatively, you could include: `format=json` in the request string.

8.2.2 User Authentication

The two types of authentication that are allowed are: 1. token and 2. session authentication methods.

While using token authentication, include the token key in the Authorization header of the request as follows:

```
Authorization: Token <token key>
```

Alternatively, you can include the token key in the query string of the HTTP request as shown below.

```
token=<token key>
```

When you enable the REST API of each user on the user setting page, an access token is generated. If you disable the REST API and re-enable it, the token is reinitialized.

8.2.3 Format

Only the JSON format of data is supported.

Datetime data

The date and time data should be in UTC and the following format of (ISO8601) must be used.

```
%Y-%m-%dT%H:%M:%S.%fZ or %Y-%m-%dT%H:%M:%SZ
```

It is acceptable to omit microseconds and seconds when entering the data. If Z (the last UTC directive) is omitted, it will be regarded as (JST) local time and will be internally converted to UTC.

Object data

Object data is represented by the absolute path of the object.

File data

When outputting file data, it becomes key holding dictionary data which displays the name and data, as shown below.

```
{ "name": "<file name>", "data": "<BASE64 encoded file data>" }
```

When entering the data, enter it as key holding dictionary data, showing name and data as shown below.

```
{ "name": "<file name>", "data": "<BASE64 encoded file contents string>" }
```

8.2.4 Error

When an error occurs, A HTTP status code will appear indicating as such. When this happens, data indicating the reason for the error will be shown in the HTTP response's content body.

Most error data will be shown in dictionary type including the detail key as follows.

```
{ "detail": "<reason of error>" }
```

In the case of a validation error in which the required data is not included in the request data, the following dictionary data will appear:

```
{ "<field name>": [<error message>, ...],  
  "<field name>": [<error message>, ...],  
  ... }
```

8.2.5 Paginate

When the list is retrieved, paginated data in the form shown, appears as below.

```
{
  "count": <total number of objects>,
  "next": <next page URL>,
  "previous": <previous page URL>,
  "results": <objects data list>
}
```

When specifying and acquiring a page, include `page = <page number>` in the query path. If you want to get the last page, specify `last` as the page number.

The default page size is 25. If you want to change the page size, enter:

```
page_size=<page size>
```

into the query string.

8.2.6 Specifying attributes to retrieve

By specifying the attribute name to be retrieved as `attrs=<attribute name>` in the query path, it is possible to retrieve only some attribute values of the object data.

For example, to get only the ID and display name of an object, specify `id` and `display_name` as the attribute names, as shown in the example below

```
/some/object?attrs=id&attrs=display_name
```

In the same way, it is possible to specify the attributes to be acquired in the list acquisition. For example, to get only the process ID and status in the process list, specify as follows

```
/process?attrs=id&attrs=status
```

8.2.7 Filtering

To filter by attribute of the object, specify `<attribute-name>=<value>` in the query path.

For example, if you want to get a list of only successfully completed processes, specified as shown below.

```
/process?status=DONE
```

If multiple attributes are specified in the query path as shown below, it is filtering by AND.

```
/app.descendant?display_name=test&owner=root
```

Although the above is filtering by exact matching, detailed filtering conditions can be specified by describing the attribute name followed by a lookup as follows.

```
<attribute-name>__<lookup>=<value>
```

For example, you can filter objects that contain `test` in the display name.

```
/app.descendant?display_name__contains=test
```

The lookup types and filtering method is as follows.

Lookup	Filtering method
exact, iexact	The attribute exactly matches the specified value.
contains, icontains	The attribute contains the specified value.
startswith, istartswith	The attribute starts with the specified value.
endswith, iendswith	The attribute ends with the specified value.
regex, iregex	The attribute matches the specified regular expression.
gt, gte	The attribute is greater than specified value (gt). The attribute is greater than or equal to the value specified (gte).
lt, lte	The attribute is less than specified value (lt). The attribute is less than or equal to the specified value (lte).
in	The attribute is included in the specified values.

In filtering others than virtual objects by attribute value, the lookup that can be specified depends on attribute.

Attribute	Specifiable Lookup
owner	exact, in
abspath	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
display_name	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
description	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
created	exact, gt, gte, lt, lte
updated	exact, gt, gte, lt, lte
type_object	exact, in
parent_object	exact, in

In filtering virtual objects by attribute value, the lookup that can be specified depends on the data type of the attribute.

Type of the attribute	Specifiable Lookup
String	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex
Integer	exact, gt, gte, lt, lte
Datetime	exact, gt, gte, lt, lte
Object	exact
User	exact
Boolean	exact

If lookup is not specified, `exact` is applied.

8.2.8 Specify sort order

To specify the order in retrieving a list of objects, specify `order_by=<attribute name>` in the query path. This will return a list of the results sorted in ascending order by the specified attribute. To sort in descending order, specify `order_by=-<attribute name>` in the query path.

The following object attributes can be used to specify the order by `order_by`

Attribute	Order applied
<code>id</code>	Order by object ID
<code>owner</code>	Order by user ID of the object's owner
<code>abspath</code>	Order by absolute path of the object
<code>display_name</code>	Order by display name of the object
<code>description</code>	Order by description of the object
<code>created</code>	Order by creation date and time of the object (oldest first)
<code>updated</code>	Order by update date and time of the object (oldest first)
<code>type_object</code>	Order by type object's ID
<code>parent_object</code>	Order by parent object's ID

New in version 1.6.6post1: Description and `parent_object` have been added to the attributes that can be specified in `order_by`.

Object

The attributes that can be used for filtering general objects (other than virtual objects) are as follows.

Attribute name	description (type of attribute) or [available lookup]
<code>owner</code>	Owner (User)
<code>display_name</code>	Display name (String)
<code>description</code>	Description (String)
<code>created</code>	Created date (Datetime)
<code>updated</code>	Updated date (Datetime)
<code>type_object</code>	Type object (Object)

In addition, in situations where type objects are identified, you can also specify filtering by field values.

```
field:<field-name>__<lookup>=<value>
```

For example, specify as follows.

```
/.descendant?type_object=/system/types/Jobflow&field:source__contains=urlopen&
↪field:defaultMonitoringMode=MAIL
```

A situation in which a type object is specified means one of the following.

- The `type_object` attribute filter specifies a type object.
- The endpoint object is a table type, and the type object is set in the table.

If type objects are not specified, specifying filtering by field value results in an error.

In filtering by field value, the lookup that can be specified differs depending on the data type of the field.

Type of field	Specifiable Lookup
String	exact, iexact, contains, icontains, startswith, istartswith, endswith, iendswith, regex, iregex, in, range
Integer	exact, isnull, gt, gte, lt, lte, in, range
Boolean	exact
Datetime	exact, isnull, gt, gte, lt, lte, range
Object	exact, isnull
File	(same as string)
Array	(same as string)
Dictionary	(same as string)

Process Type (Process)

The attributes that can be used for filtering process objects are as follows:

Attribute name	description (type of attribute) or [available lookup]
job	Job object (Object)
user	Execution user (User)
started_time	Start date and time (Datetime)
finished_time	End date and time (Datetime)
status	Status [exact]
schedule	Schedule object (Object)
parent	Parent process (Process)
current_job	Running job object (Object)
suspended	Pause flag (Boolean)
lineno	Running line number (integer)
console	Console (String)

Schedule type Processes (Scheduler)

The attributes that can be used for filtering schedule objects are as follows:

Attribute name	description (type of attribute) or [available lookup]
name	Schedule name (String)
description	Description (String)
user	User type (User)
job	Job object (Object)
year	Year [exact, contains]
month	Month [exact, contains]
day	Day [exact, contains]
week	Week [exact, contains]
day_of_week	Day of the week [exact, contains]
hour	Hour [exact, contains]
minute	Minute [exact, contains]
disabled	Disabled flag (Boolean)

Incident type processes (Incident)

The attributes that can be used for filtering incident objects are as follows:

Attribute name	description (type of attribute) or [available lookup]
name	Incident name (String)
device	Device name (String)
service	Service name (String)
created_date	Created date (Datetime)
closed_date	Completed date and time (Datetime)
status	Status [exact]
owner	Owner (User)

Task type (Task)

The attributes that can be used for filtering task objects are as follows:

Attribute name	description (type of attribute) or [available lookup]
name	Task name (String)
title	Title (String)
message	Message (String)
status	Status [exact]
owner	Owner (User)
created_date	Created date (Datetime)
closed_date	Completed date and time (Datetime)

User type (User)

The attribute that can be used for filtering user objects are as follows:

Attribute name	description (type of attribute) or [available lookup]
username	User name (String)
first_name	First name (String)
last_name	Surname (String)
email	E-mail (String)
last_login	Last login date and time (Datetime)
is_active	Enabled (Boolean)
is_ldap_user	LDAP user or not (Boolean)
home_directory	Home directory (Object)
environment	Environment variable (Object)

Group type (Group)

The attributes that can be used for group object filtering are as follows:

Attribute name	description (type of attribute) or [available lookup]
name	Group name (String)
is_ldap_group	LDAP group or not (Boolean)

8.3 Accessing Kompira objects

8.3.1 How to get object information

Request

- GET <object path>

Response

```
{
  "id": <object ID>,
  "abspath": <object path>,
  "owner": <username of object owner>,
  "fields": <field data dictionary>,
  "extra_properties": <extra properties>,
  "user_permissions": <user permissions dictionary>,
  "group_permissions": <group permissions dictionary>,
  "display_name": <display name>,
  "description": <description>,
  "created": <datetime of object created>,
  "updated": <datetime of object updated>,
  "type_object": <path of type object>,
  "parent_object": <path of parent object>
}
```

Field data dictionary and object extended attributes are dictionary data containing keys that vary depending on the object type.

Note: In the case of a configuration type object, in addition to the above, it contains a data field with dictionary data containing the keys and values of the configuration items.

Note: To retrieve password data for Password type fields, Array<Password> type fields, and Dictionary<Password> type fields, write permission to the object is required. If you do not have write permission, data replaced by a null value will be returned.

Changed in version 1.6.8: Object write permission is now required to retrieve password data.

8.3.2 Object Information Updates

Request

- PUT <object path>
- PATCH <object path>

The PUT request replaces the entire data of the object. For a partial object update, use the PATCH request instead.

Request Data

```
{
  "owner": <username of object owner>,
  "fields": <field data dictionary>,
  "user_permissions": <user permissions dictionary>,
  "group_permissions": <group permissions dictionary>,
  "display_name": <display name>,
  "description": <description>          # optional
}
```

In the case of a PATCH request, omitting an attribute does not change the value of the object corresponding to that key.

Response

Updated Object Data

8.3.3 Adding a new object

When a POST request is sent to a directory object or table object, an object is newly created.

Request

- POST <directory or table's object path>

Request Data

```
{
  "owner": <username of object owner>, # optional
  "fields": <field data dictionary>,
  "name": <object name>,
  "user_permissions": <user permissions dictionary>,
  "group_permissions": <group permissions dictionary>,
  "display_name": <display name>,      # optional
  "description": <description>,        # optional
  "type_object": <path of type object>
}
```

Response

HTTP 201 Created Response to the Newly Created Object's Data

8.3.4 Deleting an object

You can delete the object by sending a DELETE request to the object path.

Processes, schedules, incidents, tasks, objects can also be deleted in this way, one by one.

Request

- DELETE <object path>

Response

If successful, HTTP 204 No Content is returned.

8.3.5 Obtaining a list of children and descendants

You can get a list of directory objects or children and descendant objects of table objects.

Request

- GET <object path>.children # child object list
- GET <object path>.descendant # descendant object list

Response

A list of object data will be returned.

Note: For objects other than directories and tables, an empty list is returned.

Note: Of the retrieved listing data, objects without read permission do not contain the fields attribute (field data dictionary).

8.3.6 Executing a job flow

Request

- POST <job flow path>.execute

Request Data

```
{
  "step_mode": <step mode>,                # true or false
  "checkpoint_mode": <checkpoint mode>,      # true or false
  "monitoring_mode": <monitoring mode>,      # NOTHING, MAIL, ABORT_MAIL
  "parameters": <jobflow parameters dictionary>
}
```

Response

The path of the executed job flow process is returned.

8.3.7 Executing a script job

Request

- POST <script job path>.execute

Request Data

```
{
  "node": <path of node object>,
  "account": <path of account object>,
  "command_line": <command line string>
}
```

Response

The path of the executed job flow process is returned.

8.3.8 Sending Messages

Messages can be sent to Channel Objects.

Request

- POST <channel object path>.send

Request Data

Can be sent in any JSON data format

Response

If it succeeds, HTTP 200 OK is returned.

8.3.9 Received Messages

Receiving a message from a channel object

Request

- POST <channel object path>.recv

Request Data

```
{
  "timeout": <timeout (seconds)>
}
```

Response

If it succeeds, the received data is returned. When the receive timeout expires, HTTP 408 Request Timeout is returned as the status code.

Note: If there is no data on the channel, wait for the specified number of seconds with timeout. The default value for timeout is 0 seconds.

8.4 Process

8.4.1 Retrieving lists

Request

- GET /process

To retrieve the child process list, use the following request:

- GET /process/id_<process ID>.children

Response

A list of process details data will be returned.

8.4.2 Obtaining process detail data

Request

- GET /process/id_<process ID>

Response

```
{
  "id": <process id>,
  "abspath": <path of process object>,
  "user": <username of execution user>,
  "elapsed_time": <elapsed time from process started>,
  "started_time": <datetime of process started>,
  "finished_time": <datetime of process finished>,
  "status": <process status>,
  "exit_status": <exit status>,
  "result": <result>,
  "error": <error>,
  "suspended": <suspended>,
  "lineno": <line number>,
  "console": <console string>,
  "job": <path of starting jobflow>,
  "schedule": <path of schedule>,
  "parent": <path of parent process>,
  "current_job": <path of executing jobflow>
}
```

8.4.3 Process' operation

Request

- POST /process/id_<process ID>.terminate # Cancel process execution
- POST /process/id_<process ID>.suspend # Pause process execution
- POST /process/id_<process ID>.resume # Restart process execution

Request Data

You can

```
{
  "step_mode": <step mode>,          # true/false
  "checkpoint_mode": <checkpoint mode> # true/false
}
```

Response

Returns “true” on success, “false” on failure.

8.4.4 Wait for the completion of execution of the process

Request

- POST /process/id_<process ID>.wait

Request Data

```
{
  "timeout": <timeout value>          # an integer value of 0 or more
}
```

Response

On success, detailed information on the process is returned. When timeout occurs, HTTP 408 Request Timeout is returned as the status code.

8.5 Schedule

8.5.1 Obtaining the schedule

Request

- GET /scheduler

Response

A list of schedule detail data is returned.

8.5.2 Obtaining Schedule details

Request

- GET /scheduler/id_<schedule ID>

Response

```
{
  "id": <schedule id>,
  "abspath": <path of schedule object>,
  "user": <username>,
  "scheduled_datetimes": <datetimes of scheduled>,
  "parameters": <parameters list>,
  "name": <schedule name>,
  "description": <description>,
  "year": <year>,
```

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```
"month": <month>,  
"day": <day>,  
"week": <week>,  
"day_of_week": <day of week>,  
"hour": <houe>,  
"minute": <minute>,  
"disabled": <disabled>,  
"job": <path of execution jobflow>  
}
```

8.5.3 Schedule update

Request

- PUT /scheduler/id_<schedule ID>
- PATCH /scheduler/id_<schedule ID>

Request Data

```
{  
  "user": <username>,  
  "parameters": <parameters list>,  
  "name": <schedule name>,          # mandatory  
  "description": <description>,  
  "year": <year>,  
  "month": <month>,  
  "day": <day>,  
  "week": <week>,  
  "day_of_week": <day of week>,  
  "hour": <houe>,  
  "minute": <minute>,  
  "disabled": <disabled>,  
  "job": <path of execution jobflow> # mandatory  
}
```

Response

Updated Object Data

8.5.4 Creating a schedule

Request

- POST /scheduler

Request Data

Same as the update request

Response

Data of the created object

8.6 Incident

8.6.1 Obtaining the incident list

Request

- GET /incident

Response

A list of incident detail data is returned.

8.6.2 Obtaining incident details

Request

- GET /incident/id_<Incident ID>

Response

```
{
  "id": <incident id>,
  "abspath": <path of incident object>,
  "owner": <username of owner>,
  "worklogs": <worklogs>,
  "alerts": <alerts>,
  "name": <incident name>,
  "device": <device name>,
  "service": <service name>,
  "created_date": <datetime of incident created>,
  "closed_date": <datetime of incident closed>,
  "status": <incident status>          # "OPENED", "WORKING", "CLOSED"
}
```

8.6.3 Updating Incidents

Request

- PUT /incident/id_<incident ID>
- PATCH /incident/id_<Incident ID>

Request Data

```
{
  "owner": <username of owner>,
  "name": <incident name>,
  "device": <device name>,
  "service": <service name>,
  "status": <incident status>
}
```

Response

Updated Object Data

8.6.4 Adding a work log

Request

- POST /incident/id_<incident ID>.worklogs

Request Data

```
{
  "user": <username>,
  "description": <description>
}
```

Response

Data of the added work log

8.6.5 Creating a incident

Request

- POST /incident

Request Data

Same as the update request

Response

Data of the created object

8.7 Task

8.7.1 Obtaining a list of tasks

Request

- GET /task

Response

List of task detail data

8.7.2 Obtaining task details

Request

- GET /task/id_<Task ID>

Response

```
{
  "id": <task id>,
  "abspath": <path of task object>,
  "owner": <username of owner>,
  "assigned_users": <assigned users>,
  "assigned_groups": <assigned groups>,
  "name": <task name>,
```

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```

"title": <task title>,
"message": <message>,
"action_text": <action text>,
"result": <result>,
"status": <status>,          # "WAITING", "ONGOING", "DONE", "CANCELED"
"created_date": <datetime of task created>,
"closed_date": <datetime of task closed>
}

```

8.7.3 Cancelling a task

Request

- POST /task/id_<incident ID>.cancel

Response

If it succeeds, HTTP 200 OK is returned.

8.7.4 Submitting a task

Send a message to the task channel.

Request

- POST /task/id_<incident ID>.submit

Request Data

```

{
  "result": <result message>
}

```

If request data is omitted, “OK” is transmitted to the task channel.

8.8 User / Group Management

8.8.1 Obtaining a user list

Request

- GET /config/user

Response

List of user detail data

8.8.2 Obtaining User Details

Request

- GET /config/user/id_<user ID>

Response

```
{
  "id": <user id>,
  "abspath": <path of user object>,
  "groups": <groups>,
  "last_login": <datetime of last login>,
  "username": <username>,
  "first_name": <first name>,
  "last_name": <last name>,
  "email": <E-mail address>,
  "is_active": <active flag>,
  "is_ldap_user": <LDAP user flag>,
  "home_directory": <path of home directory>,
  "environment": <path of environment object>
}
```

8.8.3 Updating Users

Request

- PUT /config/user/id_<user ID>
- PATCH /config/user/id_<user ID>

Request Data

```
{
  "groups": <groups>,
  "last_login": <datetime of last login>,
  "username": <username>,           # mandatory
  "password": <password>,          # mandatory
  "first_name": <first name>,
  "last_name": <last name>,
  "email": <E-mail address>,
  "is_active": <active flag>,
  "is_ldap_user": <LDAP user flag>,
  "home_directory": <path of home directory>,
  "environment": <path of environment object>
}
```

Response

Updated Object Data

Note: The `is_active` field for the root user cannot be set to false. Built-in users (admin, root, guest) cannot have `is_ldap_user` set to true. Also, non-privileged users cannot modify the groups and `is_active` fields.

8.8.4 Create new users

Request

- POST /config/user

Request Data

Same as for Updating Users

Response

Data of the created object

8.8.5 Obtaining the group list

Request

- GET /config/group

Response

List of group detail data

8.8.6 Obtaining group details data

Request

- GET /config/group/id_<group ID>

Response

```
{
  "id": <group id>,
  "abspath": <path of group object>,
  "name": <group name>,
  "is_ldap_group": <LDAP group flag>
}
```

8.8.7 Updating Groups

Request

- PUT /config/group/id_<group ID>
- PATCH /config/group/id_<group ID>

Request Data

```
{
  "name": <group name>,
  "is_ldap_group": <LDAP group flag>
}
```

Response

Updated Object Data

Note: Cannot set `is_ldap_group` to true for built-in groups (other, wheel). Also, unprivileged users cannot update groups.

8.8.8 Adding a new group

Request

- POST /config/group

Request Data

Same as for updating groups

Response

Updated Object Data

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