# INSTALLATION TOOLS ON COMPUTER SERVER AS/400

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## ABSTRACT

This article presents about the installation tools on AS/400 which is a server platform introduced by IBM. One of the most difficulties in developing software on this system is how to install the software on this system. The process of installation is very complex and has lots of limitation, so the installation can take some time and also may risk the operation system This project was developed to reduce the errors and a damage to other software on the server when users install software manually. This project provides a script to install software automatically. The installation tools can also show users about the progress of the installation and a report of the installation.

***Index Terms***– *The Installation tools on AS/400*

## 1. INTRODUCTION

Currently, technology makes it possible to allow people to communicate widely. Communications technology has compounded the role in everyday life. As a result, today businesses need to store digital data which brings to big business data warehouse. These mean big data needs to be transferred quickly in order to match up with the online business transaction. One of the technologies that can meet this demand is using a mainframe. However, the maintenance cost of the mainframe is generally high. In order to avoid the high maintenance cost of the mainframe, the computer server AS/400 is one of the reasonable alternative. AS/400 is developed by IBM [1]. It can perform similar functionality to a mainframe, but it has much lower maintenance cost. The AS/400 can run software that meets the needs of the business as good as mainframe. However, installing software on AS/400 is a very complex. The software can be set up in various ways depending on the type of applications. It is easy to cause errors during installation. So there is a need of using experts who have the technical capability to perform the installation. In addition, the installation process also very time consuming, and need an attention from an expert at every step.

In this project, the installation tool on AS/400 is introduced. It helps users to install program with ease. All the information such as settings, parameters, every required file will be prescribed in Excel and well formatted. The tool helps to compile all necessary files at once and also checks the correction of the compilation process. The tools can also back up your files and provide the report of the compilation. This helps users with no knowledge about AS/400 system to be able to install software on AS/400 with ease.

## 2. THEORY

### 2.1 The installation program on the computer server AS / 400

The installation program on the AS/400 server computer can be done in two ways.

- Using CL (Control Language) for compile programs [2] (shown in Fig. 1).

```
   DLTF       FILE(&PFDLIP1/&PFDFNM1)
   MONMSG     MSGID(CPF9999)

   CRTPF      FILE(&PFDLIP1/&PFDFNM1) +
                SRCFILE(&PFDLIS1/&PFDSCF1) SRCMBR(&PFDSME1) +
                TEXT(&PFDDES1) MAXMBRS(&PFDMXM1) +
                  SIZE(&PFDNOR1)    AUT(&PFDAUT1)
   MONMSG     MSGID(CPF9999) EXEC(CHGVAR VAR(&CKER) +
              VALUE('ON'))


ENDPGM
```

Figure 1. Compile by CL

- Using software on computer server AS/400 for compile programs (shown in Fig. 2)

```
                  Create SQL ILE RPG Object (CRTSQLRPGI)

Type choices, press Enter.

Severity level . . . . . GENLVL          10
Date format  . . . . . DATFMT          *JOB
Date separator character . . . . DATSEP          *JOB
Time format  . . . . . TIMFMT          *HMS
Time separator character . . . . TIMSEP          *JOB
Replace  . . . . . REPLACE       > *NO
RDB connect method . . . . . RDBCNNMTH       *DUW
Default collection . . . . . DFTRDBCOL        *NONE
Dynamic default collection . . . DYNDFTCOL       *NO
Package  . . . . . SQLPKG          *OBJ
  Library  . . . . . *OBJLIB
SQL path . . . . . SQLPATH         *NAMING
                       + for more values
SQL rules  . . . . . SQLCURRULE    *DB2
IBM SQL flagging . . . . . SAAFLAG         *NOFLAG
ANS flagging . . . . . FLAGSTD         *NONE
```

Figure 2 Compile by software on computer server AS/400

These two methods mentioned above require expertise to install.

### 2.2 The terminology used in the AS/400 system

The component of the operating system on AS/400 is as following:
- Library is a collection of objects that contain the object name, type, and the address. This is comparable to a document file in other operating systems [3].
- Object is data contained in a library or a file which have already been compiled. The file in this case is comparable to a source code in general, but it is called as a Source File in AS/400 system.
- Member is source code which is the main program.
The application development on the AS/400.
- Physical file is storage data of database format.
- RPG file is a work control of program. For example, it can access to the storage, run user interface, and also connect with a printer interface in order to operate according to its purpose.
- Display file controls a display which is connected to the user interface directly [4].
- Printer file is similar to a driver or interface which is used to control a printer. The printer file will be controlled by RPG program.
- CL file is a program that can access the commands of the computer version of IBM AS/400 [2].

### 2.3 Tools and technologies for system development.

Report Program Generator (RPG) is a computer language use in software development for AS/400 system. It is often called as RPG/400. The RPG/400 code is written on a variety of specifications. Each specification has a specific set of functions. There are seven kinds of RPG/400 specifications [5-6]. When your source program is compiled, these specifications must be in the following sequence:
- Control Header (H Specifications) provides information about program generation and running of the compiled program [7].

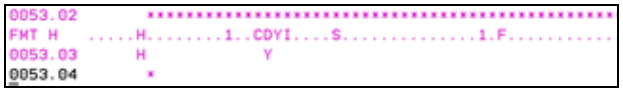


Figure 3. Specification H

- The file description (F specifications) identifies each file used by a program. One file description specification statement is required for each file in the program. A maximum of 50 files can be described per program. Only one primary file can be specified by ";". However, the presence of a primary file is not required [6-7].

- The Extension (E Specifications) describes all record address files, arrays, and tables. A maximum of 200 arrays and tables can be used in a program [7].


Figure 5. Specification E

- The line counter (L specifications) can be used for each program described in printer file to indicate the length of the form and the number of lines to print on a page. However, C specification can also use this feature.
- The input specifications (I specifications) describe the types of records within the file, the sequence of the types of records, the fields within a record, the data within the field, indicators based on the contents of the fields, control fields, fields used for matching records, and fields used for sequence checking.


Figure 6. Specification I

- The control specifications (Control Specifications) describe the calculations to be done on the data and the order of the calculations. Calculation specifications can also be used to control certain input and output operations

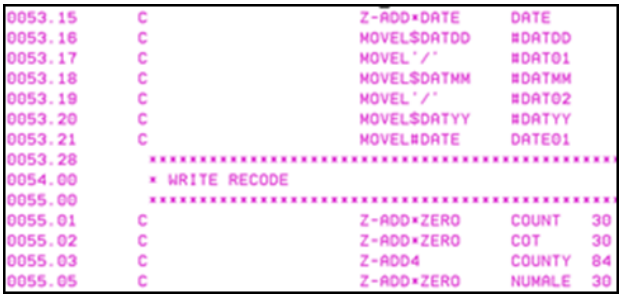


Figure 7. Specification C

- The output specifications (O specifications) describe the record and the format of fields in a program described output file and when the record is to be written. Output specifications are optional for an externally described file. Output specifications can be divided into two categories: record identification control, and field description control.

**IBM iSeries Access for Windows** is a tool used to access the computer of the IBM AS/400. It has many functions to choose from. For example, Data transfer, access to files, access interface and management software for servers [8].

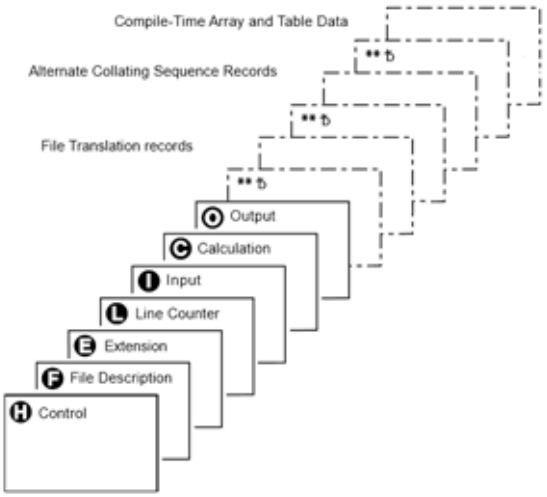


Figure 8. Order of the Type of Specifications in an RPG/400 Source Program [6]

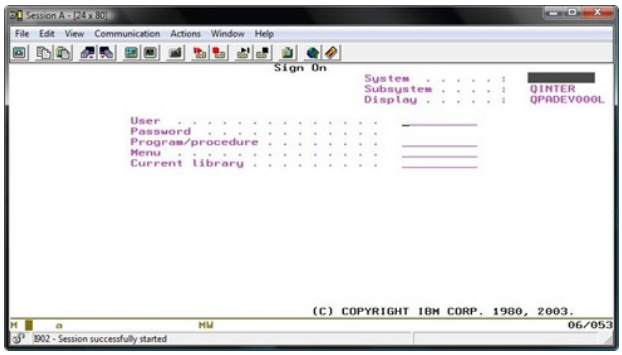


Figure 9. IBM iSeries Access for Windows

## 3. MATERIALS AND METHODS

### 3.1 Step of analysis system requirements

- Studying and data gathering from users who use computer server AS/400 regularly. Problem statement and data are collected for analysis and creating the efficiently system.
- Studying on an equipment, necessary software and file system for developing system on computer server AS/400.

### 3.2 Step of system operations

This section describes the operations of installation tools on computer server on AS/400. The first users should add requirements project into system. Then users also need to add all the source codes and a library into the installation tool. After that users will be able to begin the compilation process. The process of the compilation is as follows:
- Backup source
- Copy source
- Restore source
- Test Compile
- Backup object
- Compile.

After finishing all the compilation step, users will get a compilation report and a save file which can be used to install the same software on another AS/400 system.

### 3.3 Step of development

The system was developed using RPGLE. The physical file and logical file are used to manage the database. The display file is used for displaying a user interface on the screen. A control language is used to control AS/400 operating system. Visual Basic is used in creating macros in Microsoft Excel for report verifications. CMD (Command) is also used for downloading and uploading a file between personal computers and AS/400 system

## 4.THE INSTALLATION TOOLS DESIGN

System development of installation tools on computer server AS/400 have screen as following:

The main menu for users to access to the software function (shown in Figure 10). In this screen, there are 3 options on the main menu as following:

### 4.1. Project master maintenance

Project master maintenance screen is project management screen can add, delete, edit and search for contacts on the project. The screen shot of the project master maintenance is shown as in Figure 11.

In this menu, users can also list the item which is the software to be installed in to the system. The example of the list of the item which will be installed is shown in Figure 12. Here, users can also edit the priority of the library at the source code reference as well. Figure 13 shows the example of the edit library list screen shot.

After the project has been created and filled in all the necessary information, users will be able to compile the software. Here the step of the compilation process is as follows 1. Backup source 2. Copy source 3.Restore source 4. Test Compile 5.Backup object 6. Compile. The screen shot of the compilation step is shown in Figure 14.

### 4.2. Project status control

Project status control screen will have status each project which indicates the current function of each project. The figure 12 shows the screen of this project status control.

### 4.3 Download prepare file on your PC

The last menu on the main menu screen shot is the function to upload a file from user local computer to a server of AS/400 system.


Figure 10. Main Menu Screen Shot

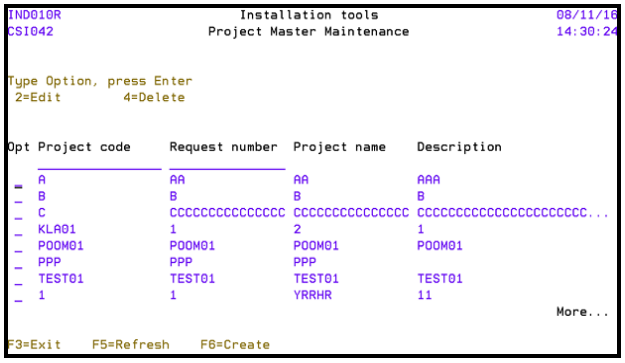


Figure 11. Project Master Maintenance

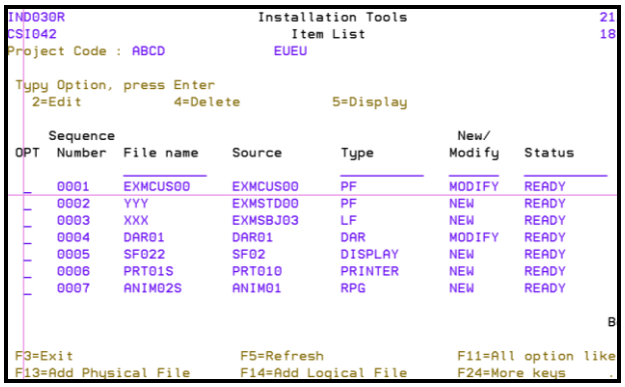


Figure 12. Item List

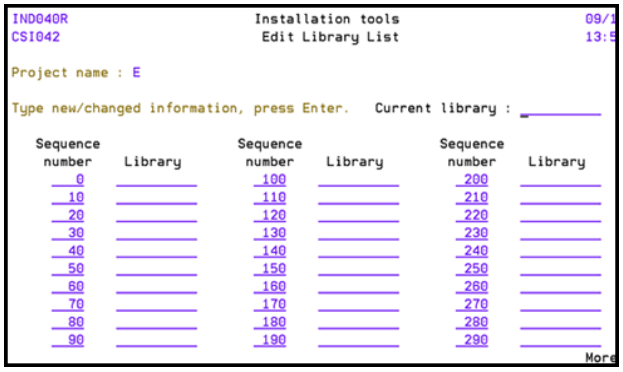


Figure 13. Edit library list

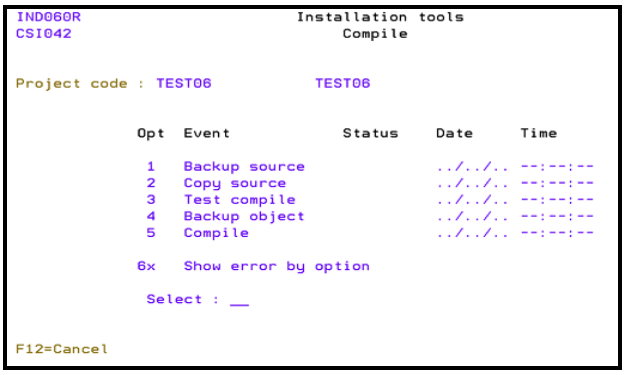


Figure 14. Compile

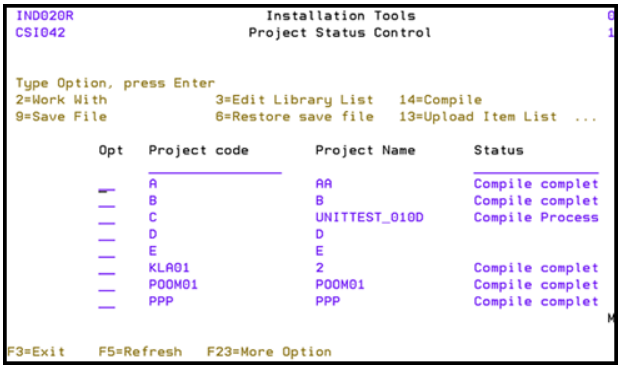


Figure 15. Project status control

## 5. EXPERIMENT AND EVALUATION

### 5.1 Experiment Setup

After the system has been developed, the installation tools will be tested by 2 groups of users which are 10 of expert users and another 10 of general user. An expert user who is considered themselves as a user who regularly use AS/400 system, while a general user has a very limited or no experience in installing a software on AS/400 system.

The installation tool will be evaluated based on 4 kinds of aspects. First is the ability to work according to user requirements. Second is the work according to duties of the system. Third is how easy to use the system. Fourth is the accuracy of the results. The satisfaction results will be defined in rating scale of the quality ranging from 5 to 1 where 5 is the most satisfied and 1 is the least satisfied.

### 5.2 Experiment Results

The results show that the feedback from general users is generally satisfied with the overall average score above 4.20 and the standard deviation of 0.48. While the average scores from the expert users was all above 4.22 and the standard deviation of 0.48. That were at a satisfactory level. The summary of the results from the experiment shows in Table 1.

Table 1. result assessment of satisfaction with the system

| Assessment | Expert User | | General User | |
|---|---|---|---|---|
| | $\bar{x}$ | *SD* | $\bar{x}$ | *SD* |
| The ability for work according to user requirements | *4.37* | *0.48* | *4.08* | *0.57* |
| Working accord to duties of the system | *4.1* | *0.49* | *4.2* | *0.53* |
| Using system | *4.23* | *0.48* | *4.2* | *0.53* |
| Accuracy of the results | *4.2* | *0.53* | *4.34* | *0.48* |
| Summary of result | *4.22* | *0.49* | *4.2* | *0.53* |

## 6. CONCLUSIONS

This project is introduced to help users who is facing difficulty in installing a software on AS/400 server. Users can use the installation tools to access the process of installing more easily and all verify installing process. The installation tool also provides a report on the installation. This software is evaluated by expert and general users and the feedback are well satisfied.

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