

# MergeCOM-3 Advanced Integrator's Tool Kit

Platform Notes for Microsoft Windows  
95/98/NT/2000/2003/XP  
Release 3.5.0 or later

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## HOW TO CONTACT MERGE eFILM

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## 1. CONVENTIONS

These notes follow a few formatting conventions.

Terms that are being defined are presented in **boldface**.

sample margin note

Margin notes (in the left margin) are used to highlight important points or sections of the document.

Sample commands appear in **bold courier** font, while sample output, source code, and function calls appear in standard courier font.

Hexadecimal numbers are written with a trailing H. For example 16 decimal is equivalent to 10H hexadecimal.

## 2. DOCUMENT REVISION HISTORY

### Revision 1.08

22-SEP-98

Revised the file list for changed files in release 2.3.0.

### Revision 1.09

22-JUN-99

Revised the file list for changed files in release 2.4.0.

### Revision 1.10

14-JAN-2000

Revised the file list for changed files in release 2.4.1, and corrected Merge phone numbers for the U.S. office.

### Revision 3

3-DEC-2001

Revised the file list for changed files, and updated for 3.0.0 release

### Revision 4

13-DEC-2001

Added information about moving Pegasus libraries to /windows/system

### Revision 5

24-OCT-2002

Updated copyright/company information. Added new sample application, duplicate.c. Removed mc3sr.h.

### Revision 6

12-Aug-2004

Rectified the misleading linking information. Replaced mc3adv.dll with mc3adll.lib

### Revision 7

12-Aug-2004

Revised Toolkit supported platforms to include Windows 2003 Server

### Revision 8

30-Mar-2005

Updated the address for the Headquarters in North America. Merged the Storage Commitment Sample Applications into the Storage Sample Applications, removed sc\_scp.c and sc\_scu.c

### 3. OVERVIEW

MergeCOM-3 Advanced for Microsoft Windows provides DICOM functionality through Merge eFilm's Applications Programming Interface to the Windows Operating Systems.

While MergeCOM-3 Advanced provides the same consistent API, it takes advantage of Windows powerful capabilities and can be multi-threaded. The MergeCOM-3 Advanced library is in the form of a **Dynamic Link Library** (or **DLL**) and a static library (**.LIB**).

### 4. DOCUMENTATION ROADMAP

The MergeCOM-3 Advanced documentation is structured as pictured in Figure 1.

Platform specific information required to use the Advanced tool kit on your target platform is specified in Platform Notes. This includes supported compilers, compiler options, link options, configuration, and run-time related issues.

#### Read Me FIRST!

The User's Manual is the foundation for all other documentation because it explains the concepts of DICOM and the Advanced Tool Kit. Before plunging into the Reference Manual or Sample Application Guides you should be comfortable with the material in the User Manual.

The Reference Manual is where you go for detailed information on the Advanced Tool Kit. This includes the Application Programming Interface (API), tool kit configuration, the runtime object database, and status logging. The Reference Manual also includes a DICOM conformance statement for the tool kit.

The DICOM Extended Tool Kit Manual describes an optional extension to MergeCOM-3 and tells about the organization of the MergeCOM-3 DICOM database. With this extension, a user can extend standard services and define his/her own private services. Tools are supplied for converting the contents of the database into the binary runtime object database.

#### Sample applications

The Sample Application Guide describes approaches to developing specific classes of DICOM applications (Image Transfer, Query/Retrieve, Print, Media, Modality Worklist, etc.). The Sample Application Guide presents the pertinent information from Parts 3 or 4 of the DICOM Standard in a more readable way and in the context of the Advanced Tool Kit. The Application Guide also details the DICOM messages that can be passed between applications on the network. In addition, the sample applications that are supplied for your platform are described within the Sample Application Guide.

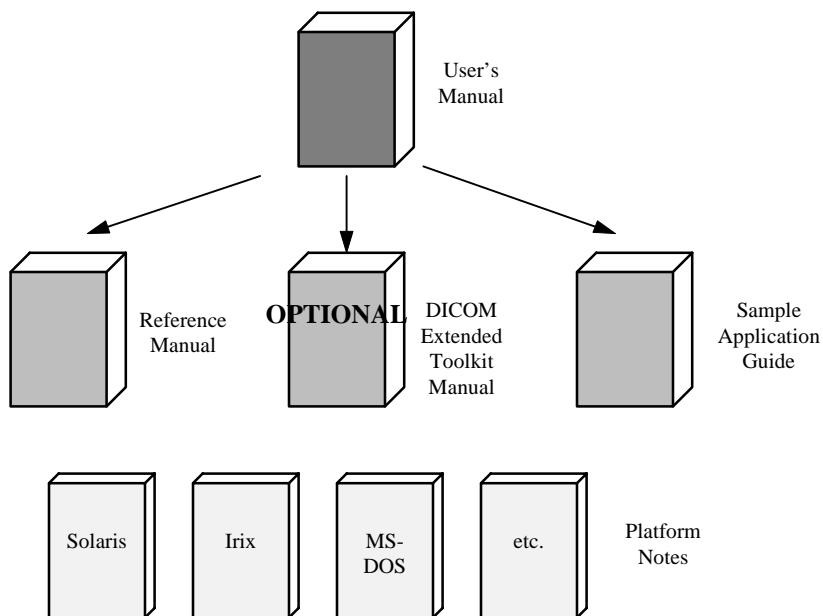


Figure 1: MergeCOM-3 Advanced Tool Kit Documentation Roadmap

## 5. SUPPORTED CONFIGURATIONS

The following table describes the system requirements for the MergeCOM-3 Advanced Tool Kit for. Merge eFilm assumes that you have met the system requirements specified either in the *Microsoft Windows NT Workstation Installation Guide*, or by the Windows 95 installation instructions.

Supported Hardware  
& Software

| Category               | Requirement  |
|------------------------|--|
| Hardware               | Microsoft Windows 95/98/NT/2000/2003/XP<br>supported Ethernet Network Interface Card.              |
| Software (base)        | Microsoft Windows 95/98/NT/2000/2003/XP.   |
| Software (development) | Microsoft Windows 95/98/NT/2000/2003/XP.<br><br>Microsoft Visual C++ Development System and Tools. |

## 6. THE MERGECOM-3 LIBRARIES

The MergeCOM-3 Advanced Tool kit is provided in two forms: a DLL and a static library.

Static Library

A static library is a collection of subroutines that are callable by your programs. To use them, simply link them with your program.

Dynamic link libraries, or DLL for short, are the cornerstone of Windows. A DLL is similar to a static library; it that it contains code that will be executed by many different modules. The difference, however, is that the code is not included in the executable file built by the linker or loader. Instead, the code is loaded at runtime when the resources are requested. The code is then mapped into the processes address space.

#### Dynamic Library

Two files make up the MergeCOM-3 Advanced Tool kit DLL: MC3ADLL.LIB and MC3ADV.DLL. The MC3ADLL.LIB file is called the MergeCOM-3 **import library**. When a sample program is linked, the user must specify this file in the load line so that the loader will know how to resolve any calls made to MergeCOM-3 DLL. The DLL file contains the actual “executable” code used by any programs that has linked with the import library.



The following compile options should be used:

| Compile Options | Description  |
|-----------------|--|
| /O2             | (Optional) optimize for speed  |
| /MT             | Application is multithreaded and uses static C libraries. This option should be used when linking with the static library (mc3adv.lib).    |
| /MD             | Application is multithreaded and uses C libraries in the form of DLLs. This option should be used when linking with the DLL (mc3adll.lib). |

The following link options should be used:

| Link Options       | Description                    |
|--------------------|--------------------------------|
| /SUBSYSTEM:console | Needed for sample applications |
| /INCREMENTAL:no    | Do not use incremental links   |
| /MACHINE:I386      | Specify Intel x86 machine type |
| /MACHINE:Alpha     | Specify Alpha machine type     |

See the example **makefile** supplied with the tool kit for an example link line with further explanation of compiler options. Note that Developer Studio projects are not included with the library.

**IMPORTANT!**  
**WINSOCK MEMORY**  
**LEAK**

**NOTE:** The Windows 95 kernel `KERNEL32.DLL` has a memory leak when using Windows Sockets. This is a known problem. Microsoft has released a new version of the kernel that fixes the memory leak problem. The Microsoft Technical Support Knowledge Base contains information about the symptom(s), cause and resolution of this problem. Please see the following Web page for specifics on the problem and how to obtain a kernel patch:

<http://support.microsoft.com/support/kb/>

[articles/Q148/3/36.asp](http://support.microsoft.com/support/kb/articles/Q148/3/36.asp)

## 7. MISCELLANEOUS NOTES

### *7.1 API Changes for Windows NT, Windows 95, and Windows 98*

Three tool kit functions have different parameters for Windows NT and 95. The following is a listing of the new parameters to these functions:

```
void MC_List_Message(  
    int AmessageID,  
    char* Afilename  
);  
void MC_List_Item(  
    int AitemID,  
    char* Afilename  
);  
void MC_List_File(  
    int AfileID,  
    char* Afilename  
);
```

The second parameter to each of these functions is defined as being a `FILE*` in the reference manual. Because `FILE*` variables cannot be passed to a DLL, we have changed these functions to pass a filename instead. With the static library, the output will be sent to stdout when the Afilename parameter is set to NULL. If it is set to NULL when using the DLL, an exception error will occur. When Afilename is set to a filename, the message, item, or file object is listed to this text file.

## 7.2 Sample Applications

Several sample programs are provided with MergeCOM-3 Advanced Integrators Toolkit. They are as follows: **stor\_scp**, **stor\_scu**, **qr\_scp**, **qr\_scu**, **prnt\_scp**, **prnt\_scu**, **work\_scp**, **work\_scu**, **ssl\_scp**, **ssl\_scu**, **duplicate** and **med\_fsx**. All of these programs have been customized to work with Windows with the store server program having been given extra attention. The sample storage server (**stor\_scp.c**) has been modified to create multiple threads to handle multiple simultaneous DICOM associations. A version of each sample application can be generated using both the static library and the MergeCOM-3 Advanced DLL.

## 8. INSTALLATION

The following notes provide some details regarding installation requirements and procedures for MergeCOM-3 Advanced ITK running under the Windows operating systems.

### 8.1 MergeCOM-3 Requirements

The distribution media contains an InstallShield executable (setup.exe). In order to use the libraries on an Intel or Alpha based computers, the following hardware and software requirements must be met. Please note that the user must meet the requirements for a Windows operating system installation before the requirements for MergeCOM-3 installation. We also assume you have installed the Microsoft Visual C++ compiler.

#### 8.1.1 Hardware

1. An Intel 32-bit x86 based (80386, 80486 or Pentium) microprocessor or a DEC Alpha microprocessor.

2. One (or more) hard disks, with approximately 11 megabytes of free disk space for the installation. For execution, 20 megabytes should be sufficient. Image storage requires extra storage space.
3. A CD-ROM drive.
4. An ethernet network adapter card which is supported by Windows 95/98/NT/2000/2003/XP.

### 8.1.2 Software

1. Microsoft® Windows operating system configured to use the TCP/IP transport services.
2. Microsoft® Visual C++™ Version 4.1 or higher.

## 8.2 *INSTALLATION PROCEDURES*

### 8.2.1 Installing MergeCOM-3

This section describes how to install MergeCOM-3 Advanced on your computer.

The distribution for MergeCOM-3 Advanced is distributed in a standard install/setup style. To install MergeCOM-3, complete the following tasks:

1. Place the distribution CD in your CD-ROM.
2. Run the setup program on the CD. If you are installing under Windows 95 or NT 4.0, choose "Run" from the start button and type "x:setup" in the dialog box which appears (where 'X' is the drive letter of your CD-ROM drive). If you are installing under Windows NT 3.51, choose "Run" from the Program Manager File menu and type "x:setup" in the dialog box which appears.
3. Follow the directions on the screen. The only information you must provide to the setup program is the name of the directory in which setup is to place the MergeCOM-3 Advanced files.
4. Copy all the library files from the mc3pic subdirectory into your windows/system directory.

This completes the installation of the MergeCOM-3 files. You are ready to perform the post-installation configuration. Carefully complete each item listed below.

### 8.2.2 Perform post-installation configuration

This section describes the necessary post-installation procedures that must be completed before MergeCOM-3 is ready to be used.

1. *Environment Variables*

MergeCOM-3 requires that an environment variable called `MERGE_INI` be set to point to the current initialization file (shipped as `merge.ini`). If this environment variable is not set, MergeCOM-3 will look in the execution directory of your application to find this configuration file.

## 2. *Directory and File Paths*

When specifying the directory or file path for a windows program, it is necessary to declare the explicit directory or file path. The examples below are from the `merge.ini` file and the `mergecom.pro` file.

### merge.ini

```
[MergeCOM3]
# MergeCOM-3 system profile parameters
MERGECOM_3_PROFILE = C:\mc3alib\mergecom.pro

# MergeCOM-3 service and message definitions
MERGECOM_3_SERVICES = C:\mc3db\mergecom.srv

# MergeCOM-3 application configurations
MERGECOM_3_APPLICATIONS = C:\mc3alib\mergecom.app

# Message log parameters.
LOG_FILE = C:\mc3alib\merge.log # Name of log file
```

### mergecom.pro

```
#####
#           MergeCOM-3 MESSAGE CONFIGURATION SECTION
#####
[MESSAGE_PARMS]
LARGE_DATA_STORE      = MEM # |FILE |VMEM Default = FILE
LARGE_DATA_SIZE       = 200
OBOW_BUFFER_SIZE      = 4096
DICTIONARY_ACCESS     = MEM # | FILE Default = FILE
DICTIONARY_FILE        = C:\mc3db\mrgcom3.dct
TEMP_FILE_DIRECTORY   = C:\temp
MSG_INFO_FILE         = C:\mc3db\mrgcom3.msg
```

## 9. FILES

The following files are contained in the MergeCOM-3 Advanced Integrators Tool kit:

| Directory | File         | Description  |
|-----------|--------------|--|
|           | READ_ME      | Any late-breaking news on this release of the tool kit                               |
|           | O_w32        | A file used for identifying the version of the tool kit.                             |
| mc3doc    | Platform.pdf | This document  |
|           | Refer.pdf    | MergeCOM-3 Advanced Integrator's Tool Kit Reference Manual in Adobe Acrobat 3 format |

|  |        |              |   |
|--|--------|--------------|---|
|  |        | User.pdf     | MergeCOM-3 Advanced Integrator's Tool Kit User's Manual in Adobe Acrobat 3 format             |
|  |        | Sample.pdf   | MergeCOM-3 Advanced Integrator's Tool Kit Sample Applications Guide in Adobe Acrobat 3 format |
|  | mc3lib | mc3adv.lib   | MergeCOM-3 Advanced Integrator's Tool Kit software object code library.                       |
|  |        | mc3adv.dll   | MergeCOM-3 Advanced Integrator's Tool Kit export library for mc3adv.dll.                      |
|  | mc3pic | mc3adv.dll   | MergeCOM-3 Advanced Integrator's Tool Kit dynamic link library.                               |
|  |        | picnm.lib    | Pegasus export library for Pegasus DLLs.  |
|  |        | picu20.dll   | Pegasus DLL which needs to be copied to /windows/system directory                             |
|  |        | picn1020.dll | Pegasus DLL which needs to be copied to /windows/system directory                             |
|  |        | picn1120.dll | Pegasus DLL which needs to be copied to /windows/system directory                             |
|  |        | picn6220.dll | Pegasus DLL which needs to be copied to /windows/system directory                             |
|  |        | picn6320.dll | Pegasus DLL which needs to be copied to /windows/system directory                             |
|  |        | picn6420.dll | Pegasus DLL which needs to be copied to /windows/system directory                             |
|  |        | picn6520.dll | Pegasus DLL which needs to be copied to /windows/system directory                             |
|  |        | mc3msg.h     | Library include file for use with MergeCOM-3 Advanced libraries.                              |
|  | mc3inc | mc3media.h   | Library include file for use with MergeCOM-3 Advanced libraries.                              |
|  |        | mcstatus.h   | Library include file for use with MergeCOM-3 Advanced libraries.                              |
|  |        | mergecom.h   | Library include file for use with MergeCOM-3 Advanced libraries.                              |
|  |        | diction.h    | DICOM Data Dictionary #DEFINES  |
|  |        | pcd.h        | Pegasus include file  |
|  |        | pic.h        | Pegasus include file  |
|  |        | stdtypes.h   | Pegasus include file  |

|         |              |  |
|---------|--------------|--|
| mc3msg  | mrgcom3.dct  | Runtime DICOM Data Dictionary File   |
|         | mrgcom3.msg  | Runtime Message Database File  |
|         | message.txt  | DICOM message formats for INFO purposes  |
|         | default.pfl  | Default configuration file used by mc3file   |
|         | diction.pfl  | Data dictionary profile (Extended tool kits only)  |
|         | info.pfl     | Message information profile (Extended tool kits only)  |
|         | mc3icomb.cfg | Example configuration file used with mc3icomb.   |
|         | mc3dcomb.pfl | Example configuration file used with mc3dcomb.   |
| mc3apps | merge.ini    | MergeCOM-3 Advanced Initialization Configuration File (used by all sample applications.)       |
|         | mergecom.pro | MergeCOM-3 Advanced System Profile Configuration File  |
|         | mergecom.app | MergeCOM-3 Advanced Application Profile Configuration File                                     |
|         | mergecom.srv | MergeCOM-3 Advanced Service Profile Configuration File   |
|         | stor_scp.c   | Sample Storage and Storage Commitment SCP Application in source form.                          |
|         | stor_scu.c   | Sample Storage and Storage Commitment SCU Application in source form.                          |
|         | qr.h         | Sample Query/Retrieve Application header file.   |
|         | qr_scp.c     | Sample Query/Retrieve Application in source form.  |
|         | qr_scu.c     | Sample Query/Retrieve Application in source form   |
|         | work_scp.c   | Sample Modality Worklist and Modality Performed Procedure Step SCP Application in source form. |
|         | work_scu.c   | Sample Modality Worklist and Modality Performed Procedure Step SCU Application in source form. |

|        |              |  |
|--------|--------------|--|
|        | workdata.c   | Sample database functions used by Modality Worklist and Performed Procedure Step SCP Application in source form.                   |
|        | workdata.h   | Sample header file for database functions used by Modality Worklist and Performed Procedure Step SCP Application.                  |
|        | work.dat     | Database flat file, used by the Modality Worklist and Modality Performed Procedure Step SCP application.                           |
|        | qr_util.c    | Sample Query/Retrieve Application utility functions in source form.  |
|        | test.dat     | Database flat file used by the Query/Retrieve Sample Applications  |
|        | ct.img       | Used by the Query/Retrieve Sample Applications (This file is generated by mc3file and can be regenerated by the user, if need be.) |
|        | prnt_scp.c   | Sample Print Application SCP in source form.   |
|        | prnt_scu.c   | Sample Print Application SCU in source form.   |
|        | prnt_svc.h   | Sample Print Application service function header function source.  |
|        | ssl_samp.c   | SSL callback for ssl_scp.c and ssl_scu.c   |
|        | ssl_scp.c    | Sample service class provider application for the Storage Service Class using secure socket connections                            |
|        | ssl_scu.c    | Sample service class user application for the Storage Service Class using secure socket connections                                |
|        | med_fsu.c    | Media File Set Updator Application in source form.   |
|        | duplicate.c  | Sample for using MC_Standard_Compressor/MC_Standard-Decompressor via MC_Duplicate_Message  |
|        | makefile     | Makefile for example programs  |
| mc3bin | mc3list.exe  | List a DICOM message object  |
|        | mc3valid.exe | Validate a DICOM message object  |
|        | mc3file.exe  | Generate a DICOM message object  |
|        | mc3echo.exe  | DICOM Echo Test Utility  |

|              |   |
|--------------|---|
| mc3conv.exe  | Convert a DICOM message or file object into a new transfer syntax |
| mc3comp.exe  | Compare the values within two DICOM message or file objects       |
| mc3dict.exe  | Dictionary Generation Utility. (Extended tool kits only)          |
| mc3info.exe  | Info file Generation Utility. (Extended tool kits only)           |
| mc3dcomb.exe | Dictionary Combine Utility. (Extended tool kits only)             |
| mc3icomb.exe | Dictionary Info Utility. (Extended tool kits only)                |
| genconf.exe  | Configuration file to C language utility.                         |
| gendict.exe  | Dictionary to C language Utility.                                 |