

Point-Of-Sale Business Application

System Architecture

Project: Point-Of-Sale
Business Application

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1 Scope

This document is the System Architecture Manual for the Point-Of-Sale Business Application. This manual describes the internal operation of the application.

1.1 General

The Point-Of-Sale (POS) Business Application is designed for the small business and provides networking capabilities not normally available to general Point-Of-Sale systems.

The principal features which set this POS Business Application Software apart from other POS accounting software systems are the following:

- Ease of Use
- Distributed Encrypted Databases
- Quicker Data Access via Calendar Indexed Databases
- Re-Posting of POS Sales transactions if database recovery is required
- Safe Non-Destructive Database Backup and Restore Operations

Please refer to the Overview document for a more detailed description of these features.

1.2 Abbreviations

CSV	Comma Separated Variable
IDE	Integrated Development Environment
PC	Personal Computer
POS	Point-Of-Sale
POSBA	Point-Of-Sale Business Application
UPS	Uninterruptible Power Supply

2 System Development Toolsets

2.1 Program Development Environment

This section describes the hardware and software which was utilized to develop the Point-Of-Sale Business Application software.

2.1.1 Hardware System

2.1.1.1 Development Work Station

The work station computer hardware used was an IBM compatible Personal Computer system utilizing the following configuration:

- Intel Motherboard
- 2.0 GHz Pentium 4 CPU
- 1 GByte RAM Memory
- 160 GByte Hard Drive
- 3 DVI Graphics Adapter cards
- Serial and Parallel Interfaces
- LAN Interface
- Keyboard and optical wireless mouse
- 3 Sony LCD Monitor Screens (19")

2.1.1.2 Test Work Station

A second computer system was used for testing Server/Client interaction and had the following configuration:

- Intel Motherboard
- 2.0 GHz Pentium 4 CPU
- 1 GByte RAM Memory
- 160 GByte Hard Drive
- 1 Graphics Adapter card
- Serial and Parallel Interfaces
- LAN Interface
- KVM to interface to development work station keyboard and mouse

2.1.2 Software System

2.1.2.1 Compiler

The POS Business Application (also called “POSBA”) was designed using the Borland C++ Builder IDE development package. This package provides a source code editor and C++ compiler/linker as well as a built-in debugger for testing.

The IDE details are as follows:

Borland C++ Builder Ver 6.0

2.1.2.2 CodeWright Editor

The CodeWright editor was also used to develop this package. When this editor is installed it attaches itself to the Borland C++ Builder IDE such that it is possible to swap between the editors with ease.

The editor details are as follows:

CodeWright Editor Ver 7.5

2.1.2.3 Qsetup Composer

The Qsetup Composer package was used to build a single executable file which could be located on a web page (or a CD-ROM). When accessed on the web page, the executable file would be automatically downloaded and installed on the customer’s computer system.

The Qsetup details are as follows:

Qsetup Installation Suite Ver: 7.5.0.8
Pantaray Research LTD.
www.pantaray.com

2.2 Program Development Process

Using a three monitor computer development workstation greatly aided the development process. The three LCD monitor screen were generally set up as follows:

- The CodeWright editor on the left screen
- Borland C++ IDE on the middle screen
- POSBA product display on the right screen / second computer system

The LCD monitors each contained three input channels – DVI plus two VGA interfaces. The right hand monitor could be switch between the main development computer and a second test computer when Server/Client testing was required.

2.3 Program Execution Environment

This section describes the hardware and associated software required to execute the Point-Of-Sale Business Application.

2.3.1 Operating Systems

The POS Business Application software is designed to execute on a standard IBM Personal Computer System (or compatible) which executes one of the following operating systems:

1. Windows Vista
2. Windows XP (Professional or Home Editions, or later versions)
3. Windows 2000 (or later versions)
4. Windows 2000 Server (or later versions)

Note: The POS Business Application may operate correctly on previous versions of Windows, however, at this time it has not been verified.

2.3.2 Hardware Requirements

The following minimum IBM PC compatible computer features are required:

- Pentium III 1GHz
- 512MB RAM
- LAN Network Interface
- Video Monitor (800 x 600 minimum)
- Mouse
- Keyboard

3 System Architecture

3.1 Limitations with current POS Packages

The POS Business Application was designed as an improvement to current POS systems by having features which are presently not available to small business operations.

When talking with small business owners it became apparent that most Point-Of-Sale systems suffered from problems in the following areas:

1. Server / Network Hardware Failures
2. Transaction Posting data can be lost
3. Slow Report Generation and Database Size Limitations
4. Database Backup and Restore Operations
5. POS Systems are designed for accountants instead for business owners

3.1.1 Server / Network Hardware Failures

The main restriction with many Point-Of-Sale accounting systems is their reliance on both the network and on the Server computer system. These accounting systems locate their central database on the server computer and the client computer systems must access this database via the network in order to perform any Point-Of-Sale operations.

A major cause for concern with users of such systems is with regard to what would happen if the network or the server were to fail. If either of these failures were to occur then the client computer systems would not be able to access the central database and would therefore not be able to perform Point-Of-Sale transactions. In this situation, the counter staff would then be required to make hand written sales receipts and refer to previously printed (and perhaps outdated) price lists. This method of operation is tedious, slow and can easily generate errors.

Later, when the Server and/or network are once more operational, the handwritten sale transactions have to be manually entered into the accounting system – another time consuming operation which is also fraught with possible errors.

3.1.2 Transaction Posting data can be lost

Most POS accounting systems use the Server to contain the central accounting databases. This database usually also includes the Point-Of-Sale transactions for each POS terminal. At the end of a business period, the POS sales transactions are posted to the sales history database and certain inventory database parameters (eg. the “On Hand” quantity) are updated. Once this posting operation has completed, the original information is then deleted since it is no longer required.

Normally this approach is successful, except under conditions when the database has had to be recovered due to system related problems (eg. disk drive failure).

If the database is to be recovered, the current day's posted (and un-posted) sales transactions for each POS Terminal may be deleted during the database backup restoration process. The sales data for the period between the backup date and the current date will then have to be manually re-entered in order to bring the database up to date. This is another time consuming operation which is also fraught with possible errors.

3.1.3 Slow Report Generation and Database Size Limitations

General POS accounting systems are very responsive when the system is first installed. However, as the days and months progress, more and more history data is created and the system can start to get sluggish. After several years of history data has been collected, the system can take a long time to scan an entire database in order to access and obtain specific information pertaining to a report.

In order to minimize this effect, some accounting systems impose database size limitations which restrict the amount of data history which may be retained.

3.1.4 Database Backup and Restore Operations

During Database Backup operations, some POS Accounting systems use the same backup storage file name and/or location, which may result in the previous backup file being overwritten.

During Database Restore operations the same POS Accounting system's active directory database is overwritten.

With this procedure a healthy database can easily be destroyed if an incorrect restore operation was performed.

3.1.5 POS Systems are designed for accountants instead for business owners

In many cases the Point-Of-Sale software is Accountant "friendly" but not small business person "friendly". Any associated documentation is written likewise such that POS operational instructions are quite vague and ambiguous to the general user.

3.2 Server / Client Operation

The POS Business Application computer program was designed to be installed on either the Server computer hardware or the Client computer hardware. With this in mind, the software was designed to execute “Installation Screens” which would allow the installer to select the required Server/Client environment.

Many POS systems use TCP/IP as an interface with which to create a communications channel between the Server computer system and the various client computer systems. During Point-Of-Sale operations, the TCP/IP interface would carry product, transaction and report information between the computer systems.

Although TCP/IP is effective it is also highly confusing to the average home business user – setting up IP addresses. With this in mind it was determined to use a directory mapping procedure such that server computer system directories may be shared with the client computer systems – this also seemed applicable since entire databases were going to be transferred between the server and the client computer systems.

3.3 Distributed Databases

In order to allow a client computer system to function during server and / or network hardware failure conditions it would be necessary to provide the client computer system with a copy of the relevant server databases. These client databases would need to be updated whenever a change was made to the primary server database.

3.3.1 System Database Header

The database header is used to indicate the lock status of the associated system database. When a system database is locked, the system user and the corresponding computer system’s name is stored in the header. If another user attempts to edit the same system database, they are informed that it is locked and also provided with the user name and computer name of the person responsible for the lock. This feature was implemented to overcome the limitations of other POS applications which simply state that the database is locked and provide no indication of which user is responsible.

The database header also contains a lock timestamp which is used to automatically unlock a database if it has been locked for an excessive amount of time. If a system database is being modified then the lock timestamp will be automatically refreshed by the relevant computer system. However, if this client system was to become inactive, the locked database timestamp would no longer be refreshed and once the timestamp was several minutes old the database lock could be overridden and the file re-accessed. Other POS systems would require the Server to be reboot to overcome this problem..

3.3.2 Server System Databases

The principal system databases are stored on the POS Business Application Server computer system. When any principal system database is edited, all modifications are performed only on the database which resides on the Server computer system.

3.3.3 Client System Databases

The POS Business Application program executing on a Client computer system constantly monitors the timestamps of all the system databases residing on the Server. This monitoring process is controlled by a background process which periodically checks every system database file on the Server computer system. If the timestamp of any specific Server database is changed, (ie. the database has been updated), the Client will automatically copy the database file and any associated database index files down from the Server on to the Client's local disk drive. The downloaded files are given a specific file extension to indicate that they are newly downloaded database files ready for installation.

If the Client determines that these specific database files are not currently being used in a POS transaction, it will proceed to install these files in the system. When the files are being installed, the active database files status are changed to "Backup" status and the new database files are marked as "Active". The newly installed database file lists are also loaded into all drop down and search lists.

This process occurs on each client computer system. It is the Client's responsibility to monitor the Server system files for any database updates. The Server does not play any role in ensuring that the Client system databases are up to date.

3.3.4 Quote Databases

Each Server and Client computer system controls its own respective Quote database.

3.3.4.1 Client Quote Database

When a new Quote has been created on the Client computer system, the quote is appended to the local Quote database. The Client periodically transfers the local Quote database up to the Server computer system for incorporation into the system wide Quote database. The Client periodically checks the Server's system wide Quote database to see if it has been updated and if so, downloads the database.

3.3.4.2 Server Quote Database

When the Server's Quote database has been updated, or the Server determines that it has received a Client's updated Quote database, it will proceed to collate its own and all other Client Quote databases into a combined single system wide Quote database. During this collating process, any duplicate and expired Quote entries will be discarded.

3.4 Processes (Tasks)

When simultaneous operation of various events are required, these events are best placed in separate tasks – also called processes or threads.

The following processes are used:

1. Timer Process
2. Network Process

3.4.1 Timer Process

The Timer Process was created in order to keep accurate timing. If the timers were controlled in the main task by a Ttimer event, timer errors might creep in due to main task loading.

When the Timer Process is created it installs a 100ms event timer which generates 10 timer messages every second. The process thread's main loop waits for these messages and then adjusts all the system timers accordingly.

This implies that each system timer is accurate to 0.1 of a second.

The system timers are 32 bit variables and therefore permit a timing range between 0.1 of a second and 429496729.5 seconds (4899.57 years).

3.4.2 Network Process

The Network Process was created in order to monitor the various server databases and to control the download process as required.

When the Network Process is created it installs a 1 second event timer which generates a single timer message every second. The process thread's main loop waits for these messages.

If the POS Business Application is being shut down, the network control variable may be placed into a deactivating state. If this state is detected, the network control variable will be placed into the deactivated state and all future network operations blocked.

During normal network operations the network process thread's main loop will determine if the POS Business Application is operating as a Server or as a Client and perform the relevant operations.

3.4.2.1 Server Network Operations

When this function executes it performs the following operations:

1. Auto Initiate specific database downloads
2. Monitor specific database
3. Build POS Quote Database Summary

3.4.2.1.1 *Auto Initiate specific database downloads*

There is a function of this type for every inventory database which may undergo an auto initiate download. When a user on the POS Business Application Server wishes to auto-initiate the download of any specific database to the Clients, the relevant function is called to mark the database file ready for download.

3.4.2.1.2 *Monitor Specific Database*

There is a function of this type which monitors if a specific database has been modified. If the database has been modified a flag is set to force the reload of the list files associated with this specific database.

The main program monitors this flag and if in a safe state (eg. not processing a sale) controls the load operation to all relevant list boxes after which the flag is reset.

3.4.2.1.3 *Build POS Quote Database Summary*

This function first determines the name of all the POS Quote Register Files for the server and all the clients. It then builds a combined POS Quote Register File by combining all the entries in each of these files into a single file. Any duplicate quotes are deleted, as are voided and expired quotes. The final combined POS Quote Database Summary file is then made available to all systems for download. During the Quote database summary build process, stable sorts are used to ensure that the quote date entries are kept in order.

3.4.2.2 Client Network Operations

When this function executes it performs the following operations:

1. Server Drive Remap Attempt
2. Auto Initiate specific database downloads
3. Monitor Specific Server Database
4. Verify License Registration
5. Obtain updated POS Quote Database

3.4.2.2.1 Server Drive Remap Attempt

If the Server is inactive, an attempt will be made to try and access the Server and map onto the server drive.

3.4.2.2.2 Auto Initiate specific database downloads

There is a function of this type for every inventory database which may undergo an auto initiate download. When a user on the POS Business Application Client wishes to auto-initiate the download of any specific database from the Server, the relevant function is called to mark the database file ready for download.

3.4.2.2.3 Monitor Specific Server Database

There is a function of this type which monitors if a specific server database has been modified. If the database has been modified the relevant database files are downloaded to the client system and a flag is set to force the reload of the database and list files associated with this specific database.

The main program monitors this flag and if in a safe state (eg. not processing a sale) controls the installation of the updated database as well as updating all the associated list boxes after which the flag is reset.

3.4.2.2.4 Verify License Registration

This function ensures that any changes to the product license is implemented. For example, if a new product key is installed on the Server to permit additional accounting modules, this function then permits these same modules to be operational on the client system.

3.4.2.2.5 Obtain Updated POS Quote Database

This function determine if a new POS Quote Summary database has been created on the Server and, if so, downloads and installs this database on the client system.

3.5 Drivers

3.5.1 Cash Register Till Printer Driver

The Cash Register Till Printer Driver is used to communicate directly with the cash register printer. The driver interfaces with serial or parallel printers and also caters for ESC/POS printers utilizing standard ESC/POS commands.

3.5.2 Cash Drawer Driver

The Cash Drawer Driver is used to communicate directly with the cash register drawer. The driver interfaces with serial or parallel cash register drawers and, when required, transmits the character “A” in order to open the drawer.

Some cash register drawers are not controlled directly by the PC computer system and simply monitor the cash register printer communication channel. If communication is detected, (ie. a sale has been made), the drawer automatically opens.

This document is under construction...