queueCTL: A Persistent CLI Job Queue

queueCTL is a robust, job queue system built in Java. It runs shell commands as background jobs, manages parallel workers, and gracefully handles failures with retries and a Dead Letter Queue (DLQ).

Tech Stack Used:
- **Java** - Core Programming Language
- **picocli** - Type-safe CLI framework.
- **Javalin** - Lightweight web framework for the dashboard.
- **SQLite-JDBC** - File-based database engine.
- **Jackson** - Fast JSON parsing library.
- **Maven** - Build Tool

Working of queueCTL:

Build Project using Maven
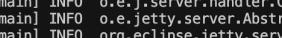
```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % mvn clean package
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------< com.queuectl:queuectl >-------------------
[INFO] Building queuectl 1.0.0
[INFO]   from pom.xml
[INFO] --------------------------------[ jar ]--------------------------------
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  3.198 s
[INFO] Finished at: 2025-11-12T13:22:11+05:30
[INFO] ------------------------------------------------------------------------
```

Renaming to queuectl

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % alias queuectl="java -jar '/Users/chiragjogi/PES/Project/queuectl/target/queuectl-1.0.0.jar'"
```

Dashboard

```
○ (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl dashboard
13:28:58.744 [main] INFO  io.javalin.Javalin - Starting Javalin ...
13:28:58.745 [main] INFO  org.eclipse.jetty.server.Server - jetty-11.0.20; built: 2024-01-29T21:04:22.394Z; git: 922f8dc188f7011e60d0361de585fd4ac4d63
064; jvm 21.0.9+10-LTS
13:28:58.771 [main] INFO  o.e.j.s.s.DefaultSessionIdManager - Session workerName=node0
13:28:58.776 [main] INFO  o.e.j.server.handler.ContextHandler - Started o.e.j.s.ServletContextHandler@4612b856{/,null,AVAILABLE}
13:28:58.779 [main] INFO  o.e.jetty.server.AbstractConnector - Started ServerConnector@6cdba6dc{HTTP/1.1, (http/1.1)}{0.0.0.0:7070}
13:28:58.787 [main] INFO  org.eclipse.jetty.server.Server - Started Server@41005828{STARTING}[11.0.20,sto=0] @804ms
13:28:58.788 [main] INFO  io.javalin.Javalin -

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      /_____  __ \
     / _  ___/ _  ___/ _  / / // /  6
    / /_/ // /_/ // /_/ / /_/ /
    \____/ \____//_/ \__,_/\___/

        https://javalin.io/documentation

13:28:58.788 [main] INFO  io.javalin.Javalin - Javalin started in 78ms \o/
13:28:58.875 [main] INFO  io.javalin.Javalin - Static file handler added: StaticFileConfig(hostedPath=/, directory=/public, location=CLASSPATH, precom
press=false, aliasCheck=null, headers={Cache-Control=max-age=0}, mimeTypes={}). File system location: 'jar:file:/Users/chiragjogi/PES/Project/queuectl
/target/queuectl-1.0.0.jar!/public'
13:28:58.877 [main] INFO  io.javalin.Javalin - Listening on http://localhost:7070/
13:28:58.882 [main] INFO  io.javalin.Javalin - You are running Javalin 6.1.3 (released March 2, 2024. Your Javalin version is 619 days old. Consider c
hecking for a newer version.).
Dashboard running at http://localhost:7070
```
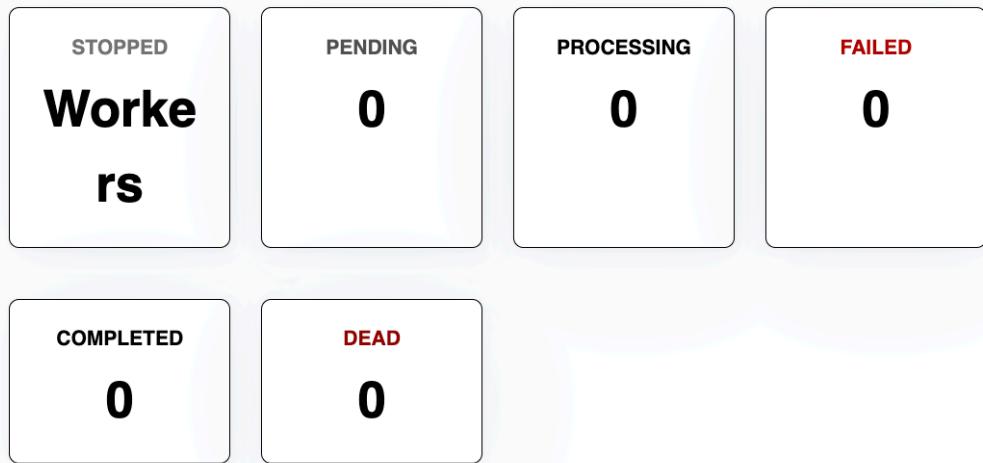
QueueCTL Dashboard

System Status

STOPPED Workers	PENDING 0	PROCESSING 0	FAILED 0

COMPLETED 0	DEAD 0

Job Queues

PENDING	PROCESSING	FAILED	COMPLETED
No jobs found.	No jobs found.	No jobs found.	No jobs found.

DEAD
No jobs found.
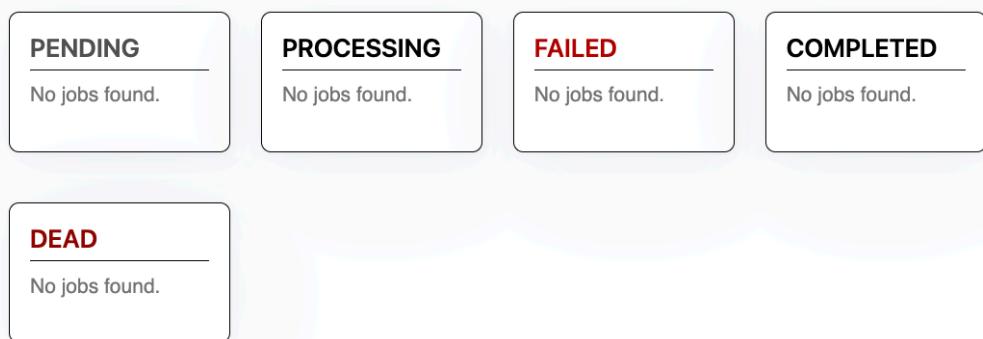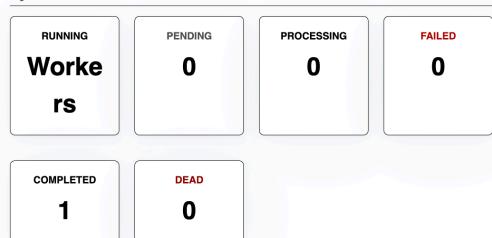
Working

```
○ (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl worker start --count 2

  Starting 2 workers...
  Workers started. Press Ctrl+C to stop.
  [Worker pool-1-thread-2] Starting...
  [Worker pool-1-thread-1] Starting...
  [Worker pool-1-thread-2] Processing Job job-good: echo Hello World!
  [Worker pool-1-thread-2] Job job-good COMPLETED
```
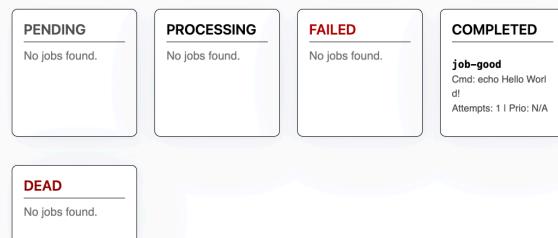
```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"job-good",
  "command":"echo Hello World!"}'
  Job enqueued with ID: job-good
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl list --state COMPLETED
  --- Jobs in COMPLETED state ---
  ID: job-good
    Command: echo Hello World!
    Attempts: 1
  ------------------------------------
```

QueueCTL Dashboard

System Status

RUNNING Workers	PENDING 0	PROCESSING 0	FAILED 0

COMPLETED 1	DEAD 0

Job Queues

PENDING	PROCESSING	FAILED	COMPLETED
No jobs found.	No jobs found.	No jobs found.	job-good Cmd: echo Hello World! Attempts: 1 | Prio: N/A

DEAD
No jobs found.

Log of a job:

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl logs job-good
  --- Logs for job-good ---

  --- ATTEMPT 1 at Wed Nov 12 13:35:35 IST 2025 ---
  Hello World!
```

Info of a job:
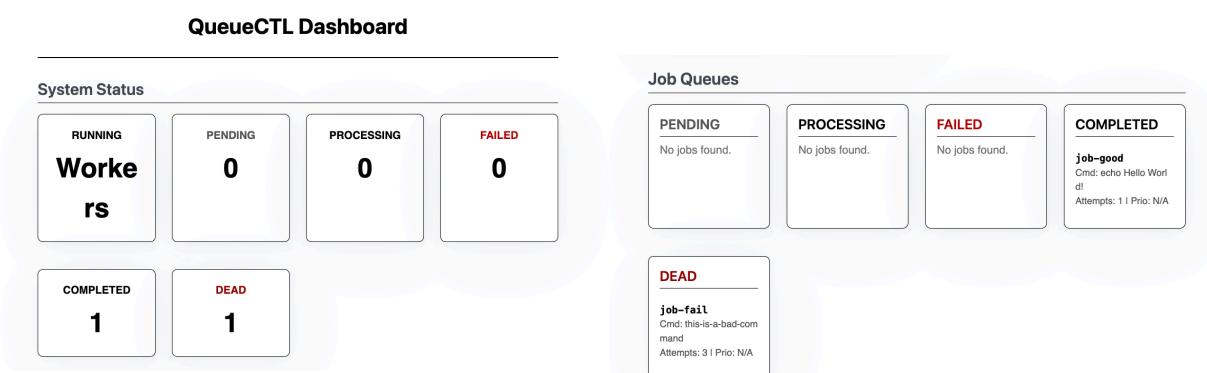
```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl info job-good
  --- Job Details ---
  ID:        job-good
  State:     COMPLETED
  Command:   echo Hello World!
  Priority:  0
  Attempts:  1 / 3
  Timeout:   300 seconds
  Created:   2025-11-12 13:35:35
  Updated:   2025-11-12 13:35:35
  --- Last Output ---
  Hello World!
```

Configure retries and working of failed/dead:(Failed State - Automatic retries)

```
○ (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl worker start --count 2

  Starting 2 workers...
  Workers started. Press Ctrl+C to stop.
  [Worker pool-1-thread-2] Starting...
  [Worker pool-1-thread-1] Starting...
  [Worker pool-1-thread-2] Processing Job job-good: echo Hello World!
  [Worker pool-1-thread-2] Job job-good COMPLETED
  [Worker pool-1-thread-1] Processing Job job-fail: this-is-a-bad-command
  [Worker pool-1-thread-1] Job job-fail FAILED. Retrying in 2000ms.
  [Worker pool-1-thread-1] Processing Job job-fail: this-is-a-bad-command
  [Worker pool-1-thread-1] Job job-fail FAILED. Retrying in 4000ms.
  [Worker pool-1-thread-1] Processing Job job-fail: this-is-a-bad-command
  [Worker pool-1-thread-1] Job job-fail FAILED (Max retries). Moved to DLQ.
```

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl config set max-retries 2
  Config set: max-retries = 2
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"job-fail",
  "command":"this-is-a-bad-command"}'
  Job enqueued with ID: job-fail
○ (base) chiragjogi@Chirags-MacBook-Air queuectl %
```

QueueCTL Dashboard

System Status

RUNNING	PENDING	PROCESSING	FAILED
Workers	0	0	0

COMPLETED	DEAD
1	1

Job Queues

PENDING	PROCESSING	FAILED	COMPLETED
No jobs found.	No jobs found.	No jobs found.	**job-good** Cmd: echo Hello World! Attempts: 1	Prio: N/A

DEAD

job-fail
Cmd: this-is-a-bad-command
Attempts: 3 | Prio: N/A

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl dlq list
  --- Jobs in DEAD state ---
  ID: job-fail
    Command: this-is-a-bad-command
    Attempts: 3
    Last Output: [ERROR] sh: this-is-a-bad-command: command not found

    [ERROR] Exited with code 1...
    ----------------------------------------
```

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DLQ retry:

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl dlq retry job-fail
  Job job-fail has been requeued.
```

```
[Worker pool-1-thread-2] Processing Job job-fail: this-is-a-bad-command
[Worker pool-1-thread-2] Job job-fail FAILED. Retrying in 2000ms.
[Worker pool-1-thread-1] Processing Job job-fail: this-is-a-bad-command
[Worker pool-1-thread-1] Job job-fail FAILED. Retrying in 4000ms.
[Worker pool-1-thread-2] Processing Job job-fail: this-is-a-bad-command
[Worker pool-1-thread-2] Job job-fail FAILED (Max retries). Moved to DLQ.
```

Priority Enqueue:

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"clog-1", "c
  ommand":"sleep 20"}'
  queuectl enqueue '{"id":"clog-2", "command":"sleep 20"}'
  Job enqueued with ID: clog-1
  Job enqueued with ID: clog-2
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"job-low-pri
  o", "command":"echo I am low priority"}'

  Job enqueued with ID: job-low-prio
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"job-high-pr
  io", "command":"echo I AM HIGH PRIORITY", "priority": 20}'
  Job enqueued with ID: job-high-prio
○ (base) chiragjogi@Chirags-MacBook-Air queuectl % █
```

Higher priority one was completed first even tho lower priority one was executed first.

```
[Worker pool-1-thread-1] Processing Job clog-1: sleep 20
[Worker pool-1-thread-2] Processing Job clog-2: sleep 20
[Worker pool-1-thread-1] Job clog-1 COMPLETED
[Worker pool-1-thread-2] Job clog-2 COMPLETED
[Worker pool-1-thread-1] Processing Job job-high-prio: echo I AM HIGH PRIORITY
[Worker pool-1-thread-2] Processing Job job-low-prio: echo I am low priority
[Worker pool-1-thread-1] Job job-high-prio COMPLETED
[Worker pool-1-thread-2] Job job-low-prio COMPLETED
```

Timeout:

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"job-timeout
  ", "command":"sleep 20", "timeout": 2}'
  Job enqueued with ID: job-timeout
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl logs job-timeout
  --- Logs for job-timeout ---

  --- ATTEMPT 1 at Wed Nov 12 13:59:13 IST 2025 ---

  --- ATTEMPT 2 at Wed Nov 12 13:59:19 IST 2025 ---

  --- ATTEMPT 3 at Wed Nov 12 13:59:27 IST 2025 ---

● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl info job-timeout
  --- Job Details ---
  ID:        job-timeout
  State:     DEAD
  Command:   sleep 20
  Priority:  0
  Attempts:  3 / 3
  Timeout:   2 seconds
  Created:   2025-11-12 13:59:13
  Updated:   2025-11-12 13:59:31
  --- Last Output ---

  [ERROR] Job timed out after 2 seconds.
```

4

DEAD
------
job-fail
Cmd: this-is-a-bad-com
mand
Attempts: 3 | Prio: N/A

job-timeout
Cmd: sleep 20
Attempts: 3 | Prio: N/A

```
[Worker pool-1-thread-1] Processing Job job-timeout: sleep 20
[Worker pool-1-thread-1] Job job-timeout FAILED. Retrying in 2000ms.
[Worker pool-1-thread-2] Processing Job job-timeout: sleep 20
[Worker pool-1-thread-2] Job job-timeout FAILED. Retrying in 4000ms.
[Worker pool-1-thread-1] Processing Job job-timeout: sleep 20
[Worker pool-1-thread-1] Job job-timeout FAILED (Max retries). Moved to DLQ.
```

Other states examples:
(New Database)

```
○ (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl dashboard
  14:06:49.450 [main] INFO  io.javalin.Javalin - Starting Javalin ...
  14:06:49.451 [main] INFO  org.eclipse.jetty.server.Server - jetty-11.0.20; built: 2024-01-29T21:04:22.394Z; git: 922f8dc188f7011e60d0361de585fd4ac4d63064; jvm 21.0.9+10-LTS
  14:06:49.470 [main] INFO  o.e.j.s.s.DefaultSessionIdManager - Session workerName=node0
  14:06:49.473 [main] INFO  o.e.j.server.handler.ContextHandler - Started o.e.j.s.ServletContextHandler@79c7532f{/,null,AVAILABLE}
  14:06:49.477 [main] INFO  o.e.jetty.server.AbstractConnector - Started ServerConnector@5cdec700{HTTP/1.1, (http/1.1)}{0.0.0.0:7070}
  14:06:49.482 [main] INFO  org.eclipse.jetty.server.Server - Started Server@2141a12{STARTING}[11.0.20,sto=0] @1963ms
  14:06:49.482 [main] INFO  io.javalin.Javalin -

        Javalin 6

        https://javalin.io/documentation

  14:06:49.482 [main] INFO  io.javalin.Javalin - Javalin started in 56ms \o/
  14:06:49.555 [main] INFO  io.javalin.Javalin - Static file handler added: StaticFileConfig(hostedPath=/, directory=/public, location=CLASSPATH, precompress=false, aliasCheck=nu
  ll, headers={Cache-Control=max-age=0}, mimeTypes={}). File system location: 'jar:file:/Users/chiragjogi/PES/Project/queuectl/target/queuectl-1.0.0.jar!/public'
  14:06:49.557 [main] INFO  io.javalin.Javalin - Listening on http://localhost:7070/
  14:06:49.561 [main] INFO  io.javalin.Javalin - You are running Javalin 6.1.3 (released March 2, 2024. Your Javalin version is 619 days old. Consider checking for a newer versio
  n.).
  Dashboard running at http://localhost:7070
```

QueueCTL Dashboard

System Status

STOPPED	PENDING	PROCESSING	FAILED
Workers	**0**	**0**	**0**

COMPLETED	DEAD
0	**0**

Job Queues

PENDING	PROCESSING	FAILED	COMPLETED
No jobs found.	No jobs found.	No jobs found.	No jobs found.

DEAD
No jobs found.

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"job-A", "command":"echo A"}'
  queuectl enqueue '{"id":"job-B", "command":"echo B"}'
  queuectl enqueue '{"id":"job-C", "command":"echo C"}'
  Job enqueued with ID: job-A
  Job enqueued with ID: job-B
  Job enqueued with ID: job-C
○ (base) chiragjogi@Chirags-MacBook-Air queuectl %
```

Without any workers:(Pending State)

QueueCTL Dashboard

System Status

STOPPED	PENDING	PROCESSING	FAILED
Workers	**3**	**0**	**0**

COMPLETED	DEAD
0	**0**

Job Queues

PENDING	PROCESSING	FAILED	COMPLETED
job-A Cmd: echo A Attempts: 0 | Prio: N/A **job-B** Cmd: echo B Attempts: 0 | Prio: N/A **job-C** Cmd: echo C Attempts: 0 | Prio: N/A	No jobs found.	No jobs found.	No jobs found.

DEAD
No jobs found.

Start one worker:(Completed State)

```
○ (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl worker start --count 1
  Starting 1 workers...
  Workers started. Press Ctrl+C to stop.
  [Worker pool-1-thread-1] Starting...
  [Worker pool-1-thread-1] Processing Job job-A: echo A
  [Worker pool-1-thread-1] Job job-A COMPLETED
  [Worker pool-1-thread-1] Processing Job job-B: echo B
  [Worker pool-1-thread-1] Job job-B COMPLETED
  [Worker pool-1-thread-1] Processing Job job-C: echo C
  [Worker pool-1-thread-1] Job job-C COMPLETED
```
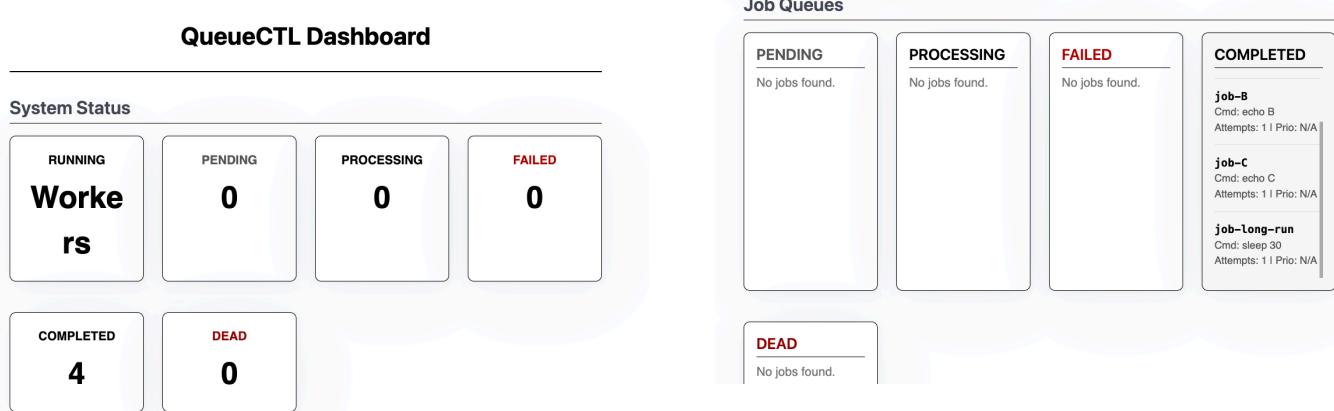
QueueCTL Dashboard

System Status

RUNNING	PENDING	PROCESSING	FAILED
Workers	0	0	0

COMPLETED	DEAD
3	0

Job Queues

| PENDING	PROCESSING	FAILED	COMPLETED
No jobs found.	No jobs found.	No jobs found.	**job-A** Cmd: echo A Attempts: 1	Prio: N/A **job-B** Cmd: echo B Attempts: 1	Prio: N/A **job-C** Cmd: echo C Attempts: 1	Prio: N/A

DEAD
No jobs found.

Processing State:

```
● (base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl enqueue '{"id":"job-lon
  g-run", "command":"sleep 30"}'
  Job enqueued with ID: job-long-run
○ (base) chiragjogi@Chirags-MacBook-Air queuectl %
```

QueueCTL Dashboard

System Status

RUNNING	PENDING	PROCESSING	FAILED
Workers	0	1	0

COMPLETED	DEAD
3	0

Job Queues

PENDING	PROCESSING	FAILED	COMPLETED
No jobs found.	**job-long-run** Cmd: sleep 30 Attempts: 1	Prio: N/A	No jobs found.	**job-A** Cmd: echo A Attempts: 1	Prio: N/A **job-B** Cmd: echo B Attempts: 1	Prio: N/A **job-C** Cmd: echo C Attempts: 1	Prio: N/A

DEAD
No jobs found.

```
[Worker pool-1-thread-1] Job job-C COMPLETED
[Worker pool-1-thread-1] Processing Job job-long-run: sleep 30
[Worker pool-1-thread-1] Job job-long-run COMPLETED
```

QueueCTL Dashboard

System Status

RUNNING	PENDING	PROCESSING	FAILED
Workers	**0**	**0**	**0**

COMPLETED	DEAD
4	**0**

Job Queues

PENDING	PROCESSING	FAILED	COMPLETED
No jobs found.	No jobs found.	No jobs found.	**job-B** Cmd: echo B Attempts: 1 | Prio: N/A **job-C** Cmd: echo C Attempts: 1 | Prio: N/A **job-long-run** Cmd: sleep 30 Attempts: 1 | Prio: N/A

DEAD

No jobs found.

Other:

Status:

```
Job enqueued with ID: job-long-run
(base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl status
--- Worker Status ---
Workers are RUNNING (PID: 12878)

--- Job Queue Status ---
PENDING    : 0
PROCESSING: 0
FAILED     : 0
COMPLETED : 4
DEAD       : 0
(base) chiragjogi@Chirags-MacBook-Air queuectl %
```

List state:

```
  state <State>   Job state (PENDING, COMPLETED, DEAD)
(base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl list --state COMPLETED
--- Jobs in COMPLETED state ---
ID: job-A
  Command: echo A
  Attempts: 1
------------------------------------
ID: job-B
  Command: echo B
  Attempts: 1
------------------------------------
ID: job-C
  Command: echo C
  Attempts: 1
------------------------------------
ID: job-long-run
  Command: sleep 30
  Attempts: 1
------------------------------------
```

Stop worker:

```
(base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl worker stop
Sending stop signal to worker process (PID: 13742)...
Workers stopped successfully.
```

```
(base) chiragjogi@Chirags-MacBook-Air queuectl % queuectl worker start --count 1
Starting 1 workers...
Workers started. Press Ctrl+C to stop.
[Worker pool-1-thread-1] Starting...

Graceful shutdown initiated...
[Worker pool-1-thread-1] Stopping...
Workers shut down.
```