

A full description of all functions code used can be found in the html generated from doxygen. Open index.html within the html folder in a browser to view the html describing the project. (I didn't include the images or html in page length... hope that's OK)

Client Side Code

- Client has a thread to listen for incoming UDP publications from the server.
- Received articles are saved to the disk.
- Client sends a UDP verification to the server after receiving an article.
- Client updates upon launching or after a server connection is re-established.
- Server IP, server port, and client's listening port are permanently set in the code.
- Command-line entering is possible by uncommenting specific lines of code.
- Client confirms server-port combination with an initial ping and continues trying to access the server if it fails.
- Client uses the first non-loopback IP for automatic update but can manually update with any valid IP and port.
- Mutual exclusion locks are in place to prevent race conditions.
- Publications should not arrive out of order due to verifications being waited for on the server side before any additional publications can be sent by the server.
- Debugging information about failed RPC calls is logged on the server-side.
- If the server connection fails, the client locks down manual commands, attempts to reconnect every 3 seconds, and updates upon successful reconnection.
- Unlocking manual calls outside the ping thread after connection re-establishment may cause client crashes, so manual calls stay locked until the application restarts. The client update and restarting of the listening thread for new publications is still operational.

Server Side Code

- Client, subscription, and failed send information is kept in memory and saved to disk upon any changes. Disk is read from during server initialization.
- No strict limit on the number of subscriptions or unverified sent messages.
- Mutual exclusion locks are in place to prevent race conditions.
- Full logging of all calls, failures, and debugging information is kept in server.log.
- Logging of verifications received and timeouts is saved in verification.log.
- Joined clients are stored in a char array.
- Subscriptions are stored in pubSub structures with an address structure.

- Hash values are made for both the address and full object, but they have not been implemented into searches.
- Articles must match publication and subscription requirements per assignment instructions, but the application can handle incorrect input well.
- Publications are sent only to clients that meet the subscription data and are actively joined.
- Blank space in articles is treated as a wildcard.
- Only one article is sent to each client even if they have multiple matching subscriptions.
- More general subscriptions supersede more specific subscriptions in determining if an article is sent.

Demonstration

The images on the following pages provide illustration for this demonstration.

1. Start the server.
2. Startup Client 1 with IP 192.168.0.6 and Client 2 with IP 192.168.0.5.
3. Call the test program on both clients.
4. Client 1 demonstrates resilience to different and incorrect RPC calls.
5. Stop and restart the server.
6. Client 1 detects server unresponsiveness, locks down manual commands, and checks for server responsiveness every 3 seconds.
7. Restart Client 2, join, subscribe, and publish an article.
8. Client 1 receives the article despite server restart while client application was active.
9. Shutdown Client 1 and have Client 2 publish an article intended for both clients.
10. Client 1 doesn't send a verification due to being inactive. Server saves failed send information. Upon restart, Client 1 automatically updates.

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Terminal Jul 13 12:32

lo0/v6 static ok ::1/128
net0/v6 addrconf ok fe80::20c:29ff:fe2c:b98a/10
admin1@SolarisTest:~/DevStudioProjects/Working$ ./communicate_client

Enter host IPv4: 192.168.0.7
Trying an initial ping...Success!

Enter the port number you want to start listening on: 54321

Using 192.168.0.6 as the local IP for update
Attempting to update 192.168.0.6 ...
success!

Enter command: test
Using 192.168.0.6 as the local IP
call to ping succeeded
call to join succeeded
call to subscribe succeeded
call to publish succeeded
call to update succeeded
call to unsubscribe succeeded
call to leave succeeded

Enter command:
```

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Terminal Jul 13 12:58

Enter command: join 168.34.543 324125234235
This has too many characters to be a valid port number: 324125234235
Enter command: join 168.34.0.24 54325
success!

Enter command: join 168.34.0.24 54325
Rejected Join. Probably due to already joined.

Enter command: leave 168.34.0.24 54325
success!

Enter command: leave 168.34.0.24 54325
Rejected Leave. Probably due to misspelling or due to not currently joined.

Enter command: join local 54321
Using 192.168.0.6 as the local IP
success!

Enter command: subscribe local 54321 incorrect;;;alsoIncorrect
Using 192.168.0.6 as the local IP
Rejected Subscribe. Could be invalid article, misspelled, or the subscription could already exist. Check server logs for more details.

Enter command: subscribe local 54321 sports;;;
Using 192.168.0.6 as the local IP
success!

Enter command: subscribe 168.34.0.24 54325 sports;;;
success!

Enter command: unsubscribe 168.34.0.24 54325 sports;;;
success!
```

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Terminal Jul 13 12:59
```

Enter command: publish local 54321 "sports;;;This is a sports message from Client1"
Using 192.168.0.6 as the local IP
success!

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Terminal Jul 13 13:00

admin1@SolarisTest:~/DevStudioProjects/Working$ ./communicate_client

Enter host IPv4: 192.168.0.7
Trying an initial ping...Success!

Enter the port number you want to start listening on: 54321

Using 192.168.0.6 as the local IP for update
Attempting to update 192.168.0.6 ...
success!

Enter command: call failed: RPC: Unable to receive; errno = Connection refused; System error

Background ping failed. Server not reachable. Blocking other Tasks. Trying another ping in 3 seconds.
Background ping succeeded! Unblocking other tasks.

using 192.168.0.6 as local IP for update
attempting to update 192.168.0.6 ...success!

Listening to the server for publications is still active.
Please restart the client application to invoke new commands.s
```

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Terminal Jul 13 13:06

Enter command: join local 54321
Using 192.168.0.5 as the local IP
success!

Enter command: subscribe local 54321 sports;;;
Using 192.168.0.5 as the local IP
success!

Enter command: publish local 54321 "sports;;;This is a sports message from client 2"
Using 192.168.0.5 as the local IP
success!

Enter command:
```

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Terminal Jul 13 13:16

Terminal

Enter command: publish local 54321 "sports;;;This is a message sent fr
om client 2 while client 1 is down"
Using 192.168.0.5 as the local IP
success!

Enter command: ^C
admin1@SolarisTest:~/DevStudioProjects/Workings
```

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Oracle Developer Studio Jul 13 13:16

Oracle Developer Studio

File Edit View Navigate Source Refactor Run Debug Team Tools Window Help
localhost Default

ReceivedArticles.txt x Disassembly x communicate_clnt.c x
Source History
1 This is an auto-generated article from the test command.
2 This is a sports message from Client1
3 This is a sports message from client 2
4 This is a message sent from client 2 while client 1 is down
5
```

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Oracle Developer Studio Jul 13 13:17

Oracle Developer S

File Edit View Navigate Source Refactor Run Debug Team Tools Window Help
localhost Default

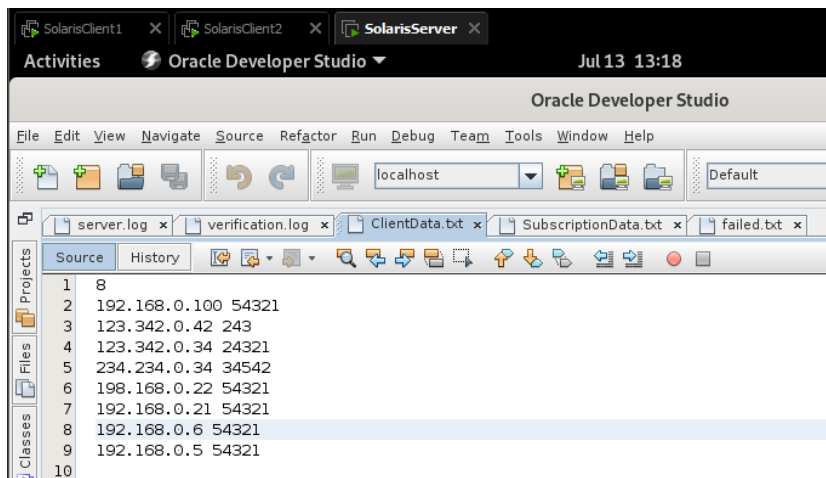
ReceivedArticles.txt x
Source History
1 This is an auto-generated article from the test command.
2 This is a sports message from client 2
3 This is a message sent from client 2 while client 1 is down
4
```

```
SolarisClient1 x SolarisClient2 x SolarisServer x
Activities Oracle Developer Studio Jul 13 13:18

Oracle Developer Studio

File Edit View Navigate Source Refactor Run Debug Team Tools Window Help
localhost Default

server.log x verification.log x ClientData.txt x SubscriptionData.txt x failed.txt x
Source History
1 Received verification from 192.168.0.6:54321
2 Finished Waiting for Verifications
3 Received verification from 192.168.0.5:54321
4 Finished Waiting for Verifications
5 Received verification from 192.168.0.6:54321
6 Finished Waiting for Verifications
7 Received verification from 192.168.0.6:54321
8 Received verification from 192.168.0.5:54321
9 Finished Waiting for Verifications
10 Received verification from 192.168.0.5:54321
11 Finished Waiting for Verifications
12
```



SolarisClient1 x SolarisClient2 x SolarisServer x

Activities Oracle Developer Studio Jul 13 13:18

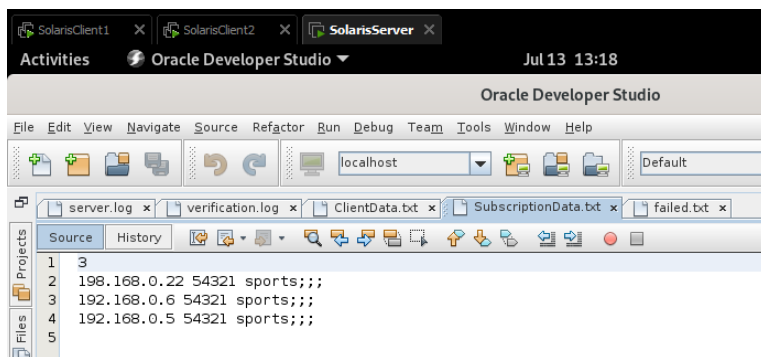
File Edit View Navigate Source Refactor Run Debug Team Tools Window Help

localhost Default

server.log x verification.log x ClientData.txt x SubscriptionData.txt x failed.txt x

Source History

```
1 8
2 192.168.0.100 54321
3 123.342.0.42 243
4 123.342.0.34 24321
5 234.234.0.34 34542
6 198.168.0.22 54321
7 192.168.0.21 54321
8 192.168.0.6 54321
9 192.168.0.5 54321
10
```



SolarisClient1 x SolarisClient2 x SolarisServer x

Activities Oracle Developer Studio Jul 13 13:18

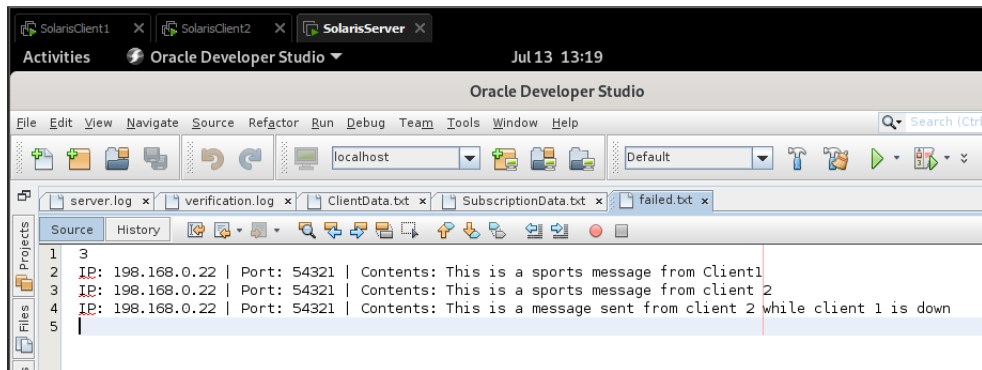
File Edit View Navigate Source Refactor Run Debug Team Tools Window Help

localhost Default

server.log x verification.log x ClientData.txt x SubscriptionData.txt x failed.txt x

Source History

```
1 3
2 198.168.0.22 54321 sports;;;
3 192.168.0.6 54321 sports;;;
4 192.168.0.5 54321 sports;;;
5
```



SolarisClient1 x SolarisClient2 x SolarisServer x

Activities Oracle Developer Studio Jul 13 13:19

File Edit View Navigate Source Refactor Run Debug Team Tools Window Help

localhost Default

server.log x verification.log x ClientData.txt x SubscriptionData.txt x failed.txt x

Source History

```
1 3
2 IP: 198.168.0.22 | Port: 54321 | Contents: This is a sports message from Client1
3 IP: 198.168.0.22 | Port: 54321 | Contents: This is a sports message from client 2
4 IP: 198.168.0.22 | Port: 54321 | Contents: This is a message sent from client 2 while client 1 is down
5
```

```

1 Got request to update: IP: 192.168.0.6 | Port: 54321
2 Initialized Server Socket. Server socket information: 0.0.0.0:12345
3 Got request to update: IP: 192.168.0.5 | Port: 54321
4 Got request to join: IP: 192.168.0.6 | Port: 54321
5 Got request to subscribe for: IP: 192.168.0.6 | Port: 54321 | Article: Sports;testAuthor;TestOrg;
6 successfully subscribed for: IP: 192.168.0.6 | Port: 54321 | Article: sports;testauthor;testorg;
7 Got request to publish from: IP: 192.168.0.6 | Port: 54321 | Article: Sports;testAuthor;TestOrg;This is an auto-generated article from the test command.
8 number of addresses found in subscriptions for given publication: 4
9 number of addresses to send publication to: 4
10 Got request to update: IP: 192.168.0.6 | Port: 54321
11 Got request to unsubscribe for: IP: 192.168.0.6 | Port: 54321 | Article: Sports;testAuthor;TestOrg;
12 successfully unsubscribed for: IP: 192.168.0.6 | Port: 54321 | Article: sports;testauthor;testorg;
13 Got request to leave: IP: 192.168.0.6 | Port: 54321
14 Got request to join: IP: 192.168.0.5 | Port: 54321
15 Got request to subscribe for: IP: 192.168.0.5 | Port: 54321 | Article: Sports;testAuthor;TestOrg;
16 successfully subscribed for: IP: 192.168.0.5 | Port: 54321 | Article: sports;testauthor;testorg;
17 Got request to publish from: IP: 192.168.0.5 | Port: 54321 | Article: Sports;testAuthor;TestOrg;This is an auto-generated article from the test command.
18 number of addresses found in subscriptions for given publication: 4
19 number of addresses to send publication to: 4
20 Got request to update: IP: 192.168.0.5 | Port: 54321
21 Got request to unsubscribe for: IP: 192.168.0.5 | Port: 54321 | Article: Sports;testAuthor;TestOrg;
22 successfully unsubscribed for: IP: 192.168.0.5 | Port: 54321 | Article: sports;testauthor;testorg;
23 Got request to leave: IP: 192.168.0.5 | Port: 54321
24 Got request to join: IP: 168.34.0.24 | Port: 54325
25 Got request to join: IP: 168.34.0.24 | Port: 54325
26 Got request to leave: IP: 168.34.0.24 | Port: 54325
27 Got request to leave: IP: 168.34.0.24 | Port: 54325
28 Got request to join: IP: 192.168.0.6 | Port: 54321
29 Got request to subscribe for: IP: 192.168.0.6 | Port: 54321 | Article: incorrect;;;alsoIncorrect
30 Error: first argument must be empty or one of the following types: Sports, Lifestyle, Entertainment, Business, Technology, Science, Politics, Health
31 failed to create subscription and thus also to add it.
32 subscribe rejected or was unsuccessful for: IP: 192.168.0.6 | Port: 54321 | Article: incorrect;;;alsoIncorrect
33 Got request to subscribe for: IP: 192.168.0.6 | Port: 54321 | Article: sports;;;
34 successfully subscribed for: IP: 192.168.0.6 | Port: 54321 | Article: sports;;;
35 Got request to subscribe for: IP: 168.34.0.24 | Port: 54325 | Article: sports;;;
36 successfully subscribed for: IP: 168.34.0.24 | Port: 54325 | Article: sports;;;
37 Got request to unsubscribe for: IP: 168.34.0.24 | Port: 54325 | Article: sports;;;
38 successfully unsubscribed for: IP: 168.34.0.24 | Port: 54325 | Article: sports;;;
39 Got request to publish from: IP: 192.168.0.6 | Port: 54321 | Article: sports;;;This is a sports message from Client1
40 number of addresses found in subscriptions for given publication: 2
41 number of addresses to send publication to: 2
42 Got request to update: IP: 192.168.0.5 | Port: 54321
43 Initialized Server Socket. Server socket information: 0.0.0.0:12345
44 Got request to join: IP: 192.168.0.5 | Port: 54321
45 Got request to subscribe for: IP: 192.168.0.5 | Port: 54321 | Article: sports;;;
46 successfully subscribed for: IP: 192.168.0.5 | Port: 54321 | Article: sports;;;
47 Got request to publish from: IP: 192.168.0.5 | Port: 54321 | Article: sports;;;This is a sports message from client 2
48 number of addresses found in subscriptions for given publication: 3
49 number of addresses to send publication to: 3
50 Got request to publish from: IP: 192.168.0.5 | Port: 54321 | Article: sports;;;This is a message sent from client 2 while client 1 is down
51 number of addresses found in subscriptions for given publication: 3
52 number of addresses to send publication to: 3
53 Got request to update: IP: 192.168.0.6 | Port: 54321
54

```

Final Note:

I had to try a ton of different things to get rpcgen to work properly and compile after generation. I even used a bunch of different operating systems. I eventually found Solaris worked to compile, but I had to do a bunch of debugging as to why communication across different VMs wasn't possible. I found the following very obscure setting needed to be manually changed after sifting through very granular log files. I wouldn't recommend using rpcgen anymore to anyone for rpc programming.

This can be changed with:

```

sudo svccfg
select network/rpc/bind
setprop -G config -P local_only -T "boolean" "false"
listprop

```

```

Usage: help [command]

Display help.
svc:/network/rpc/bind> help "general commands"
Unknown command: "general commands"
For more info, run: svccfg help
svc:/network/rpc/bind> bind
Unknown command: "bind"
For more info, run: svccfg help
svc:/network/rpc/bind> listprop
config
config/allow_indirect          boolean    true
config/enable_tcpwrappers      boolean    false
config/local_only              boolean    true
config/max_udp_dump_rqsts_per_sec count      2
config/value_authorization      astring    solaris.smf.valu
e.rpc.bind
config/verbose_logging         boolean    false
fs
fs/entities                    dependency fmri
system/minimal
fs/grouping                    astring    require_all
fs/restart_on                  astring    none
fs/type                         astring    service

```