Setting up end to end Informix connections with Connection Manager

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Informix Tech Talks by the IIUG

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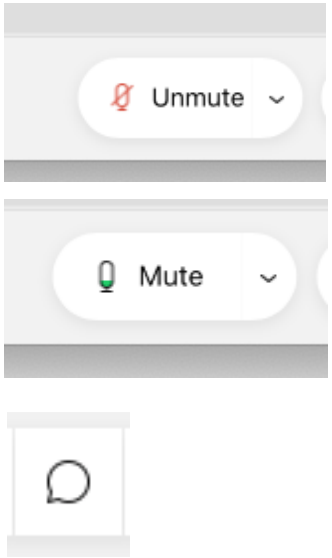


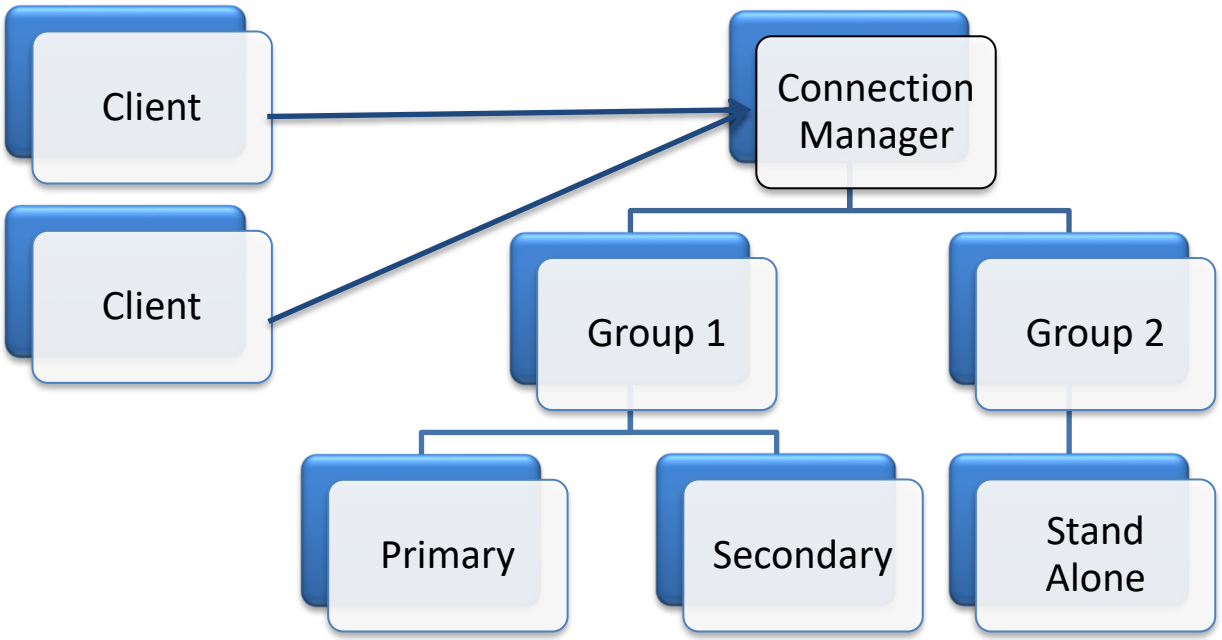
About This Talk

- Extension of my earlier talks on setting up connection manager
- Supplement the rather sparse documentation on the topic
- Documenting some of the confusion I ran into configuring this for clients
- Going into some depth of different ways connection manager can be used and steps for setup

What Is Connection Manager

- Introduced in 11.5 (revamped heavily in 11.7)
- Bundled with the engine, also included with the csdk
- Standalone program that runs and passes connections to the correct server or group
- Can be used as a central broker for connections
- Can be run solo or with a group of CM servers working together
- Usable as part of HA/DR, but also for advanced networking options for multiple or even single server environments

Topology


Client
Client
Connection Manager
Group 1
Group 2
Primary
Secondary
Stand Alone

Setting Up Access

- Can be as simple as one server and one CM
  - Client -> Connection Manager -> Instance
- It can be configured as a replication set
  - Client -> Connection Manager -> Primary + HDR + RSS
- Can use it with Enterpise Replication to multiple target servers
- It can be configured with multiple groups each with their own rules
- Clients connect to the CM on the listener that will tell the manager where to redirect them and what rules to use

Relevant Files

- SQLHOSTS
  - Specifies the groups, also controls the CM listeners
- $INFORMIXDIR/bin/oncmsm
  - Connection Manager Binary
- $INFORMIXDIR/etc/cmsm.cfg.sample
  - Sample config file, there are several versions
- $CMALARMPROGRAM
  - Program, defined in configs that triggers on a failover

ONCONFIG Parameters

- DRAUTO – Controls failover processing, 3 means it will rely on the connection manager to initiate failovers.
- HA_FOC_ORDER – Default order (HDR,RSS,SDS) to fail over servers.

oncmsm

- Startup:
  - $INFORMIXDIR/bin/oncmsm –c $INFORMIXDIR/etc/cmsm.cfg
  - Optional environmental variable $CMCONFIG
- Commands:
  - oncmsm –k –c <config file>
    - Shutdown
  - oncmsm –r –c <config file>
    - Reload with updated config file

Very Basic Example - SQLHOSTS

```
#Instance Config port 9088
instance1_tcp              onsoctcp host_ip  sqlexec
#Connection Manager Listener
report_group               onsoctcp host_ip  9090
```

Basic Example – cmsm.cfg

```
NAME samplecsm
LOGFILE
     ${INFORMIXDIR}/tmp/cmsm.log

CLUSTER samplecluster {
     INFORMIXSERVER    instance1_tcp
     SLA  report_group
     DBSERVERS=primary
```

Base CM Config Sample

```
NAME        cm_1
LOGFILE
        ${INFORMIXDIR}/tmp/cmsm.log
LOG   1
CM_TIMEOUT    300
<Connection Info>
```

cmsm.cfg Parameters

- **NAME** – Must be unique across the cluster
- **LOG** – log level, 1 is on
- **LOGFILE** – Path to CM log
- **CM_TIMOUT** – Number of seconds to wait for a response before promoting the next highest ranked connection manager. (60 default)
- **EVENT_TIMEOUT** – Number of seconds to wait before failover occurs of Informix servers. If a secondary triggers 'primary offline' it will also trigger failover before the timeout (default 60)
- **SECONDARY_EVENT_TIMEOUT** – Seconds to wait before disconnecting from a secondary (Default 60)
- **SQLHOSTS** – If it should use a local, remote or both SQLhosts files to find instances. (Default local + remote)
- **LOCAL_IP** – Optional, can be used to tie CM to a specific IP address to listen for database status changes
- **MACRO** – Used to create variables to be used in other parts of the script

Connection Types

- CLUSTER – Group or selection of servers to connect to that support HDR failover
- GRID – ER Grid to connect to
- REPL_SET – ER replicate set to connect to
- SERVERSET – Unrelated servers that do not use failover

CLUSTER Example

```
CLUSTER cluster_1
{
   INFORMIXSERVER repl1_tcp
   SLA report_1 DBSERVERS=(PRI,HDR) \
                POLICY=WORKLOAD
   FOC ORDER=ENABLED \
       PRIORITY=1
  CMALARMPROGRAM $INFORMIXDIR/etc/CMALARMPROGRAM.sh
}
```

Cluster Example

CLUSTER cluster_1 – Unique name of cluster, needs to be identical on other connection managers

{

INFORMIXSERVER repl1_tcp -- The sqlhost entry (group or server) the connection manager will listen on

SLA report_1 \ -- the SLA is for the report_1 group in sqlhosts

DBSERVERS=(PRI,HDR) \ -- This is the order it will maintain

POLICY=WORKLOAD – This is the type of SLA policy it users

FOC ORDER=ENABLED \ -- Says to use the failover order above

PRIORITY=1 – Says this connection manager is the first one to handle failover for this SLA

CMALARMPROGRAM $INFORMIXDIR/etc/CMALARMPROGRAM.sh – If failover fails after 8 attempts it calls this program.

INFORMIXSERVER

- Works with all 4 types of connection
- Specify the group of servers or standalone server this SLA should service
- This is what the connection manager will connect to when it comes up to establish the replication status

SLA

- Service Level Agreement
- This is the directive of how a connection manager should treat a particular group of servers
- Any linked connection mangers should have similar settings and the same name for a group
- Each SLA will have its own listener port

SLA - DBSERVERS

- List of servers to connect to, and the order to connect to them in
- Can use server names, group names, server aliases, server types (HDR, SDS, ANY)

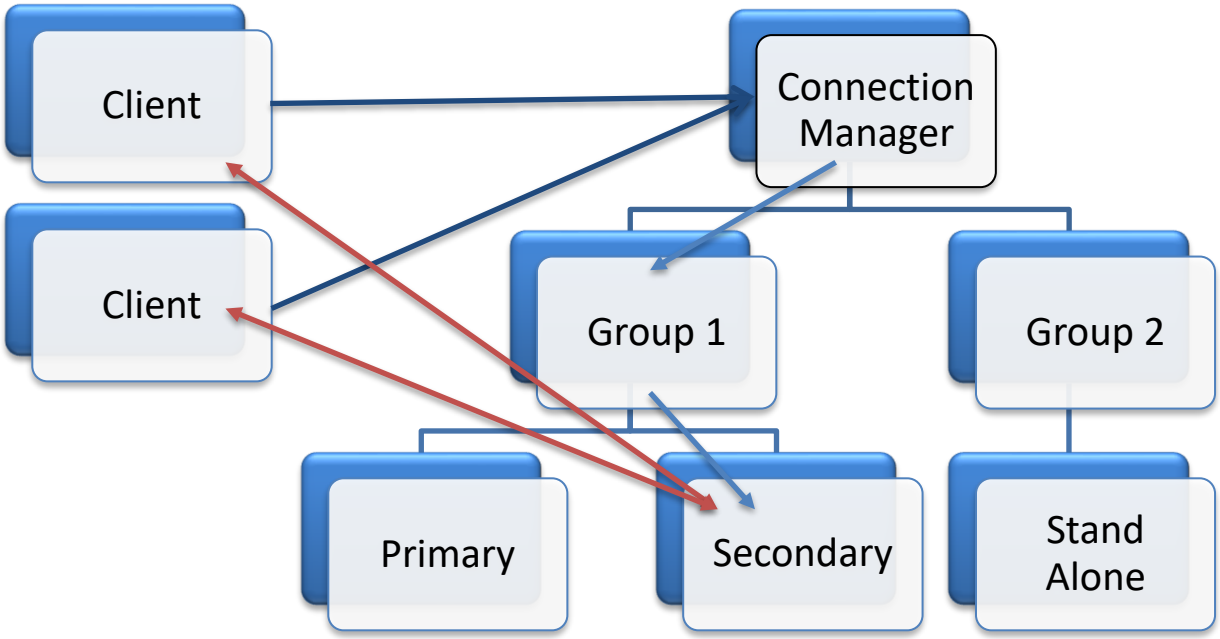
DBSERVERS - Cluster Keywords

- PRI, PRIMARY
- HDR – Secondary
- SDS – Shared disk secondary
- RSS
- ANY

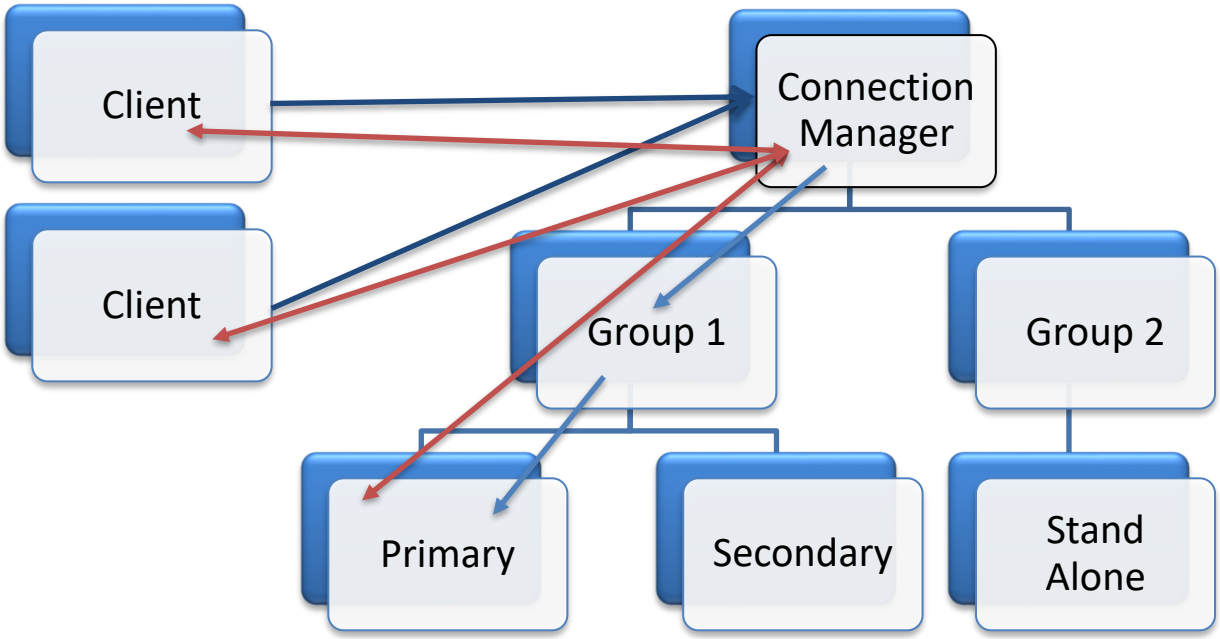
SLA - MODE

- Redirect – (Default) this will redirect the client directly to the server, only works with versions later then CSDK 3.0 and JDBC 3.5.1
- PROXY – Will pass all data through the connection manager directly, allows for older clients to be supported. Also use this if the client cannot directly access the Informix server.

Topology - Redirect



Topology - PROXY



SLA - USEALIASES

- On – Default, this will add any entries in DBSERVERALIASES into the mix.
- OFF – Only will use DBSERVERNAME none of the aliases

SLA - POLICY

- **WORKLOAD** – (Default) – Assigns the work to the least busy server at the time
- **ROUNDROBIN** – Rotates between all of the available servers
- **FAILURE** – Requests pointed to the server with the fewest apply failures. (Replset and GRID only)
- **LATENCY** – Redirects to the server with the lowest transaction latency (Replset and GRID only)
- **SECAPPLYBACKLOG**:<num of pages> -- Stops sending requests to the secondary after it exceeds the number of pages in a backlog. CLUSTER only. (version 12.10xc2 or 11.70xc8 required)

SLA - MODE

- **proxy** – Connections are made to the Connection Manager listener and data is passed through to the target system. No direct connection to the target server is needed.
- **redirect (Default)** – Connection manager figures out the best server to use based on the rules, hands off that connection and gets out of the way for the client to connect directly to the server.

- Proxy is supported by apps that either don't use the official CSDK or JDBC driver. Or are older than version 3.5.

Sample Config

```
NAME connection_manager_1
LOG 1
LOGFILE $INFORMIXDIR/tmp/my_cm1_log.log
EVENT_TIMEOUT 20
SSL_LABEL

CLUSTER primary_cluster
{
  INFORMIXSERVER cluster1
  SLA report_1 DBSERVERS=(PRI,HDR) \
          POLICY=WORKLOAD
  FOC ORDER=ENABLED \
      PRIORITY=1
}
```

Name Of This Connection Manager

Label for SSL Certificate

Internal Name, Shared Among Connection Managers

Informix Group/Server To connect to

Connection Manager Listener

SQLHOSTS - Example

```
#HDR Pair of Servers
cluster_1    group     -        -          c=1,e=repl2_tcp
repl1_tcp    onsoctcp  server1  9088       g=cluster_1
repl2_tcp    onsoctcp  server2  9088       g=cluster_1

#Group of connection managers that service the report SLA
report       group     -        -          c=1,e=report_2
 report_1    onsoctcp  server1  10088      g=report
 report_2    onsoctcp  server2  10088      g=report
```

Application Set Up

SQLHOSTS:

```
report      group    -        -          c=1,e=report_2
 report_1   onsoctcp server1 10088      g=report
 report_2   onsoctcp server2 10088      g=report
```

- Set up your application to connect to report_1

Oncmsm Log - Startup

22:45:41 listener report initializing
22:45:41 listener report_rr initializing
22:45:41 listener current_rss initializing
22:45:41 listener proxy_rss initializing
22:45:41 Listener report_rr DBSERVERS=(HDR,RSS) POLICY=ROUNDROBIN is active with 4 worker threads
22:45:41 Listener current_rss DBSERVERS=RSS POLICY=SECAPPLYBACKLOG:5500+WORKLOAD is active with 4 worker threads
22:45:41 Listener report DBSERVERS=(HDR,RSS) POLICY=WORKLOAD is active with 4 worker threads
22:45:41 Listener primary_cm DBSERVERS=primary is active with 4 worker threads
22:45:41 Listener proxy_rss DBSERVERS=RSS POLICY=WORKLOAD MODE=PROXY is active with 4 worker threads
22:45:42 Connection Manager successfully connected to maytcp
22:45:42 The server type of cluster aos_cluster server furytcp is Primary.
22:45:48 The server type of cluster aos_cluster server fury is Primary.
22:46:04 Connection Manager started successfully

Oncmsm Log – Startup Cont

22:46:04 Connection Manager successfully connected to coulsontcp
22:46:04 Cluster aos_cluster Arbitrator FOC ORDER=ENABLED PRIORITY=1
22:46:04 Connection Manager successfully connected to furynosql
22:45:42 The server type of cluster aos_cluster server furytcp is Primary.
22:45:48 The server type of cluster aos_cluster server fury is Primary.
22:46:04 Connection Manager started successfully
22:46:04 Connection Manager successfully connected to coulsontcp
22:46:04 Cluster aos_cluster Arbitrator FOC ORDER=ENABLED PRIORITY=1
22:46:04 Connection Manager successfully connected to furynosql
22:46:04 Connection Manager successfully connected to furytcp
22:46:04 Connection Manager successfully connected to furyrest
22:46:35 CM cm_1 arbitrator for aos_cluster is active
22:46:35 Cluster aos_cluster Arbitrator FOC ORDER=SDS,HDR,RSS PRIORITY=1
TIMEOUT=0

Oncmsm log - Connections

23:04:23 SLA report_rr redirect SQLI client from 10.10.20.60 to maytcp may.10088

23:30:25 SLA report_rr redirect SQLI client from 10.10.20.71 to furynosql fury.10098

23:30:25 SLA primary_cm redirect SQLI client from 10.10.20.63 to furynosql fury.10098

onstat –g cmsm

- O
- O

```
informix@fury:~$ onstat -g cmsm

IBM Informix Dynamic Server Version 12.10.UC4DE -- On-Line (Prim) -- Up 00:23:45 -- 154032 Kbytes
Unified Connection Manager: cm_1                    Hostname: fitz

CLUSTER         aos_cluster     LOCAL
        Informix Servers: shield_group
        SLA                   Connections   Service/Protocol   Rule
        primary_cm                      1     20100/onsoctcp   DBSERVERS=primary
        report                          9     20101/onsoctcp   DBSERVERS=(HDR,RSS) POLICY=WORKLOAD
        report_rr                      25     20102/onsoctcp   DBSERVERS=(HDR,RSS) POLICY=ROUNDROBIN
        current_rss                     0     20103/onsoctcp   DBSERVERS=RSS POLICY=SECAPPLYBACKLOG:5500+WORKLOAD
        proxy_hdr                       5     20104/onsoctcp   DBSERVERS=HDR POLICY=WORKLOAD MODE=PROXY

        Failover Arbitrator: Active Arbitrator, Primary is up
        ORDER=SDS,HDR,RSS PRIORITY=1 TIMEOUT=0


informix@fury:~$
```

PROXY For DMZ

- A DMZ (Demilitarized Zone) is a server that lives outside of a trusted network and allows for incoming connections.
- Has limited access to talk to servers that are otherwise isolated
- Can be a way to grant connections to Informix without direct access
- Using MODE=proxy it will leave all connections between client and CM
- Allows you to keep just a hardened CM box outside of the firewall

Encrypted Connection Manager

- You need an encrypted connection from the client to the connection manager
- And an encrypted connection from the connection manager to the Informix server
- If you use ‘redirect’ connections you need to make sure the client has encryption information for the server.

Setting up SSL

- In $INFORMIXDIR/ssl:
- Using INFORMIXSERVER=informix1

gsk8capicmd_64 –keydb –create –db informix1.kdb –pw pass_word –type cms –stash

gsk8capicmd_64 –cert –create –db informix1.kdb –stashed –label informix1 –size 2048 –default_cert yes –expire 365 –dn “CN=informix1_ssl”

- Add a new onsocssl listener to DBSERVERALIASES and to sqlhosts]
- In $ONCONFIG set SSL_KEYSTORE_LABEL to be the label above

Extracting Public Certificates

gsk8capicmd_64 –cert –extract –db informix1.kdb –format ascii –label informix1 –pw pass_word –target informix1.cert

- Writes out the certificate needed by the client keystore to a flat ascii file
- Will import the certificates for all servers into a single keystore for clients

Creating Client Keystore

gsk8capicmd_64 –keydb –create –db clikeydb.kdb –pw pass_word –type cms –stash

Adding certificates to the client keystore

gsk8capicmd_64 –cert –add –db clikeydb.kdb –stashed –label informix1 –file informix1.cert –format ascii

gsk8capicmd_64 –cert –add –db clikeydb.kdb –stashed –label informix2 –file informix2.cert –format ascii

gsk8capicmd_64 –cert –add –db clikeydb.kdb –stashed –label informix3 –file informix3.cert –format ascii

Conssl.cfg

- Create a file on all systems
- $INFORMIXDIR/etc/conssl.cfg
- SSL_KEYSTORE_FILE /opt/informix/ssl/clikeydb.kdb
- SSL_KEYSTORE_STH /opt/informix/ssl/clikeydb.sth

Set up sqlhosts for SSL

- Make sure all of the ssl listeners are in the CM server sqlhosts file

Connection Manager SSL Listener

- Note the name of the particular listener
- Create a keystore of that name .kdb
- For this example NAME = cm1
- Set SSL_LABEL as a value for your connection managers
- SSL_LABEL = Informix_cm_ssl

Create a connection manager keystore

- This needs to be in $INFORMIXDIR/ssl/${CM_NAME}

gsk8capicmd_64 –keydb –create –db cm1.kdb -pw pass_word –type cms –expire -365 –stash

- We need an internal cert for the SSL_LABEL

gsk8capicmd_64 –cert –create –db cm1.kdb –pw test_pass –dn “CN=ssl_label_`hostname`” –size 2048 –label informix_cm_ssl

Let Connection Manager Talk To SSL Listeners

- Import Informix server certificates to connection manager

gsk8capicmd_64 –cert –add –db cm1.kdb –pw pass_word –file informix3_ssl.cert label informix3_ssl –format ascii –trust enable

- Repeat for all server certificates
- Make sure to create the same keystore on all of your connection managers

Configure Client

- Extract SSL_LABEL certificate

gsk8capicmd_64 –cert –extract –db cm1.kdb –format ascii –label informix_cm_ssl –pw pass_word –target informix_cm_ssl.cert

- Import that certificate into any client keyring that you want to connect with.

Best Practices

- Use groups rather then individual servers in sqlhosts
- Run more than one connection manager
- Make sure the connection managers are on different servers from the instances.
- If running PROXY mode make sure to have the resources on the CM to handle the data.
- Make sure to set up applications to the use the group of connection managers to allow for application failover.
- Make sure applications reconnect with at least a short delay.

Things To Be Cautious Of

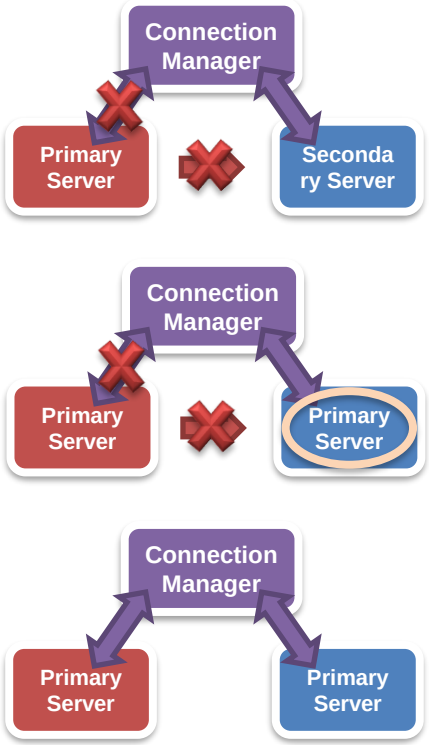
- Split Brain
- Listeners missing info
- Alias issues
- Missing Trusted status
- Make sure DBSERVERNAME is the TCP Port
- Keyrings missing CM labels

Split Brain

- Two Primary Servers on the same network
- Need to restore one of the servers and re-establish HDR
- Reduce the chance of this situation by having a reliable network connection
- Can use the Connection Manager Alarm Program to shutdown the Primary server if the Secondary cannot be reached AND can't get to the network

Auto Failover and Network Loss

- What if the PRIMARY server loses the network connection?
- Connection Manager will promote the secondary server, incorrectly assuming that the primary is down
- When network connectivity is restored, there will be TWO primary servers – **Split Brain**



Listeners Missing Info

- Will get a -930 error
- Can be caused due to missing entries from sqlhosts on the connection manager server
- Can also get errors if the port is in use, each SLA needs a unique port

Alias Issues

- By default will probe all of the systems in the cluster for DBSERVERALIASES values
- Can be disabled by USEALIASES
- If it sees tcp connections that appear valid but cannot be reached by client, such as a private replication interface, it will still try to offer them for REDIRECT connections

Missing Trusted Sources

- If one of your servers does not trust the connection manager server it will not be able to connect successfully.
- This can be resolved by using the password management process.

Questions?

Send follow-up questions to
tom@xdbsystems.com

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- July 14th 2022
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Past Connection Manager Talk

- https://www.youtube.com/watch?v=5OrQLOUSeYQ

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Thank You

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