

# iSeries Application Development

*2001 Announcements*  
*ITSO Technical Overview*  
*May 2001*

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## WebSphere Development Studio

- Client Workstation Tools (WebFacing, ...)
- Host Tools (RPG, ...)

## PASE

## Java-related tool update

# WebSphere Software Platform - Development Tools for iSeries

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## WebSphere Development Studio for iSeries (5722-WDS)

- Host Components
  - Enhanced ILE RPG (RPG IV)
  - Enhanced ILE COBOL
  - New ILE C compiler
  - New ILE C++ compiler
  - Application Development ToolSet
- Workstation Components
  - WebFacing Tool
  - WebSphere Studio for iSeries (Professional Edition)
  - VisualAge for Java for iSeries (Professional Edition)
  - Cooperative Development Environment (CODE)
  - VisualAge for RPG

**Key iSeries development tools  
consolidated into single priced  
iSeries offering**

## WebSphere Development Tools for iSeries (5724-A81)

- Workstation Components only of WebSphere Development Studio for iSeries
- From IBM with Lotus part number program

Rather than continuing to sell individual tools and compilers, this package consolidates all the key iSeries development tools, both host and workstation, traditional and new, into an attractively-priced iSeries offering.

## WebSphere DEVELOPMENT STUDIO FOR iSeries COMPONENTS

### Host Components

- ILE RPG (RPG IV) -- Improved Java interoperability and free-form C (Calculation) Specs
- ILE COBOL -- zSeries migration capabilities and Java interoperability capability
- New ILE Card ILE C++ compilers
- Application Development ToolSet: This includes Program Development Manager (PDM), Source Entry Utility (SEU), screen Design Aid (SDA), Report Layout Utility (RLU), Data File Utility (DFU), Advanced Function Print (AFP) and Common Graphical Utility (CGU).

### Workstation Components (Unlimited workstation licenses per server)

- WebFacing Tool
  - Builds a Web interface to existing 5250 application
  - Converts at development time the display file source into
    - ✓ JavaServer Pages and Java data beans
    - ✓ JSPs and beans are deployed to the WebSphere Application Server
    - ✓ Requires little change to the application's business logic
    - ✓ Easy and cost-effective to convert -- no separate tool costs or runtime charges
- WebSphere Studio for iSeries (Professional Edition)
  - Provides easy access to iSeries data and applications
  - Contains Web palette parts to generate standard HTML and Java Script
  - Includes entry field with validity checking and edit code support
  - Includes subfile parts
  - Includes a wizard to generate a functional Web user interface

WebSphere DEVELOPMENT STUDIO FOR iSeries COMPONENTS continued

## Workstation Components continued

- VisualAge for Java for iSeries (Professional Edition)
  - Provides easy access to iSeries system functions
  - Generates code to access data and applications
- Cooperative Development Environment (CODE)
  - Windows-based versions of the classic host tools SEU, SDA, RLU, PDM and the system debugger
  - Provides seamless access to iSeries source and objects
  - More efficient development of OPM/ILE RPG, OPM/ILE COBOL, OPM/ILE CL, ILE C, ILE C++, DDS and Java
  - Helps attract, retain, and grow key iSeries development skills
- VisualAge RPG
  - Creates GUI applications for Windows or any Java GUI-capable client or browser
  - Provides seamless access to iSeries data and applications

**Note:** This program contains both host and workstation tools. If customers and Solution Providers are interested in developing workstation application only, they should consider the Lotus part number program WebSphere Development Tools for iSeries V5.1 (5724-A81)

WebSphere DEVELOPMENT TOOLS FOR iSeries COMPONENTS (5724-A81)

WebSphere Development Tools for iSeries V5.1 gives customers and solution providers rapid and cost-effective ways to increase the number of Web-enabled, e-business workstation applications for the iSeries server. 5724-A81 is essentially the set of Work Station components of 5722-WD1.

## Workstation Application Components

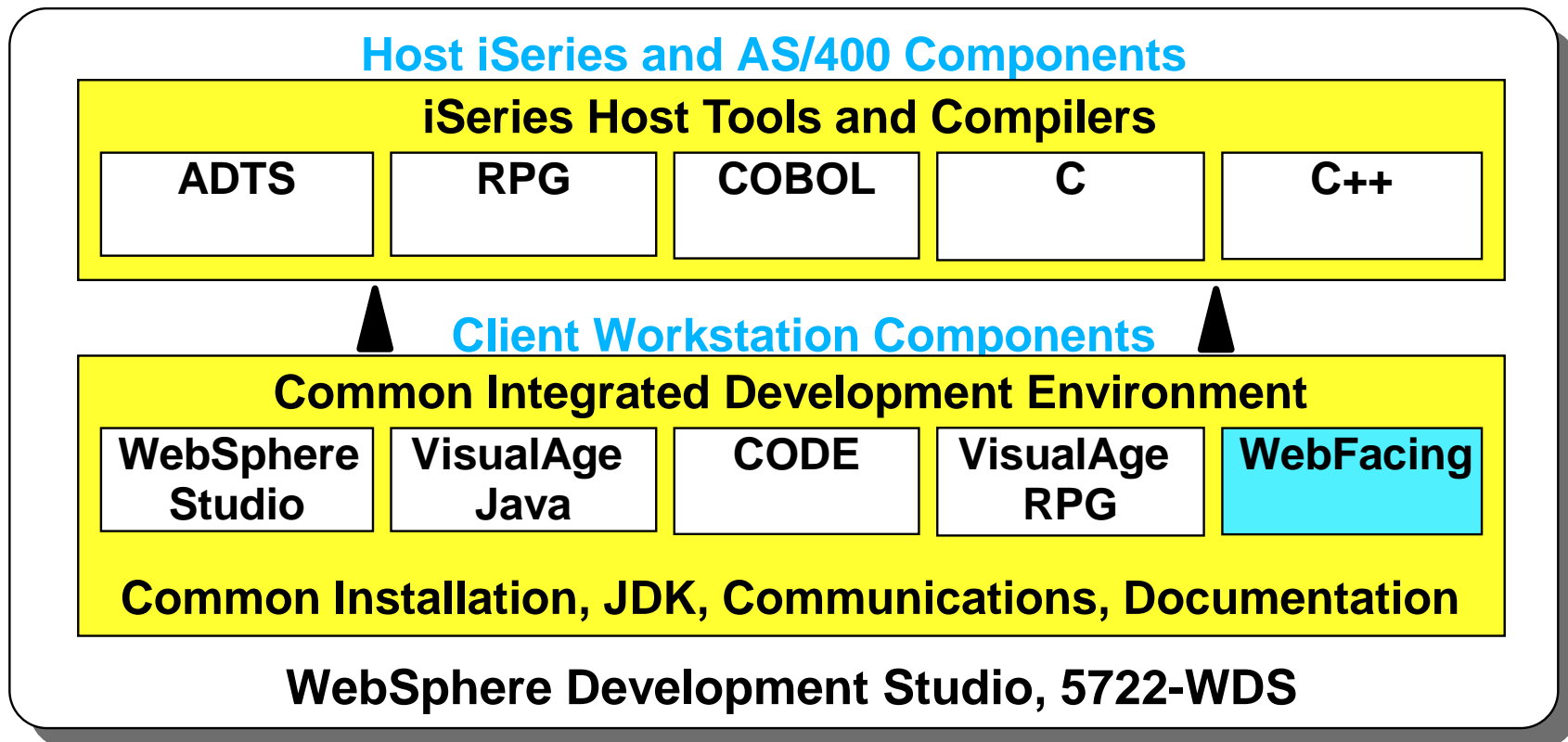
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WebSphere DEVELOPMENT TOOLS FOR iSeries COMPONENTS (5724-A81) continued

## **Workstation Application Components** continued

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A single toolset for *all* iSeries application developers

Common launch pad, project definition and maintenance

New WebFacing tool extends 5250 apps

Discontinue individual products in V4R5, V5R1

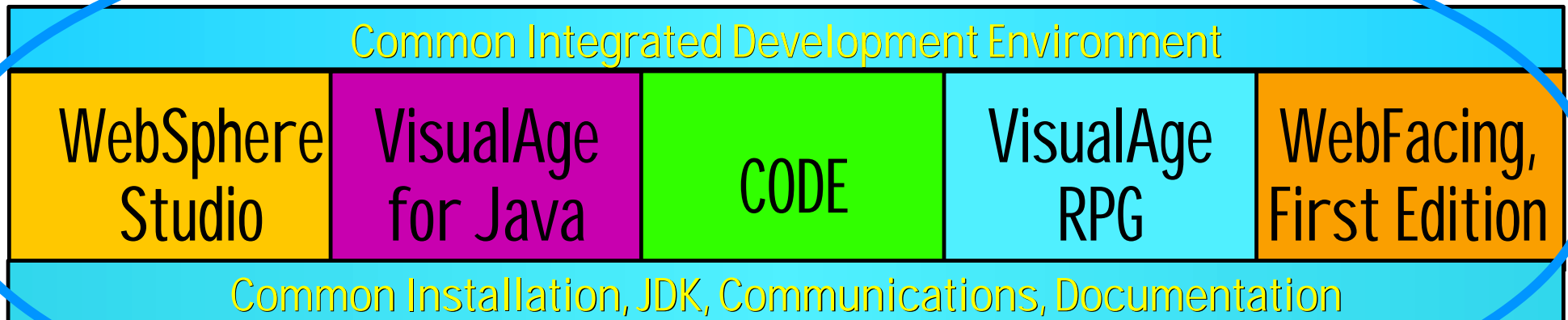
This is a graphical representation of what the WebSphere Development Studio for iSeries offers and indicates the individual products are no longer available.

Note: WebSphere Development Studio for iSeries is also being made available on OS/400 V4R5, as product number 5769-WDS. While the individual components do not have V5R1 functions, the Host and Client software packaging for 5769-WDS is very similar to 5722-WDS described in the following pages. See the April 2001 announcement letter for WebSphere Development Studio for iSeries, V4R5.

# WS Development Studio-Workstation Components

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ADTS	RPG	COBOL	C	C++
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## Workstation Components

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This section give some overview level details on the workstation components under WebSphere Development Studio for iSeries.

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# What is WebFacing?

WebFacing, First Edition is technology to run 5250 applications on the Web

- Part 1: Development conversion tool - translates Display File DDS into JavaServer Pages
- Part 2: A Runtime switch

WebFacing Goals:

- Quickly web-enable many applications
- Allow iterative optimization for the Web

No additional licensing - runtime or development

NOTES: a) WebFacing is not NL enabled nor translated at this time  
b) DBCS enablement will be done via a PTF in 3Q 2001

## Part 1:

- Translates existing Display File Data Description Specifications (DDS) source syntax) into JavaServer Pages - JSPs and Beans
- Creates an alternative user interface to existing applications (RPG, COBOL, etc.)

## Part 2:

- As application invoked from browser, a switch is set to notify program that is talking with a browser - 5250 data stream may never be created. Details are provided in subsequent foils
- This runtime intercept is part of OS/400

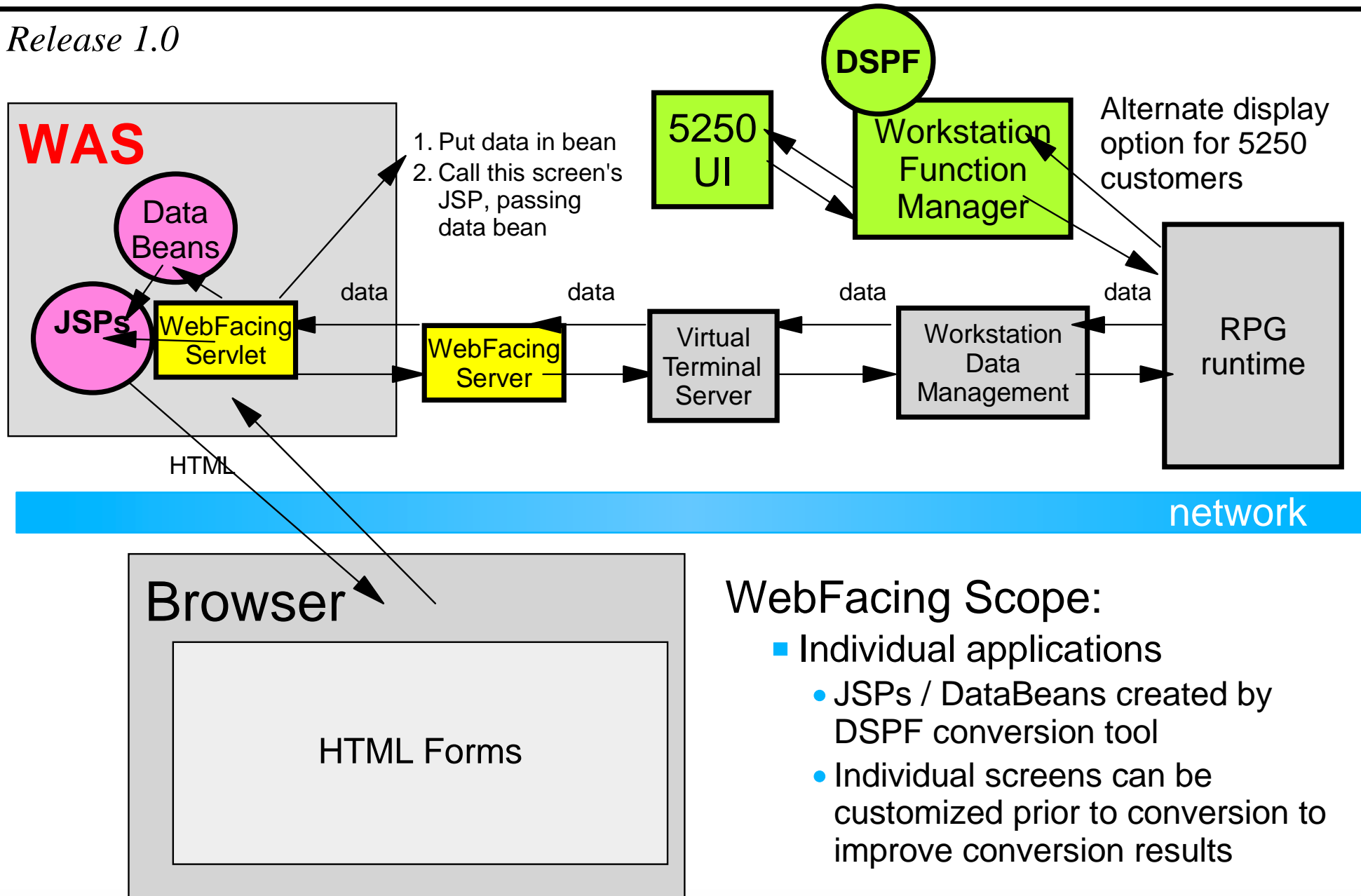
## Goals:

- Get existing applications to the Web quickly and easily than other products in the market place
- Enable additional tailoring of an application to exploit technology. You could use WebSphere Studio to modify the "default style" sheet output - such as adding graphics of a hotel room for a room reservation applications.

There is no runtime licensing.

# WebFacing Runtime -Details

Release 1.0



## WebFacing Scope:

- Individual applications
  - JSPs / DataBeans created by DSPF conversion tool
  - Individual screens can be customized prior to conversion to improve conversion results

This foil shows some more details of the implementation of the WebFacing Tool, first edition so you can see how it runs, compared to the base 5250 application environment.

There are two possible pathways for execution of an application:

- Real 5250 display/keyboard (view, starting from the right side of chart - from RPG runtime to **green** boxes)
  - 5250 screen input begins from the 5250 interface, and passes input through the Workstation Function Manager to the RPG Runtime program
  - RPG Runtime executes and generates some output
  - Data is merged with the appropriate Display File record format (DSPF) definition and then sent to the actual 5250 device
- Browser WebFacing Tool) interface (view, starting from the left side and begin with browser)
  - The URL is sent to the application server (in this example, the WebSphere Application Server (WAS), linked to the registered Servlet which calls the RPG program - through the WebFacing Server, and on to OS/400 Workstation Data Management and on to the RPG program.

At this time the RPG application in this example is counted as Interactive work under the iSeries Interactive Feature processor support.

There is planned extensive training by IBM on how to use all the WSD support to encourage web-izing your older 5250 applications and to do so with first time success!



The major difference of the WebFacing Tool from the competition is that the WebFacing Tool is a development-time conversion tool while most of the other tools are run-time conversion tools.

5250 Intercept (run time) products are preferred when:

- The application is stabilized:
  - No change to application is desired
- Cannot change the application source
- Preference is to enhance runtime output versus development time source.

The WebFacing Tool (development time) is preferred when:

- The business is still actively evolving the application
- The developer is able to change the code to improve Web rendering
- Preference is to enhance source versus the. 5250 data stream
- The web application is performance sensitive
- The web application is cost sensitive

The WebFacing Tool (First Edition) supports display file DDS and does not support:

- UIM (User Interface Manager) help or panels
- Office product help
- OS/400 operating system screens or panels

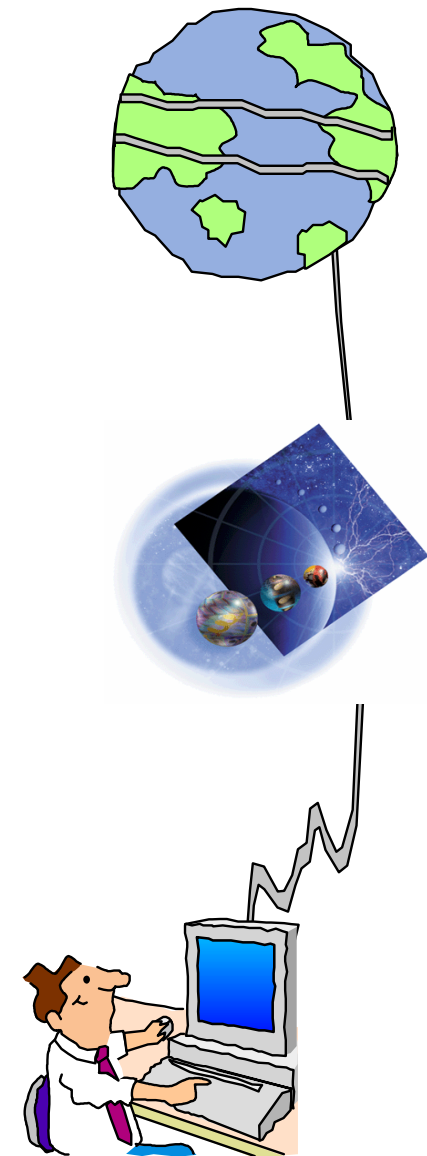
WebFacing applications continue to run in interactive mode.

# WebSphere Studio Standard Edition

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## Full Development Environment for Web

- Create and manage Web Projects
  - Group all files related to the Website
  - Check-in and Check-out files
  - Publish project to web server
  - Register any tool for any file type
  - Page Designer: WYSIWYG editing of HTML, JSPs
  - Wizards
- Integration with VA Java
  - Read classes, beans, Servlets from VA Java
  - Write classes, beans, Servlets to VA Java
  - Publish Website to VA Java for testing purposes



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WebSphere Studio (WSS) is IBM's standard client workstation development tool for the creation of Web based user interfaces with the following characteristics:

- Uses HTML and JSPs: creates standard Java objects therefore portable to any Java environment
- Fully integrated management of Web projects
- Limited change control management
- A WYSIWYG editor for creating browser interface

It is integrated with VisualAge Java:

- Can use objects created with VA Java
  - classes, beans and Servlets
- Objects created with WSS can be used in VA Java also
- Can publish Website to VA Java for testing purposes

## iSeries-Unique Support in Studio

- DSPF-like Palette Parts in Page Designer
  - HTML+JavaScript controls
  - Smart entry fields, labels, buttons, subfile, etc.
  - SmartGuides to generate JSP code to set attributes
- Program-call SmartGuide Framework
- Easy steps to the Web:
  - Describe \*PGM/\*SRVPGM inputs and outputs
  - Generate output:
    - ▶ HTML Form prompting for input
    - ▶ JSP to display output
    - ▶ Java Bean to call \*PGM or \*SRVPGM (using Common Connector Framework, the new standard for Java-to-existing connections)
    - ▶ Servlet to glue it all together
  - Use PageDesigner to iterate generated output
- Simplifies iSeries Deployment and Testing



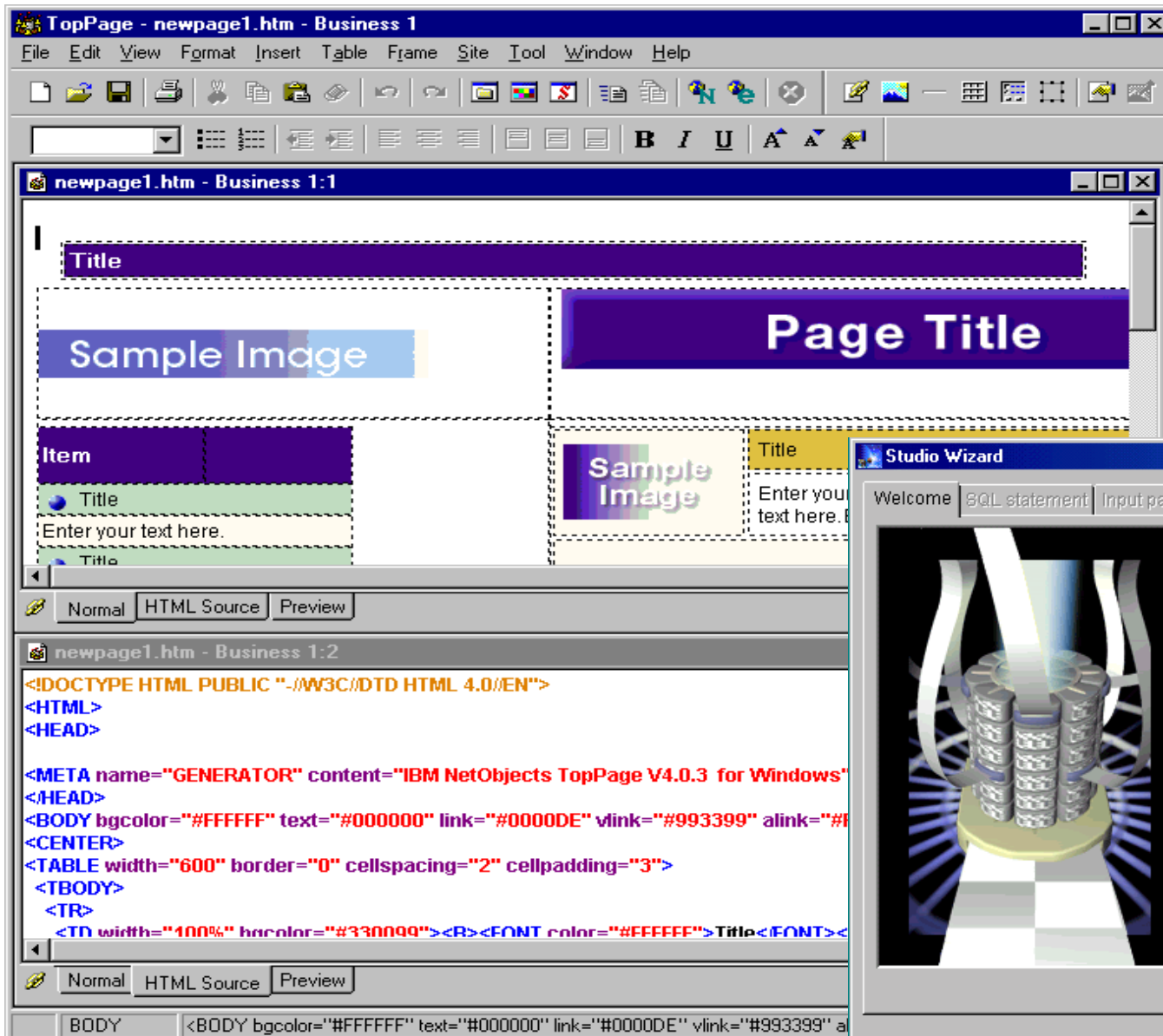
iSeries programmers have different expectations about coding for the browser. They want to do specific iSeries functions - things that display files usually do.

Affinity to iSeries was created to allow traditional programmers to easily create these traditional functions ... fill in the blanks, answer the prompts and under the covers, we'll build the HTML or the JSP.

Also, the Affinity support can be used a publishing facility ... SmartGuides to assist in publishing the newly created user interface to the Web.

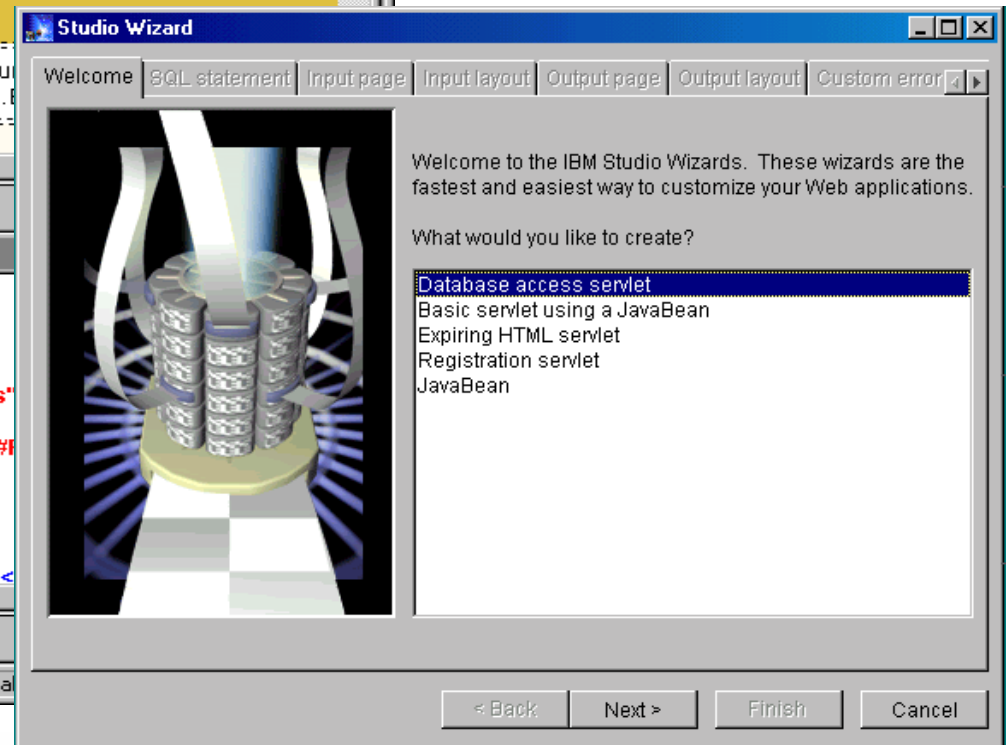
And, there are other functions.

The next foil give an example of some WebSphere Studio windows.



Top Page

Wizards



The technology to do the WYSIWYG function is based on the Top Page component of WSS. Look at the picture ... at the top, see what screen will look like ... at bottom, see sample HTML code being generated

There are a selection of wizards and SmartGuides that will help guide you through the creation of various calls to other functions, will create database accesses.

Most importantly, the Affinity piece also provides a wizard to assist in the publication of the Java objects created to the iSeries server.

Award winning Java development environment

Modern Integrated Development Environment (IDE)

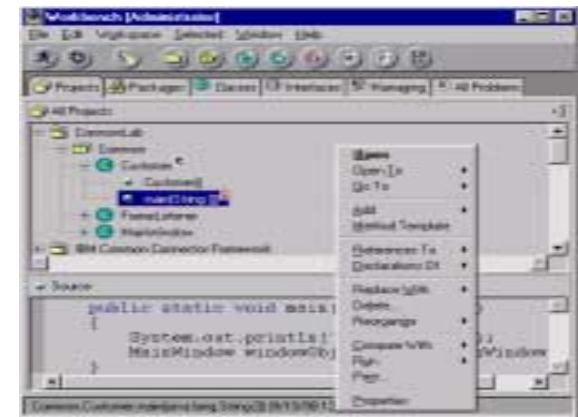
- Edit, browse, search, debug, ...

Code generation "builders":

- VisualAge Builder for WYSIWYG "construction by parts"

Enterprise ToolKit

- Toolbox for Java built-in
- Remote Export/Compile/Run/Debug
- DSPF-to-Swing Import Tool
- Program-Call SmartGuide
  - Generates Java Bean for calling \*PGM object from GUI
- DSPF-like Formatting Beans
- DFU-like Beans
- PDM-like Beans





VisualAge for Java is IBM's award winning Java development environment

Recognized within the Java development community as a fully-integrated environment, full function debug capability (will debug Java pgms along with RPG, COBOL, etc. - on multiple platforms). VisualAge for Java creates full suite of Java applications including browser applications

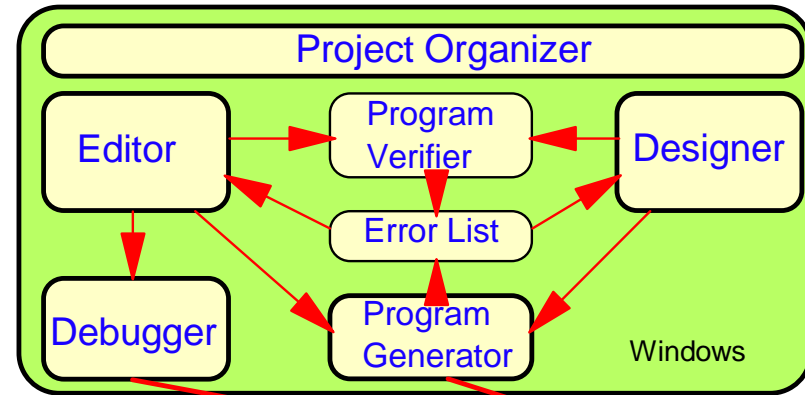
Enterprise ToolKit:

- Has special features for the creation of iSeries-like functions ... DFU fields, subfile SmartGuide, etc.
- Also has Java ToolBox included

GUI based editor, screen designer,  
debugger

For traditional application code

Now Supports Java



```
CODE - F:\ADTSWIN\SAMPLE.DSP
File Edit View Actions Options Windows Help
F:\ADTSWIN\SAMPLE.DSP
Row 209 Column 1 Replace
.....AAN01N02N03..Name+++++RLen++TDpBLinPosFunctions+++++
00206 A R SF
00207 A*%TS DD 19950930 180804 QSYS REL-U3R6M0 5716-CL1
00208 A SFL
00209 A OPTION 20 B 10 2
00209 DDS7419S Data type not valid.
00210 A CUSTNO R B 10 7REFFLD(CUSMSTR/CUSTNO *L
00211 A NAME R B 10 16REFFLD(CUSMSTR/NAME *LIB
00212 A CUTYPE R B 10 40REFFLD(CUSMSTR/CUTYPE *L
00213 A ARBAL R B 10 47REFFLD(CUSMSTR/ARBAL *LI
00214 A CRDLMT R B 10 61REFFLD(CUSMSTR/CRDLMT *L
00215 A*This record contains the source for a subfile control record
F:\ADTSWIN\SAMPLE.DSP saved
```

## CODE

- For the creation and maintenance of traditional applications - RPG, COBOL, etc. to run on iSeries machine
- Developer's environment is graphical and on the workstation
- Applications coded and maintained on the PC, then uploaded to the iSeries for compilation and execution

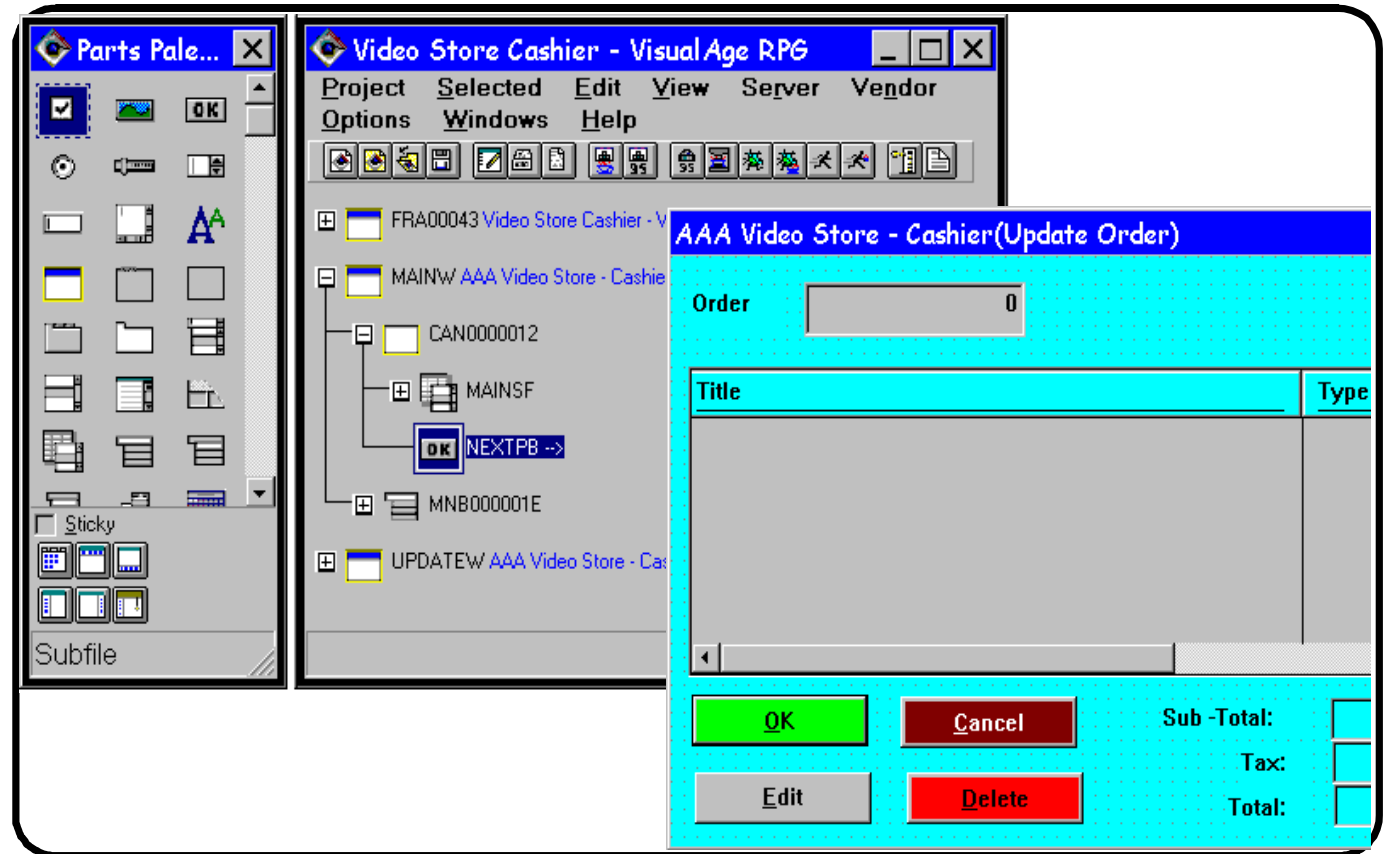
Three main components under control of CODE organizer (like PDM support)

1. editor
2. WYSIWYG screen design tool .. will generate DDS under the covers
3. Debug capability ... graphical front end to the system debug capability - multi-windowed so can see source while watching contents of variables and watching application execute

The latest releases of CODE support the editing of Java within the CODE editor.

## VisualAge for RPG

- Rapid prototyping
- Uses 3GL skills
- RPG with GUI
- modular programs/  
moving to parts



\*\*\*\* **Latest Update** \*\*\*\*

**Enter RPG code - produce Java source!!!**



## VisualAge RPG

This moves the RPG IV compiler from the iSeries server and onto the workstation for development.

Provides a graphical user interface builder to:

- Build client applications or client server applications using RPG on a PC
- Has the capability to generate Java source from the RPG code.
- When design is complete can generate Java source code
  - Move Java source code to any platform, issue the Java command to compile and it should execute
  - We recommend to do this when want to create applets ... not so much for full applications

## Host Components



Common Integrated Development Environment

WebSphere  
Studio

VisualAge  
for Java

CODE

VisualAge  
RPG

WebFacing,  
First Edition

Common Installation, JDK, Communications, Documentation

# C Compiler

Read source and includes from IFS or OS/400 source file members

Produce native or IFS spool file listings

Teraspace Phase 2 support

Improved NLS support for source file CCSIDs

Preprocessor output targeting specified file

A Qshell command for compiling

New LICOPT and CSOPT command keywords

Asynchronous signals

New compiler!

Offers many enhancements including more ANSI support

- Compliant with the finalized ANSI-X3J16/ISO WG21 1998 C++ Standard
- Template Library, and namespace support

A full licensed program product

- Replaces VAC++ cross compiler and native PRPQ compiler

New release (V5) of IBM Open Class libraries



Improved support for calls between Java and ILE RPG using the Java Native Interface (JNI)

New built-in functions

Free Form calculations

Several other enhancements



Improved support for calls between Java and ILE RPG using the Java Native Interface (JNI):

- A new data type: Object
- A new definition specification keyword: CLASS
- The LIKE definition specification keyword has been extended to support objects.
- The EXTPROC definition specification keyword has been extended to support Java procedures.
- New status codes.

New built-in functions:

- Functions for converting a number into a duration that can be used in arithmetic expressions: %MSECONDS, %SECONDS, %MINUTES, %HOURS, %DAYS, %MONTHS, and %YEARS.
- The %DIFF function, for subtracting one date, time, or timestamp value from another.
- Functions for converting a character string (or date or timestamp) into a date, time, or timestamp: %DATE, %TIME, and %TIMESTAMP.
- The %SUBDT function, for extracting a subset of a date, time, or timestamp.
- Functions for allocating or reallocating storage: %ALLOC and %REALLOC.
- Functions for finding an element in an array: %LOOKUP, %LOOKUPGT, %LOOKUPGE, %LOOKUPLT, and %LOOKUPLE.
- Functions for finding an element in a table: %TLOOKUP, %TLOOKUPGT, %TLOOKUPGE, %TLOOKUPLT, and %TLOOKUPLE.
- Functions for verifying that a string contains only specified characters (or finding the first or last exception to this rule): %CHECK and %CHECKR
- The %XLATE function, for translating a string based on a list of from-characters and to-characters.
- The %OCCUR function, for getting or setting the current occurrence in a multiple-occurrence data structure.
- The %SHTDN function, for determining if the operator has requested shutdown.
- The %SQRT function, for calculating the square root of a number.

A new free-form syntax for calculation specifications. A block of free-form calculation specifications is delimited by the compiler directives /FREE and /END-FREE

You can specify the EXTFILE and EXTMBR keywords on the file specification to control which external file is used when a file is opened.

Support for qualified names in data structures:

- A new definition specification keyword: QUALIFIED. This keyword specifies that subfield names will be qualified with the data structure name.
- A new definition specification keyword: LIKEDS. This keyword specifies that subfields are replicated from another data structure. The subfield names will be qualified with the new data structure name. LIKEDS is allowed for prototyped parameters; it allows the parameter's subfields to be used directly in the called procedure.
- The INZ definition specification keyword has been extended to allow a data structure to be initialized based on its parent data structure.

Enhanced error handling: three new operation codes (MONITOR, ON-ERROR, and ENDMON) allow you to define a group of operations with conditional error handling based on the status code.

Other enhancements have been made to this release as well. These include:

- You can specify parentheses on a procedure call that has no parameters.
- You can specify that a procedure uses ILE C or ILE CL calling conventions, on the EXTPROC definition specification keyword.
- The following /DEFINE names are predefined: \*VnRnMn, \*ILERPG, \*CRTBNDRPG, and \*CRTRPGMOD.
- The search string in a %SCAN operation can now be longer than string being searched. (The string will not be found, but this will no longer generate an error condition.)
- The parameter to the DIM, OCCURS, and PERRCD keywords no longer needs to be previously defined.
- The %PADDR built-in function can now take either a prototype name or an entry point name as its argument.
- A new operation code, ELSEIF, combines the ELSE and IF operation codes without requiring an additional ENDIF.

- The DUMP operation code now supports the A extender, which means that a dump is always produced - even if DEBUG(\*NO) was specified.
- A new directive, /INCLUDE, is equivalent to /COPY except that /INCLUDE is not expanded by the SQL preprocessor. Included files cannot contain embedded SQL or host variables.
- The OFLIND file-specification keyword can now take any indicator, including a named indicator, as an argument.
- The LICOPT (licensed internal code options) keyword is now available on the CRTRPGMOD and CRTBNDRPG commands.
- The PREFIX file description keyword can now take an uppercase character literal as an argument. The literal can end in a period, which allows the file to be used with qualified subfields.
- The PREFIX definition specification keyword can also take an uppercase character literal as an argument. This literal cannot end in a period.

# ILE RPG Free Form Calcs

```
*..1.....2.....3.....4.....5.....6.....7.....  
/free  
    read  file;                //Get next record  
    down not %eof(file);      //Keep looping while we have  
                                //a record  
  
    if %error;  
        display 'The read failed';  
        leave;  
    else;  
        chain(n)name database data;  
        time = hours *num_employees  
                + overtime_saved;  
        pos = %scan (' ','name);  
        name = %xlate(upper:lower:name);  
        exsr handle_record;  
        read file;  
    endif;  
    enddo;  
begsr handle_record;  
    eval(h)time = time + total_hours_array (empno);  
    temp_hours = total_hours -excess_hours;  
    record_transaction();  
endsr;  
/end-free
```

To create a free-form calculation specification, specify /free in positions 7 to 11 and leave positions 12 to 80 blank. The free-form calculation block ends when you specify /end-free .

In a free-form statement, the operation code does not need to begin in any specific position. Any extenders must appear immediately after the operation code on the same line, within parentheses. There must be no embedded blanks between the operation code and extenders. Following the operation code and extenders, you specify Factor 1, Factor 2, and the Result Field. If any of these are not required by the operation, you may leave them out. You can freely use blanks and continuation lines in the remainder of the statement. Each statement must end with a semicolon. The remainder of the record after the semicolon must be blank or contain an end-of-line comment.

# ILE COBOL Compiler

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UCS-2 (UNICODE) Support

Java Interoperability

Added functionality for porting

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National data, a new type of data item, has been added to provide support for the coded character set specified in ISO/IEC 10646-1 as UCS-2. The code set is the basic set defined in the UNICODE standard.

- UCS-2 character set  
This coded character set provides a unique code for each character appearing in the principal scripts in use around the world. Each character is represented by a 16-bit (2-byte) code.
- National data  
This new type of data item specifies that the item contains data coded using the UCS-2 code set. An elementary data item whose description contains a USAGE NATIONAL clause, or an elementary data item subordinate to a group item whose description contains a USAGE NATIONAL clause, is a national data item.
- INTLPADCHAR compiler option and PROCESS statement option  
This option allows you to specify three values: the SBCS padding character, DBCS padding character, and national padding character. The appropriate padding character is used when a value is moved into a national datatype item and does not fill the national datatype item completely.
- ALL national literal  
Allows the word ALL wherever a national hexadecimal literal is allowed, so that for example you could move all UCS-2 blanks into a national data item.
- PROCESS statement option NATIONAL  
When this option is specified, elementary data items defined using the picture symbol N will have an implied USAGE NATIONAL clause. A USAGE DISPLAY-1 clause will be implied for these items if the compiler option is not used.
- National hexadecimal literals  
containing national data values may be specified using the syntax: NX"hexadecimal-character-sequence..."
- Figurative constants  
The figurative constant SPACE/SPACES represents one or more UCS-2 single byte space characters (U+0020) when used with national data items.



## JAVA interoperability support

- QCBLLESRC.JNI file

This file provides the same definitions and prototypes that are provided in the JNI.h file, but written in COBOL rather than C.

- Data mapping between Java <sup>™</sup> and COBOL datatypes

## Mainframe portability support

- NOCOMPASBIN/COMPASBIN PROCESS statement option indicates whether USAGE COMPUTATIONAL or COMP has the same meaning as USAGE COMP-3 or USAGE COMP-4.

- NOLSPTRALIGN/LSPTRALIGN PROCESS statement option indicates whether data items with USAGE POINTER or PROCEDURE-POINTER are aligned at multiples of 16 bytes relative to the beginning of the record in the linkage section.

- Complex OCCURS DEPENDING ON (ODO) support. The following constitute complex ODO:

- Entries subordinate to the subject of an OCCURS or an ODO clause can contain ODO clauses (table with variable length elements).
- A data item described by an ODO can be followed by a non-subordinate data item described with ODO clause (variably located table).
- Entries containing an ODO clause can be followed by non-subordinate items (variably located fields). These non-subordinate items, however, cannot be the object of an ODO clause.
- The location of any subordinate or non-subordinate item, following an item containing an ODO clause, is affected by the value of the ODO object.
- The INDEXED BY phrase can be specified for a table that has a subordinate item that contains an ODO clause.

The LICOPT parameter has been added to the CRTCBMOD and CRTBNDCBL commands to allow advanced users to specify Licensed Internal Code options.

SEU now supports:

- New V5R1 database Trigger and Constraints support
- New RPGLE CF Format and Prompt
- Operation Codes of ELSEIF and FOR to use the CX Prompt instead of the C Prompt in RPGLE
- Source type CPP to have a default of lower case input
- Expands the spool number size from Bin (16) to Bin (31)

RLU: Printer File DDS Keywords Support.

SUPC: Expands the spool number size from Bin (16) to Bin (31)

PDM: Added new functions FNDSTRPDM2 and FNDSTRPAR2 commands to search by using a list of members to search

DFU: Trigger and constraint violation rollback information processing and messaging to inform user

**Application Development Manager now supports:**

Up to 250 libraries

Backup of user data files for new release installation

# Other Application Development Enhancements

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# Portable Application Solution Environment

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64-bit application support

Translated messages for OS/400 PASE runtime libraries, shells, and utilities

SQL CLI server mode support

Documentation for OS/400 PASE runtime, shells, and utilities included in Information Center

Header files and exports files for OS/400 PASE extensions to AIX runtime shipped in OS/400 option 30

Storage management performance improved

New and changed Utilities

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# OS/400 PASE

An integrated OS/400 runtime for porting selected UNIX applications

- Integrated with OS/400 file systems and work management

Exploits PowerPC's ability to switch runtime modes for applications

Enhanced to support AIX 4.3 64-bit application model

Enabled for National Language Versions

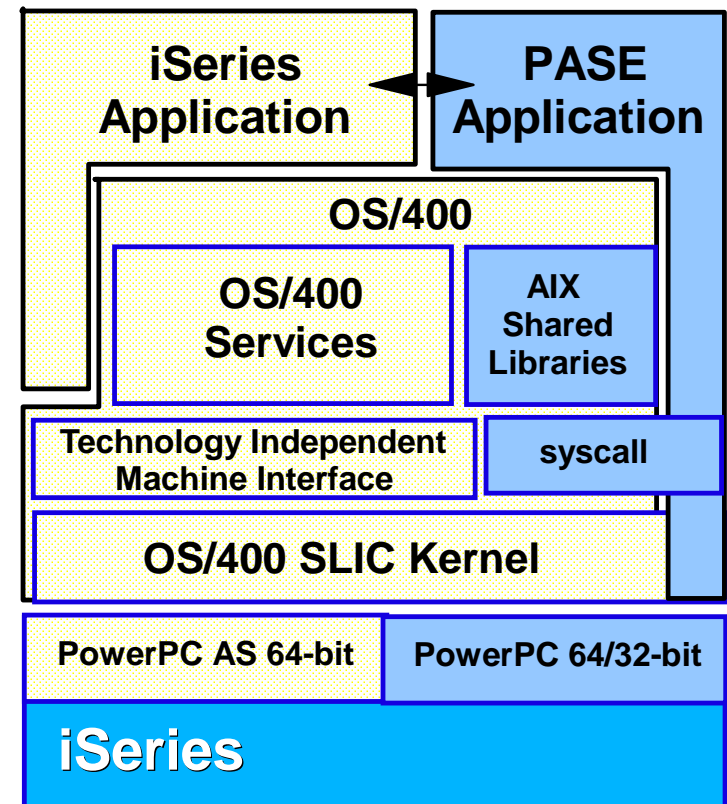
Translated messages for OS/400 PASE runtime libraries, shells, and utilities

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*iSeries Management, UNIX Development*



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The OS/400 Portable Application Solutions Environment (OS/400 PASE) is a technology designed to expand the solutions portfolio of iSeries. OS/400 PASE is an integrated runtime environment that simplifies UNIX\* application porting.

The iSeries broad base of applications is continually enhanced by new applications coming to the platform from a variety of sources. Up to now, the Integrated Language Environment (ILE) accounted for the majority of C or C++ application ports, many originating on UNIX systems. While many applications continue to be ported to iSeries in this manner, other applications, specially those with highly compute-intensive demands now have the option to use OS/400 PASE.

OS/400 PASE provides a broad set of AIX interfaces, in a runtime that allows many AIX binaries to execute directly on the PowerPC processor of iSeries. The strategy for OS/400 PASE is to use the new technology to enhance and expand its solutions portfolio in specific industry and application segment targets.

OS/400 PASE is supported on all iSeries models, as well as any AS/400e servers 6xx or Sxx, or later. OS/400 PASE applications run directly on the hardware and take advantage of OS/400 services such as file systems, security and DB2 Universal Database. OS/400 PASE applications run in a normal OS/400 job and are managed using standard OS/400 operations and management facilities.

Some of the significant enhancements to OS/400 PASE in V5R1 include:

- Support of the AIX 4.3 64-bit application model
- National Language Version (NLV) enablement - including translated message catalogs for IBM supplied runtime libraries and utilities
- Documentation for OS/400 PASE runtime, shells, and utilities in the IBM iSeries Information Center
- Header and export files for OS/400 PASE extensions now packaged with OS/400 Portable Application Solutions Environment, option 33.
- SQL Call Level Interface (CLI) server mode support
- Additional locales, runtime APIs and utilities
- Updated versions of the AIX C++ and FORTRAN language runtime libraries

For more information, see:

- <http://www.redbooks.ibm.com> (search on PASE)
- <http://www.iseries.ibm.com/developer/factory/pase>
- the IBM iSeries Information Center at: <http://www.ibm.com/eserver/series/infocenter>

Note: The updated for V5R1 Domain Name Services (DNS) support requires V5R1 Portable Application Solutions Environment be installed.

## Java Virtual Machine

- Integrated in OS/400 (V4R2 and beyond)

## iSeries Developer Kit for Java (JDK)

- V4R4 supports 1.1.6, 1.1.7, and 1.2.2
- V4R5 supports 1.1.8, 1.2.2, 1.3
- V5R1 supports 1.1.8, 1.2.2, 1.3

## iSeries Toolbox for Java

- Programmer tool to access iSeries-specific resources
- Open Source version also available (JTOpen)
  - <http://www.ibm.com/developerworks/opensource>



## WebSphere Development Studio for iSeries

- Application Development Tools for Cobol/RPG (Code/400)
- Java and Web development tools



# iSeries Developer Kit for Java (JDK)

IBM  server iSeries

Java Currency: 1.1.8, 1.2.2, 1.3

1.3.1 upgrade off release

JIT 3.6 (default exec mode)

Single object 4 GB (removal of 16 MB limit)

System Programming in Java

JVMPI infrastructure

Debug enhancements

Enhanced RAWT

Performance Tuning

Designed for Server environments

Direct Execution & JIT

Mixed Mode execution

Concurrent garbage collection

Optimized JDBC

Remote AWT

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Options for Java 1.1.8 and Java2 Standard Editions (J2SE) 1.2.2 and 1.3.0 are shipped with the V5R1 Developer Kit for Java (5722-JV1), providing concurrent support for all three major versions of Java (1.1.8, 1.2, and 1.3).

Performance enhancements in V5R1 include:

- Improved garbage collection (GC) parallelism
- Improved code optimizations and heap allocations, including cross jar inlining
- JDBC and floating-point
- Several limits to growth have been removed. Most notably, the maximum object size has increased from 16 MB to 4 GB.
- Operations Navigator enhancements include support for displaying the properties of Java classes and jar files, the ability to compile Java files, interactive support for Input and Output, as well as automating RAWT connections when launching Java programs from Operations Navigator.
- For additional Java information, including service requirements, refer to the online publication IBM Developer Kit for Java from the following iSeries Book Server at:
  - <http://publib.boulder.ibm.com/pubs/html/iseriess/inforcenter.htm>

# IBM Toolbox for Java

OS/400 use by Management Central and Install

Thread enabled program and command calls

Unity enablement and BIDI support

Currency: JDBC, IFS, Management Central, SSL,  
XA

JDBC Packed/Zoned support

Data Stream compression

HTML manipulation enhancements

Performance improvements: connection pools, list  
processing, JDBC, File I/O, data conversions



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V5R1 enhancements to the Toolbox include:

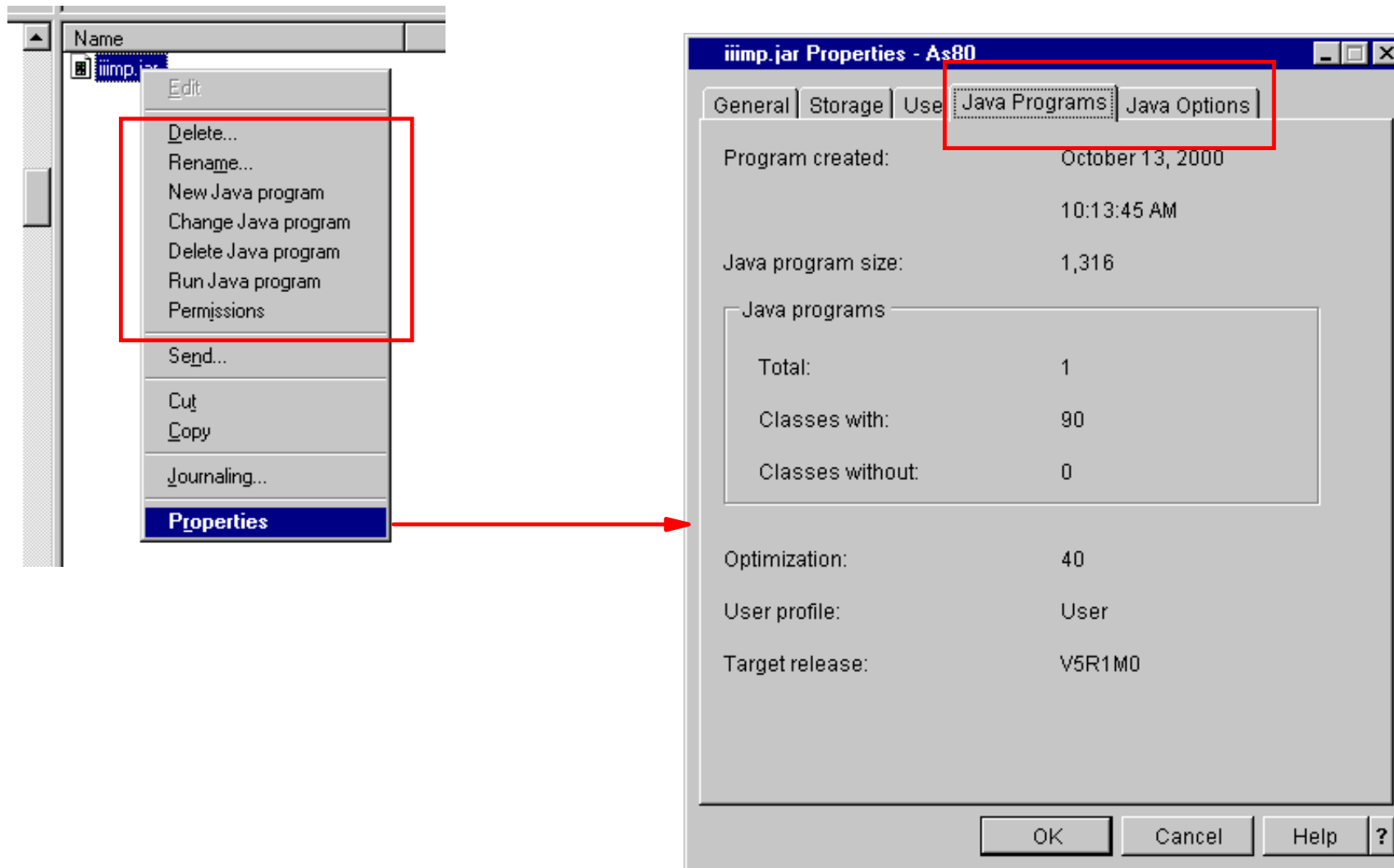
- A new set of classes in the resource package provide a generic framework and consistent programming interface for working with various iSeries objects.
- Bidirectional text conversion between iSeries and Java formats is now supported.
- JDBC 2.0 Optional Package extensions are now supported.
- A new set of classes in the report writer package provide a programming interface for creating formatted documents in Adobe's PDF format or documents that can be sent directly to HP PCL printers attached directly to the iSeries or to the network.
- A new set of print classes that enable Java applications to write data to iSeries spool files in the form of records and use existing iSeries formatting tools to format the records of data to be printed.
- Classes are included to work with iSeries environment variables.
- Classes in the HTML package are improved to increase the variety of HTML tags you can include in your Java programs.
- Classes are included to configure AS/400 NetServer.

Remember, the iSeries Toolbox for Java is at Open source community version of AS/400 Toolbox for Java JTOpen 2.0 level as it has been available in the at the following URL since mid 2000.

- (<http://oss.software.ibm.com/developerworks/opensource/>)

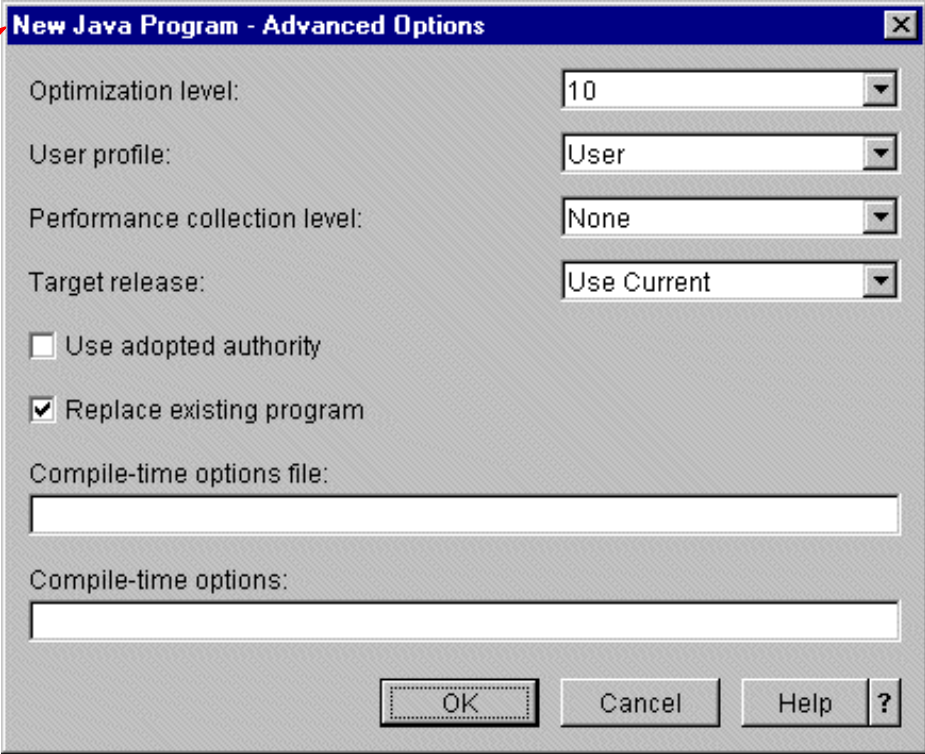
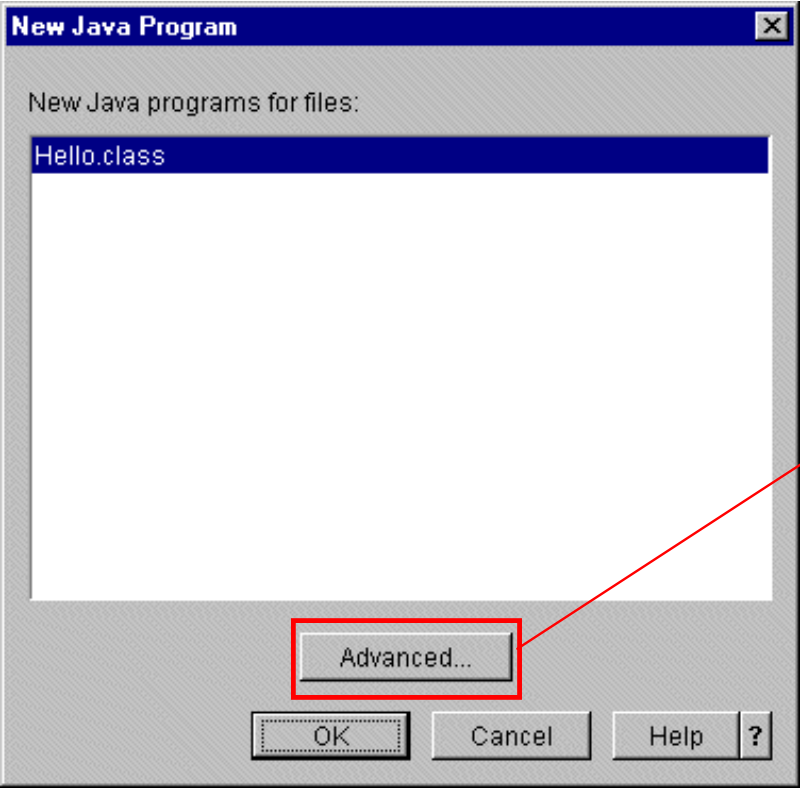
# Java Properties Interface

*New Support - AdditionalDisplay Java Program Information*



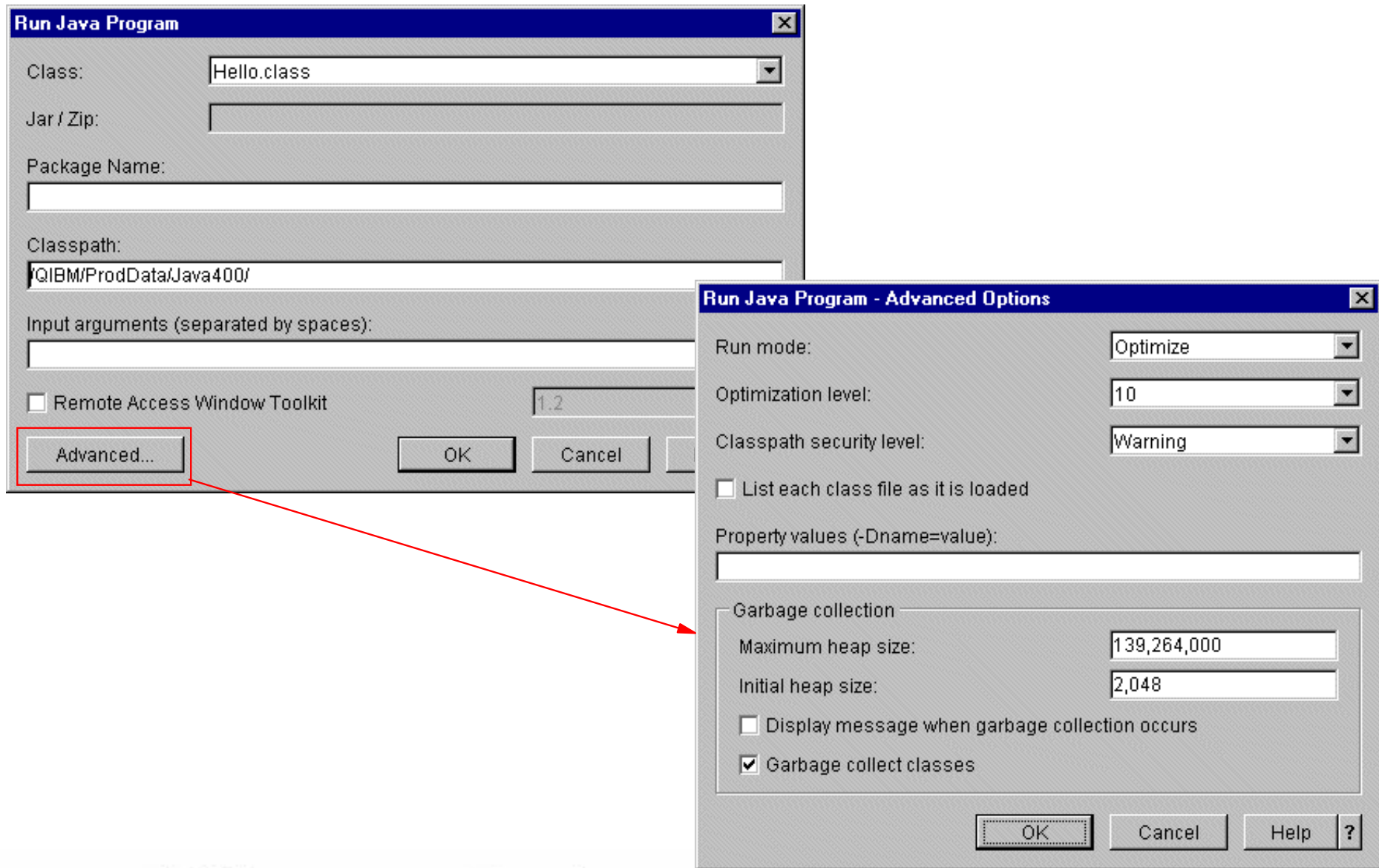
# Create Java Program

## Graphical Interface



# Run Java Program

## Graphical Interface



The **Run Java Program - Advanced Options** dialog configures the advanced properties of a Java program on OS/400.

**Run mode** specifies which mode to use to run Java classes. The possible options are:

- **Interpreted only:** specifies whether all Java class files should run interpretively. If you use this option, all Java class file bytecodes are interpreted when invoked, regardless of what OPTIMIZE value was used when the associated Java program was created.
- **JIT only:** specifies that all Java class files run using the Just-In-Time (JIT) compiler, regardless of what OPTIMIZE value was used when the associated Java program was created.
- **Direct execution:** specifies that all Java class files run in the direct execution mode at the OPTIMIZE value that was used when the associated Java program was created.
- **Optimize:** specifies that Java class files run interpretively depending on the value that is specified for the OPTIMIZE parameter.

**Optimization level** specifies the optimization level of the Java program that is created if no Java program is associated with the Java class file. The created Java program remains associated with the class file after the Java program has been run. Possible values are 10, 20, 30, 40 and JIT.

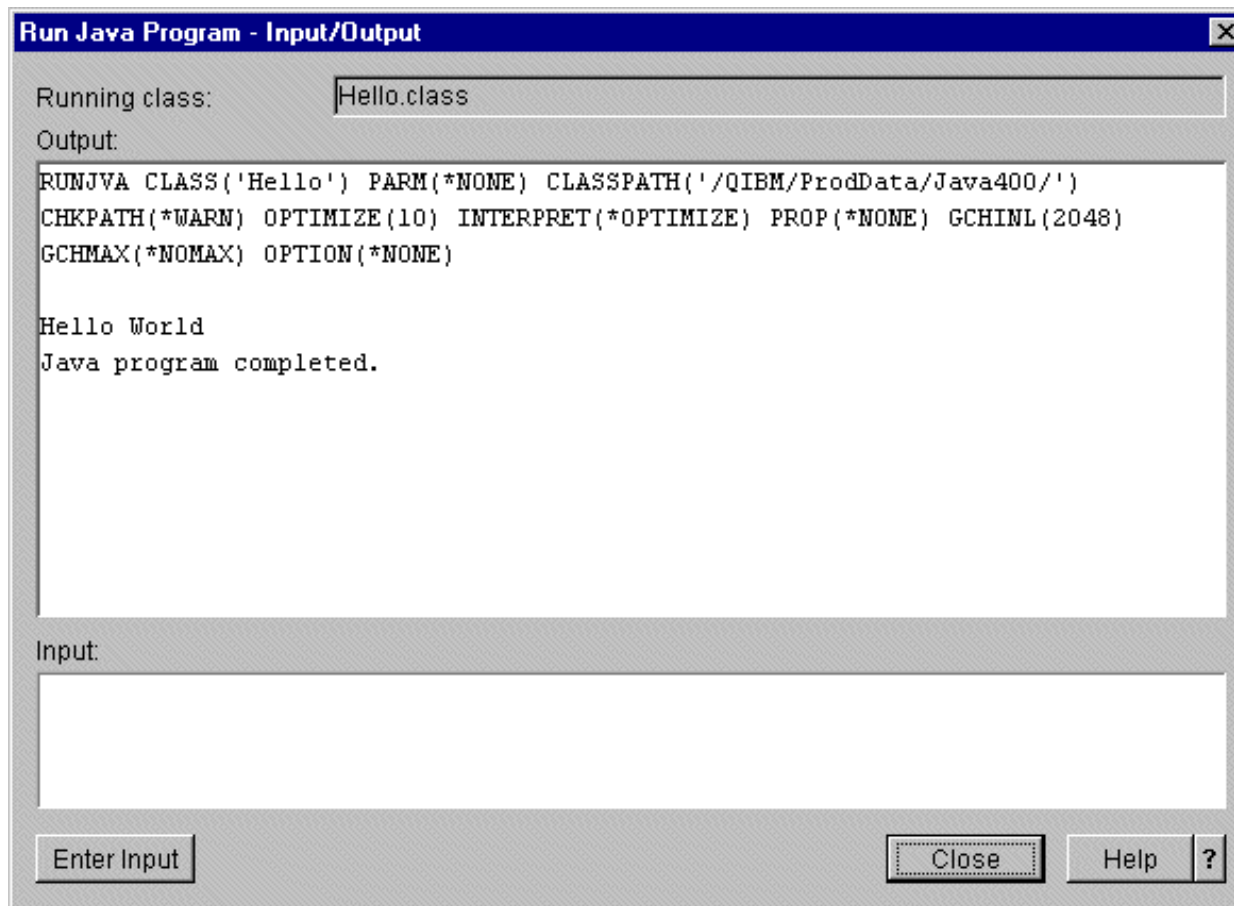
**Classpath security level** specifies the level of warnings that are given for directories in the CLASSPATH that have public write authority. A directory in the CLASSPATH that has public write authority may cause a security exposure. An exposure could occur, because an undesired class may be inserted into the directory that is found before the official class.

**Property values** specifies the values assigned to the Java program properties. You can assign up to 100 property values. The total characters specified must not exceed 5000. If you specify more than one property, you must separate each property from the next with a space.



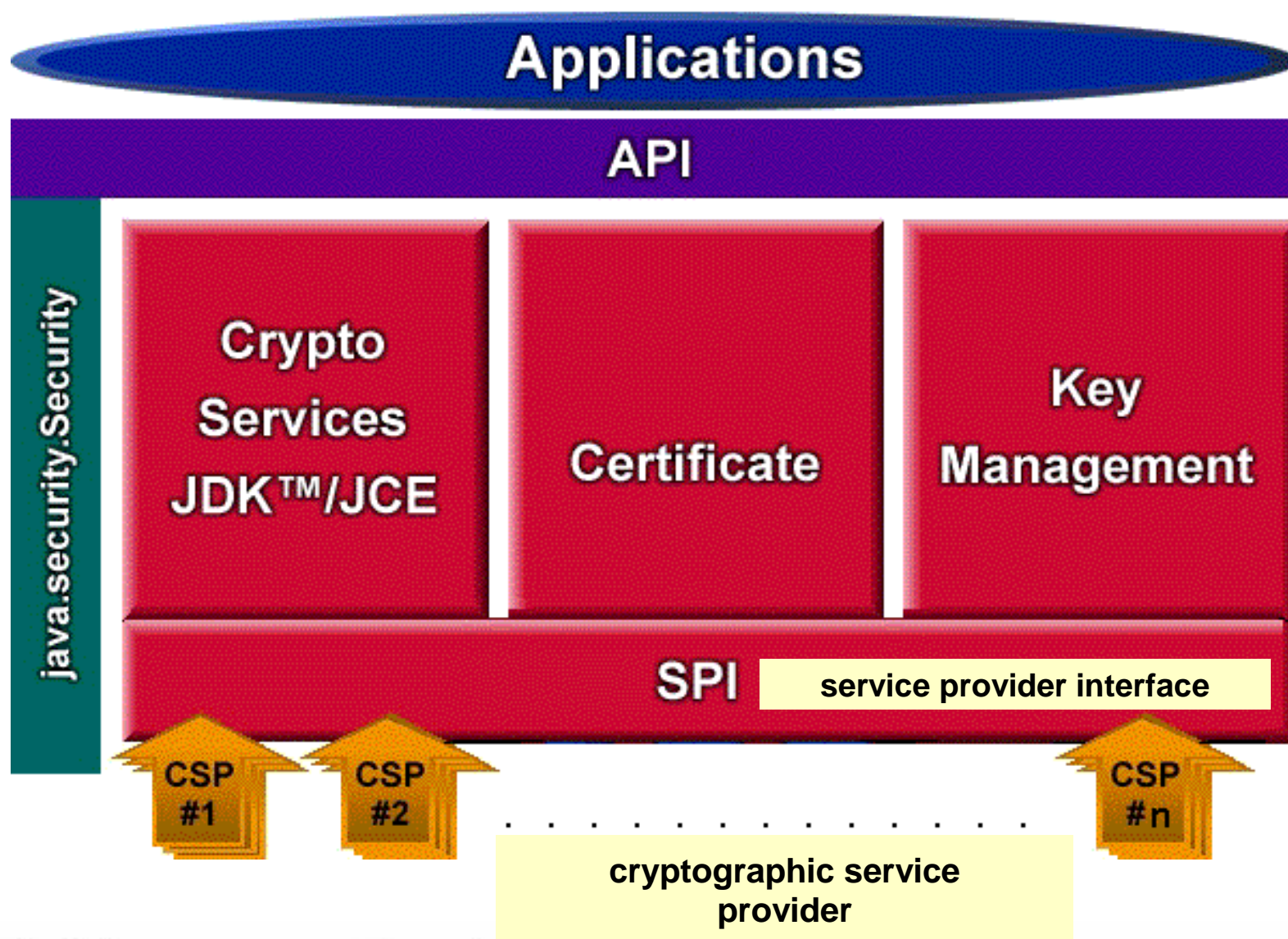
# Run Java Program

## *Graphical Interface*



# Java Cryptography Extension (JCE)

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The Java Cryptography Extension (JCE) 1.2.1 is a package that provides a framework and implementations for :

- Encryption
- Key generation
- Key agreement
- Message Authentication Code (MAC) algorithms

Support for encryption includes symmetric, asymmetric, block, and stream ciphers. The software also supports secure streams and sealed objects.

The level of encryption is controlled by the Cryptographic Access Provider Product. This is available in two versions, 5722-AC2 and 5722-AC3. The 5722-AC3 product allows all of the encryption algorithms. The 5722-AC2 product does not allow Triple-DES, and limits symmetric algorithms to 56 bits and asymmetric algorithms to 1024 bits.

With the exception of the restrictions on 5722-AC2 already mentioned, the IBM JCE Provider supports the following algorithms: DES, Triple-DES, RC2, RC4, Blowfish, RSA, Diffie-Hellman, DSA, Mars, MD2, MD5, SHA-1 and Seal.

# Java Authentication and Authorization Service IBM @server iSeries

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Java Authentication and Authorization Service (JAAS) provides an extended security architecture of the Java 2 Platform with additional support to authenticate and enforce access controls upon users:

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The Java Authentication and Authorization Service (JAAS) is a standard extension to the Java 2 Software Development Kit (J2SDK), Standard Edition. Currently, J2SDK provides access controls that are based on where the code originated and who signed the code (code source-based access controls). It lacks, however, the ability to enforce additional access controls based on who runs the code. JAAS provides a framework that adds this support to the Java 2 security model.

The JAAS API is used by IBM and Sun Microsystems, Inc. as an extension to the J2SDK, version 1.3. IBM and Sun are introducing this extension to allow the association of a specific user or identity to the current Java thread. This is done by using `javax.security.auth.Subject` methods and, optionally, with the underlying operating system thread using `com.ibm.security.auth.ThreadSubject` methods.

The JAAS implementation on iSeries 400 is compatible with the implementation of Sun Microsystems, Inc

New command Analyze Java Program (ANZJVAPGM):

- Lists classes
- Shows current status

Changes to Create Java Program (CRTJVAPGM) command

Minor changes to Display Java Program (DSPJVAPGM) command

The Analyze Java Program (ANZJVAPGM) command analyzes a Java program attached to a JAR file, lists its classes and shows the current status of each class.

Keywords:

- CLSF: Class file or JAR file
- CLASSPATH: Specifies the path used to locate classes referenced by the Java program being analyzed. Directories are separated by colons.
- JDKVER: Specifies the Java Development Kit (JDK) version to use when analyzing the Java program.
- DETAIL: Specifies the amount of detail to show.
- OUTPUT: Specifies whether the output from the command is shown at the requesting workstation or printed with the job's spooled output.

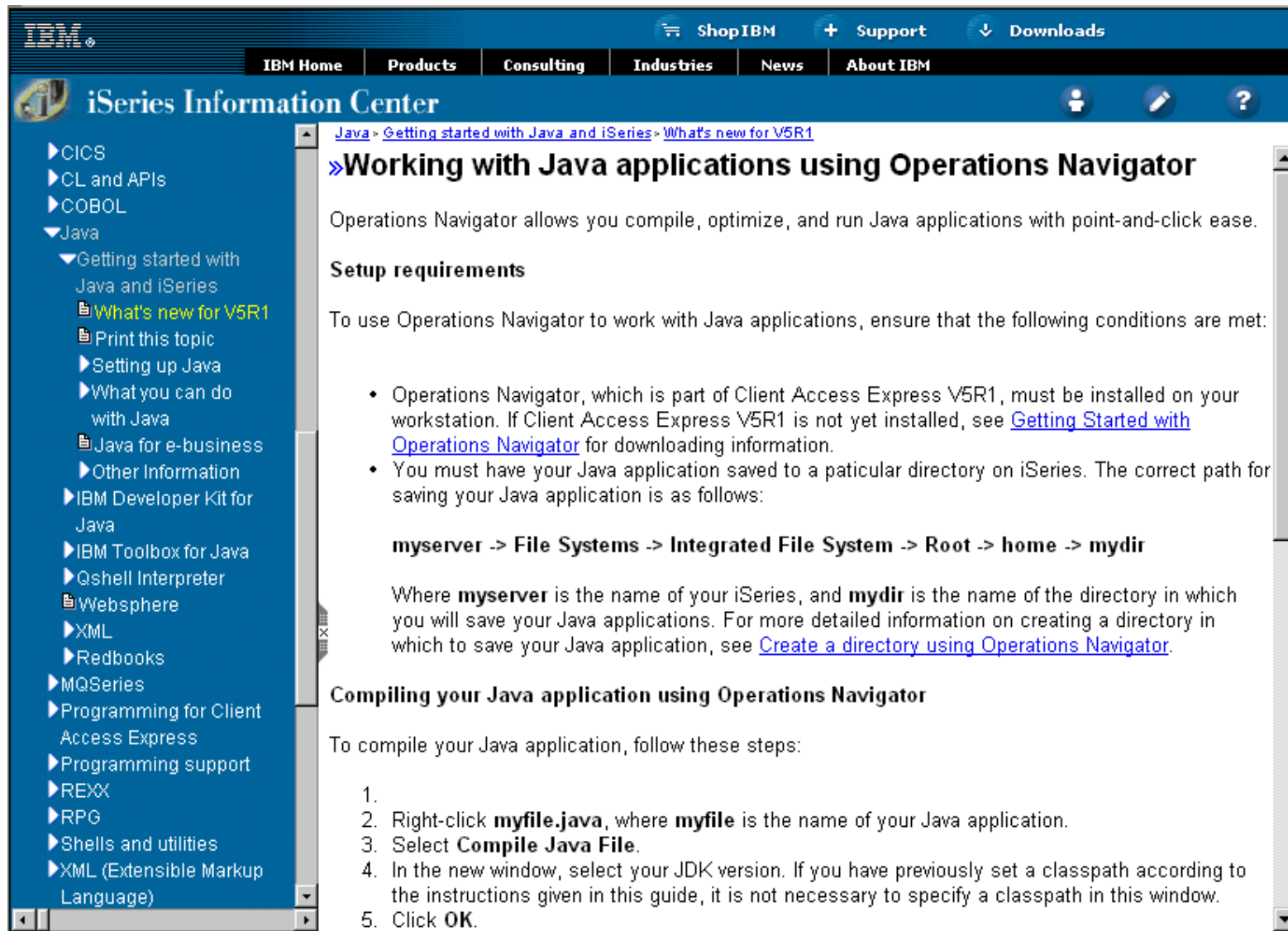
The CRTJVAPGM command add three new keywords to be displayed when Additional Parameters are displayed:

- CLASSPATH keyword added to allow the user to provide a specific classpath to be used when doing inter-JAR binding.
- JDKVER keyword can be used to specify a specific JDK to be used when doing inter-JAR binding.
- LICOPTFILE keyword add the capability to specify a file that contains License Internal Code options.

Both CLASSPATH and JDKVER may be used at the same time. The default value for both keywords is \*NONE.

The DSPJVAPGM command previously required no authority to the IFS file to display the Java program. In V5R1, \*R on the file will be required.

## Java and Operations Navigator



The screenshot shows the IBM iSeries Information Center website. The top navigation bar includes links for Shop IBM, Support, and Downloads. Below this is a secondary navigation bar with links for IBM Home, Products, Consulting, Industries, News, and About IBM. The main content area is titled "iSeries Information Center" and features a left-hand navigation menu with categories like CICS, CL and APIs, COBOL, and Java. The selected article is "Working with Java applications using Operations Navigator". The article text describes how Operations Navigator allows for easy compilation, optimization, and execution of Java applications. It lists setup requirements, such as having Client Access Express V5R1 installed and saving the Java application to a specific directory on the iSeries. The directory path is given as `myserver -> File Systems -> Integrated File System -> Root -> home -> mydir`. The article also provides a list of steps for compiling the Java application using Operations Navigator.

IBM Home Products Consulting Industries News About IBM

iSeries Information Center

Java -> Getting started with Java and iSeries -> What's new for V5R1

### » Working with Java applications using Operations Navigator

Operations Navigator allows you compile, optimize, and run Java applications with point-and-click ease.

#### Setup requirements

To use Operations Navigator to work with Java applications, ensure that the following conditions are met:

- Operations Navigator, which is part of Client Access Express V5R1, must be installed on your workstation. If Client Access Express V5R1 is not yet installed, see [Getting Started with Operations Navigator](#) for downloading information.
- You must have your Java application saved to a particular directory on iSeries. The correct path for saving your Java application is as follows:

**myserver -> File Systems -> Integrated File System -> Root -> home -> mydir**

Where **myserver** is the name of your iSeries, and **mydir** is the name of the directory in which you will save your Java applications. For more detailed information on creating a directory in which to save your Java application, see [Create a directory using Operations Navigator](#).

#### Compiling your Java application using Operations Navigator

To compile your Java application, follow these steps:

- 1.
2. Right-click **myfile.java**, where **myfile** is the name of your Java application.
3. Select **Compile Java File**.
4. In the new window, select your JDK version. If you have previously set a classpath according to the instructions given in this guide, it is not necessary to specify a classpath in this window.
5. Click **OK**.