Getting started

Description

A project implements the protocol “Read one copy, write all available copies” based on the ideas from "Site Recovery in Replicated Distributed Database Systems", 6th IEEE Distributed Computing Systems Conference, May 1986. User transactions can read and write logical objects at any available site, changed values replicate among available sites and they are marked in fail-lock tables for further recovery of unavailable sites. If at least one site is always up, it is possible to perform operations on available copies and failed sites can recover successfully after crashing.

The project consists from 2 java modules. The first one simulates 3 sites which communicate with each other via java RMI. The second one is used as a simulator for demonstration, it forces sites to fail or wake up and simulates user queries to the sites.

Requirements

- Java version 1.8 or higher.

Compile

Windows and Linux

1. Compile from the Site project directory (Site/):

   ```
   javac -d bin src/*.java
   ```

2. Compile from the SiteController project directory (SiteController/):

   ```
   javac -d bin src/*.java
   ```

Start

Windows

1. Set Site/bin/ as a working directory;

2. Start RMI:

   ```
   rmiregistry
   ```

3. Starting the application it is necessary to set option “-Djava.rmi.server.codebase” to the full path of the directory with binary files of the project. For example, “D:\Eclipse\workspace\Site\bin\”.

   To start single container for 3 sites of Site project:

   ```
   java -Djava.rmi.server.codebase=file:D:\Eclipse\workspace\Site\bin\bin\ SiteImpl
   ```

   OR start 3 sites separately:

   ```
   java -Djava.rmi.server.codebase=file:D:\Eclipse\workspace\Site\bin\bin\ Site0
   java -Djava.rmi.server.codebase=file:D:\Eclipse\workspace\Site\bin\bin\ Site1
   java -Djava.rmi.server.codebase=file:D:\Eclipse\workspace\Site\bin\bin\ Site2
   ```

4. Set SiteController/bin/ as a working directory;

5. Start SiteController:

   ```
   java SiteController
   ```

Linux

From the command line:

1. Set Site/bin/ as a working directory;

2. Start RMI:

```
rmiregistry
```

3. Starting the application it is necessary to set option “-Djava.rmi.server.codebase” to the full path of the directory with binary files of the project. For example, “/tkuznets/workspace/Site/bin/”.

   To start single container for 3 sites of Site project:

   ```
   java -Djava.rmi.server.codebase=file:/tkuznets/workspace/Site/bin/ SiteImpl
   ```

   OR start 3 sites separately:

   ```
   java -Djava.rmi.server.codebase=file:/tkuznets/workspace/Site/bin/ Site0
   ```

   ```
   java -Djava.rmi.server.codebase=file:/tkuznets/workspace/Site/bin/ Site1
   ```

   ```
   java -Djava.rmi.server.codebase=file:/tkuznets/workspace/Site/bin/ Site2
   ```

4. Set SiteController/bin/ as a working directory;

5. Start SiteController:

   ```
   java SiteController
   ```

Commands

Commands for site controller:

Command	Format	Description
HELP	HELP	Print help
READ	<site_num> READ <item>*	Read data item at the site
WRITE	<site_num> WRITE <item>* <value>	Write data item at the site
FAIL	<site_num> FAIL	Simulate site failure
WAKE_UP	<site_num> WAKE_UP	Simulate site recovery
PRINT_ITEMS	<site_num> PRINT_ITEMS	Print all values of data items of the site
PRINT_VECTOR	<site_num> PRINT_VECTOR	Print session vector of the site
PRINT_FLOCKS	<site_num> PRINT_FLOCKS	Print all fail-locks stored at the site
PRINT_UNREAD	<site_num> PRINT_UNREAD	Print unreadable data items
PRINT_SESSION	<site_num> PRINT_SESSION	Print sctual sesison number
TIMER	<site_num> TIMER true|false	Turn timer on/off
LOG	<site_num> LOG true|false	Turn logging on/off
SLEEP	<site_num> SLEEP true|false	Turn sleeping mode on/off
HELP	HELP	Print help message
Q	Q	Exit site controller

* item in range {X, Y, Z, L, M, N, A, B, C, D, E, F}

Test scenarios

Test 1

Simple test which shows read and write operations and replication of new values.

Input in the SiteController command line:

1. `>>> 0 PRINT_ITEMS`

2. `>>> 1 PRINT_ITEMS`

3. `>>> 2 PRINT_ITEMS`

4. `>>> 0 READ X`

5. `>>> 0 WRITE X 0`

6. >>> 0 READ X
7. >>> 1 READ X
8. >>> 2 READ X
9. >>> 0 PRINT_ITEMS
10. >>> 1 PRINT_ITEMS
11. >>> 2 WRITE Y 0
12. >>> 2 PRINT_ITEMS
13. >>> 0 PRINT_ITEMS

Test 2

This test shows failure and recover of 2 sites and writing values while 1 or 2 sites are down.

Input in the SiteController command line:

1. >>> 0 FAIL
2. >>> 1 PRINT_VECTOR
3. >>> 2 PRINT_VECTOR
4. >>> 1 WRITE X 2
5. >>> 1 PRINT_VECTOR
6. >>> 2 PRINT_VECTOR
7. >>> 0 WAKE_UP
8. >>> 0 PRINT_ITEMS
9. >>> 1 PRINT_VECTOR

Test 3

This test shows the recovery process when one site fails after another and they recover in the same order.

Input in the SiteController command line:

1. >>> 0 FAIL
2. >>> 1 WRITE Z 0
3. >>> 1 FAIL
4. >>> 2 PRINT_VECTOR
5. >>> 0 WAKE_UP
6. >>> 0 PRINT_ITEMS
7. >>> 0 PRINT_VECTOR
8. >>> 2 PRINT_VECTOR
9. >>> 2 WRITE Y 0
10. >>> 1 WAKE_UP
11. >>> 1 PRINT_ITEMS

Test 4

This test shows the maintenance and collection of fail-locks.

Input in the SiteController command line:

1. >>> 0 FAIL
2. >>> 1 PRINT_FLOCKS
3. >>> 2 PRINT_FLOCKS
4. >>> 1 WRITE Z 0
5. >>> 1 PRINT_FLOCKS
6. >>> 2 PRINT_FLOCKS
7. >>> 2 WRITE A 0
8. >>> 1 PRINT_FLOCKS
9. >>> 1 PRINT_ITEMS
10. >>> 0 WAKE_UP
11. >>> 0 PRINT_ITEMS

Test 5

This test shows the performance of the recovery if during failure none or all logical objects were updated.

Input in the SiteController command line:

1. >>> 0 TIMER true
2. >>> 0 LOG false
3. >>> 0 FAIL
4. >>> 0 WAKE_UP
5. >>> 0 FAIL
6. >>> 1 WRITE X 0
7. >>> 1 WRITE Y 0
8. >>> 1 WRITE Z 0
9. >>> 1 WRITE L 0
10. >>> 1 WRITE M 0
11. >>> 1 WRITE K 0
12. >>> 1 WRITE A 0
13. >>> 1 WRITE B 0
14. >>> 1 WRITE C 0
15. >>> 1 WRITE D 0
16. >>> 1 WRITE E 0
17. >>> 1 WRITE F 0

```
18. >>> 1 PRINT_FLOCKS

19. >>> 0 WAKE_UP
```

Test 6

Shows the ability to receive write and replicate commands during recovery and perform them after it. To send those commands it is necessary to change the mode of the site that will recover and to start second SiteController.

Input in the first SiteController command line:

```
1.  >>> 0 SLEEP true

2.  >>> 0 FAIL

3.  >>> 0 WAKE_UP
```

Input in the second SiteController command line:

```
1.  >>> 0 WRITE X 5

2.  >>> 1 WRITE Y 6
```