

# CACHÉ ADMINISTRATION

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**INDEX**

**Module 1: Overview**

What is Caché? ..... 06  
 Completely Connected ..... 06  
 The Toolset ..... 07  
 The Caché Cube ..... 07  
 Caché Object Architect ..... 08  
 Caché Studio ..... 08  
 Caché SQL Manager ..... 09  
 Caché Explorer ..... 09  
 Caché Terminal ..... 10  
 Caché Control Panel ..... 10  
 Caché Configuration Manager ..... 11  
 Remote System Access ..... 11  
 The System Viewer ..... 12

**Module 2: Installation and Licensing**

Windows Installation ..... 14  
 Type of Installation ..... 14  
 License Units ..... 14  
 License Server ..... 14  
 License Key ..... 14  
 Starting and Stopping Caché ..... 15  
 Administration Overview ..... 15

**Module 3: Architecture**

Operating Systems and Versions ..... 17  
 Basic Structure ..... 17  
 Databases ..... 17  
 Database Size vs. Disk Size ..... 18  
 Routines ..... 18  
 Globals ..... 18  
 Routines in Globals ..... 19  
 Data Integrity ..... 19  
 Namespaces ..... 19

**Module 4: Configuration**

Initial Configuration ..... 21  
 Processes ..... 21  
 Buffers ..... 21  
 Global I/O ..... 22  
 2k vs. 8k Database Cache ..... 22  
 Routine I/O ..... 22  
 Journal Files ..... 23  
 Databases and Namespaces ..... 23  
 Deleting Databases ..... 23  
 Global/Routine Mapping ..... 24  
 CACHETEMP Database ..... 24  
 Devices ..... 24  
 Identifying Devices ..... 24  
 Configuration Files ..... 25

**Module 5: Caché Networking**

Remote System Access ..... 27  
 Connection Dialog ..... 28  
 Networking Configuration ..... 28  
 DCP ..... 28  
 Caché to Caché Networking ..... 29

**Module 6: Security**

User Accounts ..... 31  
 Account Names ..... 31  
 TRM: Device Account ..... 31  
 Caché Direct Security Checking ..... 32  
 ODBC Connections ..... 32  
 Inhibit Logons ..... 32  
 Global Protection ..... 33  
 Global Access ..... 33

**Module 8: Journaling**

Types of Journaling ..... 35  
 Write Image Journal (WIJ) ..... 35  
 Configuring Journaling ..... 35  
 Journaling Selected Globals ..... 36  
 The Journal File ..... 36  
 Journal File Properties ..... 37

**Module 9: Backup**

Backup ..... 39  
 Types of Backup ..... 39  
 Cumulative ..... 39  
 Incremental ..... 39  
 A Backup Example ..... 39  
 Creating a Database List ..... 40  
 Running the Backup ..... 40  
 Restore using the BACKUP utility ..... 41

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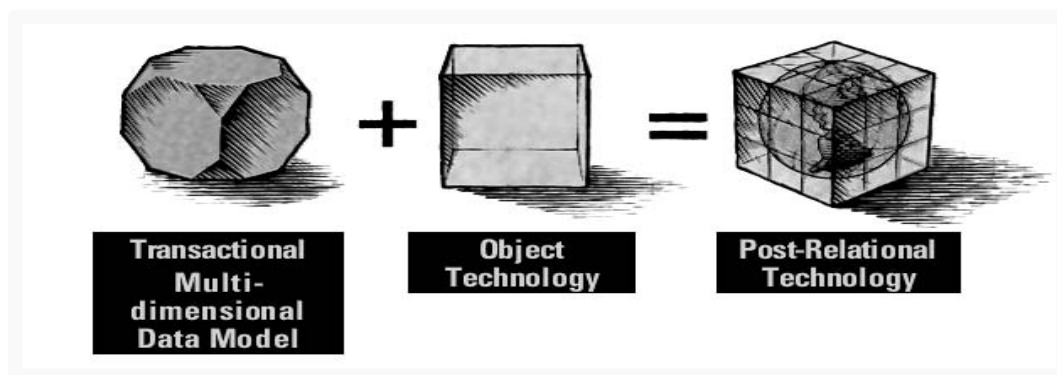
# MODULE 1: OVERVIEW

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## 1 OVERVIEW

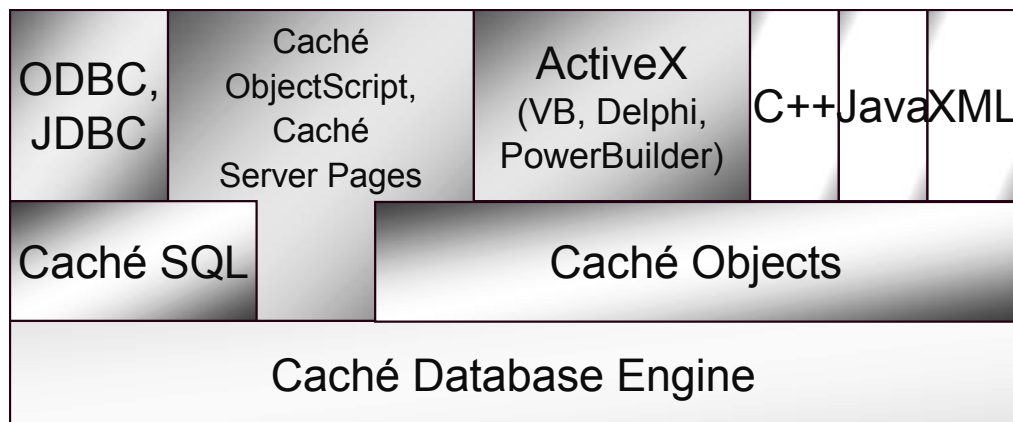
### What is Caché?

- Caché is a high-performance post-relational database management system. It features:
  - An object-oriented design environment
  - Integrated object and SQL access (Unified Data Architecture)
  - Web development tools
  - A simple, powerful scripting language
  - An efficient and scalable multidimensional database



### Completely Connected

- Choice of tools, programming languages and data access modes.

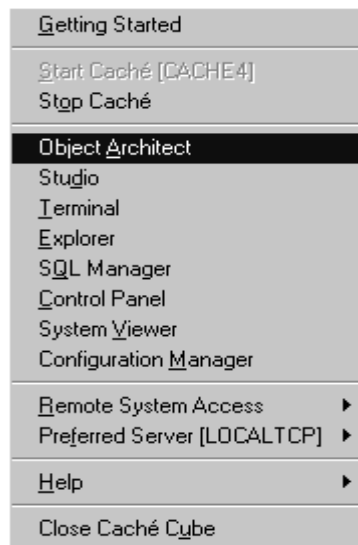


## The Toolset

- GUI tools: the Caché Object Architect, the Caché Studio, and the Caché SQL Manager.
- Scripting language: Caché ObjectScript.
- Caché Server Pages connect Web pages to the Caché database via a Web server.
- Caché SQL Server allows any ODBC-compliant application or development tool to connect to Caché.
- Caché SQL Gateway allows Caché to connect to any ODBC-compliant database.
- Caché Object Servers expose Caché objects to ActiveX or Java.

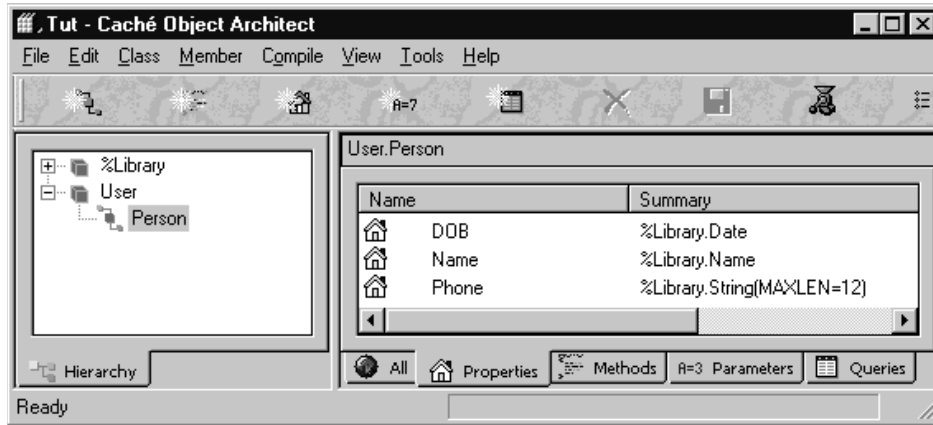
## The Caché Cube

- To access the GUI tools, use the Caché cube.
- The Caché cube icon appears in the system tray.
- Right-click on the cube to see the Start menu.
- The option to stop and start Caché is available only for the local system.
- The other GUI tools are also available for remote systems.



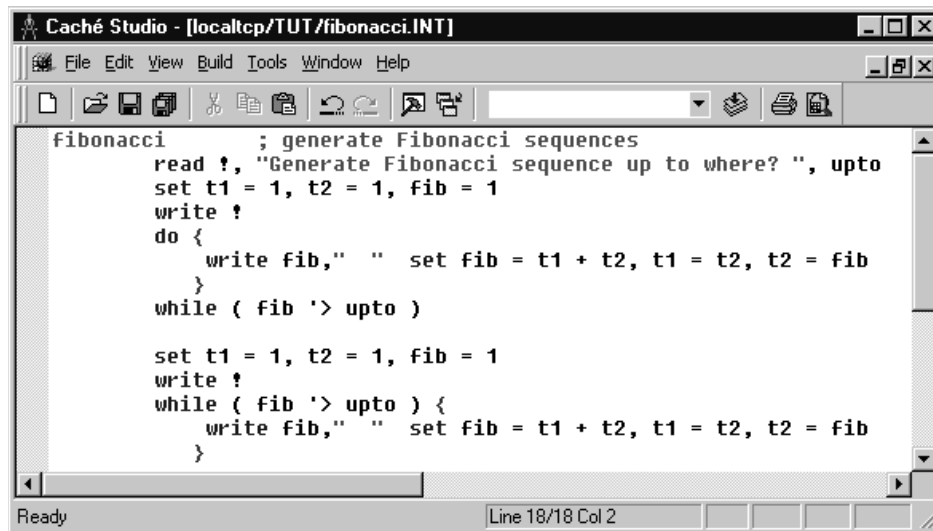
## Caché Object Architect

- Provides an environment for creating, editing, deleting and compiling classes.
- Altering classes alters their associated table definitions.



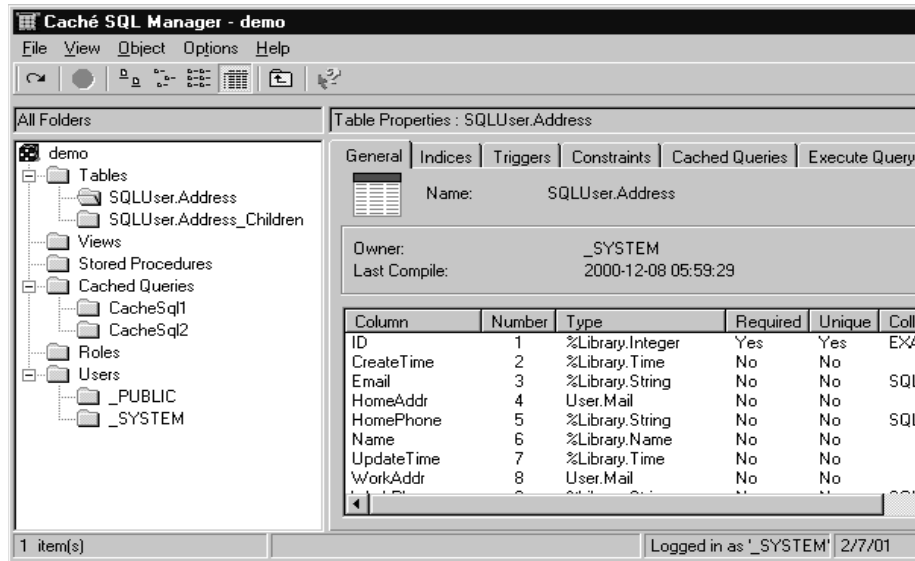
## Caché Studio

- Allows editing of ObjectScript or HTML.



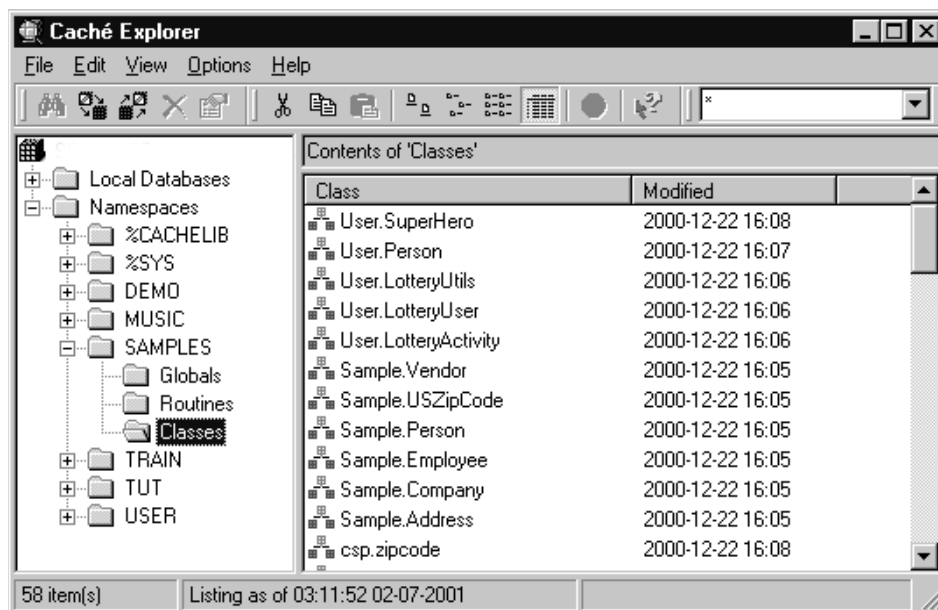
## Caché SQL Manager

- Provides a relational database view of Caché.
- Access the table definitions from here, as well as the data in the tables.
- The “Execute Query” tab executes any valid SQL statement on the Caché database.



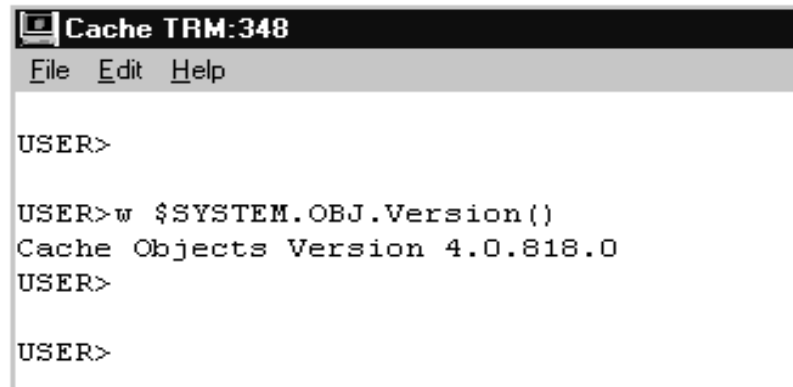
## Caché Explorer

- Provides access to class, global and routine management functions.



## Caché Terminal

- Provides direct access to the real-time ObjectScript programming environment.



```
Cache TRM:348
File Edit Help

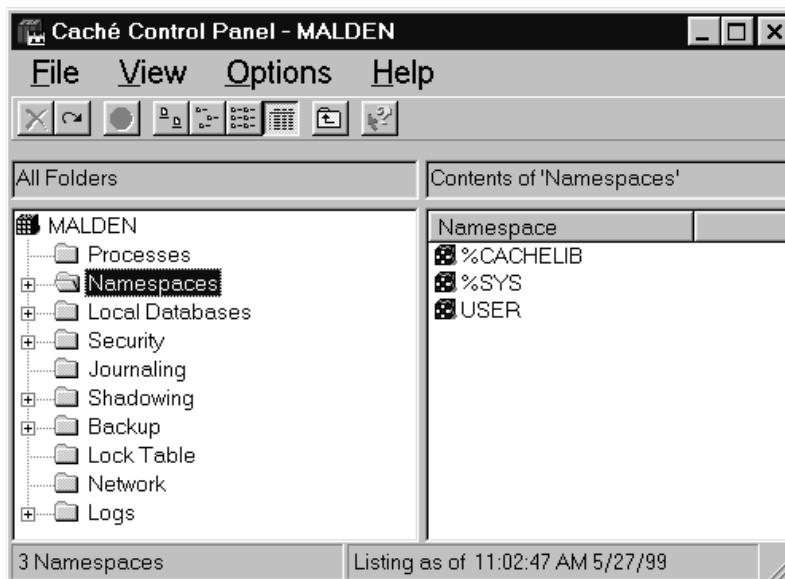
USER>

USER>w $SYSTEM.OBJ.Version()
Cache Objects Version 4.0.818.0
USER>

USER>
```

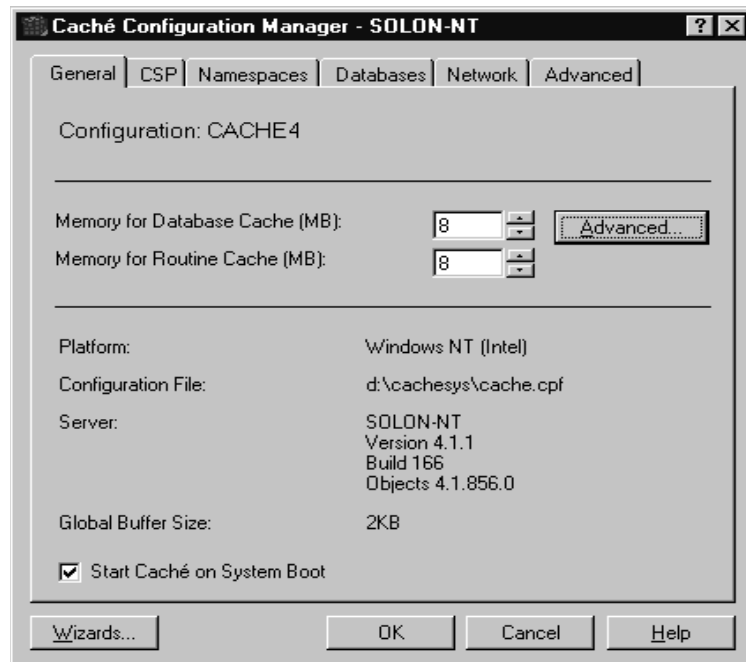
## Caché Control Panel

- Provides an interface to system management utilities.



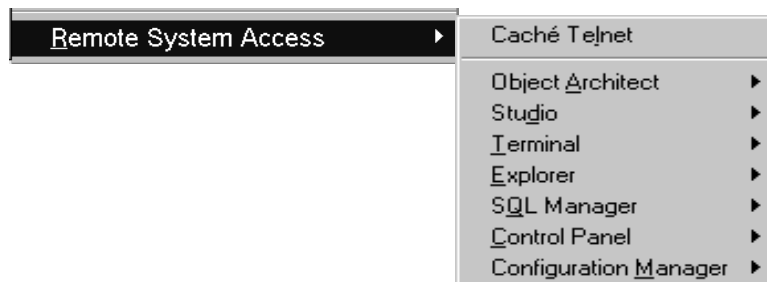
## Caché Configuration Manager

- Provides an interface to create and modify namespaces, databases, network connections, and Caché Server Pages applications.
- The “Wizards” button also provides access to the License and Printer wizards.



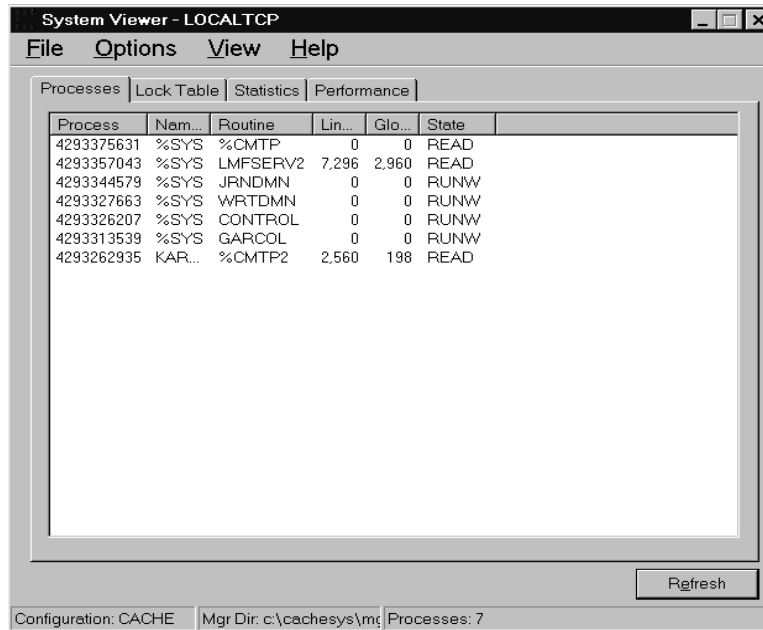
## Remote System Access

- Using the “Remote System Access” option allows management of multiple systems from a single PC.



## The System Viewer

- The System Viewer monitors system processes, performance and database locks on the local host.



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## MODULE 2: INSTALLATION AND LICENSING

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## 2 INSTALLATION AND LICENSING

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### Windows Installation

- Windows installation is easy! The Caché CD for Windows contains an Installation Guide, in the wininstall folder.
- You must install Caché on all development machines, database servers, and other machines (without Caché databases) that will use the GUI utilities or run Caché applications.
- Once the Windows installation is complete, you can read the Installation Guides for other platforms, by clicking Help, and then Documentation, on the Caché Cube.

### Type of Installation

- Standard: server machines.
- Client: machine can be used to access remote servers, but cannot support local databases.
- Custom: allows you to select which components are installed.
  - Choose this option to install the source code for Caché utilities.

### License Units

- Licenses are priced based on license units.
- A license unit is equivalent to a server process.
- A client may access the server and start up to 12 processes, yet it uses one license unit.

### License Server

- A single machine can act as the license server for multiple servers.
- Each server points to the license server.
- As clients try to connect to a server, it checks with the license server to determine if there is an available license unit.
- If so, the client may connect to the server. If not, a "License Limit Exceeded" error appears.

### License Key

- The license key is a file named cache.key, in the cachesys\mgr folder.
- You can copy a cache.key file into the folder, or enter the values from your license using the License Wizard from the Configuration Manager.
  - The "Finish" button in the Wizard becomes active when you've entered the information correctly.
- Caché must be re-started whenever you add or change a license.

## Starting and Stopping Caché

- Caché 4.0 allows multiple configurations (with different names) to run at the same time on the same server.
- On Windows systems, there will be a Caché cube for each configuration.
  - From the Caché Cube, click Start Caché or Stop Caché.
  - From the command line, type:  
css start/stop <configuration name>
  - css help will display other options
- Upon startup, Caché performs many actions, most of which can be seen by reviewing the Console Log in Control Panel.
- Startup may also call ZSTU or %ZSTART routines that you can customize for your site.

## Administration Overview

- Module 3: Architecture
- Module 4: Server and Client Configuration
- Module 5: Caché Networking
- Module 6: Security
- Module 7: Applications
- Module 8: Journaling
- Module 9: Backup
- Module 10: Regular Operations
- Module 11: Scaling Up
- Module 12: System Monitoring

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## MODULE 3: ARCHITECTURE

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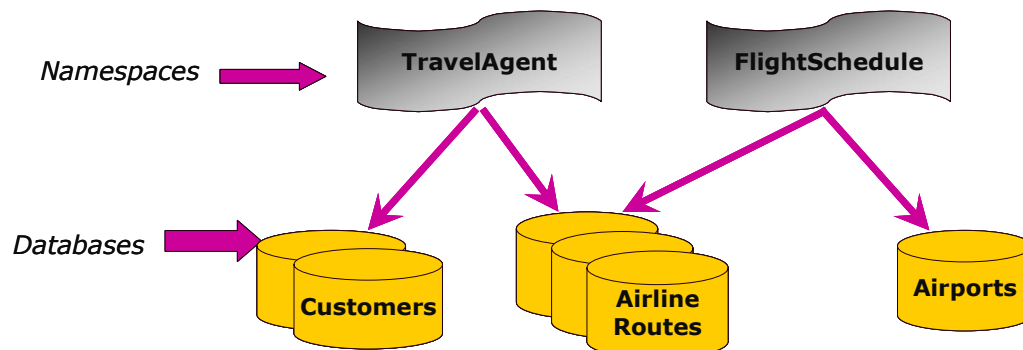
## 3 ARCHITECTURE

### Operating Systems and Versions

- Caché runs on Windows, UNIX/Linux, and VMS. The Release Notes contain details about the supported platforms for each operating system.
- Most of the information presented in this course applies to Caché versions 3.2, 4.0, and 4.1
- Version 4.1 introduces a new internal database structure, which increases the speed and scalability of Caché. Features of this release will be mentioned during this course, where appropriate.

### Basic Structure

- Data and programs are stored in Caché in databases, referred to by namespaces.
  - Databases are physical storage locations.
  - Namespaces are logical references to several databases.



### Databases

- Each Caché database represents a cache.dat file somewhere in the file system of the underlying operating system.
  - In version 3.2 and 4.0, databases used a "2k block" format and could grow to 16GB. This format is still supported for version 4.1.
  - Starting with version 4.1, databases can use the new "8k block" format and can grow to 32TB.
- A database contains programs (routines) and data (globals).
- A database may grow in two ways:
  - Automatically, in chunks whose size you specify
  - To a new size you specify

## Database Size vs. Disk Size

- Caché allows databases to be much larger than the capacity of a single disk. There are two techniques for dealing with this.
- For 2k databases, add an extent (cache.ext) on another disk. A database may have up to seven extents.
- For either database format, use the features provided by the operating system that allow large files to span several disks, such as:
  - Disk striping
  - RAID
  - Tru64 Advanced File System

## Routines

- Developers usually write either MAC routines or INT routines, but there are four extensions in all:
  - INC (like .h files in C) routines contain common code that may be included in MAC routines.
  - MAC (like .c files in C). routines contain code, including references to INC routines, Embedded SQL or Embedded HTML. When a developer compiles a MAC routine, Caché first creates an INT routine, followed by an OBJ routine.
  - INT (like .o files in C). routines contain ObjectScript code only, and Caché compiles them into OBJ routines.
  - OBJ (like .exe files in C). routines contain executable code.



## Globals

- Globals are persistent, multi-dimensional arrays.
- The name "global" indicates that potentially all users on a system can access the data.
- Multiple dimensions allow globals to contain hierarchical data. For example, for invoices containing transactions:
  - One global could contain the invoice data, and another could contain the transaction data, or
  - A single global could contain invoice data at one level, and the transactions for each invoice at another level. With this more typical structure, "joins" are implicit and fast.

## Routines in Globals

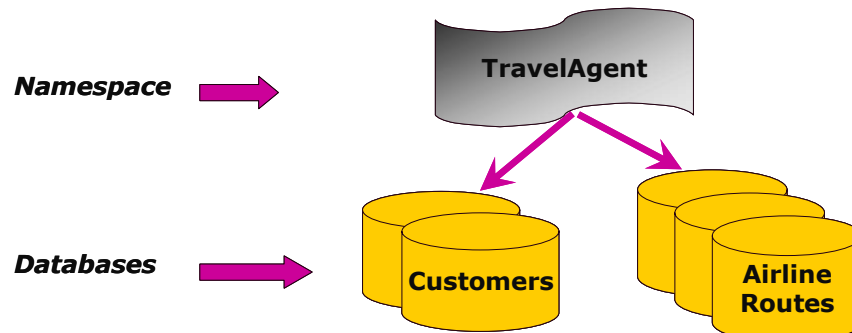
- Caché stores the source code of routines in globals; routines are data too!
  - ^rINC contains INC routines.
  - ^rMAC contains MAC routines.
  - ^ROUTINE contains INT routines.
  - ^rOBJ contains OBJ routines. You cannot view the OBJ routine source code.

## Data Integrity

- Caché protects the globals in a database in several ways.
  - Locking ensures that two processes can't update the same record(s) at the same time.
  - Transaction Processing ensures that either all updates within a transaction occur (commit transaction), or none occur (rollback transaction). This ensures that there are no partial updates.
  - Network Hardening ensures that network transactions will be written after a network failure.
  - Write Image Journaling ("before-image") ensures that each individual write to a global will occur, even if there is a hardware crash.
  - Journaling ("after-image") ensures that each transaction and each write to a global since the last backup will be re-applied after a restore.

## Namespaces

- All access to Caché databases is via namespaces. This separates the application code from the physical location of the databases.
- A namespace is a logical entity that groups several Caché databases into a single unit.
- A database can be part of several namespaces.



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# MODULE 4: CONFIGURATION

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## 4 CONFIGURATION

### Initial Configuration

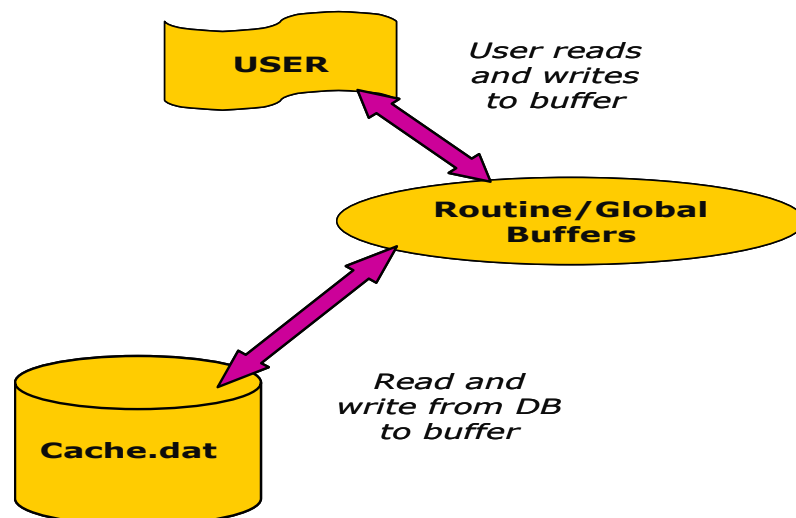
- Each server and client in your network requires some initial configuration, which you set up using Configuration Manager.
- Allow for batch jobs by increasing the number of allowed processes.
- Minimize disk I/O for routine and global accesses by allocating sufficient memory for database and routine caches.
- Maximize network performance by allocating system resources to match network usage.
- Specify alternate locations for the Write Image Journal and After Image Journal files.
- Create a collection of databases and namespaces for the needs of the application.
- Add devices (printers, tape drives, etc.) to the Device table.
- If your application uses SQL, allow "delimited identifiers."
  - This allows SQL reserved words to be used as SQL identifiers. For example, your application could have an Order table.
- Create several configuration files (development, test, deployment, default client).

### Processes

- Your license allows a specified number of concurrent users.
- The number of processes allowed on a server is also limited by the "Max # of User Processes" in the General section of the Advanced tab of the Configuration Manager.
- This should be larger than the license limit to allow for batch jobs.

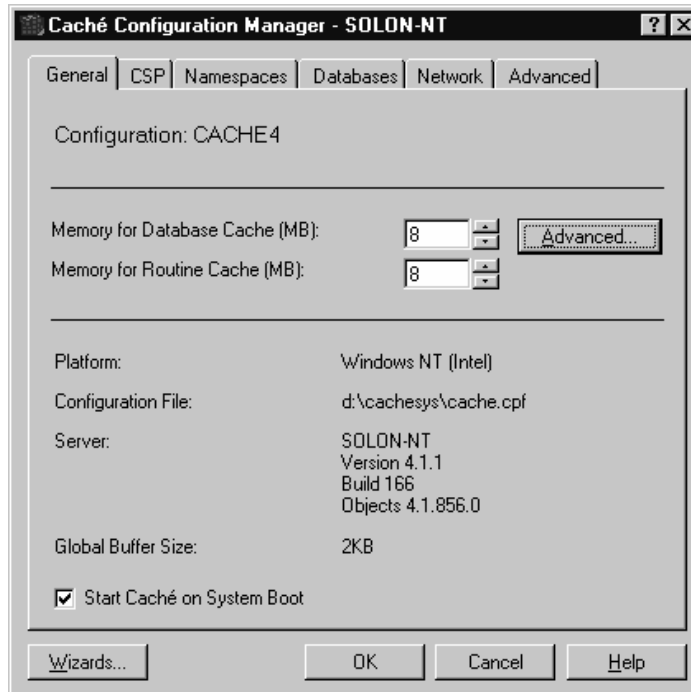
### Buffers

- Buffers are sections of memory that store globals and routines for access by running processes.



## Global I/O

- To adjust the global cache, select the General tab.
- You should allocate from 100Kb – 2Mb per user, using 25-50% of the memory of the server.



## 2k vs. 8k Database Cache

- In version 4.1, you have the option of distributing the global cache among the 2k and 8k databases, by clicking the Advanced button on the General tab of Configuration Manager.
  - You can assign all of the memory to the 8k databases and the 2k databases will use that cache also.
  - If you assign any of the memory to the 2k databases, they will use only that cache.

## Routine I/O

- To adjust the routine cache, start with 50% of the memory you assigned to the global cache.
- Once your system is running applications, record the value of the Routine Buffer Transfers field, from the Statistics tab of the System Viewer.
- Decrease the memory assigned to the routine cache by 5% each day until the Routine Buffer Transfers starts to increase. You've determined the smallest routine cache with which the applications will run efficiently.
- You probably should increase it slightly from this number.

## Journal Files

- The default location for both journal files (Write Image and After Image) is in c:\cachesys\mgr.
  - The Write Image journal has a high volume of writes.
  - The After Image journal has a low volume of writes.
- Put the journal files on another disk (different from the Caché database disks), that is part of the same controller group.
- This helps ensure database integrity in the event of a system crash.

## Databases and Namespaces

- You create databases and namespaces using Configuration Manager Wizards.
- If you start by using the Namespace Wizard, you can create the associated database at the same time (the Namespace Wizard calls the Database Wizard).
- Applications can use a single namespace/database combination for all their routines and globals, or they may use a combination of several, using global/routine mapping.
- When using Terminal, you can switch namespaces by typing either:  
 zn "<namespace>" or  
 do ^%CD and entering the namespace at the prompt.

## Deleting Databases

- Databases can be deleted from the Configuration Manager or the Control Panel.
- Deleting a database does not delete the directory containing the database. You can remove this using OS commands.
- While Caché is running, you can dismount the database and then use OS commands to delete the cache.dat files.



## Global/Routine Mapping

- Applications can use a single namespace/database combination for all their routines and globals, or they may use a combination of several.
- By default, all the non-system routines and globals in a namespace come from the same database.
- However, we can create a namespace that accesses the “active” globals from one database, the “static” globals from another, and the routines from a third database.
- The namespace definition has sections to define:
  - Default Databases for globals and routines,
  - Global Mapping for additional globals, and
  - Routine Mapping for additional routines.

## CACHETEMP Database

- Caché automatically maps any temporary globals (named as follows) to the CACHETEMP database:
  - ^CacheTemp\*
  - ^mtemp\*
- You can map any other global to this namespace.
- For example, if you set ^mtemp2=1 in the USER namespace, Caché will store this global in CACHETEMP.
- This global is now visible in all other namespaces, since they all use CACHETEMP for temporary globals.
- In 4.1, CACHETEMP is an in-memory database: globals may never need to be written out to disk. In all versions:
  - Globals are not journaled (even if you check the option).
  - The database is never backed up.

## Devices

- Caché supports both physical and logical I/O devices
  - Physical: terminals, printers, disk drives, magnetic tape, cartridge tape
  - Logical: spooler, flat files
- Caché installs default device definitions. You can define additional devices.
  - |PRN| is the device for the default printer.
- Device information is found in the Device section of the Advanced tab.
- To quickly add one or more network printers to the device table, use the Add Printer Wizard.

## Identifying Devices

- You can identify a device in one of 3 ways: Mnemonic, Device Id, or Alias. All must be unique.
- For a network printer, the Mnemonic is:  
|PRN|\\<server>\<printer>
- The Device Id is the name of the device in the device table.

- The Alias is usually a number.

## **Configuration Files**

- A configuration file, `cache.cpf`, contains all of the parameters in the Configuration Manager.
- A system may have several configuration files, and you can start Caché using any one of them.
- To create a new one, use the Configuration File Wizard.

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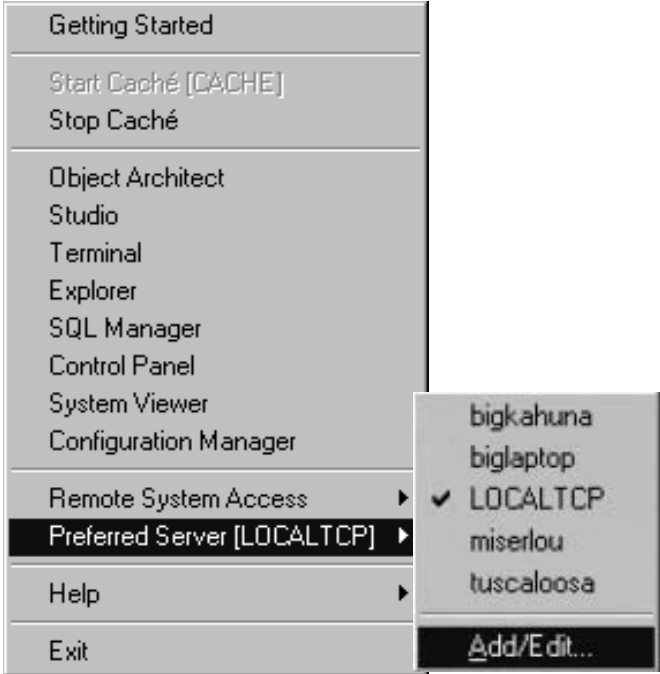
# MODULE 5: CACHÉ NETWORKING

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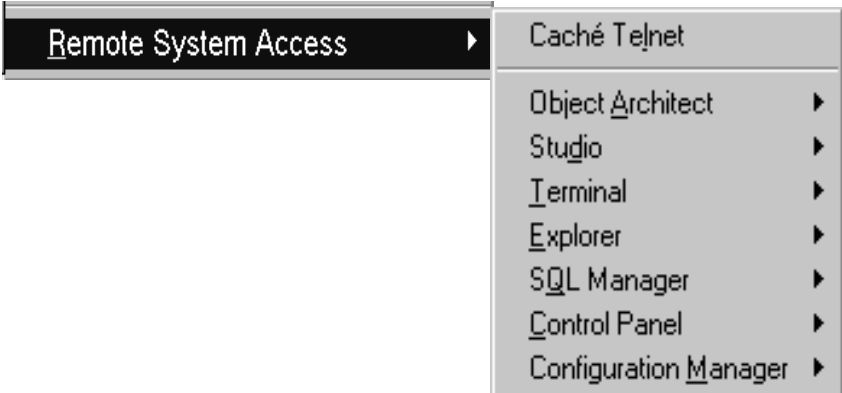
## 5 CACHÉ NETWORKING

### Remote System Access

- Using the “Remote System Access” option allows management of multiple systems from a single PC.
- First, add one or more servers to the Preferred Server list.
- Then select one to be your preferred server. Now the GUI tools will run on that server instead of the local machine.

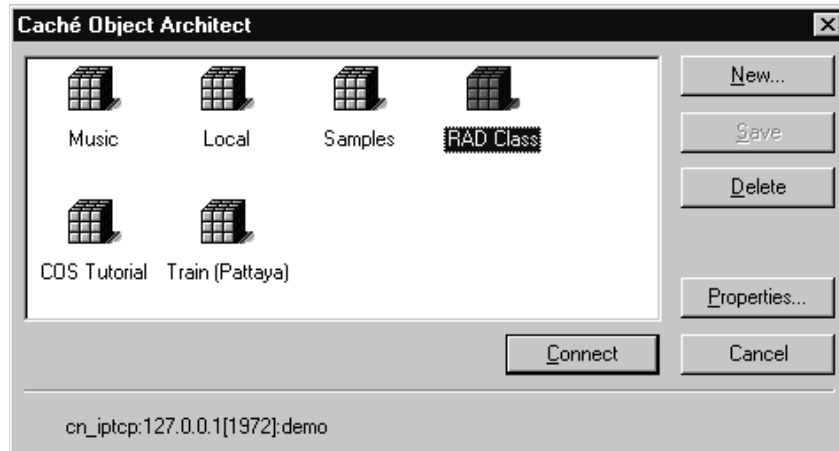


- Alternatively, you can use the Remote System Access option to first choose the GUI tool, and then choose the server on which to run it.



## Connection Dialog

- Object Architect and SQL Manager both use the Connection Dialog box.
- Each connection specifies a server, port, and namespace.
- This takes precedence over the Preferred Server and Remote System Access options.



## Networking Configuration

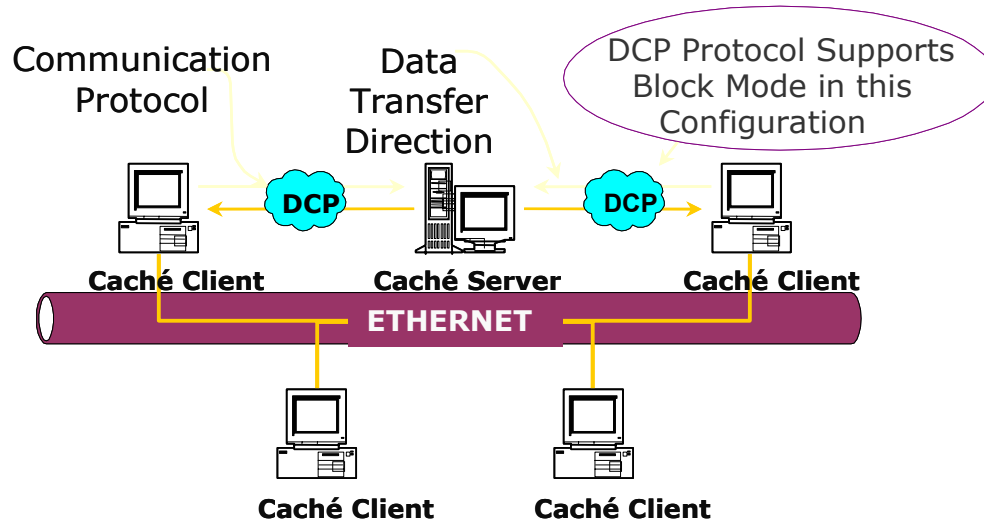
- Caché has its own networking configuration that describes the remote computers, their associated directories, and the ports via which the local node communicates with them.
- Caché only sees the servers within its configuration.
  - Some computers known to the operating system may not be part of the Caché configuration and should not be known to Caché.

## DCP

- *Distributed Caché Protocol (DCP)* is a proprietary protocol used by Caché.
  - In 4.1, you cannot use DCP to remotely access the new 8k databases. A new networking protocol is planned for version 4.2.
- DCP message format protocol can be used with UDP or Ethernet communication protocols.
- It provides the fastest transmission of all the message format protocols over the Ethernet because Caché networking interacts directly with the Ethernet interface device.

## Caché to Caché Networking

- DCP in block mode is the preferred connection between clients and servers for this network configuration.



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# MODULE 6: SECURITY

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## 6 SECURITY

### User Accounts

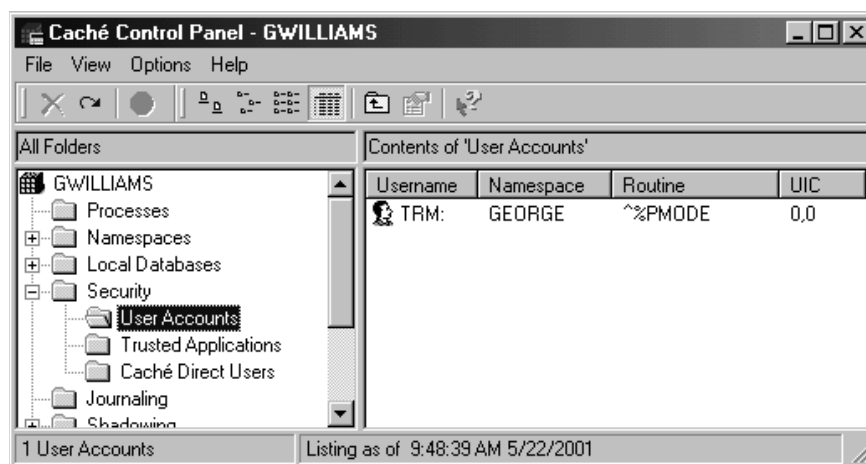
- You can create User Accounts and/or Device Accounts to control which users have access to specific routines and namespaces.
- User Accounts allow users to log in to specific routines and namespaces on your system remotely and locally.
- Device Accounts allow LAT users, TELNET users, specific LAT servers or TELNET hosts, or specific terminals to log in to a preset routine and namespace.

### Account Names

- You can create the following accounts:
  - TRM: – default device account
  - <username> – an account for a specific user
  - TELNET – an account for all TELNET users
  - <servername> – an account for all terminals tied to a specific terminal server (the terminal server name of the LAT server, or fully qualified domain name of the TELNET host)
  - <servername>/PORT\_<n> - an account for the terminal connected to a port #n on the terminal server
  - sys - a hidden user account (password: XXX) that logs into the %SYS namespace

### TRM: Device Account

- The default device account, TRM:, opens the Caché Terminal to the User namespace.
  - You can change the namespace for this account.

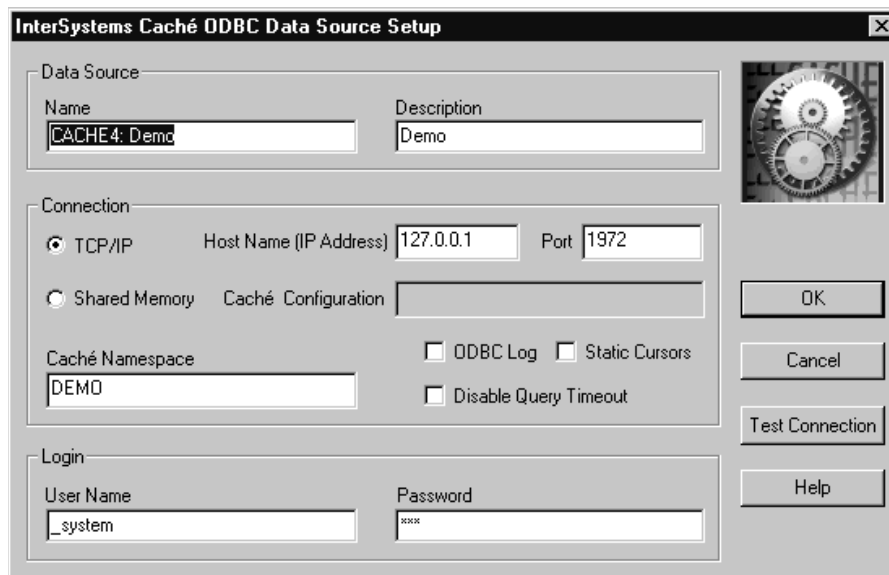


## Caché Direct Security Checking

- Caché Direct Security Checking is a layer of security between client-server applications (such as VB applications) and Caché. Any user who attempts to run a client-server application must enter a username/password in order for that routine to connect to the database.
- Trusted Applications bypass this Security Check.
- You must add at least one Caché Direct user account, and then Enable Security Checking by right-clicking Caché Direct Users.
- The Caché GUI tools are also client-server applications, subject to the Security Check.

## ODBC Connections

- To provide access to a namespace from other tools such as MS Access via ODBC, you must create an ODBC Data Source for it.
- Run "ODBC" from Windows Control Panel, and add a new System DSN that references the namespace, and uses a SQL username and password.



## Inhibit Logons

- To keep users off the system, use Control Panel.
  - Right-click the Cube above the folders.
  - Click the System Access tab.

## Global Protection

- Both databases and users have a UIC.
- A UIC is a pair of numbers. The first number is a group ID; the second is a user ID.
- Each global in a database has protection settings.
- The default settings for newly created globals are in the General section of the Configuration Manager.



## Global Access

- If the UIC is (0,0) then protection settings have no effect. Otherwise, Caché assigns access privileges based on the following process.
- When a user tries to access a global:
  - Caché first checks whether that user is on another node of the network. If so, it assigns Network privileges.
  - If not, or if the Network privilege is UIC, Caché checks whether the user's UIC matches the UIC of the database. If they match, it assigns Owner privileges.
  - If not, Caché checks whether the user is in the same group as the database. If so, it assigns Group privileges.
  - If not, it assigns World privileges.

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# MODULE 8: JOURNALING

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## 8 JOURNALING

### Types of Journaling

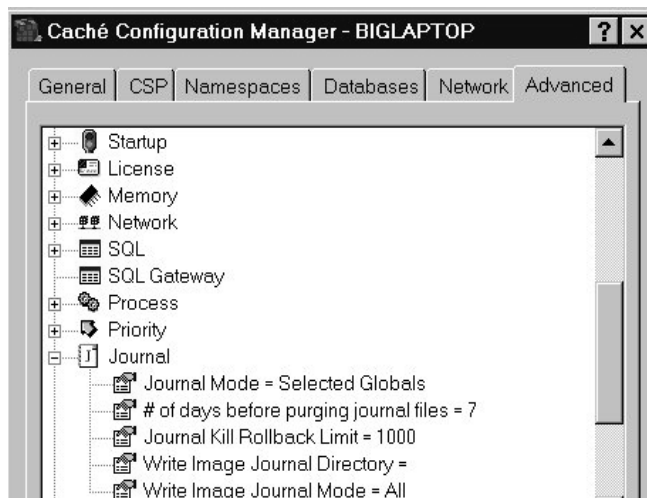
- Write Image Journaling (before-image) is the interim step of recording database modifications before the actual write into the database.
  - Write Image Journaling is automatically enabled when you start Caché.
  - Caché automatically applies the Write Image Journal to the database upon startup after a system crash.
- After Image Journaling is the record of changes made to the database between backups.
  - Journaling is optional.
  - The user can restore the contents of the After Image Journal file to the database after a restore from backup takes place.
  - Shadowing (in Module 11) requires journaling.

### Write Image Journal (WIJ)

- When a process requests a routine or global, Caché retrieves it and places it into a buffer. The process then accesses the information in the buffer.
- If the process changes the routine/global, Caché writes the change into both the buffer and the WIJ. A flag is set which specifies the changed data has not been written into the database.
- At certain intervals, Caché writes the information into the database from the buffers and the flag is reset.

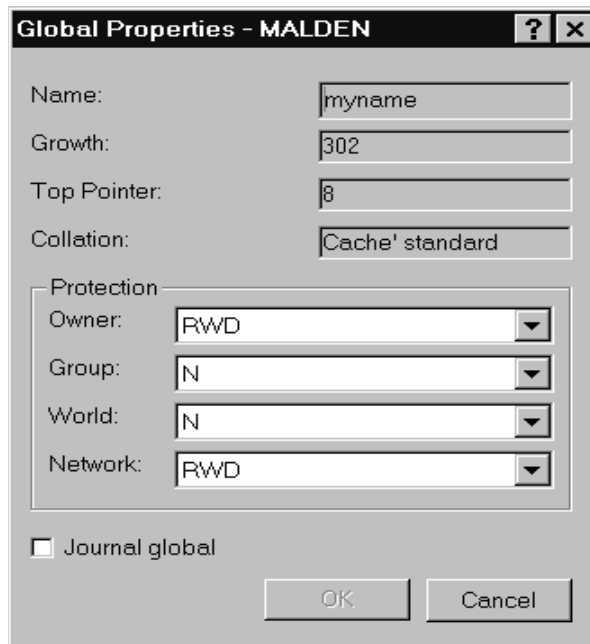
### Configuring Journaling

- To configure Journaling, go to the Journal section on the Advanced Tab of the Configuration Manager.
- The Miscellaneous section contains two other entries regarding journaling, for ^z\* and ^Z\* globals, and new globals.



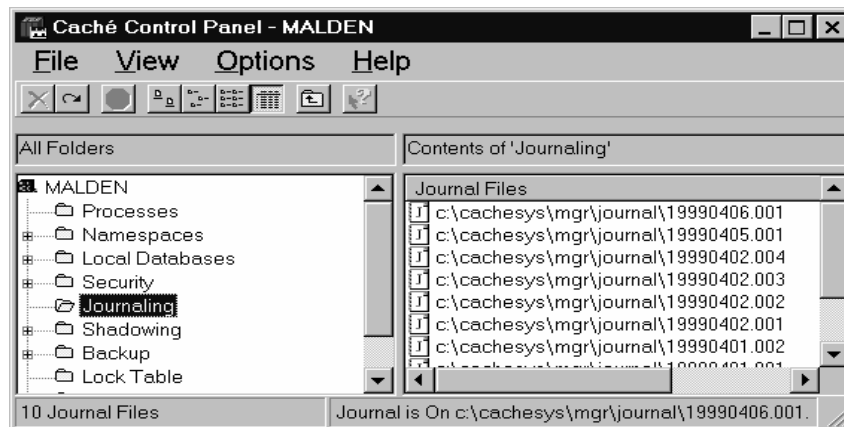
## Journaling Selected Globals

- If you're journaling selected globals, you can turn journaling on/off for a global via the Control Panel.
- Select the database and global you want and access its Properties page.
- You can use the %JOURNAL utility to select multiple globals for journaling.
- Note: Open Caché connections (such as Terminal) won't begin journaling the global; only new connections will.



## The Journal File

- The name is current date format (yyyymmdd.nnn).
- By default, the journal is kept in (c:\Cachesys\mgr\journal). You must move it to a different disk.



## Journal File Properties

- Alternate Directory: if specified, Caché will automatically use this directory if the primary fills.
- Maximum file size: Caché will automatically switch to a new file when the max size is reached.
- Prefix: prefix for the name of the journal file.

**Journal File Properties - MALDEN** [?] [X]

Journal file:

Current directory:

Alternate directory:

Current size:

Maximum file size allowed:

Session begin: 02 Apr 99 10:01:54

Session end: 02 Apr 99 15:33:42

Prefix:

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# MODULE 9: BACKUP

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## 9 BACKUP

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### Backup

- Caché allows you to run backup while applications are running and while the database is changing.
- Multiple passes allow for data integrity and a snapshot of the database in time.
  - First pass: backup all blocks and begin tracking any blocks that are changing from this point.
  - Second...nth pass: backup any of the blocks that were changed during previous pass.
  - Last pass: modifications are prohibited (users will be delayed, not terminated) while final blocks are being backed up.

### Types of Backup

- Caché provides a backup utility that allows for three types of backups.
- Full: a complete backup of the database.
- Cumulative: tracks all changes since the last full backup.
- Incremental: tracks all changes since last backup, regardless of the type of the previous backup.

### Cumulative

- Only includes changes since last full backup.
- Short backup time initially; gets longer with each subsequent cumulative backup.
- Restore time is much faster, since you only restore the last full and last cumulative backups.

### Incremental

- Includes changes since last backup, regardless of the type of the last backup.
- Short backup time; can perform backups more frequently.
- Small files created from backup; could potentially backup to disk instead of tape.
- More complex restore: need to go back to last full backup then restore each incremental in order.

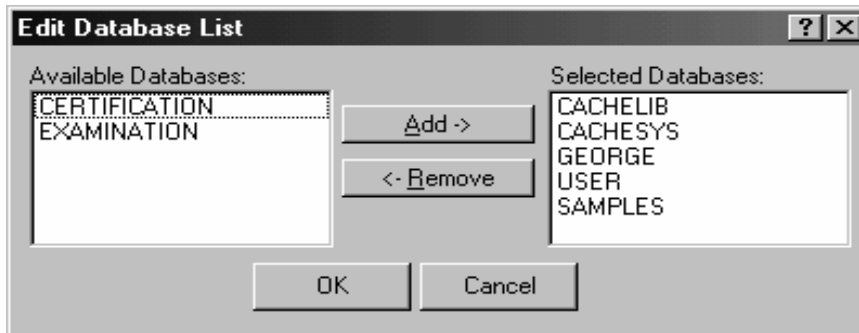
### A Backup Example

- Backups are performed at 4 am daily according the following schedule:
  - Sunday - Full
  - Monday - Incremental
  - Tuesday - Incremental
  - Wednesday - Cumulative

- Thursday - Incremental
- Friday – Incremental
- Saturday - Cumulative

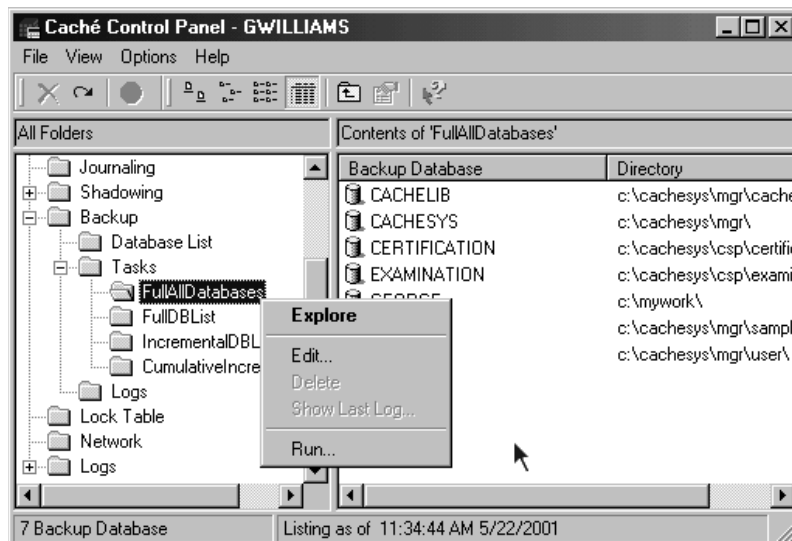
## Creating a Database List

- Run Caché Backup from the Control Panel.
- Click on Backup, then right click on Database Lists and select Edit.
- Add or remove any databases you want included in the list of databases to be backed up.



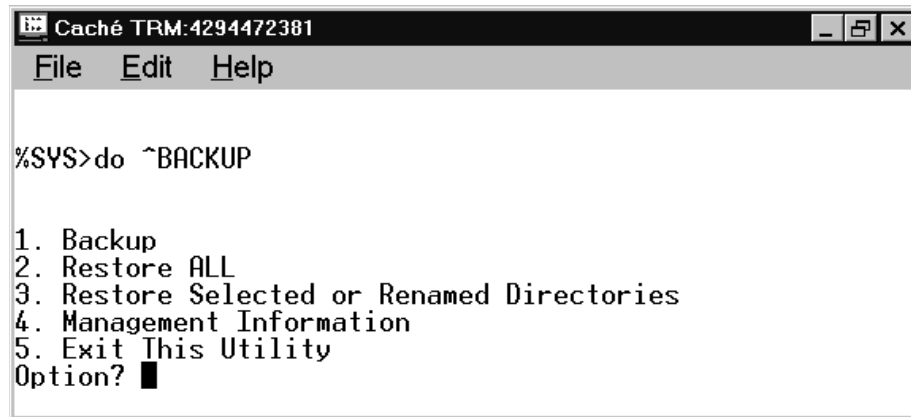
## Running the Backup

- To run a backup, right click on the backup task name and select Run...
- The backup results will be displayed in a status window and saved to a backup log.



## Restore using the BACKUP utility

- Run the BACKUP utility from Terminal.
  - %SYS> do ^BACKUP
  - Select the Restore ALL or Restore Selected option.

A screenshot of a terminal window titled "Cache TRM:4294472381". The window has a menu bar with "File", "Edit", and "Help". The terminal content shows the command "%SYS>do ^BACKUP" followed by a numbered list of options: "1. Backup", "2. Restore ALL", "3. Restore Selected or Renamed Directories", "4. Management Information", and "5. Exit This Utility". The prompt "Option?" is followed by a cursor (a small black square).