



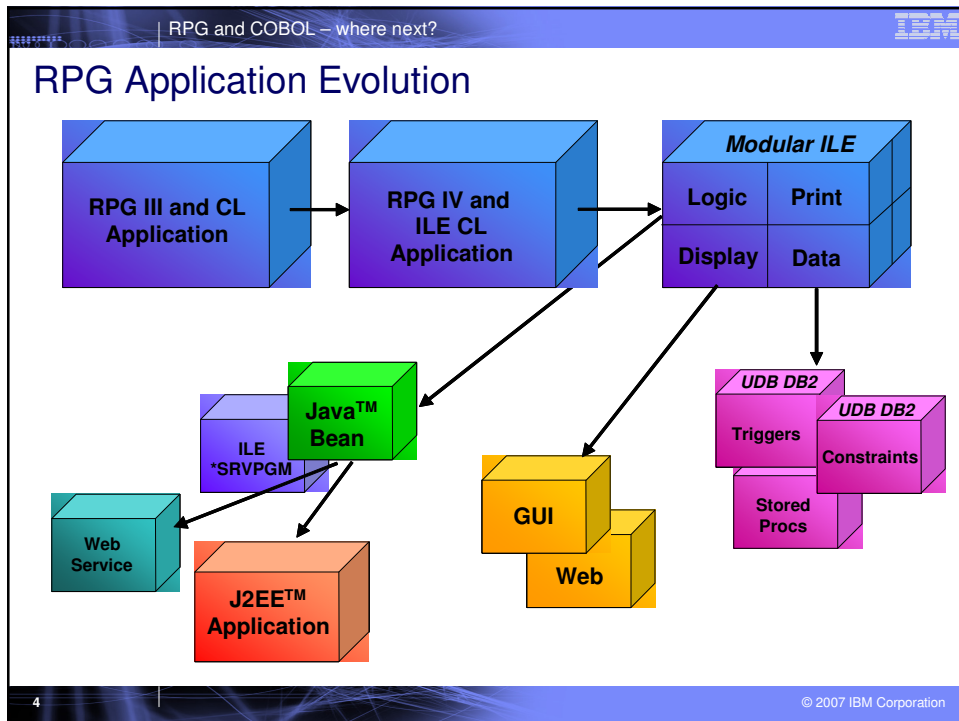
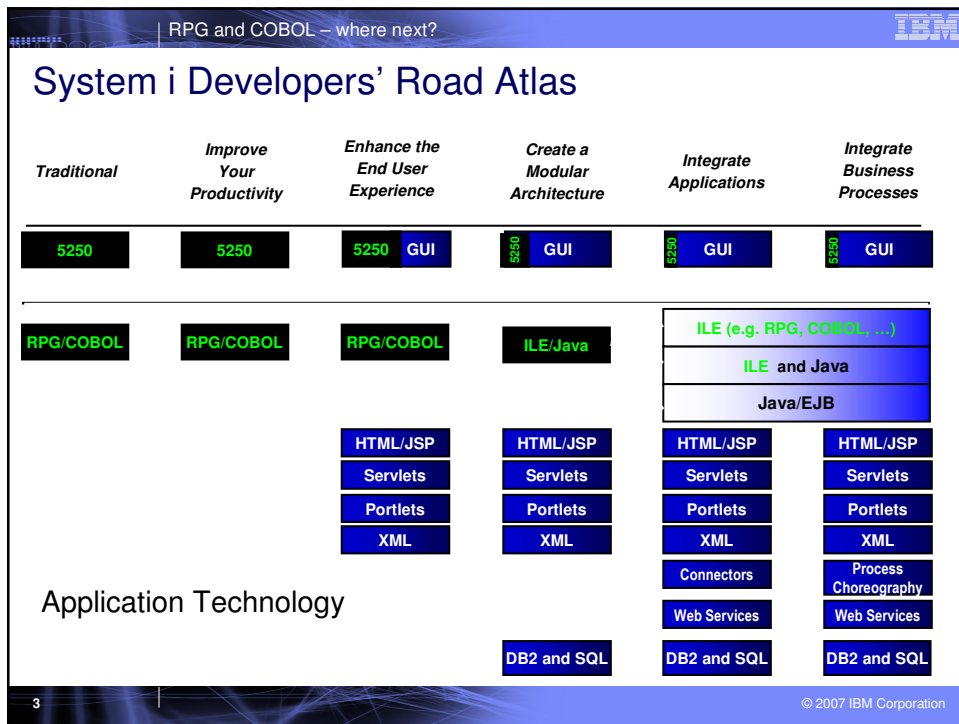
RPG and COBOL Now *Where next for i5/OS Development?*

Bruce Wassell
IBM Innovation Centre
Hursley Park



Agenda

1. The latest on DB2 Web Query
2. **RPG and COBOL now, where next for i5/OS development?**
3. JAVA, J2EE, Web Services and SOA
4. Brighten up the front end: V7.0 of HATS, WebFacing and WDHT
5. Getting into the Web: JSF, EGL and PHP for i5/OS
6. What about .NET? Interoperability with i5/OS and DB2



Free Format RPG

```

C/FREE
  read file;           // Get next record
  dow not %eof(file);  // Keep looping while we have
                      // a record

  if %error;
    dsply '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

```

RPG Support for XML

- Introduced with V5R4
- New op code XML-SAX initiates a SAX parse for an XML document
- New op code XML-INTO reads the contents of an XML document directly into an RPG variable
- *XMLSAX can be specified to enable an array of event names that can be used while debugging an XML-SAX event handling procedure

RPG and COBOL – where next?

EXAMPLE: XML-INTO variable %XML(xml_document)

```

D*****
D info          DS
D  name          10A
D  val           5I 0 DIM(2)
D*****

```

myfile.xml

```

<info>
  <name>Bruce</name>
  <val>10</val>
  <val>-5</val>
</info>

```

Target field

```

/free
XML-INTO info %XML('myfile.xml' : 'doc=file');
// info now has the value
//   name = 'Bruce'
//   val(1) = 10
//   val(2) = -5

```

Source of XML

Options

7

© 2007 IBM Corporation

RPG and COBOL – where next?

XML-SAX: Event-driven process

XML Info.

↓

RunTime reads Records!

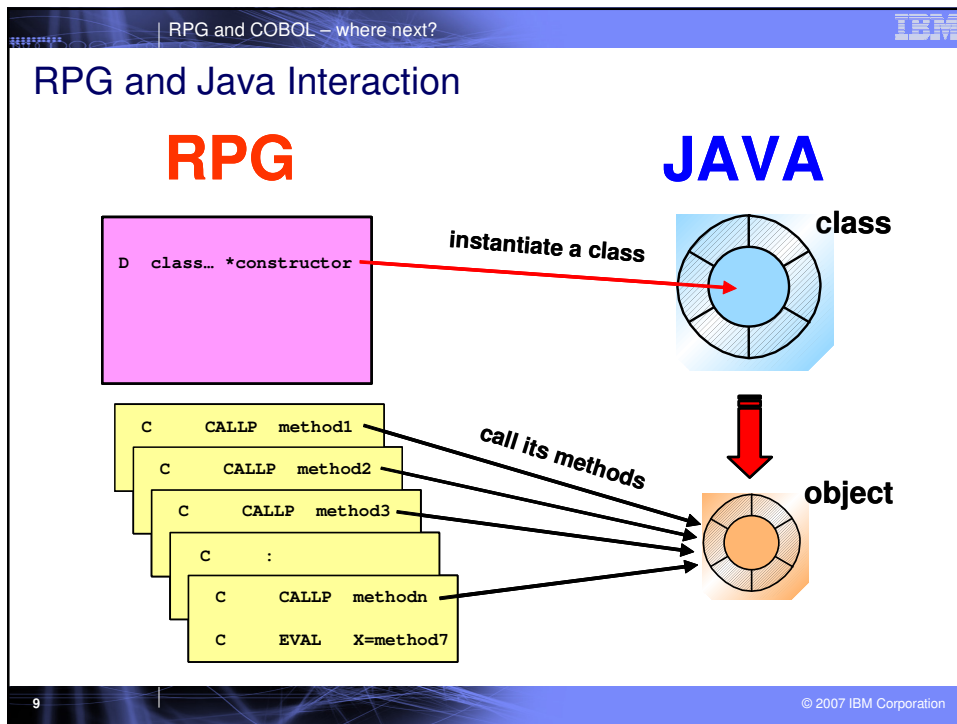
Call RPG procedure to process

For every SAX event:

- Start XML Document
- Start XML Element
- XML attribute
- End XML Element
- End XML Document
- XML exception
- etc...

8

© 2007 IBM Corporation



RPG and COBOL – where next?

Integrating Web Services and RPG or COBOL

- Deploy an RPG application as Web Service *provider*
 - Make your core applications available to others as a Web service
 - Uses SOAP engine in WebSphere Application Server and a Java wrapper to the RPG application
 - With V5R4, a new wizard in WDSC generates a Web service from RPG source in a single step
- Enable an RPG application as a *requester* to a Web Service
 - Link your core applications to Web applications and services provided by others
 - With V5R4 XML Toolkit now provides open APIs based on Apache AXIS to connect RPG out to a Web service

10

© 2007 IBM Corporation

XML Support in COBOL

■ V5R3

- New statement, XML PARSE, parses an XML document into its individual pieces and passes each piece, one at a time, to a user-written processing procedure

■ V5R4

- New statement, XML GENERATE, converts the content of COBOL data records to XML format

Examples

```
XML PARSE XMLDOCUMENT
  PROCESSING PROCEDURE XMLEVENT-HANDLER
ON EXCEPTION
  DISPLAY 'XML document error ' XML-CODE
  STOP RUN
NOT ON EXCEPTION
  DISPLAY 'XML document was successfully parsed.'
END-XML
```

```
XML GENERATE XML-OUTPUT FROM SOURCE-REC
  COUNT IN XML-CHAR-COUNT
ON EXCEPTION
  DISPLAY 'XML generation error ' XML-CODE
  STOP RUN
NOT ON EXCEPTION
  DISPLAY 'XML document was successfully generated.'
END-XML
```

RPG and COBOL – where next?

WebSphere Development Studio Client

13
© 2007 IBM Corporation

RPG and COBOL – where next?

IBM Software Development Platform

GOVERNANCE DASHBOARD

Solutions for geographically distributed development, compliance, SOA

Process & portfolio management

- IBM Rational® Portfolio Manager
- IBM Rational Method Composer
- Best practices content (IBM Rational Unified Process®)

Requirements & analysis

- IBM WebSphere® Business Modeler & Monitor
- IBM Rational RequisitePro®
- IBM Rational Software Architect
- IBM Rational Software Modeler
- IBM Rational Data Architect

Design & construction

- IBM Rational Software Architect
- IBM Rational Application Developer
- IBM WebSphere Integration Developer
- IBM WebSphere® Development Studio for iSeries
- Enterprise Generation Language

Software quality

- IBM Rational ClearQuest Test Manager
- IBM Rational Manual Tester
- IBM Rational Functional Tester
- IBM Rational Performance Tester

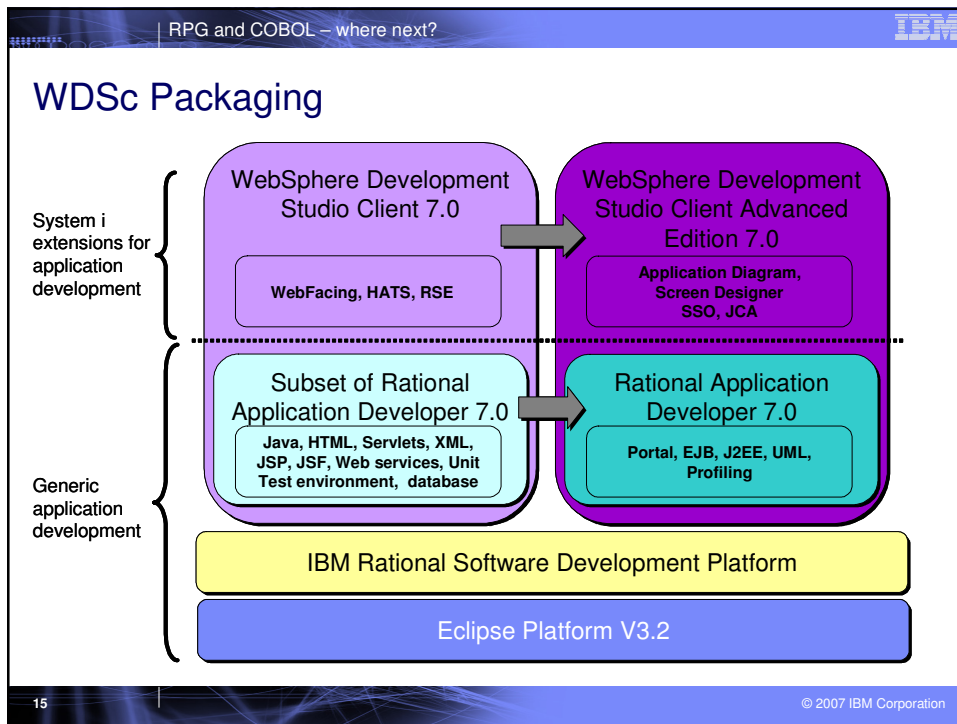
Change & configuration management

- IBM Rational ClearCase®
- IBM Rational ClearQuest®
- IBM Rational Portfolio Manager®
- IBM Rational BuildForge®

Partner ecosystem & open computing

- Eclipse™, Linux®, Microsoft® Windows®, UNIX®, IBM i5/OS®, IBM z/OS®

14
© 2007 IBM Corporation



RPG and COBOL – where next?

WebSphere Development Studio Client

All the tooling in Rational Application Developer + ...

- **Remote System Explorer**
 - Starting point for developing traditional i5/OS code
- **iSeries Integrated Debugger**
- **Application Diagram (AE only)**
 - Graphical view of application structure
- **iSeries Projects**
 - Convergence point for managing i5/OS source with tools like Ratnal ClearCase, CVS etc
- **WebFacing / HATS**
- **Web Development**
 - I5/OS specific wizards
- + ...

16 © 2007 IBM Corporation

WDSC V7 – Why Move From PDM/SEU?

1. **Inhibitor: Hardware Requirement – reduced with**
 - Selective Install (256 MB RAM, 1GB disk for working with native i5OS applications)
2. **Inhibitor: Getting started Hurdle – reduced with**
 - Install from System i
 - iSeries RSE Getting Started page
 - PDM & SEU Transition Guide
3. **Reason to Move: Enhancements in RSE for native i5OS applications**
 - LPEX: ILE RPG SQL support and more
 - iSeries Data Table View
 - Outline view support for CL
4. **Reason to Move: Build e-business Applications**
 - Web, Web Services for SOA, Rich Web UI, Rich Client, Java, XML
 - WDHT V7 for WebFacing Tool and HATS Toolkit in V7
 - Leverage New Technologies: Rich web UI with JSF
 - Web Services Wizard Productivity for SOA
 - Debug Suspended Programs
5. **Reason to Move: Build System i ecosystem**
 - Eclipse provides new integration point for Tool Vendors
 - Every PDM/SEU users already have WDSC

Install

- Memory and disk requirements is one of the biggest complaints about the RSE
 - WDSC install was all or nothing
 - Recommended 1GB RAM and 5 GB hard disk space
 - That's a lot to edit, compile and debug RPG applications!
- V6.0.1 started to address this with "WDSC Lite Technology Preview"
 - Created a 2nd workbench instance with only Eclipse + RSE + debugger
 - Required only 256 MB RAM, but extra hard disk space
 - Kludgy to install and update

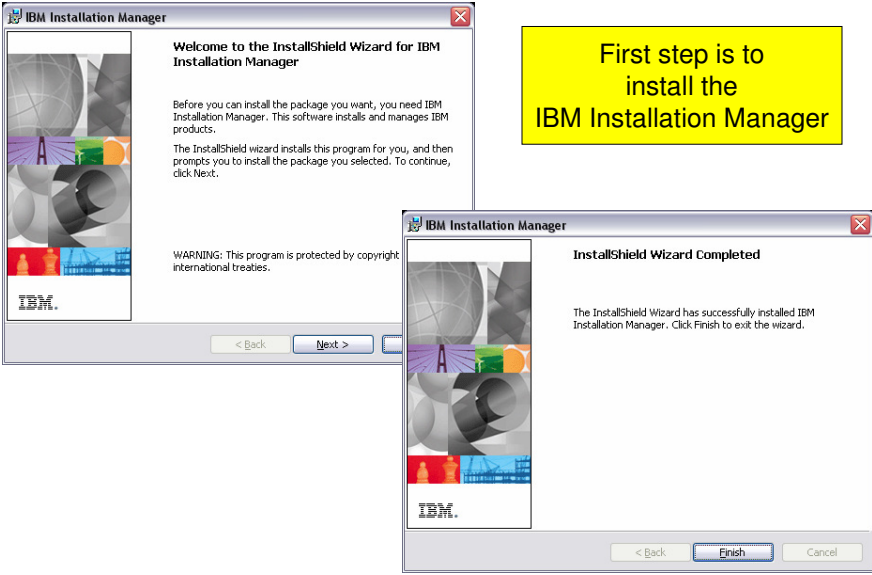
Install

- V7.0 now has a proper selective install
 - Install only the features you need
 - “i5/OS Development Tools”
 - Eclipse + RSE + debugger
 - 256 MB RAM and 1 GB disk space
- Install and updates now use IBM Installation Manager
 - No more Rational Product Updater
 - Add, remove and update features after initial install



RPG and COBOL – where next?

IBM



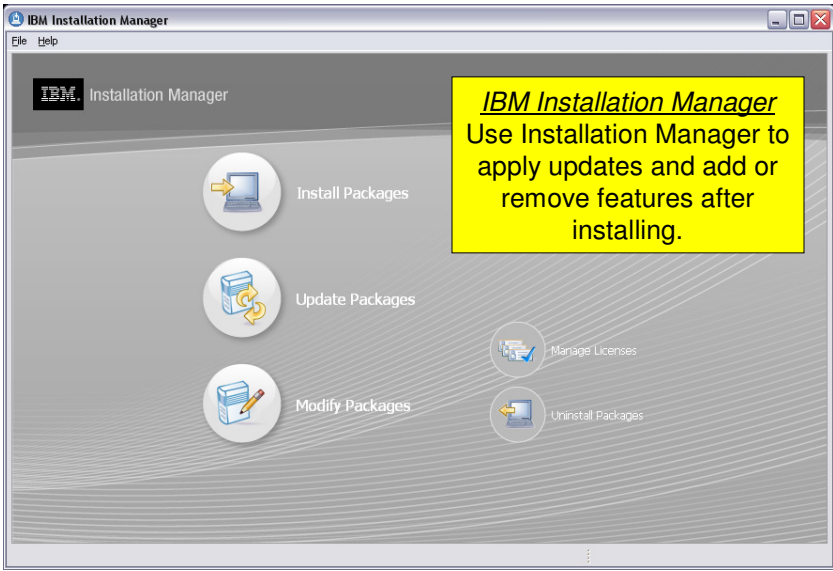
First step is to install the IBM Installation Manager

21

© 2007 IBM Corporation

RPG and COBOL – where next?

IBM



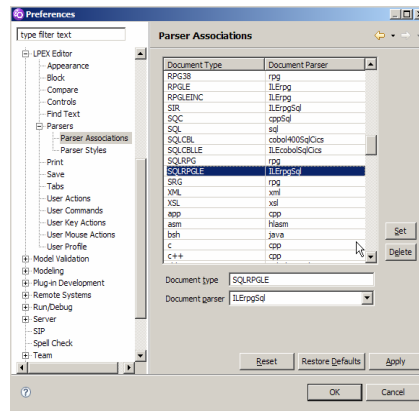
IBM Installation Manager
Use Installation Manager to apply updates and add or remove features after installing.

22

© 2007 IBM Corporation

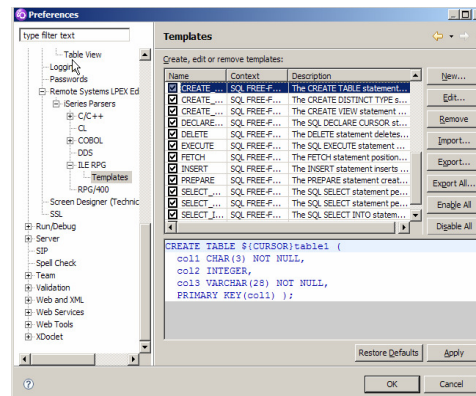
SQL Parser

- New ILE RPG SQL parser is added. This allows the user to associate the source member types with this parser.



SQL Templates

- Templates for SQL in Free Form ILE RPG have been added.



SQL Tokenization

- SQL Statements are Tokenized in Free Form and Fixed Form ILE RPG.

```

000100      /free
000200      exec sql create procedure median_result_set
000300      language sql dynamic result sets 1
000400      BEGIN
000500          case v_workdept when 'B01'
000600              -- comments
000700              then update department set deptname = 'DATA ACCESS 2';
000800              else update department set deptname = 'DATA ACCESS 3';
000900          end case;
001000      end;
001100      /end-free

001500      C/EXEC SQL
001600      11 C+ DECLARE C2 CURSOR FOR
001700      C+ SELECT EMPFPROJACT.PROJNO, PROJNAME, COUNT(*),
001800      C+ SUM((DAYS(EMENDATE) - DAYS(EMSTDATE)) * EMPTIME *
001900      C+ DECIMAL((SALARY/:WRKDAY),8,2))
002000      C+ FROM CORPDATA/EMFPROJACT, CORPDATA/PROJECT, CORPDATA/EMPLOYEE
002100      C+ WHERE EMPFPROJACT.PROJNO = PROJECT.PROJNO AND
002200      C+ EMPFPROJACT.EMPNO = EMPLOYEE.EMPNO AND
002300      C+ PRENDATE > :RDATE
002400      C+ GROUP BY EMPFPROJACT.PROJNO, PROJNAME
002500      C+ ORDER BY 1
002600      C/END-EXEC

```

RSE enhancements

- Table View now can also display the contents of data physical file members.

The screenshot shows the RSE interface with a tree view on the left containing various data physical file members (e.g., AAA.dspf, BBA.dspf, CTUFL2.pf). A right-click context menu is open over a member, with the 'Show Table' option selected. The 'Show Table' submenu is visible, showing options like 'Members', 'Data', 'Details', 'Tasks', and 'Log'. The 'Data' option is highlighted.

Below the menu, the 'Series Table View' is displayed, showing a table of data for the selected member. The table has columns: PARTNO, PARTSHIP, BRANCH, TIME_T, QTY, DESTINATN, and COUNTRY. The data is organized into rows, with the first row being a header and subsequent rows containing numerical and text data.

PARTNO	PARTSHIP	BRANCH	TIME_T	QTY	DESTINATN	COUNTRY
00002	1999-09-02	20322	14.15.30	2,012.50	CHICAGO AIRPORT	USA
00003	1999-09-13	20333	13.15.30	33,333.328	LAS VEGAS AIRPORT	USA
00005	1999-09-09	12345	11.12.16	1,234.77	BUTTONVILLE AIRPORT	CANADA
00010	1999-09-10	10010	10.30.15	4,001.23	VANCOUVER AIRPORT	CANADA
00011	2000-01-11	12345	11.11.11	110.00	FUN WORLD	ARGENTINA
00012	2000-01-12	12345	12.12.12	12.12	DUMMY WORLD	DUMMY
00015	2000-01-15	12345	15.15.15	150.00	PARTY ROOM	CUBA
00021	2000-01-25	12345	10.22.35	543.00	TORONTO AIRPORT	CANADA
00022	2000-01-22	12345	22.12.12	22.20	DUMMY AIRPORT	FANTASY ISLAND

RSE enhancements

- For ILE RPG and CL source members, a pop-up source menu action "Show Block Nesting" has been added. This is used to determine a control block from the current cursor location and any control blocks contained within. Actions have also been added to jump to the beginning and end of the control block.

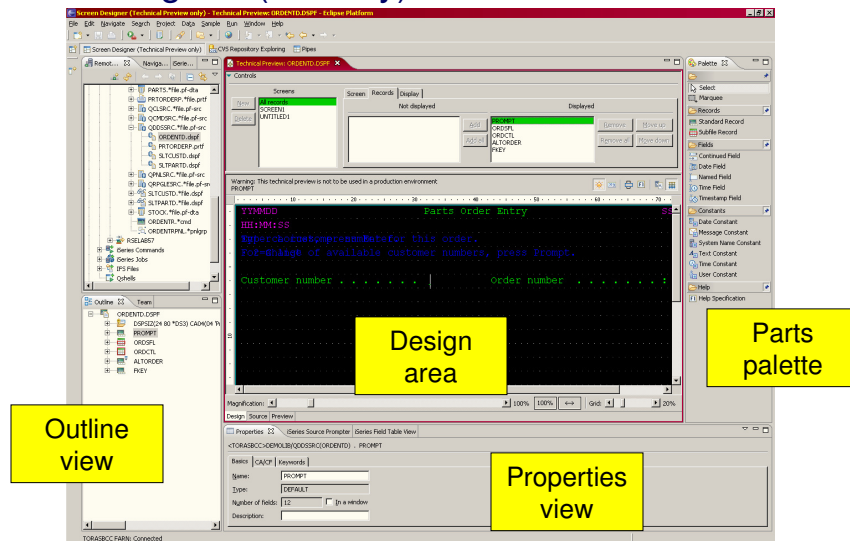
```

042100 C      fill_subfile begsr
042200 C      * Clear subfile
042300 C      eval      sfldsp = *off
042400 C      write      sfldt1
042500 C      * Write MAX_SFL records
042600 C      eval      rrrn = 1
042700 C      eval      cur_top = current
042800 C      dow      rrrn <= MAX_SFL and current <= num
042900 C      eval      line = msgarr(current)
043000 C      eval      current = current + 1
043100 C      write      sfl
043200 C      eval      rrrn = rrrn + 1
043300 C      enddow
043400 C      if      num <= MAX_SFL
043500 C      eval      moremsg = *blanks
043600 C      elseif   current <= num
043700 C      eval      moremsg = 'More ...'
043800 C      else
043900 C      eval      moremsg = 'Bottom'
044000 C      endif
044100 C      endsr

```

Shortcut key:
Ctrl + Shift + O

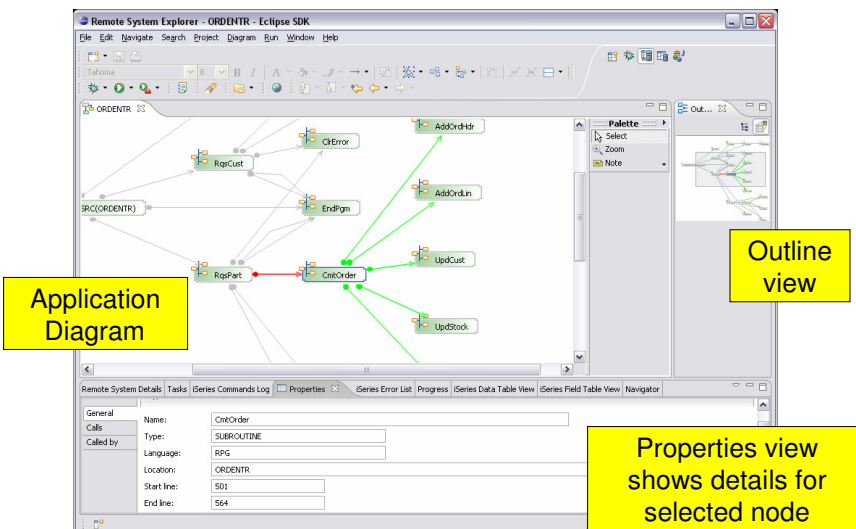
Screen Designer (AE only)



Screen Designer (AE only)

- Screen designing joins the rest of the WDSC Eclipse based tooling
- Launchable from Remote Systems Explorer
- Fully integrated with the Remote Systems LPEX Editor
 - Changes can be made in either the design area, or the LPEX editor
 - Changes and selections are automatically coordinated and reflected in all views
 - Lpex editor
 - Design area
 - Properties view
 - Outline view
- Technical Preview for V7.0
 - WDSC Advanced Edition Only
 - English only

Application Diagram (AE only)



RPG and COBOL – where next?

IBM Application Diagram Component (AE only)

- Application Diagram
 - Graphical representation of the structure of an application
 - Call Graph Diagram shows
 - Source call graph showing RPG and COBOL subroutine and procedure calls
 - Program Structure Diagram shows
 - ILE binding relationships between programs and service programs
 - Modules bound into programs and service programs
- Features
 - Outline view shows high level overview and helps navigate diagram
 - Double click on nodes to launch Remote Systems LPEX editor
 - Properties view shows additional details for selected node in diagram
 - Exported procedures for module or service program
 - Starting and ending line numbers for subroutines and procedures
 - Save, print, export to text or image file
 - Attached notes to document the diagram

31 © 2007 IBM Corporation

RPG and COBOL – where next?

iSeries Projects

- Source Change Management with iSeries Projects
 - Can use any “stream file” based repository that supports Eclipse
 - Rational ClearCase, Subversion, CVS, ...
 - Store i5/OS source members in same SCM repository as Java, Web, .NET source
- 7.0 includes features for improved integration between iSeries Projects and Rational ClearCase
 - Automatic removal of date field and sequence number
 - Save file support (AE only)
 - Support for workbench decorators

32 © 2007 IBM Corporation

Trademarks & Disclaimers

© IBM Corporation 1994-2003. All rights reserved.

References in this document to IBM products or services do not imply that IBM intends to make them available in every country.

The following terms are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both:

AS/400	IBM (logo)
AS/400e	iSeries
e (logo) business	OS/400
IBM	System i

Lotus, Freelance Graphics, and Word Pro are registered trademarks of Lotus Development Corporation and/or IBM Corporation. Domino is a trademark of Lotus Development Corporation and/or IBM Corporation.

C-bus is a trademark of Corollary, Inc. in the United States, other countries, or both.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

ActionMedia, LANDesk, MMX, Pentium and ProShare are trademarks of Intel Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

SET and the SET Logo are trademarks owned by SET Secure Electronic Transaction LLC.

Other company, product and service names may be trademarks or service marks of others.

Information is provided "AS IS" without warranty of any kind.

All customer examples described are presented as illustrations of how those customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics may vary by customer.

Information in this presentation concerning non-IBM products was obtained from a supplier of these products, published announcement material, or other publicly available sources and does not constitute an endorsement of such products by IBM. Sources for non-IBM list prices and performance numbers are taken from publicly available information, including vendor announcements and vendor worldwide homepages. IBM has not tested these products and cannot confirm the accuracy of performance, capability, or any other claims related to non-IBM products. Questions on the capability of non-IBM products should be addressed to the supplier of those products.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only. Contact your local IBM office or IBM authorized reseller for the full text of the specific Statement of Direction.

Some information in this presentation addresses anticipated future capabilities. Such information is not intended as a definitive statement of a commitment to specific levels of performance, function or delivery schedules with respect to any future products. Such commitments are only made in IBM product announcements. The information is presented here to communicate IBM's current investment and development activities as a good faith effort to help with our customers' future planning.

Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

Photographs shown are of engineering prototypes. Changes may be incorporated in production models.