

Report – Web Sockets

In this report, I have described code along with explanation of the implementation both locally and remotely.

Ability for one node's shell to remotely control another node.

The communication to support this will be performed using Websockets, using a very simple protocol where command lines are sent from a controlling client to a controlled server, and the server sends responses back to the client.

Code:

Get the successor of the node. Perform a Web service call to that node, and then retrieve its routing state from its local RMI object. Special case for when this is the local node, i.e. `info.addr.equals(localInfo.addr)`, otherwise get an infinite loop.

Added the web service call.

```
private NodeInfo getSucc(NodeInfo info) throws Failed {  
    NodeInfo localInfo = this.getNodeInfo();  
    if (localInfo.addr.equals(info.addr)) {  
        return getSucc();  
    } else {  
        // TODO: Do the Web service call.  
        return client.getSucc(info);  
    }  
}
```

ProxyContent:

A proxy context reads from a command line buffer that it maintains internally, synchronizing with the insertion of command lines into that buffer, and sends responses over a Web Socket connection to a controlling client.

It provides API for reading commands which were sent by the client and sending back responses.

@Override

```
public void msg(String m) throws IOException {  
    // TODO display the message on the remote client console  
    sender.sendText(m);  
}
```

```

@Override

public void msgIn(String m) throws IOException {

    // TODO display the message on the remote client console

    sender.sendText(m+"\n");

}

```

ProxyShell:

Proxyshells sends its command to a remote server node that has agreed to remotely controlled.

There are some commands which are handled by Proxyshell.

```

if ("connect".equals(cmd)) {

connect(inputs);

} else if ("accept".equals(cmd)) {

accept(inputs);

} else if ("reject".equals(cmd)) {

reject(inputs);

} else if ("quit".equals(cmd)) {

quitShell();

return;

} else if ("help".equals(cmd)) {

help(inputs);

} else {

sender.sendObject(inputs);

}

```

Session Manager:

Once accepting a request from remote, with the use of proxy context we need to push a local shell on the stack.

After that remote control request by sending ACKnowledge to the client.

```

SHELL_MANAGER.addShell(LocalShell.createRemotelyControlled(SHELL_MANAGER.getCurrent
tShell().getLocal(),

```

```

ProxyContext.createProxyContext(this.getCurrentSession().getBasicRemote()));

```

```
currentServer.endInitialization();  
currentServer.getSession().getBasicRemote().sendText(ACK);
```

Add, Get and Delete nodes:

```
public String[] get(NodeInfo node, String skey) throws DHTBase.Failed {  
    UriBuilder ub = UriBuilder.fromUri(node.addr);  
    URI getPath = ub.queryParam("key", skey).build();  
    info("client getBindings(" + getPath + ")");  
    Response response = getRequest(getPath);  
    if (response == null || response.getStatus() >= 300) {  
        throw new DHTBase.Failed("GET /?key=K");  
    } else {  
        TableRow row = response.readEntity(tableRowType).getValue();  
        return row.vals;  
    }  
}  
  
// TODO  
/*  
 * Put bindings under a key.  
 */  
  
public void add(NodeInfo node, String skey, String v) throws DHTBase.Failed  
{  
    UriBuilder ub = UriBuilder.fromUri(node.addr);  
    URI putPath = ub.queryParam("key", skey).queryParam("val", v).build();  
    info("client putBindings(" + putPath + ")");  
    Response response = putRequest(putPath);  
    if (response == null || response.getStatus() >= 300) {  
        String s = String.format("Failed to add binding: %s -> %s", skey, v);  
        throw new DHTBase.Failed(s);  
    }  
}
```

```

}
// TODO
/*
 * Delete bindings under a key.
 */
public void delete(NodeInfo node, String skey, String v) throws
DHTBase.Failed {
    UriBuilder ub = UriBuilder.fromUri(node.addr);
    URI deletePath = ub.queryParam("key", skey).queryParam("val",v).build();
    info("client deleteBindings(" + deletePath + ")");
    Response response = deleteRequest(deletePath);
    if (response == null || response.getStatus() >= 300) {
        throw new DHTBase.Failed("DELETE /?key=K&val=V");
    }
}

Accept and Reject Shell:
protected void accept(String[] inputs) throws IOException {
    if (inputs.length != 1) {
        msgln("Usage: accept");
    } else {
        // TODO
        this.sessionManager.acceptSession(); // Accept the session
        this.shellManager.getCurrentShell().cli(); // Execute the CLI for the new shell
    }
}

/**
 * TODO Reject and remove the pending session (see SessionManager).
 */
protected void reject(String[] inputs) throws IOException {

```

```

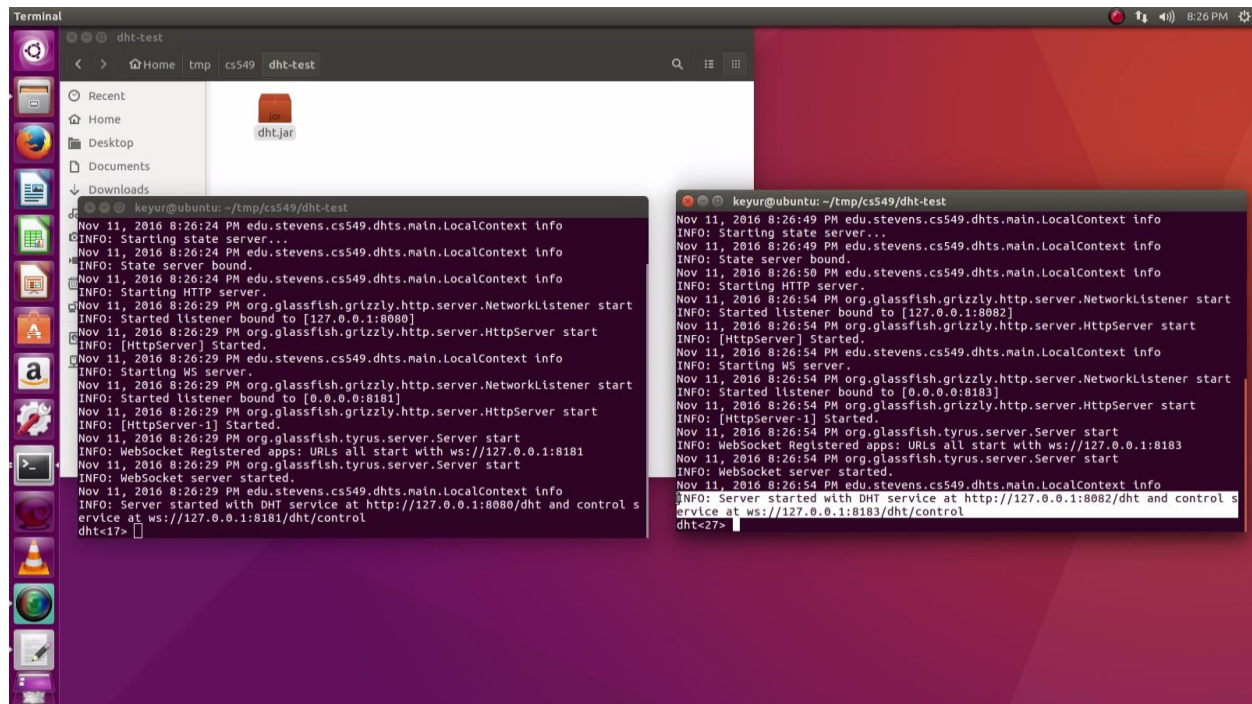
    if (inputs.length != 1) {
        msgln("Usage: reject");
    } else {
        // TODO
        this.sessionManager.rejectSession(); // reject
        this.sessionManager.closeCurrentSession(); // remove currentsession
    }
}

```

Used connect host port, accept, reject and quit operation.

Local Test:

Connect host port, accept, reject and quit command.



```
Terminal
dht-test
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [127.0.0.1:8080]
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer] Started.
Nov 11, 2016 8:26:29 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Starting WS server.
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [0.0.0.0:8181]
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 11, 2016 8:26:29 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://127.0.0.1:8181
Nov 11, 2016 8:26:29 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 11, 2016 8:26:29 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Server started with DHT service at http://127.0.0.1:8080/dht and control s
ervice at ws://127.0.0.1:8181/dht/control
dht<17> add foo abc
dht<17> add foo xyz
dht<17> get foo
{abc,xyz}
dht<17> connect localhost 8183
Requesting control of node at ws://localhost:8183/dht/control/keyur...request re
jected.dht<17> []

keyur@ubuntu: ~/tmp/cs549/dht-test
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [127.0.0.1:8082]
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer] Started.
Nov 11, 2016 8:26:54 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Starting WS server.
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [0.0.0.0:8183]
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 11, 2016 8:26:54 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://127.0.0.1:8183
Nov 11, 2016 8:26:54 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 11, 2016 8:26:54 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Server started with DHT service at http://127.0.0.1:8082/dht and control s
ervice at ws://127.0.0.1:8183/dht/control
dht<27> get foo
** Pending connection request from keyur

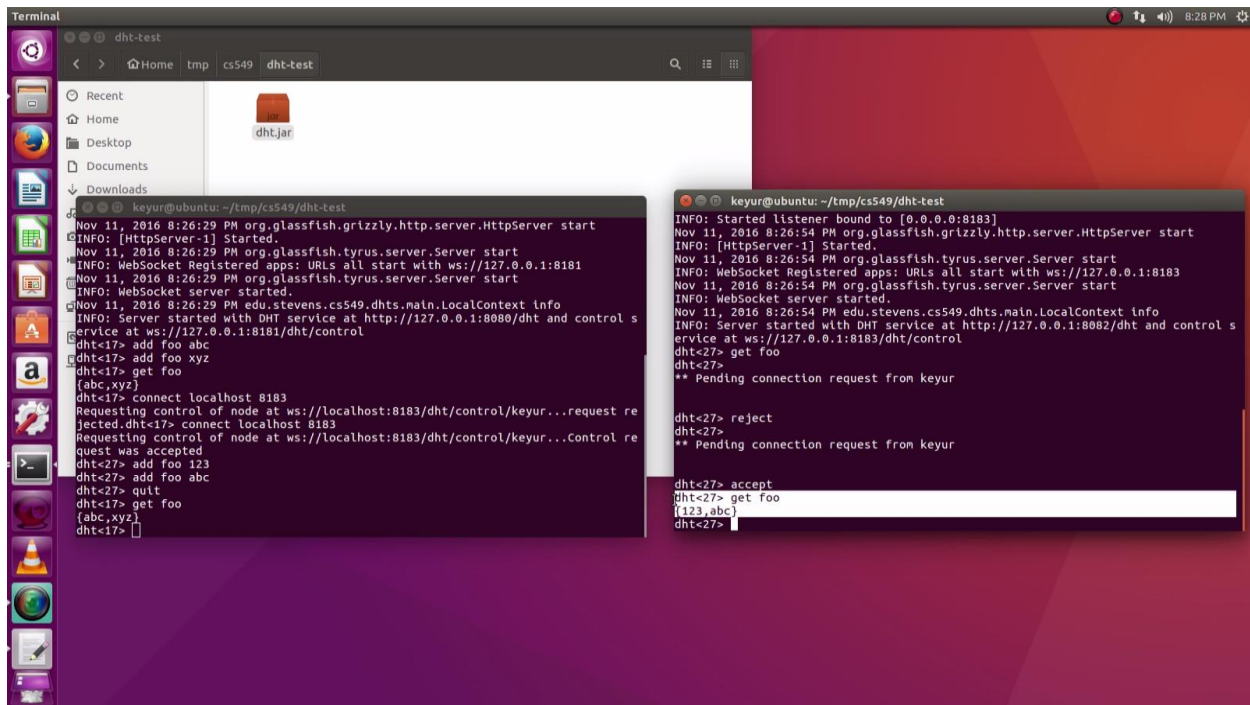
dht<27> reject
dht<27> []
```

```
Terminal
dht-test
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [127.0.0.1:8080]
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer] Started.
Nov 11, 2016 8:26:29 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Starting WS server.
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [0.0.0.0:8181]
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 11, 2016 8:26:29 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://127.0.0.1:8181
Nov 11, 2016 8:26:29 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 11, 2016 8:26:29 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Server started with DHT service at http://127.0.0.1:8080/dht and control s
ervice at ws://127.0.0.1:8181/dht/control
dht<17> add foo abc
dht<17> add foo xyz
dht<17> get foo
{abc,xyz}
dht<17> connect localhost 8183
Requesting control of node at ws://localhost:8183/dht/control/keyur...request re
jected.dht<17> connect localhost 8183
Requesting control of node at ws://localhost:8183/dht/control/keyur...Control re
quest was accepted
dht<27> []

keyur@ubuntu: ~/tmp/cs549/dht-test
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [127.0.0.1:8082]
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer] Started.
Nov 11, 2016 8:26:54 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Starting WS server.
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [0.0.0.0:8183]
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 11, 2016 8:26:54 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://127.0.0.1:8183
Nov 11, 2016 8:26:54 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 11, 2016 8:26:54 PM edu.stevens.cs549.dhts.main.LocalContext Info
INFO: Server started with DHT service at http://127.0.0.1:8082/dht and control s
ervice at ws://127.0.0.1:8183/dht/control
dht<27> get foo
** Pending connection request from keyur

dht<27> reject
dht<27> ** Pending connection request from keyur

dht<27> accept
```

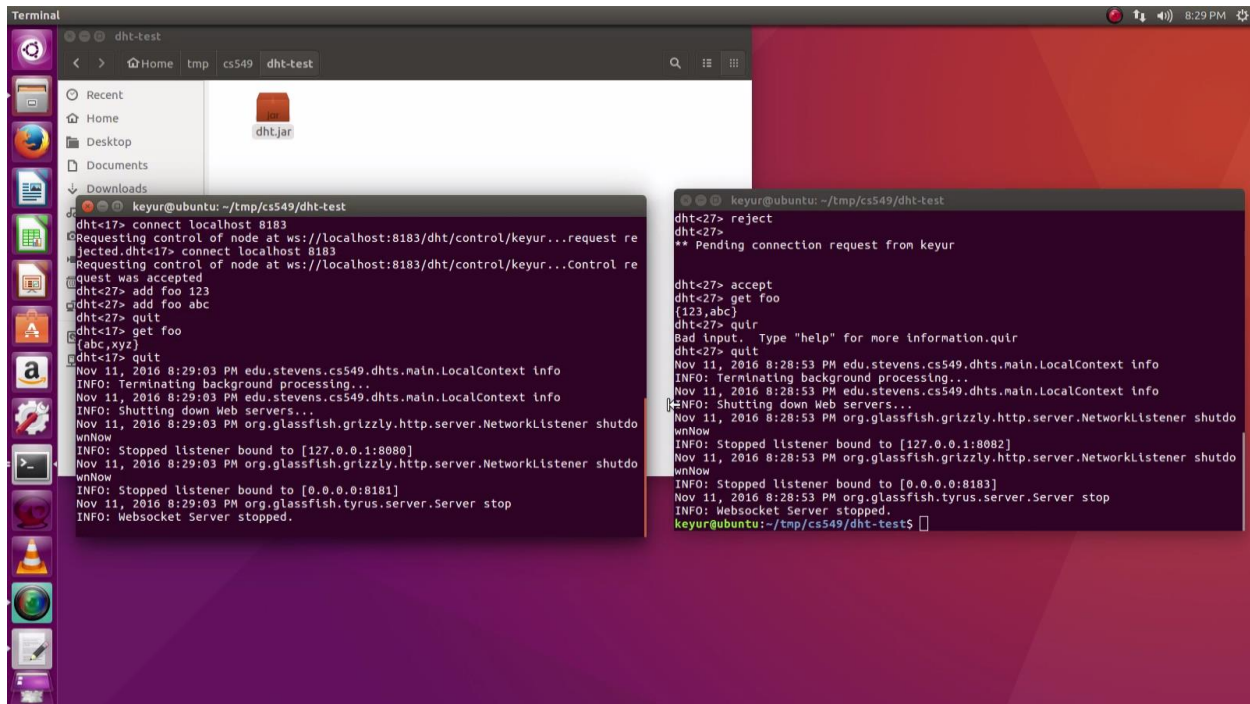


```
Terminal
dht-test
Nov 11, 2016 8:26:29 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 11, 2016 8:26:29 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://127.0.0.1:8181
Nov 11, 2016 8:26:29 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 11, 2016 8:26:29 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Server started with DHT service at http://127.0.0.1:8080/dht and control s
service at ws://127.0.0.1:8181/dht/control
dht-i7> add foo xyz
dht-i7> get foo
{abc,xyz}
dht-i7> connect localhost 8183
Requesting control of node at ws://localhost:8183/dht/control/keyur...request re
jected.dht-i7> connect localhost 8183
Requesting control of node at ws://localhost:8183/dht/control/keyur...Control re
quest was accepted
dht-27> add foo 123
dht-27> add foo abc
dht-27> quit
dht-i7> get foo
{abc,xyz}
dht-i7>

keyur@ubuntu: ~/tmp/cs549/dht-test
INFO: Started listener bound to [0.0.0.0:8183]
Nov 11, 2016 8:26:54 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 11, 2016 8:26:54 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://127.0.0.1:8183
Nov 11, 2016 8:26:54 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 11, 2016 8:26:54 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Server started with DHT service at http://127.0.0.1:8082/dht and control s
service at ws://127.0.0.1:8183/dht/control
dht-27> get foo
** Pending connection request from keyur

dht-27> reject
dht-27>
** Pending connection request from keyur

dht-27> accept
dht-27> get foo
{123,abc}
dht-27>
```



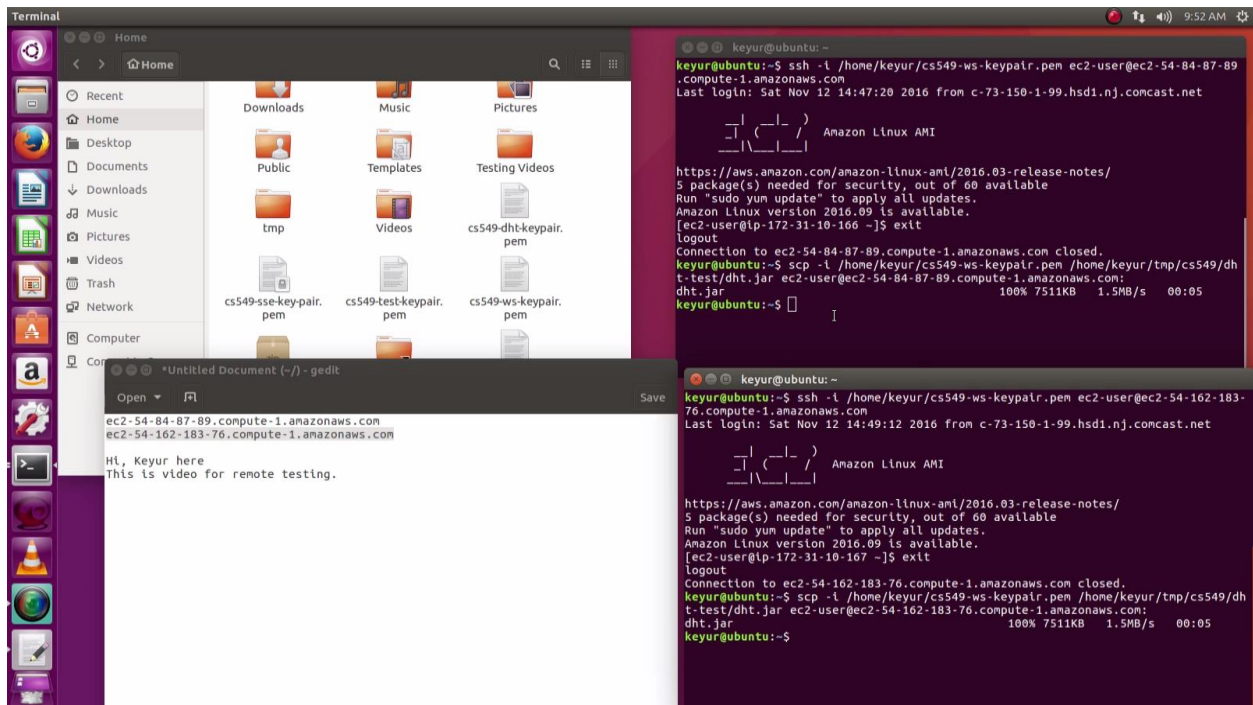
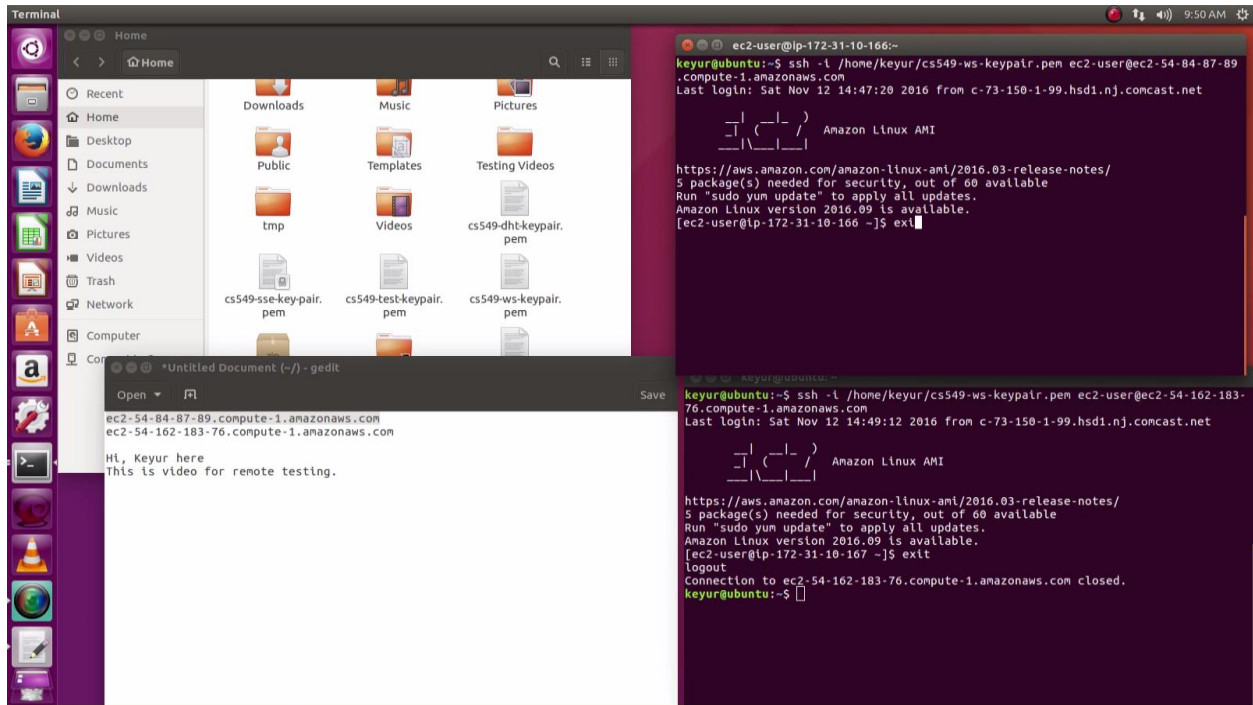
```
Terminal
dht-test
Nov 11, 2016 8:29:03 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Terminating background processing...
Nov 11, 2016 8:29:03 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Shutting down Web servers...
Nov 11, 2016 8:29:03 PM org.glassfish.grizzly.http.server.NetworkListener shutdo
wnNow
INFO: Stopped listener bound to [127.0.0.1:8080]
Nov 11, 2016 8:29:03 PM org.glassfish.grizzly.http.server.NetworkListener shutdo
wnNow
INFO: Stopped listener bound to [0.0.0.0:8181]
Nov 11, 2016 8:29:03 PM org.glassfish.tyrus.server.Server stop
INFO: Websocket Server stopped.

keyur@ubuntu: ~/tmp/cs549/dht-test
dht-27> reject
dht-27>
** Pending connection request from keyur

dht-27> accept
dht-27> get foo
{123,abc}
dht-27> quir
Bad input. Type "help" for more information.quir
dht-27> quit
Nov 11, 2016 8:28:53 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Terminating background processing...
Nov 11, 2016 8:28:53 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Shutting down Web servers...
Nov 11, 2016 8:28:53 PM org.glassfish.grizzly.http.server.NetworkListener shutdo
wnNow
INFO: Stopped listener bound to [127.0.0.1:8082]
Nov 11, 2016 8:28:53 PM org.glassfish.grizzly.http.server.NetworkListener shutdo
wnNow
INFO: Stopped listener bound to [0.0.0.0:8183]
Nov 11, 2016 8:28:53 PM org.glassfish.tyrus.server.Server stop
INFO: Websocket Server stopped.
keyur@ubuntu:~/tmp/cs549/dht-test$
```

Remote Test:

Transfer dht.jar file on amazon ec2 instance using Secure Copy (Scp) and connect that instance using Secure Shell (SSH).




```
Terminal
ec2-user@ip-172-31-10-166:~$
Nov 12, 2016 2:54:15 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Starting state server...
Nov 12, 2016 2:54:16 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: State server bound.
Nov 12, 2016 2:54:17 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Starting HTTP server.
Nov 12, 2016 2:54:21 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [172.31.10.166:8080]
Nov 12, 2016 2:54:21 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer] Started.
Nov 12, 2016 2:54:21 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Starting WS server.
Nov 12, 2016 2:54:21 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [0.0.0.0:8183]
Nov 12, 2016 2:54:21 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 12, 2016 2:54:21 PM org.glassfish.tyrus.server.Server start
INFO: WebSocket Registered apps: URLs all start with ws://172.31.10.166:8183
Nov 12, 2016 2:54:21 PM org.glassfish.tyrus.server.Server start
INFO: WebSocket server started.
Nov 12, 2016 2:54:21 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Server started with DHT service at http://172.31.10.166:8080/dht and control service at ws://172.31.10.166:8183/dht/control
dht<27>
ec2-54-84-b7-b9.compute-1.amazonaws.com
ec2-54-162-183-76.compute-1.amazonaws.com
HI, Keyur here
This is video for remote testing.
```

```
Terminal
ec2-user@ip-172-31-10-166:~$
INFO: [HttpServer] Started.
Nov 12, 2016 3:22:04 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Starting WS server.
Nov 12, 2016 3:22:04 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [0.0.0.0:8184]
Nov 12, 2016 3:22:04 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 12, 2016 3:22:04 PM org.glassfish.tyrus.server.Server start
INFO: WebSocket Registered apps: URLs all start with ws://172.31.10.166:8184
Nov 12, 2016 3:22:04 PM org.glassfish.tyrus.server.Server start
INFO: WebSocket server started.
Nov 12, 2016 3:22:04 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Server started with DHT service at http://172.31.10.166:8083/dht and control service at ws://172.31.10.166:8184/dht/control
dht<17> add foo abc
dht<17> add foo xyz
dht<17> get foo
{abc,xyz}
dht<17> connect 172.31.10.167 8181
Requesting control of node at ws://172.31.10.167:8181/dht/control/john...request rejected.dht<17> connect 172.31.10.167 8181
Requesting control of node at ws://172.31.10.167:8181/dht/control/john...Control request was accepted
dht<27>

ec2-user@ip-172-31-10-167:~$
INFO: Starting WS server.
Nov 12, 2016 3:22:14 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [0.0.0.0:8181]
Nov 12, 2016 3:22:14 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 12, 2016 3:22:14 PM org.glassfish.tyrus.server.Server start
INFO: WebSocket Registered apps: URLs all start with ws://172.31.10.167:8181
Nov 12, 2016 3:22:14 PM org.glassfish.tyrus.server.Server start
INFO: WebSocket server started.
Nov 12, 2016 3:22:14 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Server started with DHT service at http://172.31.10.167:8080/dht and control service at ws://172.31.10.167:8181/dht/control
dht<27> get foo
** Pending connection request from john
dht<27> reject
dht<27>
** Pending connection request from john
dht<27> accept
```

```
Terminal
Home
ec2-user@ip-172-31-10-166:~$
INFO: [HttpServer-1] Started.
Nov 12, 2016 3:22:04 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://172.31.10.166:8184
Nov 12, 2016 3:22:04 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 12, 2016 3:22:04 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Server started with DHT service at http://172.31.10.166:8083/dht and control service at ws://172.31.10.166:8184/dht/control
dht<17> add foo abc
dht<17> add foo xyz
dht<17> get foo
{abc,xyz}
dht<17> connect 172.31.10.167 8181
Requesting control of node at ws://172.31.10.167:8181/dht/control/john...request rejected.dht<17> connect 172.31.10.167 8181
Requesting control of node at ws://172.31.10.167:8181/dht/control/john...Control request was accepted
dht<27> add foo 123
dht<27> add foo abc
dht<27> get foo
{123,abc}dht<27> quit
dht<17> get foo
{abc,xyz}
dht<17>

Save
ec2-user@ip-172-31-10-167:~$
INFO: Started listener bound to [0.0.0.0:8181]
Nov 12, 2016 3:22:14 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer-1] Started.
Nov 12, 2016 3:22:14 PM org.glassfish.tyrus.server.Server start
INFO: Websocket Registered apps: URLs all start with ws://172.31.10.167:8181
Nov 12, 2016 3:22:14 PM org.glassfish.tyrus.server.Server start
INFO: Websocket server started.
Nov 12, 2016 3:22:14 PM edu.stevens.cs549.dhts.main.LocalContext info
INFO: Server started with DHT service at http://172.31.10.167:8080/dht and control service at ws://172.31.10.167:8181/dht/control
dht<27> get foo
** Pending connection request from john
dht<27> reject
dht<27>
** Pending connection request from john
dht<27> accept
dht<27> get foo
{123,abc}
dht<27> 
```