### Chapter 15: Troubleshooting and Recovery

Topics covered in this section:
- The process of Isolating Problems
- Software Problems
  - the Network
  - Windows 2000/XP Operating System
  - Empower
- Hardware Problems
  - LAC/E³²
  - Printer
  - Server
- Other Issues
- Help

### General Recommendations

- Develop a systematic troubleshooting strategy
- Check simple things first, such as cable connections, share privileges.
- Try to reproduce a symptom and note all steps leading up to the problem.
- Make only one change at a time to identify the cause of a problem.
- Record all system problems and troubleshooting activities in a System Problem log.
- Read the Software Release Notes and Service Pack Notes.
### Common “Answers”

- “We have a backup”
- “We have on-site support”
- “We have a redundant power supply”

### Common “Answers”

- “We have a spare system”
- “We have a service contract (TAP)”
- “We’re running RAID”
- “That can’t happen to us”
Disaster Preparedness Cycle

Develop/test *Disaster Preparedness plan*

Put plan into production

Test plan

Evaluate and refine plan

Disaster Recovery

Disaster Preparedness

Recording Problems

Investigate and record the problem before calling Waters. Here are some documents that you might need:

- OS Event Viewer
- OS System Information
- Oracle Alert Log
- Logs: Empower.log, Milerror.log, Oradim.log
- Checksum.txt, install.log
- Empower Node Recover.log
- Empower Message Center
- Empower System Audit Trail and Project Audit Trail
- Screen captures of errors
Calling for Help

Investigate the problem before calling Waters:

- When you call Waters, have the following information available:
  - Software support plan number
  - Specific symptoms of the problem
  - Severity of the problem, for example, system down, server down, PC down, PC client not connecting to server, occasional malfunction
  - When the problem started, whether it is reproducible, intermittent, or constant, and whether it is data-related or account-related

Identify the Team

- Identify roles and responsibilities
- May include people outside of the organization
- Create call list and contact procedures
  - Primary Contacts
  - Backup person
  - Phones, pagers, etc.
  - Email and other notification methods
  - On-call schedule
Disaster Kit

- Call list
  - Contact information, service plan information
- Documentation
  - Operating system setup
  - Hard drives (including RAID) configuration
    - Firmware Backup
  - Network settings
  - Empower 2 Organization/Site info
    - Instruments
    - Accounts
    - Security Grid
    - "Empower" User backup
  - Empower 2 performance optimization
    - Custom setup implementation

Disaster Kit

- Media
  - Operating System
    - Service Packs
  - Oracle
    - Oracle Patches
  - Empower 2
  - Oracle and 3rd Party Tools
  - Boot floppies
  - Drivers diskettes
  - Emergency repair disk
- Tool kit
- Printed version of the plan
- Snacks 😊
Isolating Problems

Network Issues

- Do not forget the cable plant
  - Are network wires plugged in?
  - Do you have bad cabling, failing ports/hubs, crashing network devices?
  - Are the cables set up properly? (improper lengths, strung over fluorescent lights, under carpet, and so on)
    - this includes IEEE-488 cabling as well as network cables
- Network setup
  - Are there collisions?
    - Collision detection
  - Is there a name resolution issue?
    - Empower server name vs. IP address
    - Local HOSTS file vs. DNS
**Network Issues**

- Use the TCP/IP diagnostic utilities to troubleshoot network issues.
  - Can you ping the Empower server host name?
    - If no, there may be a problem with name resolution.
  - Can you ping the Empower server IP address?
    - If no, the problem may be with the server or with the network path to the server.
  - Can you ping others on the same hub?
    - If no, the problem may be with your cable or the hub.
    - If yes, the problem may be with the next network device.
  - Can you ping yourself?
    - If no, TCP/IP may not be set up correctly.
  - Remember the other TCP/IP utilities available to assist in troubleshooting
    - Tracert, arp, ipconfig, pathping, and so on

**Windows OS Issues**

- Use the Windows Administrative tools
  - Check Performance - System Monitor
  - Check Event Viewer
  - Check Services
  - Use Computer Management MMC
  - Have an Emergency repair disk
  - Registry Backup
  - NetDiag.exe
  - DCDiag.exe
Space and Disk Issues

• System performance degraded
  ◆ Not enough free disk space. Archive or delete files to regain disk space.
  ◆ Not enough contiguous free disk space (disk fragmentation). Defragment drive.
  ◆ Not enough contiguous tablescape (database fragmentation). Defragment the database.

• Error when checking disk status

Empower Issues
Empower Communication Pathway

```
Empower Client
  └── Windows 2000/XP
      │      └── TCP/IP
      │           └── Oracle Net
      │               └── TCP/IP
      │                   └── Windows 2000/2003 Server
      │                           └── Raw Data Files
      │                                           └── Empower Database
```

Empower Issues

- Client cannot connect to the database
  - Server is down - Restart the server. May need more work.
  - Listener is not running - Start Listener (OracleEmpower10gTNSListener) as a service using the Services applet in the Control Panel.
  - Client configuration problem - Use the test function in the Oracle Net Configuration Assistant. (Start>Programs>Oracle - Empower10g> Configuration and Migration Tools>Net Configuration Assistant). Verify that the entries to the tnsnames.ora file are correct or that the TNS_ADMIN variable is pointing to the correct share.
  - Network problem - Verify network connectivity. Use the Windows XP or 2000 TCP/IP utility on the client to ping the server. When routing, ensure that the default gateway is set properly.

- Client cannot connect to Run Samples on LAC/E32.
  - User does not have appropriate privileges. From the client, ensure that the user is logged in to a domain relationship.
  - No results are created when attempting to process data using Run and Report or background processing.
    - Ensure that the Empower path is listed before other paths in the operating system's path environment variable.
    - The TNS_ADMIN variable references a Win2003 database server that has not had its security setting properly configured. See the Installation and Configuration Guide.
Empower Issues

- No COM connection error occurs when attempting to connect to an acquisition server.
  - Either Waters Service is not running or the acquisition server is not in a domain relationship. Start the Waters Service (if the Waters Service is not on the list of services in the operating system, call Waters Technical Support) or enable two one-way trusts between the domains.

- Cannot copy multi-sample sets as result sets.
  - Sample sets may have the same name. Ensure that sample sets have unique names.

Empower Issues

- Client in another domain cannot access Empower resources.
  - Domain trusts are not set up - Ensure that there is a two-way trust between domains, or create an account in the Empower domain specifically for that user.

- Run not starting - database fetch error or connect error.
  - Incorrect database alias for the LAC/E\textsuperscript{32}. Check the database alias on the LAC/E\textsuperscript{32} or acquisition client for the database you are trying to connect to.

- LAC/E\textsuperscript{32} began acquisition in buffering mode.
  - Mismatch of database service names between clients and LAC/E\textsuperscript{32}. Standardize the tnsnames.ora file.
Empower Issues

- Client cannot see chromatograms or create and/or delete projects.
  - User is not logged in to the domain or permissions are not correct in the raw data share.
- Enterprise manager console displays a warning message informing you that there are a large number of cursors open.
  - Known Oracle bug. Ignore the warning.

Hardware Issues: LAC/E\textsuperscript{32} or Acquisition Client

- LAC/E\textsuperscript{32} power LEDs do not glow.
  - LAC/E\textsuperscript{32} not plugged in to power outlet - Connect LAC/E\textsuperscript{32} to the power outlet.
  - LAC/E\textsuperscript{32} power not on - Power on the LAC/E\textsuperscript{32}.
  - No power at outlet - Check power at the outlet.
  - Hardware failure - Call Waters Technical Service.
Hardware Issues: LAC/E$^{32}$ or Acquisition Client

- Failure to connect to LAC/E$^{32}$ Acquisition Server over the network or through Empower.
  - Incorrect LAC/E$^{32}$ configuration.
    - Check that LAC/E$^{32}$ is in the correct network domain.
    - Check configuration of all network parameters (IP address, Subnet Mask, and so on.)
  - Network card not functioning - Call Waters Technical Service.
  - Service pack not updated - Install Service Pack 4 if using Windows 2000 or Service Pack 1a or 2 if using Windows XP.
  - BusLAC/E hardware error - Call Waters Technical Service.

Hardware Issues: LAC/E$^{32}$ or Acquisition Client

- Data files not available for review because data files were not copied to the database server.
  - Waters Service not running on LAC/E$^{32}$ or acquisition client. Set Waters Service Startup to Automatic, then reboot the LAC/E$^{32}$ Acquisition Server.
  - Waters Service not running on database server. Set Waters Service Startup to Automatic, then start the service; wait 10 minutes for the data file upload.
  - General networking failure. Call Waters Technical Service.
- Cannot see print resources from Run Samples.
  - Print queues not registered. Register print queues on the LAC/E$^{32}$ or acquisition client. Click Start > Programs > Empower > Register Empower Node Printers. If the configured printer is not registered, click Get Printers to add to the list.
  - You must be logged in to the operating system as an Administrator.
## Hardware Issues: Printers

- **No response when you power on printer.**
  - Power cord not connected - Connect power cord.
  - No power at wall outlet - Check wall outlet.
  - Hardware failure - Call the printer manufacturer.

- **Printer does not print.**
  - Printer not powered on - Power on the printer.
  - Printer not online - Check the READY LED light. If not lit, check printer guide.
  - Data or method problem - Preview the file to screen. If the file previews to the screen, troubleshoot the printer. Otherwise, the problem is data-related or method-related.
  - Paper jammed - Reload the paper.

### Hardware Issues: Printers (continued)

- **Printer does not print (continued)**
  - Print queues not running properly - Check printer settings and properties. If a queue is stopped, stalled or paused, restart the printer.
  - Printer not connected to system - Check the cable connections to the computer or network.
  - Wrong printer specified - Specify the correct printer.
  - Printer error - Check the printer display for errors. Check printer’s guide for troubleshooting.
  - No batch processing or Run and Report printing - Register the Empower Node printers as a local or domain Admin. Also, check printer privileges on the printer server and set permissions to Everyone.
Hardware Issues: Citrix

- When using Citrix Web interface to access Empower as a browser-enabled application, the Empower Login window launches full screen and may crash if a user clicks the Advanced button.
  - The appearance of the Citrix Web interface is set to maximize windows when they open. In the Citrix management console, access the Application Appearance table and clear the Maximize application on startup check box.

- When using Citrix Web interface to access Empower as a browser-enabled application, a user cannot select the System Default Interface.
  - In the Citrix management console, access the Application Appearance table and clear the Maximize application on startup check box.

Hardware Issues: Citrix

- When using Citrix Web interface to access Empower, local drives and directories are not accessible as options when you perform tasks that enumerate the local drives, such as backing up and restoring a project.
  - This behavior is related to the response given to the ICA Security dialog box that appears the first time a user performs a task that requires enumeration of the local drives; for example, when projects are backed up or restored or when methods or reports are exported. If at any time "No Access" was selected from the ICA Security dialog box, no Citrix web interface users will be able to access the client local drives on that workstation. If the user makes an incorrect selection for the ICA Security settings, browse the %Systemroot%\webica.ini file. The next time a user performs an action requiring an enumeration of the local drives, the ICA Security dialog box will appear and ask the user to select the appropriate level of access. At this time, select "Full Access" and "Never ask again for any application". A new webica.ini file with these parameters will be created.
Other Issues

- Acquired data appears with a date acquired but no time stamp.
  - It was acquired at midnight (only show date).
- When running Run Samples from a LAC/E³², connection is very slow and may disconnect.
  - Remove the NetBIOS protocol from the LAC/E³² configuration (OS and Remotely Possible/Control/I/O)
- In the Project window, the tables in the various tabs appear blank.
  - This may happen if the database on the server was shut down while a client is logged in. Exit and log back in again.

Server Protection

- Hardware protection and redundancy
  - Uninterruptible Power Supply (UPS)
  - Hardware-based RAID
    - Avoid RAID 5 on the database drive for better I/O
  - Hot swappable spare drives
  - Redundant switchover systems or sites
Different Types of Server Failures

- Why would the database need recovery?
  - Several different types of errors may occur to cause the database to need recovery including:
    - Network failure
    - User error
    - Process failure
    - Statement failure
    - Instance failure
    - Media failure

Server Failures

- Network failure
  - In a client/server environment, network failure can be caused by many factors.
  - Network failures will certainly interrupt the normal functioning of the database.
    - If the database connection is lost due to network failure, LAC/E32 Acquisition Servers will go into buffering mode and users will be unable to access their projects and data within Empower.
    - In general, Oracle can perform self-recovery from a network failure once the network connections are reestablished.
Server Failures

• User error
  • Several possible user errors could have a relatively minor impact, such as being unable to find data in Empower, or could cause the disruption of the normal operation of the database. Examples of user errors are:
    • Deleting an important Empower data file, method or project
    • Deleting or moving an Oracle data file or folder
  • Depending on the type of user error, Oracle may be able to perform self-recovery or you may be involved in the recovery process.

Server Failures

• Process failure
  • A process failure is the result of an abnormal termination of a process.
  • A process failure can be caused by either Oracle or by a user (for example, if a user types Ctrl+C or terminates a Empower session through the Task Manager).
    • If the failure is due to a user action, Oracle can generally perform self-recovery using the process monitor database (PMON).
    • If the process failure is due to Oracle, it is likely that the database will have to be shut down and restarted for self-recovery to take place.
Server Failures

- Statement failure
  - A statement failure occurs when Oracle is unable to execute a SQL statement.
  - While Empower is running, a transaction may have multiple statements to be executed and one may fail due to a number of causes.
    - Either the Empower software or the operating system generate error codes as a result of these statement failures.
  - Recovery from statement failures is automatic.

- Instance failure
  - Instance failure can be caused by either a software or a hardware problem.
Server Failures

- Media failure
  - This is the most dangerous kind of failure.
    - The possibility of data loss exists.
    - It may take a long time to recover.
  - The most common failure that results in data loss is a hard drive disk failure.
- Loss of physical disk drive
  - Windows 2000 Operating System drive
  - Oracle and Empower program drive
  - Empower database drive
  - Empower raw data file drive

Server Failures

- Loss of physical disk drive
  - Windows operating system drive
    - Restore from the last full OS backup.
    - Manually make the changes since last full OS backup
      - Service pack updates, etc.
  - OR
    - Reinstall the OS and Service Packs
    - Reinstall Empower the same way that you have done before (plus any Oracle Patches or Empower Service Packs as necessary).

Note: You may have to recreate OracleServiceWat6, WatersService, or any other services before having the database available.

Note: Contact your Waters Data Specialist.
Server Failures

- Loss of physical disk drive (continued)
  - Empower program drive
    - This drive is not included in the database backup scripts.
    - Restore from last full backup or disk image
    - Back up database immediately.
      - Potential loss of archive logs

  OR

  - When no disk image or full backup, have to reinstall Empower from installation media.
  - Back up database immediately.

  Note: See Installation and Configuration Guide, Section 5.2.4 for more details.

  Note: Contact your Waters Data Specialist.

Server Failures

- Loss of physical disk drive (continued)
  - Empower database drive
    - Shutdown database (if using hot backup)
    - Restore files necessary into the database drive from last hot or cold backup (with the exception of the control and redo logs)
    - Copy the mirrored control file and mirrored redo logs from the raw data drive.
    - Use the Database Control Console to recover. Recover from previously restored datafiles to current time or point-in-time.

  Note: Transactions stored in Redo logs are lost unless redo logs were mirrored and mirrors were not lost.

  Note: See Installation and Configuration Guide, Section 5.2.2 for more details.

  Note: Contact your Waters Data Specialist.
Server Failures

• Loss of physical disk drive (continued)
  • Empower raw data file drive
    • Restore from last full backup the raw data files.
    • Copy and rename the control file and redo logs from the Database Drive

  **Note:** Unlike the database drive (which can be rolled forward using archive logs), the raw data file drive can only be recovered to the point of your last backup. Redo logs have to be applied after media recovery is complete.

  **Note:** See Installation and Configuration Guide, Section 5.2.3 for more details.

  **Note:** Contact your Waters Data Specialist.

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Recovery

• Recovery methods - RECOVER command
  • Recovery is when a backup of the database is rolled forward to a later point in time.
  • Rolled forward means that changes made to the database since the backup are taken from the redo logs (and possibly the archive logs) and applied to update the backup of the database.
    • Using the rollback segments also undo any non-committed transactions.

  • This command is invoked through the Oracle Web Database Control Console (Oracle Enterprise Manager – Database Web Console) using RMAN.
Oracle Recovery Methods

• Recovery methods
  ✦ How does Oracle know when to recover a datafile?
    • If the checkpoint counter (SCN number) in the data file does NOT match the one in the control file
      • The datafiles contain a checkpoint counter that contains the start SCN number.
      • The Control files have a copy of the current stop SCN for all data files.
      • On a normal or immediate shutdown the stop value in the control files is set to the start value in the data file.
      • The start SCN is incremented each time the DBWR writes to the data file.
  ✦ The goal is for the database to be in a consistent state.

Oracle Recovery Methods

• Recovery methods (continued)
  ✦ When to do media recovery:
    • When a datafile is restored from a backup
      • For example, if data files went offline without a checkpoint
    • When the database cannot be opened
      • The database will not open if any of the files that make it up need recovery.
Oracle Recovery Methods

- Different types of recovery:
  - Full recovery (Recover to the current time or a previous point-in-time)
  - Partial recovery (recover to a specific time, SCN or log sequence)
  - Recover from previously restored datafiles

Confirmation

- Confirm that the database is fully recovered by:
  - Logging into Empower
  - Assess the status of different files of the database
- Once the database has been recovered, the database be brought down and a cold backup must be done immediately.
  - A good rule of thumb is to do a full cold backup before and after recovery.
Recovery Strategies

- Recovery strategies
  - How much data can I afford to lose?
  - Should recovery be needed, how quickly do I need to recover the data?
  - What resources are available for me to do the backup and recovery?

Recovery Strategies

- Recovery strategies
  - Considerations
    - Use ARCHIVELOG mode.
      - Enabled by default for Empower Client/Server setup.
    - Keep a second copy of the offline redo files (Archive logs) on a tape.
    - Detect disk errors by physically copying the disk to tape
      - Or run a disk utility (ScanDisk, Speed disk, Diskeeper)
    - Have a complete set of all creation and backup scripts offline and also in hard copy
Getting Help Online

- **Empower software**
  - Built into the Empower software are extensive help files.
  - Show Me help in QuickStart

- **Oracle database**
  - Documentation is provided on the Oracle CD.
    - You may want to copy documentation to your office desktop.
  - For information about Oracle system and utility error messages, see the “Oracle 9i Error Messages” topic in the Oracle Online Documentation Library at the server.

Help

- **Windows 2000/XP issues**
  - Microsoft
    - Windows 2000 or 2003 or Windows XP Help
    - Windows 2000 or 2003 Resource Kit
    - TechNet $$$ per year
    - KnowledgeBase
    - support.microsoft.com

- **Hardware issues**
  - Contact the hardware vendor.

- **Empower issues**
  - Call Waters Technical Support.
  - Refer to Empower Software Release Notes
  - www.waters.com (see Elite site)
Recommendations

- Site recommendations
  - Purchase a premium level of support from your vendors.
  - Use UPS for mission critical / real-time systems.
  - Use system monitoring tools.
    - A NMS (HP OpenView, TGV framework)
  - Hire a qualified system administrator.

Recommendations

- Failure analysis
  - Minimizing the need for disaster recovery
    - Site recommendations
      - You should install proper hardware protection.
        - RAID level (0, 1, 0+1, 5)
      - System must be sized so that it can provide acceptable performance when all diagnostic utilities are active.
      - Systems should be in a proper environment.
      - Users expectations should be set for application response time and availability.
        - You should be able to tell the users the minimum recovery time (you may want to double this.)