

Operations Procedures and Support Document
FIX Engine 4.1 (FIX-ORS)

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Regular Daily Operator Procedures for Startup/Shutdown and End of Day for FIX-ORS

This section is all that Operations will require to maintain FIX-ORS on a daily basis. The rest of the document contains information about FIX-ORS that can be used by Support Services for trouble-shooting problems if they arise.

Starting up the FIX-ORS System

From the Patrol Console, double-click on *FIXApps* Icon.

Right-click on *FixPri* icon and Click on *Start All PrimaryServers*.

Right-click on *FixSec* icon and Click on *Start All Secondary Servers*.

To view monitored fix processes go to the patrol main view and click on *FIXApps* icon this will start another view with icons for *fixPri* and *fixSec* icons. Double-click on each of them to ensure that all icons are Green.

FixPri view:

1. Left click on icon to bring up the Primary process icon list.
2. Right click on *fixPri* icon *list fix system processes* shown as icons *Pri001* through *Pri005* in the view.
3. The *Cluster00[1-5]*, *DbSrv* and *PrivateNic*, *FirmNic* processes are the failover and cluster processes which should be up at all times.

FixSec view:

1. Left click on icon to bring up the Secondary process list.
2. Right click on *fixsec* icon to list the fix secondary processes.
3. The *Cluster00[1-5]* *DbSrv* and *PrivateNic*, *FirmNic* processes are the failover and cluster processes which should be up at all times

Bring up the *FIXometer*, preferably on the NT workstation connected to the Management VLAN.

On the NT workstation:

1. Execute *startFixometerb.bat* [C:\Fixometer]

Or

On UNIX Xterm:

Login to *fix1b* as *fixprod*, export the display and execute the command:

StartFixometerb

End of Day – Running EOD and Stopping the FIX-ORS System

Use the FIXOMETER End Of Day Menu, to clear out the Database for the FIX Engines. All Firm connections must be “SUSPENDED” before End Of Day is executed.

Fixometer, Menu Commands, Option Suspend

Pick ALL engines and Select All.

Login using the required login: (fxscr,fxscr0 can be used as username,password on fix1b)

(coppelia, fixeng0 can be used as username,password on fixtest (dev only))

Fixometer, Menu Commands, Option Run End of Day

Pick ALL engines and Select All.

NOTE: The FIXometer will issue a warning if there are queued messages and End of Day is run for that FIRM connection. If this happens, do the following:

1. Cancel out and Do not Run the EOD.
2. Right click on the connection that has the Queue Count > 0 and View Queued Messages.
3. Execute Print, to print a hard copy of the queued messages and contact Support Services.
4. Make a note of the Order-Ids queued.
5. Proceed to run EOD.

Ensure that all the Sequence numbers and counts are reset for all firms.

Shutdown the FIXometer. On the Fixometer, Menu File, Option Exit

Stop FIX Engines on both fix1a and fix1b . First do the slave [fix1b], then do the master(fix1a).

Use Patrol to stop the system on fix1b

(or login to fix1b as fixprod and execute *stopFixSystem Secondary all*) – for slave (fix1b by default)

Use Patrol to stop the system on fix1a

(or login to fix1a as fixprod and execute *stopFixSystem Primary all*) – for master (fix1a by default)

Execute showFixProcesses on fix1a and fix1b to ensure that all processes are down.

[For test only: If the Simulator is UP, bring it down by running: *stopTpfsimulator*]

Use Patrol to Run CleanupFixSystem on fix1a and fix1b

(or login to **fix1a** and **fix1b** and Run the following command on the UNIX command line to cleanup

Application Log files *cleanupFixSystem*)

If no errors are generated, the system is ready for the next production day.

Special Operator Procedures for FIX-ORS

Starting up the FIX-ORS System as Primary on the backup server (fix1b)

Operations may chose to bring up the FIX Engines as Primary on fix1b. Following are the procedures to do this. To start the Primary on fix1b do the following.

1. Left double-click on either CBOEGroup_A or CBOEGroup_B icon and find the cboeFIX group.
2. Right click on the cboeFIX icon to start, stop or list the FIX processes.
3. This will bring up a node selection window in this window select *Individual Fix server*.
4. This will open another window with individual servers select the desired server and click ok.

Follow the same procedure to start up fix1a as Secondary.

Use the following procedures to bring up the FIXometer:

Bring up the FIXometer, preferably on the NT workstation connected to the Management VLAN.

On the NT workstation:

Execute startFixomentera.bat [C:\Fixometer]

Or

On UNIX Xterm:

Login to fix1a as fixprod, export the display and execute the command: *startFixomentera*

Operations procedures after the FIX servers are rebooted

On reboot of fix1a and/or fix1b, the HA scripts should start automatically and hence require NO operator intervention. Status of this can be checked by running monitor_ha from the command line, or via patrol.

From the Patrol Console, double-click on *FIXApps* Icon.

Right-click on *FixPri* icon and Click on *Monitor_HA*.

Right-click on *FixSec* icon and Click on *Monitor_HA*.

Operations is however, require to bring up the 2 Oracle instances each and the Listener on fix1a and fix1b using Patrol:

From the Patrol Console, Double-click on OracleApp.

Select Instance FXENGP0A

Right click on FXENGP0A and Click on Start and then Click on Start Oracle

Select Instance FXSCR0A

Right click on FXSCR0A and Click on Start and then Click on Start Oracle

Select Instance FXENGP0A

Right click on FXENGP0A and Click on Start and then Click on Start Listener

– Note: There is only one Oracle Listener, which is shared by FXENGP0A and FXSCR0A.

Select Instance FXENGP0B

Right click on FXENGP0B and Click on Start and then Click on Start Oracle

Select Instance FXSCR0B

Right click on FXSCR0B and Click on Start and then Click on Start Oracle

Select Instance FXENGP0B

Right click on FXENGP0B and Click on Start and then Click on Start Listener

– Note: There is only one Oracle Listener, which is shared by FXENGP0B and FXSCR0B.

Ensure the status of the 2 Oracle Instances via Patrol Oracle App

Double-click on OracleApp. Select the Instance

FXENGP0A

FXSCR0A

FXENGP0B

FXSCR0B

Double-click each of the icons and verify that all the icons within show Green.

Or Operation can bring up the 2 Oracle instances each and the Listener on fix1a and fix1b using the following procedures:

Login to fix1a as user **oracle** :

cd /orahome/home/bin

Start up Instance FXENGP0A with the following command:

ora_dbstartFXENGP0A

Start up Instance FXSCR0A with the following command:

ora_dbstartFXSCR0A

Start up the listener with the following command:

Lsnctrl<Enter>

start

Login to fix1b as user **oracle** :

cd /orahome/home/bin

Start up Instance FXENGP0B with the following command:

ora_dbstartFXENGP0B

Start up Instance FXSCR0B with the following command:

ora_dbstartFXSCR0B

Start up the listener with the following command:

Lsnctrl<Enter>

start

Components of the FIX-ORS System

Each server has the following processes running:

High Availability Scripts

/usr/bin/NicFailover -t FirmNic

/usr/bin/NicFailover -t PrivateNic

/usr/bin/CoppeliaSimpleCluster -t Cluster001

/usr/bin/CoppeliaSimpleCluster -t Cluster002

/usr/bin/CoppeliaSimpleCluster -t Cluster003

/usr/bin/CoppeliaSimpleCluster -t Cluster004

/usr/bin/CoppeliaSimpleCluster -t Cluster005

Fix Engine Clusters

Pri001 (Sec001 on fix1b)

Pri002 (Sec001 on fix1b)

Pri003 (Sec001 on fix1b)

Pri004 (Sec001 on fix1b)

Pri005 (Sec001 on fix1b)

Dbserver

DbSrv

Oracle Instances

FXENGPOA (FXENGP0B on fix1b)

FXSCRPOA (FXSCRPOB on fix1b)

Listener

Fixometer

This is the FIX Engine GUI (This is usually started up from an NT workstation). However it can also be started up by logging into fix1b, after exporting the DISPLAY.

Four-digit Strike Price File (symbol.table) from Compass Production Module

In order to handle 4-digit strike prices, the FIX-ORS application needs the file **symbol.table** from the Compass Production Module M8/M9, ftp'd in ASCII format to the RUN_DIR on fix1a and fix1b.

High Availability Scripts

These scripts that are started at the UNIX Run Level 2 of both servers fix1a and fix1b. There are 2 main scripts in /usr/bin:

NicFailover - This script fails over a Logical IP from a Primary Nic Card to a Backup NIC card. This script is called by /etc/rc2.d/fix1anicfailover(/etc/rc2.d/fix1bnicfailover on fix1b) to monitor 2 pairs of NIC cards on each server, namely the Firm NIC pair, and the PrivateNIC pair.

CoppeliaSimpleCluster – This script brings a FIRM Alias IP online depending on whether the Coppelia Engine is MASTER on the Server it is running. This is the script that will allow the FIRM to connect to a particular HOST and PORT on the FIX Cluster. This script is called by /etc/rc2.d/fixclusterfailover. It is currently setup to monitor 5 FIX Engine clusters.

FIX Engine Cluster(s)

Fix1a and fix1b are currently setup to run 5 FIX Engine Clusters (Ref. To Appendix A for a process layout on the servers).

The FIX Engine Cluster is a process that contains 3 subsystems, running in-process, as described below:

The Coppelia FIX Engine - This is the FIX Engine Server that is responsible for maintaining firm connections.

The CoppeliaTPFAdapter - This is the interface that converts FIX messages to and from the TPF Format.

The TPF FIX Service - This is the generic connection server that makes a connection to TPF via the Host Gateway.

Each cluster comprises a process pair that runs on the primary server fix1a as MASTER, and its SLAVE that runs on the backup server fix1b. The MASTER accepts FIRM connections by LISTENING on the FIRM port (21501-21505). The SLAVE receives a duplicate copy of every message and syncs up its duplicate database.

Dbserver

Servers, fix1a and fix1b have a dbserver process running. This process establishes a connection with the MASTER FIX Engine. Each dbserver connects as SLAVE to the MASTER FIX Engine servers. They receive a duplicate copy of every message received by the MASTER and log these messages to the Back End Screen database (FXSCRPOA and FXSCRPOB).

Oracle Databases

Each server has 2 databases:

FXENGP0A/B – This is the High performance database used by the FIX Engine to maintain its persistence.

FXSCR0A/B - This is the Backend database that the dbserver logs to. The messages can be viewed in a User friendly format via the FIXometer. This database is indexed and allows query searches.

The Oracle Instances and the Listener should be running on fix1a and fix1b and are maintained by cron jobs running on the servers. Manual intervention is only required when the servers are rebooted.

FIXometer

The FIXometer is the GUI Operations Front End Monitor to the FIX Engine System. It is used for:

- Monitoring the status of the FIX Engine Clusters and FIRM connections.

- Viewing messages received and sent from the Engines.

- Disconnecting or Holding individual, group or ALL firm connections.

- Sending Test messages to firms.

- Running End of Day.

Four-digit Strike Price File (symbol.table) from Compass Production Module

In order to handle 4-digit strike prices, the FIX-ORS application needs the file **symbol.table** from the Compass Production Module M8/M9, ftp'd is ASCII format to the RUN_DIR on fix1a and fix1b. A script named *getCompassStrikePrice* is cron'd for the fixprod user that automatically runs this script at 07:01am. If the script fails to ftp the file, a Patrol POPUP is sent to the Console. An email is also generated to fixsupport@cboe.com. If this happens, Operations may manually run this script by logging into fix1a/fix1b user=fixprod. This script ftp's the file symbol.table from M8/M9 production running_dir to directory. The newly ftp'd file should be loaded into the FIX system (if already started up) by using the Web Maintenance Screen. /apps/fixengine/prod/running_dir/log/getCompassftpfile.log is the logfile created by this script.

Startup and Shutdown Procedures

High Availability Scripts

Login

root

Startup

NIC FAILOVER SCRIPT- /etc/rc2.d/S68nicfailover start

FIX CLUSTER SCRIPT- /etc/rc2.d/S99fixclusterfailover start

Shutdown

NIC FAILOVER SCRIPT- /etc/rc2.d/S68nicfailover stop

FIX CLUSTER SCRIPT- /etc/rc2.d/S99fixclusterfailover stop

Oracle Databases

Login

oracle

Startup

On fix1a:

cd /orahome/home/bin

To start up Instance = FXENGP0A

ora_dbstartFXENGP0A

To start up Instance = FXSCR0A

ora_dbstartFXSCR0A

On fix1b:

cd /orahome/home/bin

To start up Instance = FXENGP0B

ora_dbstartFXENGP0B

To start up Instance = FXSCR0B

ora_dbstartFXSCR0B

To startup the Listener on either box:

lsnrctl <Enter>

start

Shutdown

On fix1a:

cd /orahome/home/bin

To stop Instance = FXENGP0A

ora_dbstopFXENGP0A

To stop Instance = FXSCR0A

ora_dbstopFXSCR0A

On fix1b:

cd /orahome/home/bin

To stop Instance = FXENGP0B

ora_dbstopFXENGP0B

To stop Instance = FXSCR0B

ora_dbstopFXSCR0B

To stop the Listener on either box:

lsnrctl <Enter>

stop

FIX Engine Cluster(s)

Login

Testing: fix

Assurance: fixassur

Production: fixprod

Startup

To start the FIX System as Primary(MASTER):

startFixSystem Primary all

To start the FIX System as Secondary(SLAVE) :

startFixSystem Secondary all

To start a FIX Engine(001-005) as Primary(MASTER):

startFixSystem Primary 00n (where n is the number of the FIX Engine from 1 to 5).

To start a FIX Engine(001-005) as Secondary(MASTER):startFixSystem Secondary 00n (where n is the number of the FIX Engine from 1 to 5).

Shutdown

To stop the FIX System as Primary(MASTER): stopFixSystem Primary all
 To stop the FIX System as Secondary(SLAVE) : stopFixSystem Secondary all

To stop a FIX Engine(001-005) as Primary(MASTER): stopFixSystem Primary 00n (where n is the number of the FIX Engine from 1 to 5).
 To stop a FIX Engine(001-005) as Secondary(MASTER): stopFixSystem Secondary 00n (where n is the number of the FIX Engine from 1 to 5).

Dbserver

Login

Testing: fix
 Assurance: fixassur
 Production: fixprod

Startup

To start the dbserver on either box: startDbServer

Shutdown

To stop the dbserver on either box: *stopDbServer*

FIXometer

The FIXometer should be started from the NT workstation that is connected to the Management VLAN by execution startFixometerb.bat from C:\Fixometer directory. If the fix1b server is not available, use startFixometera.bat to connect to the fix1a server's backend database.

To run on the UNIX side:

Login

Testing: fix
 Assurance: fixassur
 Production: fixprod

Startup

Export your DISPLAY (eg. export DISPLAY=xnv1:0.0)
 NOTE: As a rule, always login to fix1b and start the FIXometer, unless fix1b is not available.
 To start the FIXometer on **fix1b**: *startFixometerb* (PREFERRED)
 To start the FIXometer on **fix1a**: *startFixometera*

Shutdown

Use File Exit.

Monitoring the FIX Engine ORS System

High Availability Scripts

Run the following command:

monitor_ha (usr/bin)

There should be 2 daemons for NicFailOver and 5 daemons for the CoppeliaSimpleCluster.

Example Output:

NIC FAILOVER SCRIPTS

```
root 838 1 0 Aug 03 ? 6:37 /bin/sh /usr/bin/NicFailOver -t FirmNic -f /usr/tmp/nicfailoverlog_firm qfe2 qf
root 808 1 0 Aug 03 ? 5:52 /bin/sh /usr/bin/NicFailOver -t PrivateNic -f /usr/tmp/nicfailoverlog_priv qfe0
```

HA CLUSTER SCRIPTS

```
root 762 1 0 Aug 03 ? 36:56 /bin/sh /usr/bin/CoppeliaSimpleCluster -t Cluster004 -f /usr/tmp/clusterfix004l
root 763 1 0 Aug 03 ? 36:56 /bin/sh /usr/bin/CoppeliaSimpleCluster -t Cluster005 -f /usr/tmp/clusterfix005l
root 760 1 0 Aug 03 ? 37:04 /bin/sh /usr/bin/CoppeliaSimpleCluster -t Cluster002 -f /usr/tmp/clusterfix002l
root 761 1 0 Aug 03 ? 37:16 /bin/sh /usr/bin/CoppeliaSimpleCluster -t Cluster003 -f /usr/tmp/clusterfix003l
root 759 1 0 Aug 03 ? 36:38 /bin/sh /usr/bin/CoppeliaSimpleCluster -t Cluster001 -f /usr/tmp/clusterfix001l
```

PRIVATE NETWORK

```
qfe0 1500 fix1aprivboot1 fix1aprivboot1 34 0 0 0 0 0
qfe4 1500 fix1apriv fix1apriv 1219624 0 1219413 0 0 0
```

FIRM NETWORK

```
qfe2 1500 fix1afirm fix1afirm 443272 0 437259 0 0 0
qfe6 1500 fix1afirmboot2 fix1afirmboot2 6884 0 5017 0 0 0
```

FIX CLUSTER NETWORK ALIASES

```
qfe2:1 1500 cboefix001.cboe.com cboefix001.cboe.com 0 0 0 0 0
qfe2:3 1500 cboefix003.cboe.com cboefix003.cboe.com 0 0 0 0 0
qfe2:2 1500 cboefix002.cboe.com cboefix002.cboe.com 0 0 0 0 0
qfe2:4 1500 cboefix004.cboe.com cboefix004.cboe.com 0 0 0 0 0
qfe2:5 1500 cboefix005.cboe.com cboefix005.cboe.com 0 0 0 0 0
```

FIX CLUSTER NETWORK ALIASES

```
*.21501 *. 0 0 0 0 LISTEN
*.21502 *. 0 0 0 0 LISTEN
*.21503 *. 0 0 0 0 LISTEN
*.21504 *. 0 0 0 0 LISTEN
*.21505 *. 0 0 0 0 LISTEN
```

FIX Engine Applications

Login

Testing: fix
Assurance: fixassur
Production: fixprod

Run the following command to monitor FIX processes running :*showFixProcesses*
Use the FIXometer(run from fix1b) to display the status of FIX Engines on both servers. The FIXometer displays status information on the MASTER and SLAVE of each FIX cluster.

Oracle Databases

Login

oracle

On fix1a:
To monitor Instance = FXENGP0A *ora_dbstatus FXENGP0A*
To monitor Instance = FXSCR0A *ora_dbstatus FXSCR0A*

On fix1b:
To monitor Instance = FXENGP0B *ora_dbstatus FXENGP0B*
To monitor Instance = FXSCR0B *ora_dbstatus FXSCR0B*

To check listener status on either box: **lsnrstat.sh**

Log Files and Important Shortcuts

Login

Testing: fix
Assurance: fixassur
Production: fixprod

Log File Descriptions

FixEngine001.log (link to CYYYYMMDD.log) - FIX Engine Log File
FixEngine001.rej (link to CYYYYMMDD.rej) - FIX Engine Log File

The files above should contain all Session layer logging. Every FIX message to and from the FIX engine is also logged. Messages rejected by the FIX Engine will be logged to the .rej file.

CBOEFIX001.log (TPFAdapter and TPFFIXService log file)

This file will have errors specific to the adapter or FIX Service. Any TPF rejects will be logged in this file.

CBOEFIX001.debug (TPFAdapter and TPFFIXService log file, will have info when debug is turned on).

CBOEFIX001.out (Standard Output).

This file is the standard output file. View this file for errors generated as a result of FIX Server startup issues.

Aliases

Note (full path names are shown for login fixprod)

FIX Engine Logs

fix001log (/apps/fixengine/prod/running_dir/log/CBOEFIX001)

fix002log (/apps/fixengine/prod/running_dir/log/CBOEFIX002)

fix003log (/apps/fixengine/prod/running_dir/log/CBOEFIX003)

fix004log (/apps/fixengine/prod/running_dir/log/CBOEFIX004)

fix005log (/apps/fixengine/prod/running_dir/log/CBOEFIX005)

dbserverlog (/apps/fixengine/prod/running_dir/log/DBSERVER)

Upon running *cleanupFixSystem* the logfiles from these directories are moved into the directory specified by the Day of the Week. Log files are stored for 7 days prior.

Coppelia Configuration Files (.ini files)

- Coppelia Engine Config Files

copetc (/apps/fixengine/prod/Coppelia/etc)

Coppelia JAR Files (jar files)

- Coppelia Executables (classes)

copclass (/apps/fixengine/prod/Coppelia/classes)

Server Configuration Files (.ini files)

servetc

- FIX Service and Tpf Adapter Config files

(/apps/fixengine/prod/Server/etc)

Server Scripts

servbin

- Startup, shutdown scripts.

(/apps/fixengine/prod/Server/bin)

FAILOVER AND RECOVERY OF THE FIX ENGINE SYSTEM

IMPORTANT NOTE:

Unlike other production servers at CBOE, the failover on fix1a and fix1b is AUTOMATIC and should require no manual intervention. The HA scripts start up when the servers are rebooted. Manual procedures that are documented in this section should be followed only in the event of a problem, with authorization from Support Services.

HA FAILOVER FOR THE PRIVATE AND FIRM NETWORK INTERFACE

PRIVATE NETWORK INTERFACE INFORMATION:

(S68nicfailover starts/stops both the Private and Firm NicFailover scripts)

NIC CARDS:

Private Nic Pair: qfe0, qfe4

Firm Nic Pair: qfe2, qfe6

HA FAILOVER SCRIPT:

/etc/rc2.d/S68nicfailover (symbolic link to /etc/init.d/fix1anicfailover on fix1a,

symbolic link to /etc/init.d/fix1bnicfailover on fix1b).

To Manually Start: /etc/rc2.d/S68nicfailover start

To Manually Stop: /etc/rc2.d/S68nicfailover stop

(S68nicfailover starts/stops both the Private and Firm NicFailover scripts)

Step 1. Fix1a and Fix1b after Servers are Re-booted

PRIVATE NIC PAIR

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe0	Fix1aprivboot1	172.16.150.1	Fix1bprivboot1	172.16.150.2	PRIVATE SERVICE IP IS UNAVAILABLE
Qfe4	Fix1aprivboot2	172.16.151.1	Fix1bprivboot2	172.16.151.2	

FIRM NIC PAIR

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe2	Fix1afirmboot1	172.16.13.20	Fix1bfirmboot1	172.16.13.21	PRIVATE SERVICE IP IS UNAVAILABLE
Qfe6	Fix1afirmboot2	172.16.14.20	Fix1bfirmboot2	172.16.14.21	

Step 2. Level 2 INIT State - (/etc/rc2.d/S68nicfailover start)

PRIVATE NIC PAIR

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe0	Fix1apriv	172.16.100.1	Fix1bpriv	172.16.100.2	PRIVATE SERVICE IPs ARE AVAILABLE
Qfe4	Fix1aprivboot2	172.16.151.1	Fix1bprivboot2	172.16.151.2	

FIRM NIC PAIR

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe2	Fix1afirm	170.137.93.30	Fix1bfirm	170.137.93.31	PRIVATE SERVICE IPs ARE AVAILABLE
Qfe6	Fix1afirmboot2	172.16.14.20	Fix1bfirmboot2	172.16.14.21	

NIC FAILOVER -

PRIVATE NIC FAILOVER

(HA Script is not able to ping partners service IP (fix1a pings 172.16.100.2, fix1b pings 172.16.100.1))

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe0	Fix1aprivboot1	172.16.150.1	Fix1bprivboot1	172.16.150.2	
Qfe4	Fix1apriv	172.16.100.1	Fix1bpriv	172.16.100.2	PRIVATE SERVICE IPs ARE AVAILABLE

NOTE: A private NIC failover on fix1a would initiate a failover on fix1b also. This is required, as the 2 networks are private and directly connected to each other via crossover cables.

FIRM NIC FAILOVER

(HA Script on fix1a is not able to ping well known address (170.137.93.254))

fix1a FAILOVER only

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe2	Fix1afirmboot1	172.16.13.20	Fix1bfirm	170.137.93.31 (service IP)	PRIVATE SERVICE IPs ARE AVAILABLE
Qfe6	Fix1afirm	170.137.93.30 (service IP)	Fix1bfirmboot2	172.16.14.21	

fix1b FAILOVER only

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe2	Fix1afirm	170.137.93.30 (service IP)	Fix1bfirmboot1	172.16.13.21	PRIVATE SERVICE IPs ARE AVAILABLE
Qfe6	Fix1afirmboot2	172.16.14.20	Fix1bfirm	170.137.93.31 (Service IP)	

NOTE:

The Firm NIC failover on fix1a is independent of the Firm NIC failover on fix1b. In other words, a Firm Nic failover on fix1a does not initiate a Firm nic Failover on fix1b and vice versa.

CLUSTER NETWORK ALIAS FAILOVER

IMPORTANT NOTE:

Unlike other production servers at CBOE, the failover on fix1a and fix1b is AUTOMATIC and should require no manual intervention. The HA scripts start up when the servers are rebooted. Manual procedures that are documented in this section should be followed only in the event of a problem, with authorization from Support Services.

NIC CARDS : qfe2 and qfe6

CLUSTER FAILOVER SCRIPT:

/etc/rc2.d/ S99fixclusterfailover (symbolic link to /etc/init.d/fixclusterfailover)

To Manually Start: /etc/rc2.d/S99clusterfailover start

To Manually Stop: /etc/rc2.d/S99clusterfailover stop

IMPORTANT NOTE: qfe2 and qfe6 are the 2 NICs that would house the Cluster Network aliases. One of these 2 interfaces should be UP and configured to the Service IP, before this script starts up.

This script starts up an instance of CoppeliaSimpleCluster(/usr/bin) for each FIX Engine cluster (currently 5 clusters are operational). Each instance is responsible for monitoring the alias firm port, as below:

Instance	Engine	Port	Alias IP online (when Engine is listening on port)
Cluster001	CBOEFIX001	21501	170.137.93.41
Cluster002	CBOEFIX002	21502	170.137.93.42
Cluster003	CBOEFIX003	21503	170.137.93.43
Cluster004	CBOEFIX004	21504	170.137.93.44
Cluster005	CBOEFIX005	21505	170.137.93.45

Step 1. FIX System CBOEFIX001-5 brought up on fix1a (fix1a is listening on port 21501-5)

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe2	Fix1afirm	170.137.93.30	fix1bfirm	170.137.93.31	FIRM SERVICE IPs ARE AVAILABLE
Qfe2:1 (on fix1a)	Fix001-firm	170.137.93.41			Firms on fix001 can connect
Qfe2:2 (on fix1a)	Fix002-firm	170.137.93.42			Firms on fix002 can connect
Qfe2:3 (on fix1a)	Fix003-firm	170.137.93.43			Firms on fix003 can connect
Qfe2:4 (on fix1a)	Fix004-firm	170.137.93.44			Firms on fix004 can connect
Qfe2:5 (on fix1a)	Fix005-firm	170.137.93.45			Firms on fix005 can connect
Qfe6	Fix1afirmboot2	172.16.14.20	Fix1bfirmboot2	172.16.14.21	

FAILOVER TYPE – NIC FAILURE on fix1a – The FIRM Service Address fails over to qfe6

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe2	Fix1afirmboot1	172.16.13.20	fix1bfirm	170.137.93.31	FIRM SERVICE IPs ARE AVAILABLE
Qfe6	Fix1afirm	170.137.93.30	Fix1bfirmboot2	172.16.14.21	
Qfe6:1 (on fix1a)	Fix001-firm	170.137.93.41			Firms on fix001 can connect
Qfe6:2 (on fix1a)	Fix002-firm	170.137.93.42			Firms on fix002 can connect
Qfe6:3 (on fix1a)	Fix003-firm	170.137.93.43			Firms on fix003 can connect
Qfe6:4 (on fix1a)	Fix004-firm	170.137.93.44			Firms on fix004 can connect
Qfe6:5 (on fix1a)	Fix005-firm	170.137.93.45			Firms on fix005 can connect

FAILOVER TYPE – PROCESS FAILURE or System Brought up as Master on fix1b – The FIRM aliases are disabled on fix1a and enabled on fix1b. (The table below shows all 5 Engines failing over to fix1b).

NIC Card	HostName (On fix1a)	IP Address	HostName (On fix1b)	IP Address	COMMENT
Qfe2	Fix1afirm	170.137.93.30	fix1bfirm	170.137.93.31	FIRM SERVICE IPs ARE AVAILABLE
Qfe2:1 (on fix1b)			Fix001-firm	170.137.93.41	Firms on fix001 can connect
Qfe2:2 (on fix1b)			Fix002-firm	170.137.93.42	Firms on fix002 can connect
Qfe2:3 (on fix1b)			Fix003-firm	170.137.93.43	Firms on fix003 can connect
Qfe2:4 (on fix1b)			Fix004-firm	170.137.93.44	Firms on fix004 can connect
Qfe2:5 (on fix1b)			Fix005-firm	170.137.93.45	Firms on fix005 can connect
Qfe6	Fix1afirmboot2	172.16.14.20	Fix1bfirmboot2	172.16.14.21	

FIX-ORS – FAILURE CONDITIONS HANDLING PROCEDURES

The FIXometer is used to monitor the FIX-ORS system. Among the various components monitored are:

FIX Engine Clusters(Master/slave) state

External Connections from the FIX Engine to TPF. This includes the Order Service, Report Service and the Tag Service for the Master and the Tag Service for the Slave Engine.

Firm Connections to each Fix Engine.

System States

FIX Engine States

State	Condition	Description
Master	Normal	The first FIX-Engine started in the cluster assumes the MASTER role.
Slave	Normal	The second FIX-Engine started in the cluster assumes the SLAVE role.
DOWN	Error	The FIX-Engine process is down.

External Host Gateway (to TPF) Connection States

State	Condition	Description
UP	Normal	The FIX-Engine has successfully established a Host Gateway connection to TPF.
DOWN	Error	The external connection to TPF is not available.

Firm Connection States

State	Condition	Description
UP	Normal	The Firm has successfully connected to the Engine
DISCONNECTED	Warning	The Firm has disconnected from the Engine.
DOWN	Warning	The Firm was not connected when the FIXometer started.
LOGON	Error	A Logon message has been received from the firm but not acknowledged.
SUSPEND	Manual	One or more, or ALL connections have been manually suspended using the FIXometer. Firms are disconnected and logon messages will be rejected.
HOLD	Warning	The connection is on hold, incoming messages will be rejected.
SERVICE DOWN	Error	The External TPF connection is down. Firms are disconnected and logon messages will be rejected.

FIX Engine Failure Handling

Symptom	Condition	Handling
The FIXometer complains “SERVER IS DOWN”. The icon shows RED . No Firm traffic is affected	The Slave FIX-Engine is DOWN.	<p>Ensure that the Master Engine is successfully receiving messages, uninterrupted. Firm Connection Status should show “UP”.</p> <p>Login to the server where the slave is running and restart the process, or use Patrol to restart the Process.</p>
The FIXometer complains “SERVER IS DOWN”. The icon shows RED. Firm Connections get DISCONNECTED .	The Master FIX-Engine is DOWN.	<p>The Slave Engine should automatically take over as MASTER. Firm connections should switch to the new MASTER. Login to the server that runs the new MASTER and type “<i>monitor_ha</i>”. The FIRM IP aliases should show on the master.</p> <p>Ensure that the new MASTER successfully connects to TPF. Verify the state UP for the Order Service, Report Service and Tag Service.</p> <p>Ensure that the FIRM connections successfully re-connect after the switch. State should be UP.</p> <p>Contact Support Services before bringing the failed engine back up. Restarting this engine will make it a SLAVE and sync messages from the MASTER.</p> <p>If the Slave Engine, for some reason does not take over as MASTER, Operations should contact Support Services. Firms should be asked to route their traffic to their 2nd connection on another engine, while the failed engine is restarted. This is NOT normal behavior for the system and should be addressed with Javelin Tech.</p>

Firm Connection Failure Handling

Symptom	Condition	Handling
FIXometer shows FIRM Connection state as "DISCONNECTED"	The Firm has disconnected from the Engine.	The Firm should automatically re-connect. Support Services should be contacted if manual intervention is required. This would be an abnormal condition. IMPORTANT NOTE: If a FIRM is unable to re-connect, any outbound Fill reports/cancel reports will be queued Outbound for that connection (FIXometer Outbound Queue reflects). Operations can view Outbound queued messages (Right-click mouse on Firm connection line and chose View Outbound queued messages. If the connection will not come back up, these queued messages should be printed (select ALL and Print) and faxed to the Firm contact before End of Day is run (the End of Day run will warn Operations if there are any Outbound queued messages).
DOWN	The Firm was not connected when the FIXometer started	Handling is same as the DISCONNECTED state.
LOGON	A Logon message has been received from the firm but not acknowledged	Operations should DISCONNECT the FIRM using the FIXOMETER. (Right-click the mouse with the cursor on the FIRM connection). Only users with authorization will be allowed to perform this.
HOLD	The FIX-Engine has lost the connection to TPF and is de-queueing received orders.	Refer to External Connections – (TPF Connection) Failure Handling.
SERVICE DOWN	Connection to TPF is down. Firms have been disconnected.	Refer to External Connections – (TPF Connection) Failure Handling.
SUSPEND	This is a manual Operation that is executed via the FIXometer.	Operations/Support Services will Suspend Firms, when there is a business condition that should prevent firms from sending in orders to the CBOE. Operations may RELEASE Firms, when that condition has cleared.

External Connections – (TPF Connection) Failure Handling

NOTE:

The MASTER FIX Engine establishes 3 connections to TPF, namely:

The Order Service
The Report Service
The Tag Service

The SLAVE FIX Engine establishes 1 connection to TPF, namely:

The Tag Service

The current release of the FIX Engine may or may not show the status of the connection to TPF for the SLAVE. This should be verified via **Host Gateway** instead (Enhancement will be provided in phase 2)

The FIX-Engine uses the TPF FIXService to establish connections to TPF. Each server has dual connections (over separate NIC cards) to Backbone A and Backbone B. Failover to the backup network/Hostgateway system is, as a result, automatically handled by the TPFService and will require no Operator intervention.

Symptom	Condition	Handling
The FIXometer shows one Order Service DOWN.	The FIX-Engine has a problem establishing a connection to TPF over Host Gateway.	There is a 20 sec(configurable) duration where incoming orders will queue in the FIX-Engine. The FIXometer will reflect this in the Inbound Queue. The state will reflect in Yellow if more than 3 orders are queued. If the Engine cannot recover the TPF connection within 20 secs, it will set the FIRM connection status to HOLD. During this time, all inbound queued messages will be rejected with reason "ORS System is Unavailable". New messages will be rejected with the same reason. When the queue is drained, the Firm connection state will be set to SERVICE DOWN. Firms will be disconnected and incoming connections will be refused, while the Engine retries the TPF connections. When the TPF connections resume, Firm connections are automatically enabled. FIXometer will show the state as DISCONNECTED until the Firm re-connects and sets the state to UP.

Issuing a Manual SUSPEND (Wack All) of Firm Connection(s)

Firm connections may be manually suspended using the FIXometer:

Chose the FIXometer menu:

Commands

Suspend

This provides the option to pick a specific engine, or ALL engines. If a specific engine is picked, either a single firm or ALL firms can be picked from the GUI interface.

To perform a Wack All Operation:

Check *Select All* for Server Group Selection and *Select All* for Connection Selection, then hit the *Suspend* Button. If not previously logged into each engine, you will be prompted to login, specifically to each engine. The login once performed will persist until the FIXometer is exited.

Host Gateway/TPF Connection Failure – What happens when

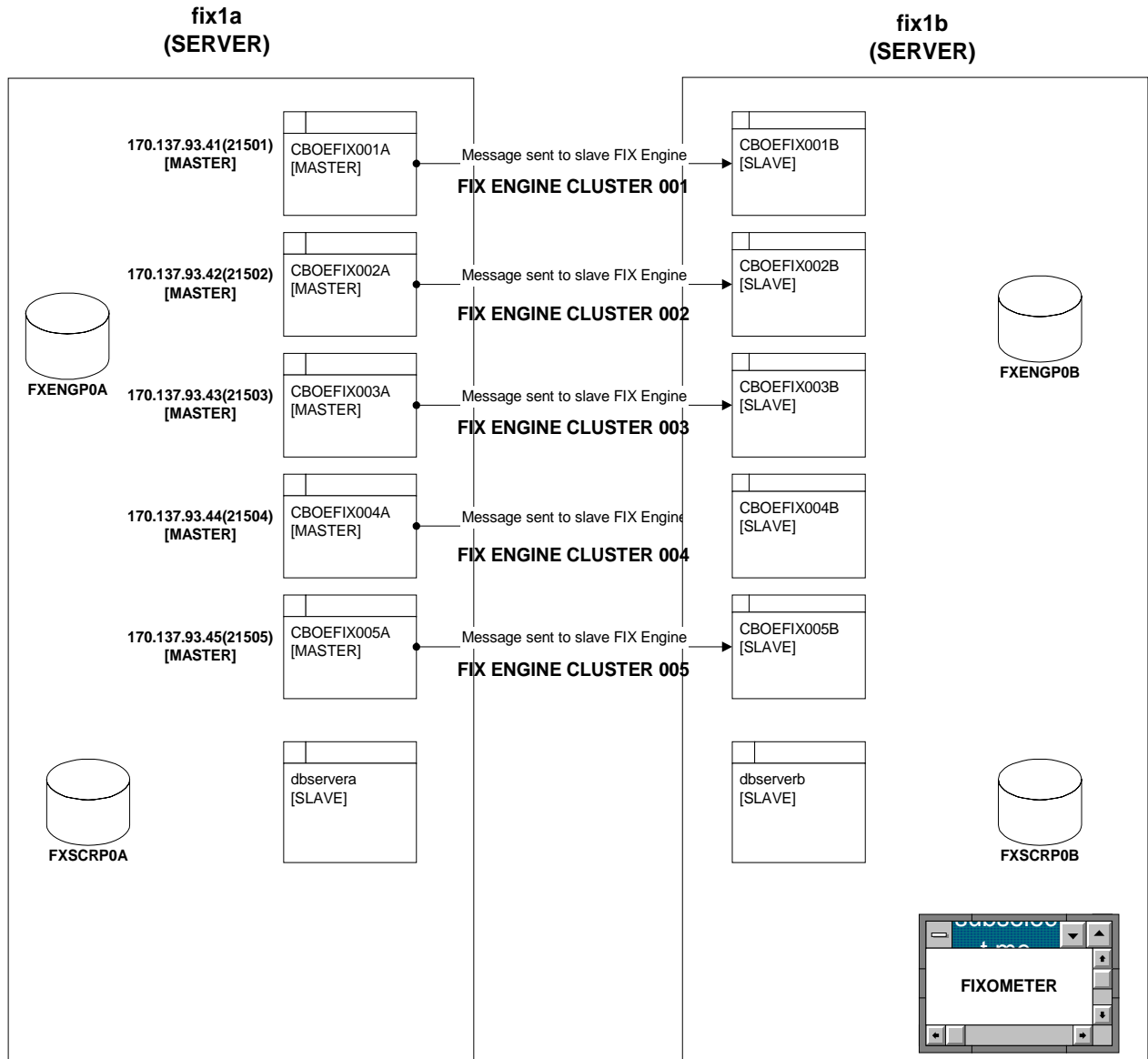
1. Report Service goes down and the Order Service is still UP.
In this case, Orders will still come in from firms and will be acknowledged by TPF. However, no Fill Reports will be sent to the firms, until the Report Service resumes. Fill Reports will be queued in TPF. When the connection does resume, these reports should be automatically sent out. If Operations/Support Services determines that orders should not come in, manual intervention is required. A Wack-All Operation will need to be performed in this case, if found necessary.
2. One or all of the Host Gateway Connections (Order/Report/Tag Service) breaks:
The TPF Fix Service currently has a list of 4 destination IPs in its config table, m24a,m24b,m25a,m25b. If the connection to first IP fails or breaks it does the following:
 1. Retries this connection.
 2. If it fails to connect, it sleeps for 7secs.
 3. It then tries the next IP. It will try this for all the IPs in its list, until it succeeds.
 4. (Applies to Order Service only).
The TPFAdapter has a timeout period of 20secs. During this time, orders will come in and queue. If the TPFAdapter cannot make a connection to TPF within 20 secs, it will:
 - stop the front door (new incoming messages will be rejected),
 - reject any queued orders and
 - Wack all Firms (disconnect connections and set the state to SERVICE DOWN)When the connections do come back, the Adapter will automatically recover the connections (FIXometer will show HGW Order Service connection state as UP) and Release the Firm connections. This should change the state of Firm connections in the FIXometer to DISCONNECTED. IF the Firms have setup to automatically reconnect, their connections should succeed when this happens and normal processing should resume.

Running End of Day if there are Queued Inbound/Outbound Messages

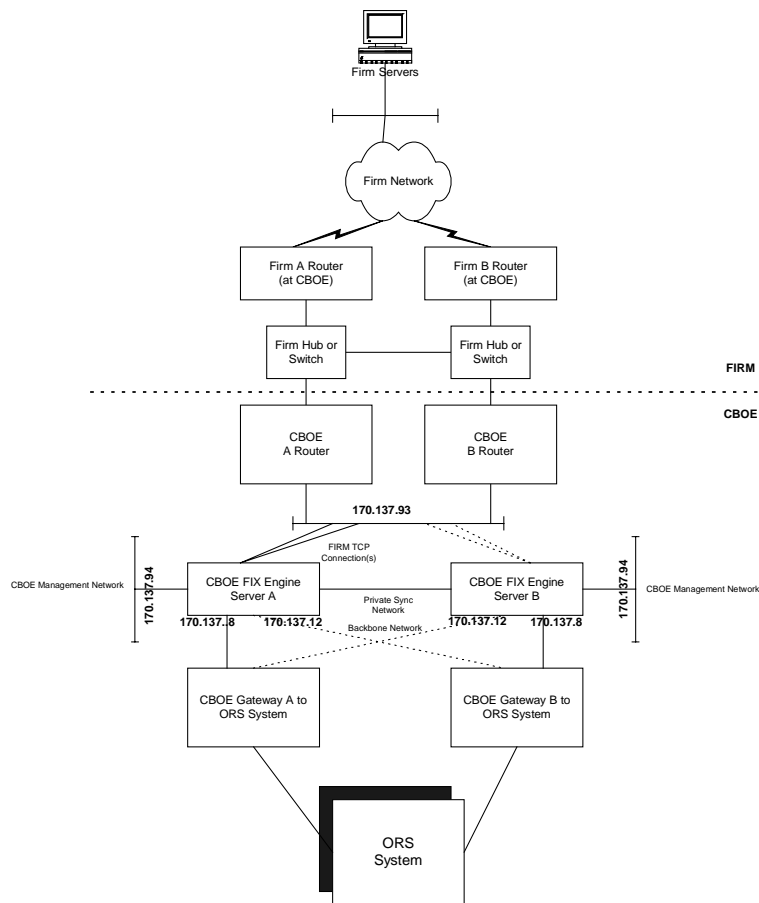
NOTE: The FIXometer will issue a warning if there are queued messages and End of Day is run for that FIRM connection. If this happens, do the following:

1. Cancel out and Do not Run the EOD.
2. Right click on the connection that has the Queue Count > 0 and View Queued Messages. Operations should make a note of the Order-Ids that are queued.
3. Execute Print, to print a hard copy of the queued messages and contact Support Services.
4. Proceed to run EOD.

APPENDIX A – FIX PRODUCTION SYSTEM DIAGRAM



APPENDIX B1 – FIX-ORS HIGH-LEVEL NETWORK DIAGRAM



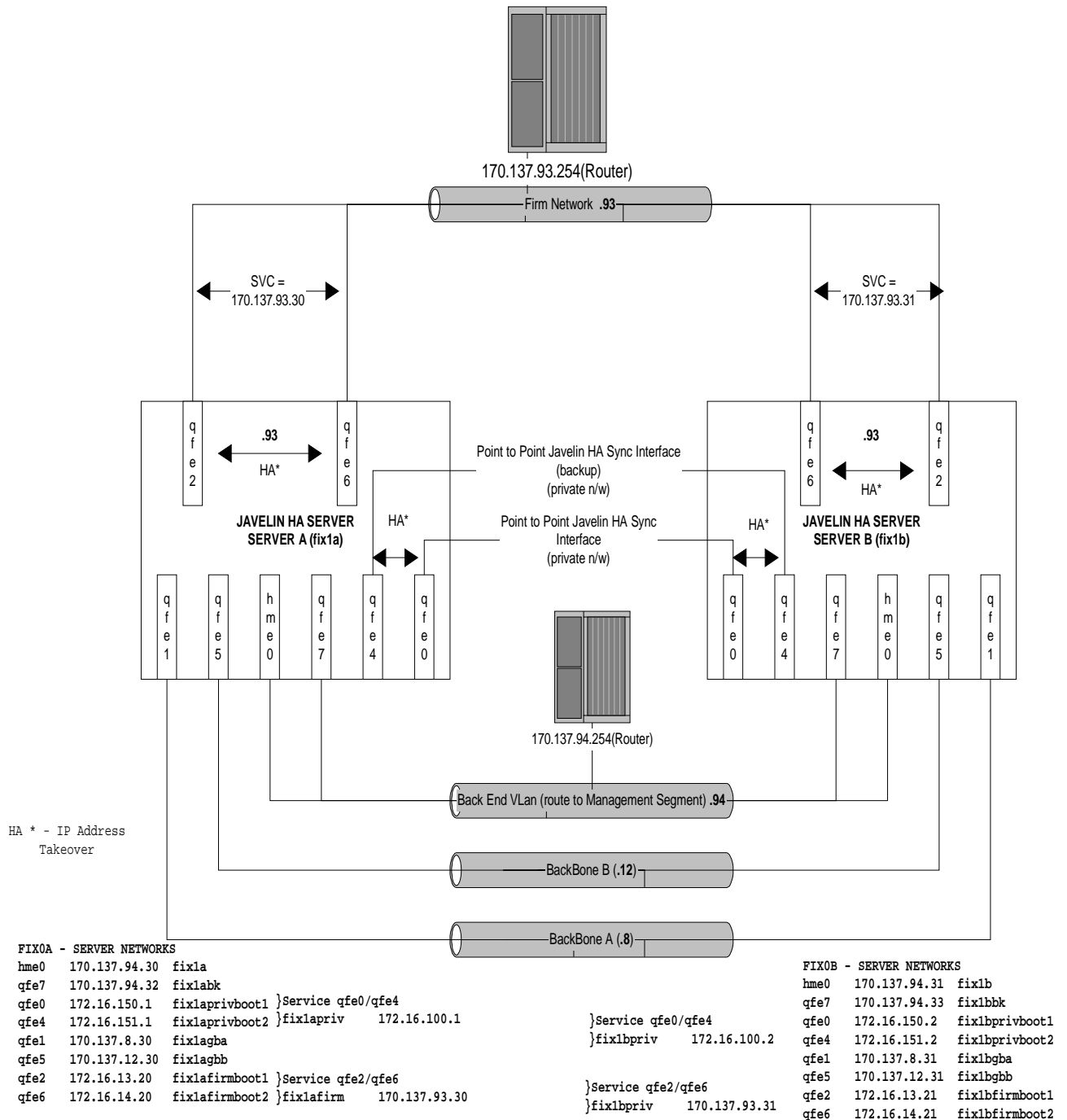
This diagram shows the standard network design that CBOE has developed for firm connections. This standard was developed to provide complete redundancy and rapid and automatic fail-over in the event of problems.

Firms are highly encouraged to provide redundant routers and serial links to CBOE. They are also encouraged to investigate the redundancy of their own networks. CBOE will provide Ethernet interfaces on redundant routers. The CBOE network is also fully redundant.

The two CBOE routers and the two Firm routers are connected to a single common network. The Firm must provide a hub or switch for this network. They are highly encouraged to provide two hubs or switches to avoid a single point of failure. CBOE will provide the required cabling to connect the routers and hubs or switches.

Each CBOE FIX Engine server runs multiple FIX Engines. Each FIX engine accepts TCP/IP Firm connections over a separate alias IP address and Port number (Ref. To Appendix A). A FIRM is encouraged to have multiple TCP/IP connections distributed over multiple Engines.

APPENDIX B2 – FIX NETWORK CONNECTION DIAGRAM



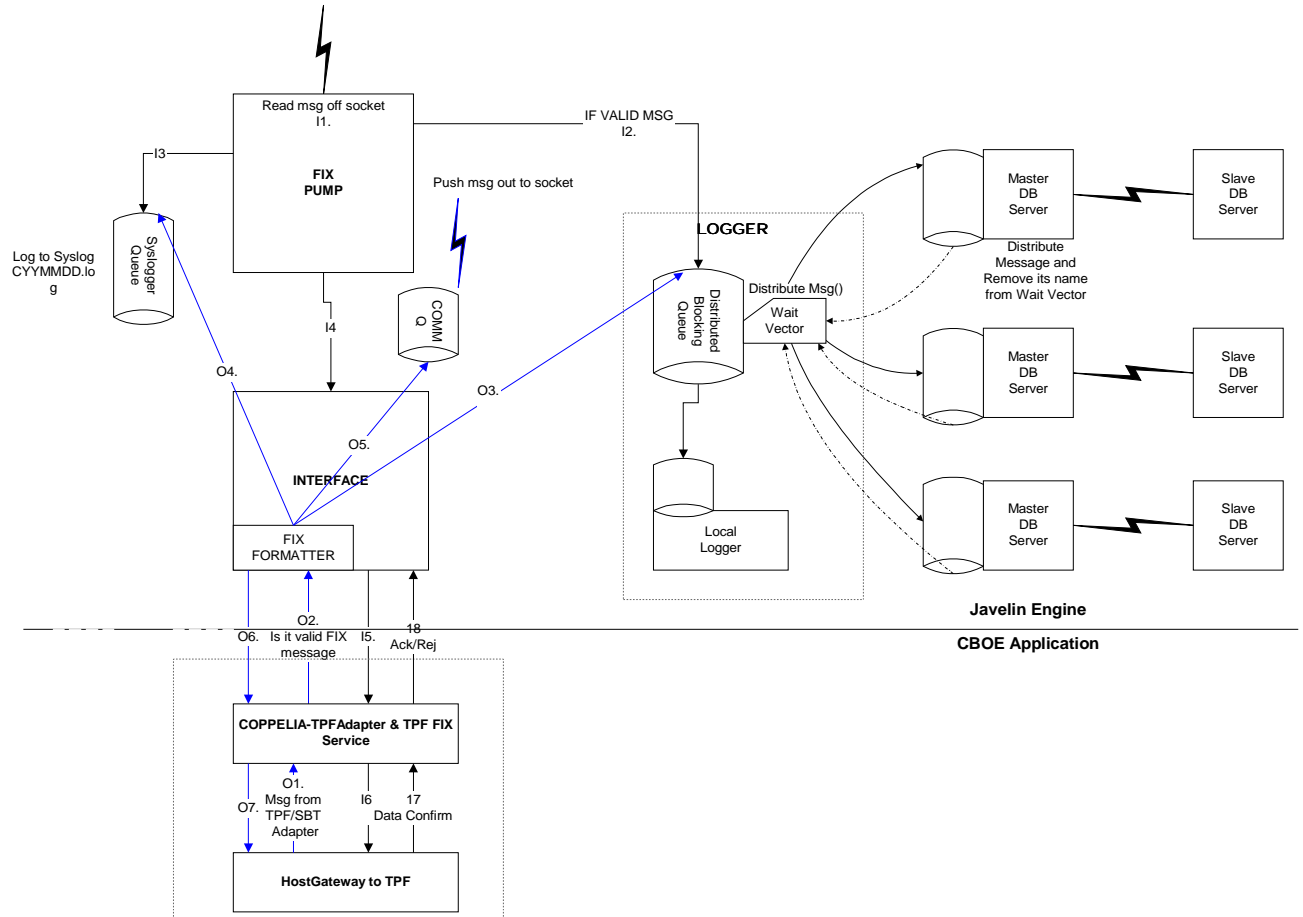
APPENDIX C – ASSIGNED PORT NUMBERS

	<i>COPPELIA RMI</i>	<i>COPPELIA FIRM</i>	<i>COPPELIA IIOP</i>	<i>TPF FIX SERVICE</i>	<i>TPF REMOTE SYNCRONIZ ER</i>	<i>HTTP PORT</i>	
DBSERVERA/B	21000						
CBOEFIX001A/B	21001	21501	21701	22001	22301	22701	
CBOEFIX002A/B	21002	21502	21702	22002	22302	22702	
CBOEFIX003A/B	21003	21503	21703	22003	22303	22703	
CBOEFIX004A/B	21004	21504	21704	22004	22304	22704	
CBOEFIX005A/B	21005	21505	21705	22005	22305	22705	
CBOEFIX006A/B	21006	21506	21706	22006	22306	22706	future use
CBOEFIX007A/B	21007	21507	21707	22007	22307	22707	future use
CBOEFIX008A/B	21008	21508	21708	22008	22308	22708	future use
CBOEFIX009A/B	21009	21509	21709	22009	22309	22709	future use
CBOEFIX010A/B	21010	21510	21710	22010	22310	22710	future use

HOST-GATEWAY CONNECTION PORT NUMBERS

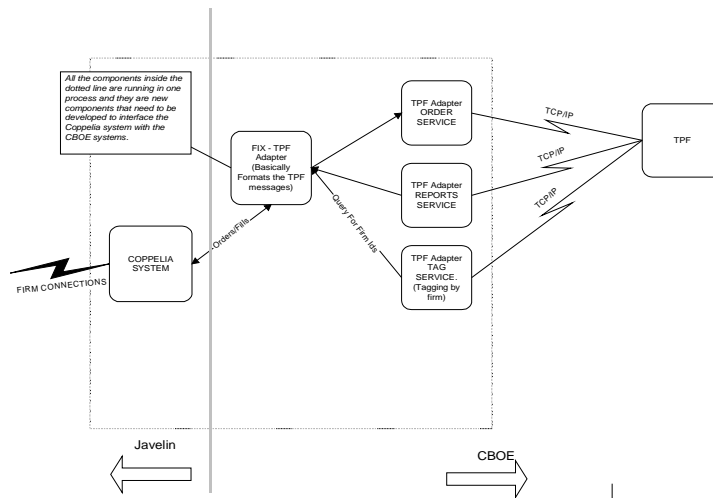
PORT NAME	PORT-NUMBER	DESCRIPTION
Hgw_ords	30030	ORDER-SERVICE
Hgw_rpts	30032	REPORT-SERVICE
Hgw_tags	30033	TAG-SERVICE

APPENDIX D – COPPELIA FIX ENGINE – PROCESS DETAIL

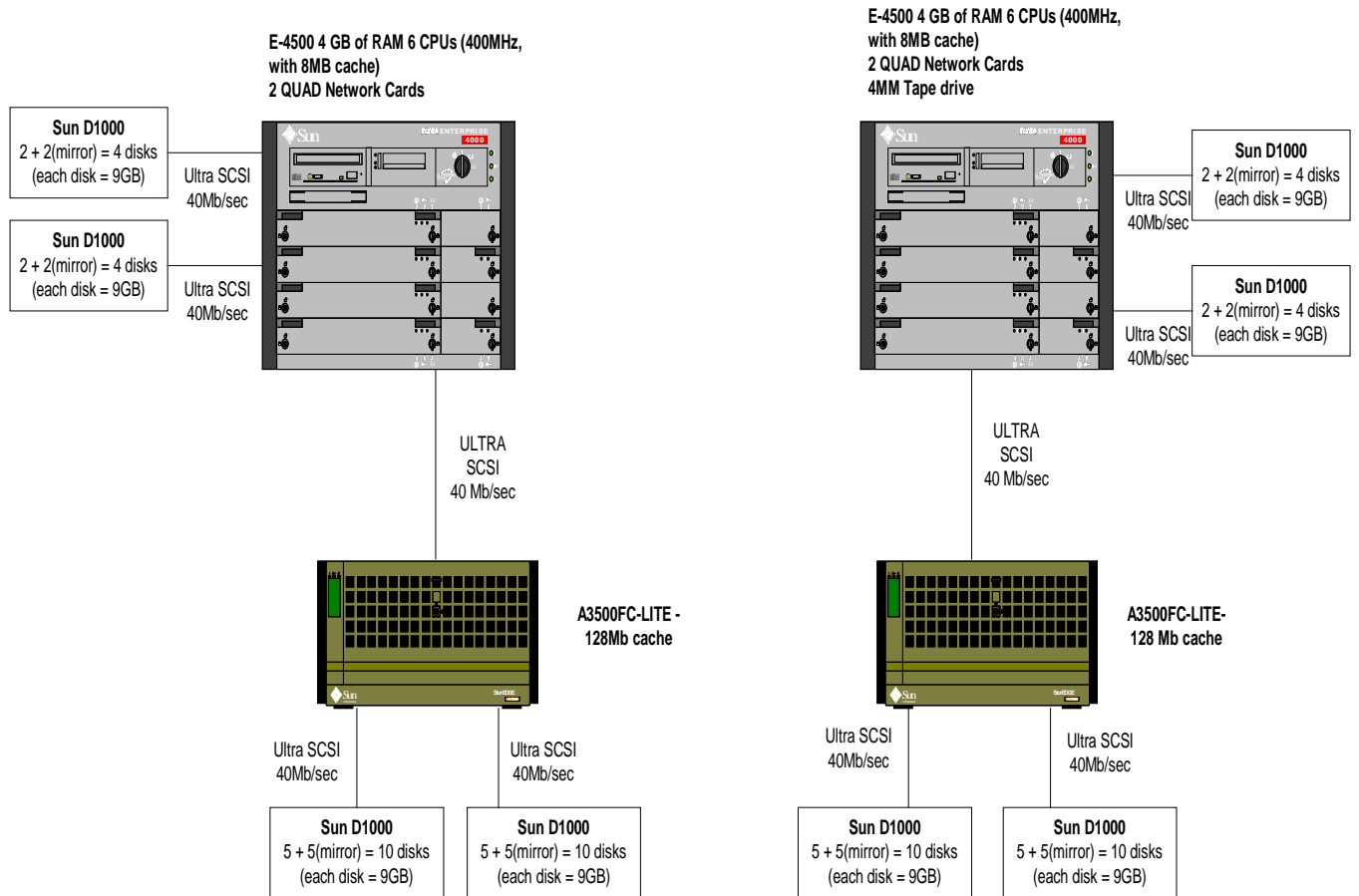


APPENDIX E – FIX-ORS APPLICATION COMPONENT DIAGRAM

Application Component Diagram for FIX into CBOE



APPENDIX F – CBOE FIX-ORS SUN HARDWARE COMPONENTS



SYSTEM SOFTWARE
SUN SOLARIS OS
VERITAS MIRRORING
VxFS FILE SYSTEMS

APPENDIX G – PATROL MONITORED LOG FILES

Log File Full Path Name	Monitored for String	Description of Problem
/apps/fixengine/prod/running_dir/log/CBOEFIX001/FixEngine001.log /apps/fixengine/prod/running_dir/log/CBOEFIX002/FixEngine002.log /apps/fixengine/prod/running_dir/log/CBOEFIX003/FixEngine003.log /apps/fixengine/prod/running_dir/log/CBOEFIX004/FixEngine004.log /apps/fixengine/prod/running_dir/log/CBOEFIX005/FixEngine005.log	1. <i>Is down</i> 2. <i>Heartbeat failed</i>	Slave Takeover of FIX Engine
/usr/tmp/nicfailoverlog_firm	<i>MAC takeover</i>	Nic failure of the FIRM Network Interface
/usr/tmp/nicfailoverlog_priv	<i>MAC takeover</i>	Nic failure of the Private Network Interface
/apps/fixengine/prod/running_dir/log/getCompassssftpfile.log	<i>FTP Failed</i>	FTP of file symbol.table from Compass Production Module Failed.

The above files are monitored for certain error messages. The product used to monitor the logs is LOGWATCH. Each log is represented by an icon, which is placed underneath the icon for the physical server. Once a condition is met the log's icon will turn red. It will continue to be red until you disarm the condition.

Using server fix1a as an example the procedure to disarm the alert is as follows:

From the main map traverse through the AllServers icon->fix1a->Bitwatch->Logwatch
 Here is where all the log icons are placed for fix1a, find the icon that is in alarm state and select it (single click).
 With MB3 (right mouse) you will see a drop down menu. One option will be RESET->Reset Logfile Status.
 After selecting that option the alarm is reset.

You can configure Logwatch to also present a popup window with the alarm condition. The above holds true for this type of configuration. The only difference is that any additional popup windows will be suppressed until the procedure to reset the alarm (exactly like above) is completed.

APPENDIX H – VIEWING THE FIX ENGINE ORACLE DATABASE TABLES

The FIX Engine's Oracle Database tables (Oracle Instance FXENGP0A on fix1a and FXENGP0B on fix1b) can be viewed through the Access ODBC connection setup on the PC that runs the FIXometer by doing the following:

1. Go to the folder C:\FIXORSDATABASE and open the table **fxeng.mdb** (double-click on fxeng.mdb).
2. For each firm connection the following tables are available:

On fix1a (Instance=FXENGP0A):

Firm_Inbound
Firm_Outbound
Firm_Stats

On fix1b (Instance=FXENGP0B):

Firm_Inbound
Firm_Outbound
Firm_Stats

Where *Firm* is the Firm ID

3. When a New Firm is added, the following steps need to be performed to add the link to the required Firm tables, 3 for FXENGP0A and FXENGP0B:

Open the fxeng.mdb database and Click on New, Link Table. Chose Files of Type = ODBC Databases.
Enter the Service name (FXENGP0A or FXENGP0B) [User=coppelia, password=fixeng0]