Qlib-Server Documentation

Microsoft

Sep 24, 2020

Contents

`Qlib-Server` is the assorted server system for `Qlib`, which utilizes `Qlib` for basic calculations and provides extensive server system and cache mechanism. With `Qlib-Server`, the data provided for `Qlib` can be managed in a centralized manner.

CHAPTER 1

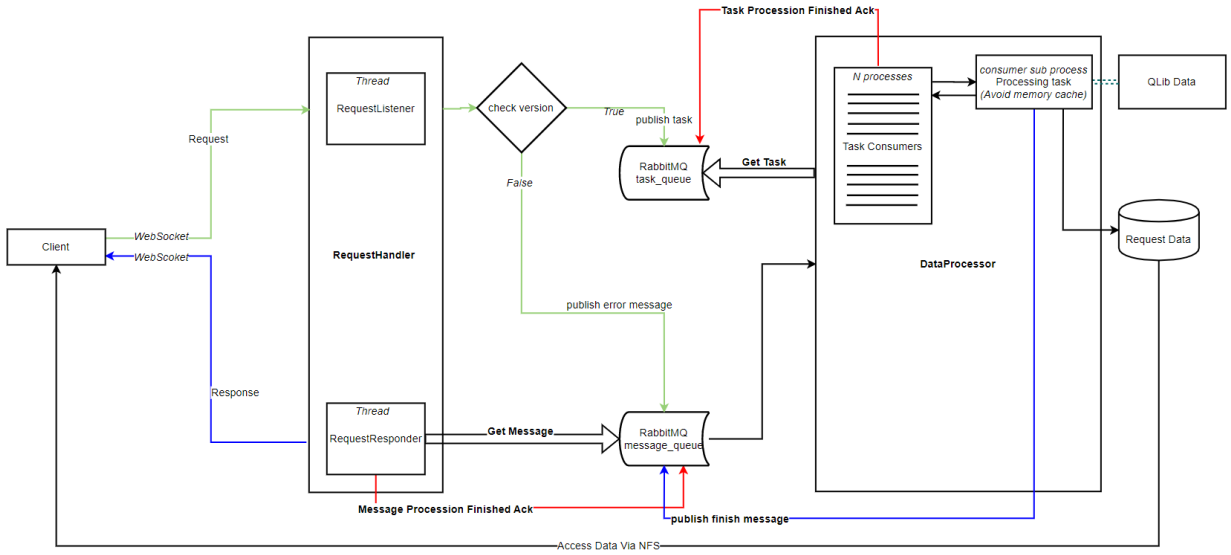
Document Structure

1.1 `Qlib-Server`: Quant Library Data Server

1.1.1 Introduction

`Qlib-Server` is the assorted server system for `Qlib`, which utilizes `Qlib` for basic calculations and provides extensive server system and cache mechanism. With `Qlib-Server`, the data provided for `Qlib` can be managed in a centralized manner.

1.1.2 Framework



The `Client/Server` framework of `Qlib` is based on `WebSocket` considering its capability of **bidirectional communication** between client and server in **async** mode.

`Qlib-Server` is based on Flask, which is a micro-framework for Python and here Flask-SocketIO is used for websocket connection.

`Qlib-Server` provides the following procedures:

Listening to incoming request from client

The clients will propose several types of requests to server. The server will parse the requests, collect the identical requests from different clients, record their session-ids, and submit these parsed tasks to a pipe. `Qlib` use RabbitMQ as this pipe. The tasks will be published to a channel *task_queue*.

RequestListener is used for this function:

After receiving these requests, the server will check whether different clients are asking for the same data. If so, to prevent repeated generation of data or repeated generation of cache files, the server will use Redis to maintain the session-ids of those clients. These session-ids will be deleted once this task is finished. To avoid IO conflicts, Redis_Lock is imported to make sure no tasks in redis will be read and written at the same time.

Responding clients with data

The server consumes the result from *message_queue* and get the session-ids of the clients requring this result. Then it responds to these clients with results.

RequestResponder is used for this method.

The two class above is combined as **RequestHandler**, which is responsible for communicating with clients.

Accepting tasks from RabbitMQ and processing data

The server will automatically collect tasks from RabbitMQ and process the relevant data. RabbitMQ provides a mechanism that when the server consumes a task, a callback function is triggered. The data processing procedure is implemented within these callbacks and it currently supports the three types of tasks corresponding to above:

- Calendar
- Instruments
- Features

DataProcessor is used for this function.

The server will use *qlib.data.Provider* to process the data. RabbitMQ also provides a mechanism that can make sure all tasks is succesfully consumed and completed by consumers. This requires the consumer call *ch.basic_ack(delivery_tag=method.delivery_tag)* after succesfully processing the data. If the task is not **acked**, it will return to the pipe and wait for another consuming.

Once the task is finished, a result *(could be data or uri)* will be published to another channel *message_queue*.

1.2 `Qlib-Server` Deployment

1.2.1 Introduction

To build a `Qlib-Server`, user can choose:

- One-click Deployment of Qlib-Server
- Step-by-step Deployment of Qlib-Server

1.2.2 One-click Deployment

One-click deployment of Qlib-Server is supported, users can choose either of the following two methods for one-click deployment:

- Deployment with docker-compose
- Deployment in Azure

One-click Deployment with docker-compose

Deploy Qlib-Server with docker-compose according to the following processes:

- Install docker, please refer to Docker Installation.
- Install docker-compose, please refer to Docker-compose Installation.
- Run the following command to deploy Qlib-Server:

```
git clone https://github.com/microsoft/qlib-server
cd qlib-server
sudo docker-compose -f docker_support/docker-compose.yaml --env-file␣
↪docker_support/docker-compose.env build
sudo docker-compose -f docker_support/docker-compose.yaml --env-file␣
↪docker_support/docker-compose.env up -d
# Use the following command to track the log
sudo docker-compose -f docker_support/docker-compose.yaml logs -f
```

One-click Deployment in Azure

Note: Users need to have an Azure account to deploy Qlib-Server in Azure.

Deploy Qlib-Server in Azure according to the following processes:

- Install azure-cli, please refer to install-azure-cli
- Add the Azure account to the configuration file azure_conf.yaml

```
sub_id: Your Subscription ID
username: azure user name
password: azure password
# The resource group where the VM is located
resource_group: Resource group name
```

- **Execute the deployment script** Run the following command:

  To know more about parameters, please run the following command:

1.2.3 Step-by-step Deployment

Users can deploy Qlib-Server step by step, which has the following processes:

- Build RabbitMQ
- Build Redis
- Build NFS
- Build Qlib-Server

Build RabbitMQ

RabbitMQ is a general task queue that enables qlib-server to separate request handling process and data generating process.

Note: Users need not to build RabbitMQ instance on the same server as Qlib-Server.

Build RabbitMQ according to the following processes:

- Import RabbitMQ signing key on your system:

```
echo 'deb http://www.rabbitmq.com/debian/ testing main' | sudo tee /etc/
↪apt/sources.list.d/rabbitmq.list
wget -O- https://www.rabbitmq.com/rabbitmq-release-signing-key.asc | sudo␣
↪apt-key add -
```

- Update apt cache and install RabbitMQ server on your system:

```
sudo apt-get update
sudo apt-get install rabbitmq-server
```

- Enable the RabbitMQ service and start it.

```
# Using Init -
sudo update-rc.d rabbitmq-server defaults
sudo service rabbitmq-server start
sudo service rabbitmq-server stop

# Using Systemctl -
sudo systemctl enable rabbitmq-server
sudo systemctl start rabbitmq-server
sudo systemctl stop rabbitmq-server
```

- **Create admin user in RabbitMQBy** By default RabbitMQBy creates a username *guest* with password *guest*. Users can also create admin user in RabbitMQ:

```
sudo rabbitmqctl add_user admin <your password>
sudo rabbitmqctl set_user_tags admin administrator
sudo rabbitmqctl set_permissions -p / admin ".*" ".*" ".*"
```

- **Enable web management console** RabbitMQ also provides and web management console for managing the entire RabbitMQ. To enable web management console run following command. The web management console helps users with managing RabbitMQ server.

```
sudo rabbitmq-plugins enable rabbitmq_management
```

Visit *<your rabbitmq host>:15672* to manage your queue. Keep in mind your rabbitmq host and credentials. It will be used in qlib-server config.

Build `Redis`

`Qlib-Server` needs `redis` to store and read some meta info as well as thread lock.

Note: Users need not to build redis instance on the same server as `Qlib-Server`.

Build `redis` according to the following processes:

- **Download the latest version of redis and install**

```
mkdir ~/redis
cd ~/redis
wget http://download.redis.io/releases/redis-5.0.4.tar.gz
tar -zxvf redis-5.0.4.tar.gz
cd redis-5.0.4
sudo make && make install
```

- **Start redis service**

```
/usr/local/bin/redis-server
```

The default port of redis is **6379**. Keep in mind your redis host and port. It will be used in qlib-server config.

Build `NFS`

Before starting `Qlib-Server`, it's necessary to make sure the cache file directories are mounted (or at least ready to be mounted) to clients by configuring nfs service.

Build `NFS` according to the following processes:

- Install NFS service:

```
sudo apt-get install nfs-kernel-server
```

- **Check if the nfs port is open:**

```
netstat -tl
```

Note: By seeing `tcp 0 0 *:nfs *:* LISTEN`, the nfs port is ready for listening. Restart the service to ensure it can be used:

```
sudo /etc/init.d/nfs-kernel-server restart
```

- Modify `/etc/exports` to give the directories ability to be mounted. To find out how the keywords like *rw* work and change them, please refer to nfs documents.

```
sudo echo '<your data directory> *(rw,sync,no_subtree_check,no_root_squash)'>>/etc/
↪exports
```

Use *showmount* to view the exported directories.

Build `Qlib-Server`

Users can choose one of the following two methods to build `Qlib-Server`:

- Build with Source Code
- Build with Dockerfile

Build with Source Code

Build `Qlib-Server` with source code according to the following processes:

- Enter the `Qlib-Server` directory and run *python setup.py install*.
- Modify the config.yaml according to users' needs and configs.
- **Start using `Qlib-server` by running:**

```
cp config_template.yaml config.yaml
edit config.yaml  # Please edit the server config.
python main.py -c config.yaml
```

Warning: Rabbitmq and redis configurations cannot be shared among multiple qlib-server instances

Eg:

```
In config_1.yaml, redis_db:1 task_queue: 'task_queue_1'
In config_2.yaml, redis_db:2 task_queue: 'task_queue_2'
-------------------------------------------------------
In config_1.yaml, redis_db:1 task_queue: 'task_queue_1' ×
In config_2.yaml, redis_db:1 task_queue: 'task_queue_1' ×
```

Note: The content of config.yaml is as follows

- ***provider_uri*** `Qlib` data directory
- ***flask_server*** Flask server host/ip, can be `0.0.0.0` or `private ip`
- ***flask_port*** Data service port, with which the client port must be consistent to access server
- ***queue_host*** `RabbitMQ` server ip/host
- ***queue_user*** `RabbitMQ` user name
- ***queue_pwd*** `RabbitMQ` password
- ***task_queue*** Task queue of `Qlib-Server`, if rabbitmq serves multiple `Qlib-Server` s, this value cannot be repeated
- ***message_queue*** Message queue of `Qlib-Server`, if rabbitmq serves multiple `Qlib-Server` s, this value cannot be repeated

- ***redis_host*** `Redis` server host/ip
- ***redis_port*** `Redis` server port
- ***redis_task_db*** `Redis` database name
- ***auto_update*** Currently, this parameter is not used
- ***update_time*** Currently, this parameter is not used
- ***client_version*** The version of `Qlib` must be newer than *client_version* to access the `Qlib-Server`
- ***server_version*** The version of `Qlib` must be newer than *server_version* to install or run `Qlib-Server`
- ***dataset_cache_dir_name*** The name of the dataset cache directory, it is not recommended to modify
- ***features_cache_dir_name*** The name of the features cache directory, it is not recommended to modify
- ***logging_level*** Level control of `Qlib-Server` log
- ***logging_config*** Log configuration, it is not recommended to modify

Build from Dockerfile

Build `Qlib-Server` with Dockerfile according to the following processes:

- Install `docker`, please refer to Docker Installation.
- Start using `Qlib-Server` by running:

```
git clone https://github.com/microsoft/qlib-server
cd qlib-server
sudo docker build -f docker_support/Dockerfile -t qlib-server \
    --build-arg QLIB_DATA=/data/stock_data/qlib_data \
        QUEUE_HOST=rabbitmq_server \
        REDIS_HOST=redis_server \
        QUEUE_USER=rabbitmq_user \
        QUEUE_PASS=rebbitmq_password \
        FLASK_SERVER_HOST=127.0.0.1 \
        QLIB_CODE=/code
sudo docker run qlib-server
```

1.3 Using `Qlib` in `Online` Mode

1.3.1 Introduction

In the Qlib Document, the `Offline` mode has been introduced. In addition to `offline` mode, users can use `Qlib` in `Online` mode.

The `Online` mode is designed to solve the following problems:

- Manage the data in a centralized way. Users don't have to manage data of different versions.
- Reduce the amount of cache to be generated.
- Make the data can be accessed in a remote way.

In `Online` mode, the data provided for `Qlib` will be managed in a centralized manner by `Qlib-Server`.

1.3.2 Using `Qlib` in `Online` Mode

Use `Qlib` in `online` mode according to the following steps:

- Open `NFS` Features in `Qlib` Client
- Initialize `Qlib` in `online` Mode

Opening `NFS` Features in `Qlib` Client

- **If running on Linux, users need tp install `nfs-common` on the client, execute:**
- **If running on Windows, do as follows.**
  - Open `Programs and Features`.
  - Click `Turn Windows features on or off`.
  - Scroll down and check the option `Services for NFS`, then click OK

  Reference address: https://graspingtech.com/mount-nfs-share-windows-10/

Initializing `Qlib` in `online` Mode

If users want to use `Qlib` in `online` mode, they can choose either of the following two methods to initialize `Qlib`:

- Initialize `Qlib` with configuration file
- Initialize `Qlib` with arguments

Configuration File

The content of configuration file is as follows.

```
calendar_provider:
    class: LocalCalendarProvider
    kwargs:
        remote: True
feature_provider:
    class: LocalFeatureProvider
    kwargs:
        remote: True
expression_provider: LocalExpressionProvider
instrument_provider: ClientInstrumentProvider
dataset_provider: ClientDatasetProvider
provider: ClientProvider
expression_cache: null
dataset_cache: null
calendar_cache: null

provider_uri: 127.0.0.1:/
mount_path: /data/stock_data/qlib_data
auto_mount: True
flask_server: 127.0.0.1
flask_port: 9710
```

- ***provider_uri*** nfs-server path; the format is `host:  data_dir`, for example: `127.0.0.1:/`. If using `Qlib` in `Local` mode, it can be a local data directory.

- ***mount_path*** local data directory, `provider_uri` will be mounted to this directory
- ***auto_mount*:** whether to automatically mount `provider_uri` to `mount_path` during qlib `init`; User can also mount it manually as follows.

  Note: Automount requires sudo permission

- ***flask_server*** data service host/ip
- ***flask_port*** data service port

Initialize `Qlib` with parameters configuration file as follows.

```
import qlib
qlib.init_from_yaml_conf("qlib_clinet_config.yaml")
from qlib.data import D
ins = D.list_instruments(D.instrumetns("all"), as_list=True)
```

Note: If running `Qlib` on Windows, users should write correct **mount_path**.

- **In windows, mount path must be not exist path and root path,**
  - correct format path eg: *H*, *i...*
  - error format path eg: *C*, *C:/user/name*, *qlib_data...*

The configuration file can be:

```
...
...
provider_uri: 127.0.0.1:/
mount_path: H
auto_mount: True
flask_server: 127.0.0.1
flask_port: 9710
```

Arguments

Initialize `Qlib` with arguments as follows.

```
import qlib

# qlib client config

ONLINE_CONFIG = {
    # data provider config
    "calendar_provider": {"class": "LocalCalendarProvider", "kwargs": {"remote": True}
↪},
    "instrument_provider": "ClientInstrumentProvider",
    "feature_provider": {"class": "LocalFeatureProvider", "kwargs": {"remote": True}},
    "expression_provider": "LocalExpressionProvider",
    "dataset_provider": "ClientDatasetProvider",
    "provider": "ClientProvider",
    # config it in user's own code
    "provider_uri": "127.0.0.1:/",
```

(continues on next page)

(continued from previous page)

```
    # cache
    # Using parameter 'remote' to announce the client is using server_cache, and the␣
↪writing access will be disabled.
    "expression_cache": None,
    "dataset_cache": None,
    "calendar_cache": None,
    "mount_path": "/data/stock_data/qlib_data",
    "auto_mount": True,  # The nfs is already mounted on our server[auto_mount:␣
↪False].
    "flask_server": "127.0.0.1",
    "flask_port": 9710,
    "region": "cn",
}

qlib.init(**client_config)
ins = D.list_instruments(D.instrumetns("all"), as_list=True)
```

Note: If running `Qlib` on Windows, users should write correct **mount_path**.

The arguments can be:

```
ONLINE_CONFIG = {
    ...
    ...
    "mount_path": "H",
    "auto_mount": True,
    "flask_server": "127.0.0.1",
    "flask_port": 9710,
    "region": "cn",
}
```

1.4 Changelog

Here you can see the full list of changes between each QLibServer release.

1.4.1 Version 0.1.0

This is the initial release of QLibServer.

1.4.2 Version 0.1.1

- Fix multi-process log bug, using `logging.handlers.QueueHandler`
- Modify to create a rabbitmq `connection` and `channel` for each process, before sharing a one that causes `basic_ack` to be unsuccessful
- Add `max_process` to config
- The log is set through the configuration file, refer to config.yaml.example

1.4.3 Version 0.1.2

- Format PEP8