The Current State of
Application Modernization on IBM i

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Architect Application Development

Modernization of IBM i Applications
from the Database Up to the User Interfase

http://www.redbooks.ibm.com/abstracts/sg248185.html?Open

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What is Modernization ?

- ❖ Creating a new user interface
- ❖ Re-factoring a database
- ❖ Making major changes to code
- ❖ Making minor changes to code
- ❖ Making no changes to code
- ❖ Integrating new applications
- ❖ Using a new tool
- ❖ Free form
- ❖ Using New tools
- ❖ Model-View-Controller
- ❖ SQL

- ❖ Thinking in a new and different manner
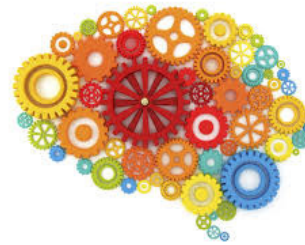
The continual process of improving

Look to leverage new Methodologies, ideas and tools

2

Reason to Modernize

- High cost to do nothing
  - Divert significant % of IT budget for maintenance
  - Continues to grow each year

- Better integration
  - Easier to connect to new or external systems

- Regulatory changes

- Productivity gain
  - Leverage new faster technology, Faster DB access, multi-threads

- Intuitive User Interface
  - Reduce User training
  - Access anywhere – Mobile

- Faster, secure, robust database access

Development Paradigms of Today

- Graphical User Experiences
  - Grown from GUIs to Experiences
  - Mobile device enablement is key
  - Web
  - Simple, intuitive

simple is beautiful.

3

Development Paradigms of Today

- Agile Development
  - Work in highly collaborative groups
  - Time line is strict
  - Small adaptive modules
  - Tools
  - Incremental development
  - Iterative

Development Paradigms of Today

- Framework Development
  - Component based
  - Model – View – Controller
  - Services Orientation
  - Componentized code
  - Business based

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Application Development Strategy for IBM i

Compilers & Languages

Common development and management tools across operating systems and languages

MOBILE PHP JEE COBOL RPG

Eclipse

Continuous Delivery

Open Lifecycle and Service Management Integration Platform
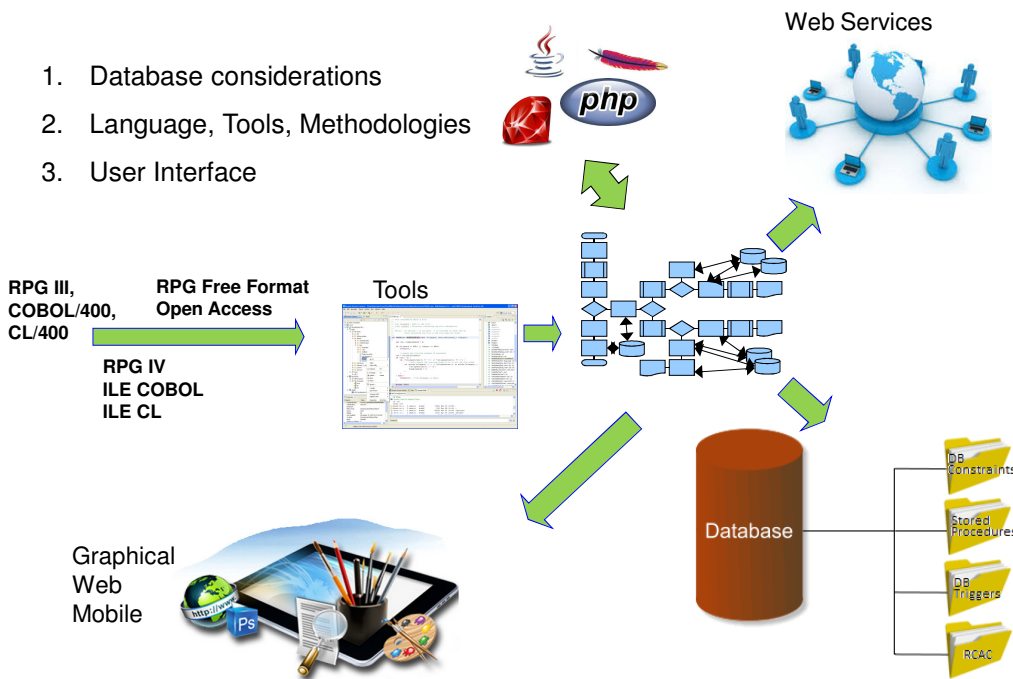
Embrace Open Source Solutions

Integrate web and development technologies into IBM i

Include vendor tools as necessary

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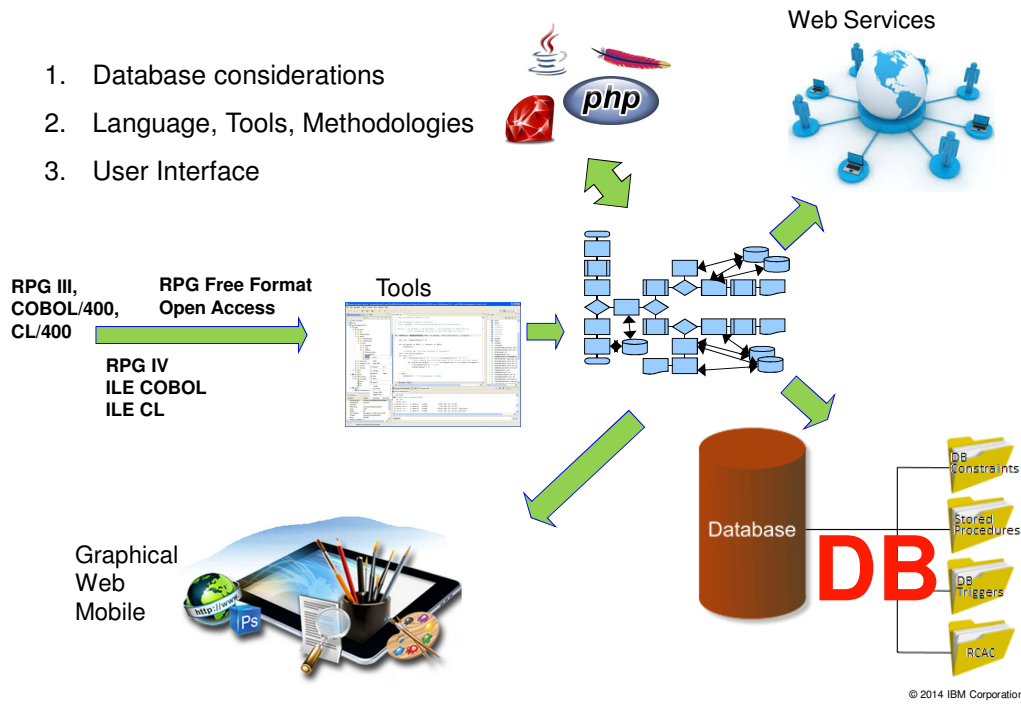## Modernization of Applications and Data

Web Services

1. Database considerations
2. Language, Tools, Methodologies
3. User Interface

php

RPG III,
COBOL/400,
CL/400

RPG Free Format
Open Access

Tools

RPG IV
ILE COBOL
ILE CL

Graphical
Web
Mobile

Database

DB Constraints

Stored Procedures

DB Triggers

RCAC

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Modernization of Applications and Data

1. Database considerations
2. Language, Tools, Methodologies
3. User Interface

Web Services

**RPG III,
COBOL/400,
CL/400**

**RPG Free Format
Open Access**

**RPG IV
ILE COBOL
ILE CL**

Tools

Database

DB

DB Constraints

Stored Procedures

DB Triggers

RCAC

Graphical
Web
Mobile

Why Modernize the DB?

- Data-centric
- Performance
- Data integrity
- SQL
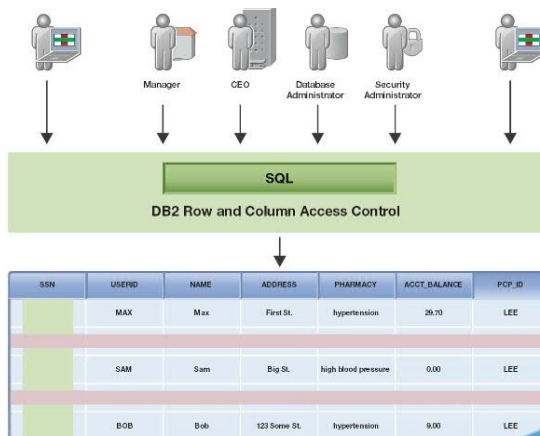- Referential integrity
- Security
- Simplify Data Access

SQL

INTEGRITY

Design

Optimize   Policies   Develop
Models
Metadata

Operate   Deploy
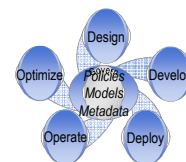
Infosphere Optim Test
Data Management
- Streamlined test data management

IBM DB2

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What is RCAC?

IBM Advanced Data Security for i
(**Boss option 47**)
No Charge

- Additional layer of data security available with DB2

- Complementary to table level security

- Subsetting access to only the required data for a task

- Controls access to a table at the row, column, or both

- Two sets of rules
  - Permissions for rows
  - Masks for columns

- **IBM Advanced Data Security for i**
  - **No-charge feature - Option 47**

| | Manager | CEO | Database Administrator | Security Administrator | |

SQL

DB2 Row and Column Access Control

SSN	USERID	NAME	ADDRESS	PHARMACY	ACCT_BALANCE	PCP_ID
	MAX	Max	First St.	hypertension	29.70	LEE
	SAM	Sam	Big St.	high blood pressure	0.00	LEE
	BOB	Bob	123 Some St.	hypertension	9.00	LEE

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Row and Column Access Control

```
CREATE MASK SSN_MASK ON EMPLOYEE
    FOR COLUMN SSN RETURN
      CASE
        WHEN (VERIFY_GROUP_FOR_USER(SESSION_USER,'PAYROLL') = 1)
          THEN SSN
        WHEN (VERIFY_GROUP_FOR_USER(SESSION_USER,'MGR') = 1)
          THEN 'XXX-XX-' CONCAT SUBSTR(SSN,8,4)
        ELSE NULL
      END
    ENABLE;

ALTER TABLE EMPLOYEE
   ACTIVATE COLUMN ACCESS CONTROL;
```

Column

Payroll – Entire number

Manager – xxxxxx1234

```
CREATE PERMISSION NETHMO.ROW_ACCESS
ON HOSPITAL.PATIENT
FOR ROWS
WHERE(VERIFY_GROUP_FOR_USER(SESSION_USER,'PATIENT') = 1 AND
       HOSPITAL.PATIENT.USERID = SESSION_USER) OR
      (VERIFY_GROUP_FOR_USER(SESSION_USER,'PCP') = 1 AND
       HOSPITAL.PATIENT.PCP_ID = SESSION_USER) OR
      (VERIFY_GROUP_FOR_USER(SESSION_USER,'MEMBERSHIP') = 1 OR
       VERIFY_GROUP_FOR_USER(SESSION_USER,'ACCOUNTING') = 1 OR
       VERIFY_GROUP_FOR_USER(SESSION_USER,'DRUG_RESEARCH') = 1)  ENFORCED FOR ALL ACCESS
    ENABLE;

ALTER TABLE HOSPITAL.PATIENT
   ACTIVATE ROW ACCESS CONTROL;
```

View Row if Patient

View Row if Accounting

View Row if Drug_Research

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Slide 15

IBM

Built in DB2 Services – Use SQL to get info from the system!

Who's password is about to expire

SELECT * from qsys2.user_info where status = '*ENABLED' AND
DATE_PASSWORD_EXPIRES BETWEEN CURRENT TIMESTAMP AND CURRENT TIMESTAMP + 7
DAYS;

SELEcT * from qsys2.user_info where status = '*ENABLED' AND DATE_PASSWORD_EXPIRES BETWEE ... - X1423p2.rch.stglabs.ibm.com(X1423p2)

AUTHORIZATION_NAME	PREVIOUS_SIGNON	DAYS_UNTIL_PASSWORD_EXPIRES	DATE_PASSWORD_EXPIRES
APASSE	2014-05-01 12:03:5...	3	2014-05-05 00:00:00.0...
BOT5001USR	2013-10-31 00:49:2...	2	2014-05-04 00:00:00.0...
LJAMESON	2014-04-30 13:50:0...	3	2014-05-05 00:00:00.0...

SELECT USER_NAME, SUM(STORAGE_USED) AS TOTAL_STORAGE_USED from
qsys2.user_storage
GROUP BY USER_NAME ORDER BY TOTAL_STORAGE_USED DESC FETCH FIRST 10 ROWS
ONLY ;

Find who is using the most storage!

SELECT USER_NAME, SUM(STORAGE_USED)...

USER_NAME	TOTAL_STORAGE_USED
JONATHAN	93509680
JDPWRSYS	62605300
QDFTOWN	57895476
QSYS	45151156
EBERHARD	38515152
QQSMART	31275908
SCHRIB	20879664
QSECOFR	12509896
QSPL	11011312
SCOTTF	10756532

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Slide 16

IBM

DB2 for i & IBM i 7.2 – Other enhancements

Application Development
•Increased timestamp precision
  •Named and Default parameter support on UDF/UDTFs
  •Function resolution using casting rules
  •Use of ARRAYs within UDF/UDTFs
  •Obfuscation of SQL triggers
  •Built-in Global Variables
  •Expressions on PREPARE & EXECUTE IMMEDIATE
  •Autonomous procedures
  •CURRENT USER special register
  •LPAD and RPAD scalar functions
  •TRUNCATE TABLE
  •Constants in LANGUAGE SQL routines
  •Unified debugger support for SQL functions
  •Datetime scalar function improvements

Navigator for DB Application Development
  •*Support of all new SQL features*
    –*Permissions*
    –*Masks*
    –*Named arguments and parameter defaults*
    –*Obfuscation of Triggers*
   –*Arrays in user-defined functions*
    –*Create based ON*

DBA/DBE
•Queued exclusive locks control
•SQL Server Mode detail in collection services
•SQL Details for Jobs enhancement
•Improved VARCHAR & LOB space management
•Automatic record movement between partitions

Navigator for DBA/DBE
  •*Performance Data Investigator (PDI)*
    –*Investigate Data – DB2 category*
    –*SQL Plan Cache perspectives*
    –*Physical vs Logical I/O breakdowns*
    –*And more…*
  •*On Demand Performance Center*
    –*Observance of Native Queries*
    –*Advanced Monitor Compare*

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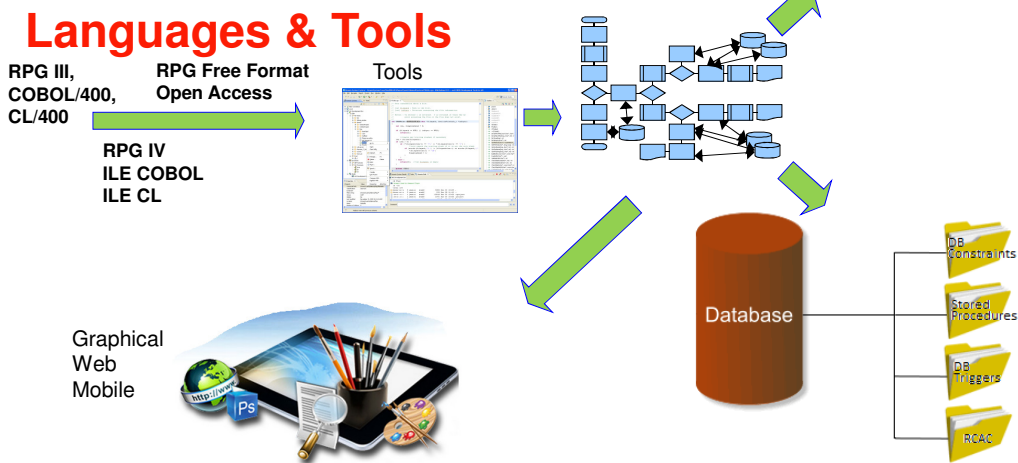
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Why Modernize Your Reporting Environment

- Turn DATA into INTELLIGENCE

- Delivered at the right time, in the right formats

- Take advantage of SQL Capabilities

- Document the database, and standardize on data meaning (single version of the truth)

- Get I/T out of the Report Writing Business
  - With self service reporting solutions

- Eliminate redundancy

- Adapt more quickly to changes in the operational systems/databases

- Deploy reports in a variety of highly intuitive ways
  - Mobile, Excel, Dashboards, OLAP

- Improve the perception of the "AS/400"
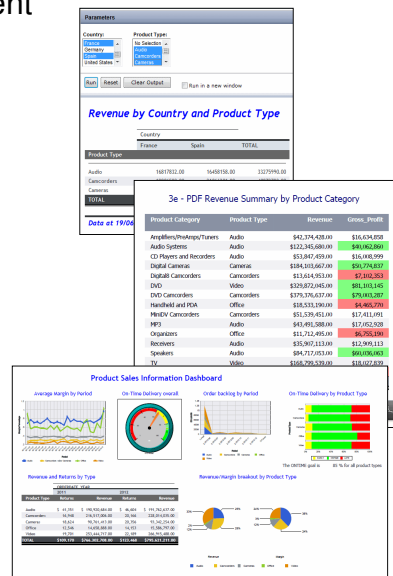
DB2 Web Query

Modernization of Applications and Data

Web Services

1. Database considerations
2. Language, Tools, Methodologies
3. User Interface

Languages & Tools

RPG III, COBOL/400, CL/400	RPG Free Format Open Access	Tools

RPG IV
ILE COBOL
ILE CL

Graphical
Web
Mobile

Database
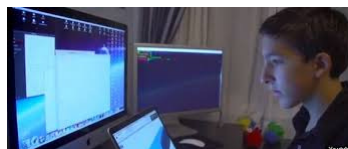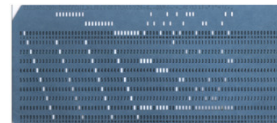
DB Constraints
Stored Procedures
DB Triggers
RCAC

Why Modernize Your Code?

- Maintainability
- Flexibility
- Modularization
- Simplify understanding
- More reliable testing
- Reusability
- Expendability
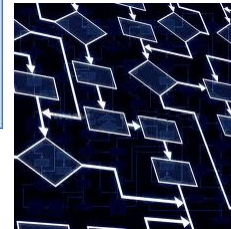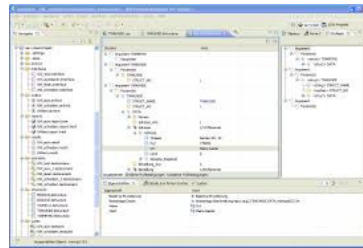
Reasons to modernize

- Skill acquisition

- Replace retiring work force

- Talent retention

- Future Developer

RPG IV - A Modern Business Language

Primary goals for RPG IV

- Interoperability
  - Java
  - XML
  - SQL
- Readability
  - Free form
  - Blank lines
  - Comments
- Functionality
  - Procedures
  - Data areas
  - Data structures
  - More data types
  - Extended file support
- Modern Tools
  - RD i, RTC, ARCAD Power Pack

Free format C specs

```
read  file;              // Get next record
dow not %eof(file);      // Keep looping with 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;
```

7.1 TR7, and a future release of RDI

```
ctl-opt bnddir('ACCRCV');

dcl-f custfile usage(*update);
dcl-ds custDs;
dcl-f report printer;

read custfile custDs;
dow not %eof;
   if dueDate > %date(); // overdue?
      sendOverdueNotice ();
      write reportFmt;
      exec sql insert :name, :duedate into
              mylib/myfile;
   endif;
   read custfile custDs;
enddo;
inlr = '1';

dcl-proc sendOverdueNotice;
    /copy invoices
   sendInvoice (custDs : IS_OVERDUE);
 end-proc;
```

```
No /FREE, /END-FREE

All free-form statements

Better colorization options
  in the editor
```

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Calc Specs get out of jail

```
C                    dou        wasFound
C* Look up the custId in the file
C      'custKey'     LOOKUP     custArray                    01
C                    EVAL       custAddress = %SUBST(fullAddress :1 :50);
C      custAddress   MOVEA              fullAddress
C      custId        CHAIN      custFile
C                    ENDDO
```

- Bracketed by /free and /end-free directives
- Calcs begin with opcode and end with semicolon

  - In 9.0.1 we no longer need /free directives
  - The styling of the text is now token-based rather than operand-based.
  - Highlighting of literals, BIFs, control op-codes

```
/free
   dou wasFound;
        //Look up the custId in the file
        custName = %LOOKUP('custKey' : custArray: 1: %SIZE(custArray));
        custAddress = %SUBST(fullAddress :1 :50);
/end-free
C     custAddress   MOVEA               fullAddress
/free
        CHAIN   custKey  custFile;
   ENDDO;
/end-free
```

```
            dou wasFound;
              //Look up the custId in the file
              custName = %LOOKUP('custKey' : custArray
                                          : 1
                                          : %SIZE(custArray));
            custAddress = %SUBST(fullAddress :1 :50);
C     custAddress   MOVEA               fullAddress
            CHAIN   custId   custFile;
          enddo;
```

Today H, F, D and P specs are free too!

Compiler Options

```
....HKeywords+++++++++++++++++++++++++++++++++++++++.
    HOPTION(*SRCSTMT :*NODEBUGIO) ALWNULL(*USRCTL)
```

```
ctl-opt option(*SRCSTMT: *NODEBUGIO)
        alwnull(*USRCTL);
```

File Definitions

```
....FFilename++IPEASFRlen+LKlen+AIDevice+.Keywords+++
000101    Fkeyfilea  IF   E              DISK
```

```
dcl-f keyfilea;
```

Data Definitions

```
DMAX_ELEMS       C            1000
DfullName        S        50A  VARYING
D                             INZ('Unknown name')
Dds1             DS            QUALIFIED
D num                    10I 0
D name                   100C
DQp01RenamUnlink PR      10I 0
D oldName                  *   VALUE OPTIONS(*STRING)
D newName                  *   VALUE OPTIONS(*STRING)
```

```
Dcl-C MAX_ELEMS 1000;
Dcl-S fullName VARCHAR(50) INZ('Unknown name');
Dcl-DS ds1 QUALIFIED;
  num INT(10);
  name UCS2(100);
End-DS;
Dcl-PR Qp01RenamUnlink INT(10);
   oldName POINTER VALUE OPTIONS(*STRING);
   newName POINTER VALUE OPTIONS(*STRING);
End-PR;
```

Procedure Definitions

```
PgetCurrentUserName...
P              B            EXPORT
D              PI      10A
P getCurrentUserName...
P              E
```

```
Dcl-Proc getCurrentUserName EXPORT;
   Dcl-Pi *N CHAR(10) End-Pi;
End-Proc;
```

Letsos Company transforms its core applications, enabling efficient software maintenance without additional staffing & training

LETSOS COMPANY
MECHANICAL CONTRACTORS

"Transforming our existing application, revitalizes our investment, allowing developers with Java & Windows skills to maintain and extend our IBM i code effectively into the future."
Jason Feng, Application Development, Letsos Company

- **Letsos is a leading mechanical contracting company located in Texas.**

- **Needed to update their RPG based accounting applications, so existing staff could proactively and efficiently maintain and enhance the software using modern development tools.**

- **Solution:**
  – IBM i 7.1, IBM RDi
  – ARCAD-Transformer RPG automatically transformed the application into Free Format RPG

- **The resulting Free Format RPG application:**
  – Protects their application investment, avoiding purchase of a new ERP
  – No additional hardware or staffing was required
  – Software maintenance can be performed by non- IBM i experts
  – Expedites software updates

Arcad

ARCAD-Converter : Application Modernization
Convert to Free Format RPG

NEW

Help the latest generation of developers to manage and maintain your applications by converting to Free Format RPG
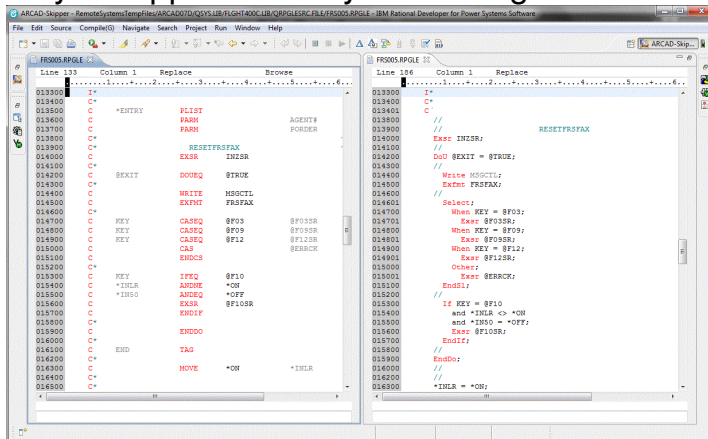
- Rational Developer for i plug-in On-demand or bulk conversion
- Support for the latest compiler specs (C, H, F, D and P)

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Converting Calculations to Free Form using RPG Toolbox

Before

```
CL0N01N02N03Factor1+++OpcdeFactor2+++ResultLenDHHiLoEq
C          *LIKE    DEFN AREACD    WAREA
C* Retrieve customer record
C          CNBR     CHAINCUSTMAS              99
C* Prepare values
C                   MOVE *ZEROS    XX
C   N99             MOVE AREACD    WAREA
C   N99             EXSR PROCESS
C* Calculate
C          PROCESS  BEGSR
C                   ADD  1         XX        30
C          WAREA    IFNE *BLANK
C          XX       MULT 100       NUMBER
C                   SETON                    61
C                   END
C                   ENDSR
```

After

```
// Control Specifications
ctl-opt datfmt(*usa) copyright('LINOMA SOFTWARE');

// File Specifications
dcl-f cdlcm1 disk(*ext) usage(*input : *output)
      keyed rename(cdrcm:cdrcm2);

// Data Structure
dcl-ds phoneds;
  areacode char(3);
  prefix char(3);
  last4 char(4);
end-ds;

// Stand-alone fields
dcl-s taxrate packed(5:2);
dcl-s creditlimit like(cmcrlm);
dcl-s state char(2);
```

RPG Toolbox:

- Reformats fixed-format operations into free format style
- Uses BIFs to perform intelligent conversions when dissimilar field types and lengths
- Redefines work fields from the calcs into the D specs
- Converts case to lower, Mixed or UPPER
- Adds semicolon delimiters to the end of free format operations
- Converts asterisk (*) comment designators to slashes (//) comment designators
- Indents nested logic

IBM Confidential

Power Systems

IBM

Tools

Speed

Quality

Damage

Use the right tool for the job!

Rational Developer for i

- _Modern_, Eclipse-based, development tools for IBM i
- Visual editors, outline views, content assist, integrated language help
- _Integrated_ file management, search, edit, compile/build, debug capabilities
- Analysis tools (application diagram, call hierarchies, type hierarchies)
- Easily debug batch, interactive, and Web applications with a common visual debugger
- Visual DDS design tools: Screen and Report Designer
- Supports RPG, COBOL, C, C++, SQL, DDM

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...To This

Best of Both Worlds
Familiar AND Modern

- SEU look and feel
  - Prefix commands
  - Format bar
- Modern look and feel
  - Syntax Coloring
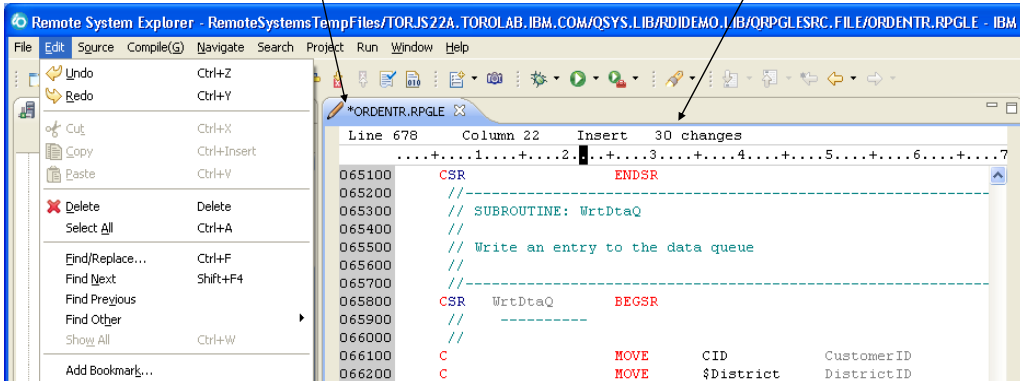 - Modern editor features

Shortcut to open a member, Ctrl + Shift + A

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IBM

Undo / Redo

* means editor has unsaved changes

Number of changes made since last save.

Remote System Explorer - RemoteSystemsTempFiles/TORJS22A.TOROLAB.IBM.COM/QSYS.LIB/RDIDEMO.LIB/QRPGLESRC.FILE/ORDENTR.RPGLE - IBM

File Edit Source Compile(G) Navigate Search Project Run Window Help

Undo	Ctrl+Z
Redo	Ctrl+Y
Cut	Ctrl+X
Copy	Ctrl+Insert
Paste	Ctrl+V
Delete	Delete
Select All	Ctrl+A
Find/Replace...	Ctrl+F
Find Next	Shift+F4
Find Previous	
Find Other	
Show All	Ctrl+W
Add Bookmark...	

*ORDENTR.RPGLE

```
Line 678      Column 22     Insert    30 changes
....+....1....+....2..+....3....+....4....+....5....+....6....+....7
065100      CSR             ENDSR
065200      //----------------------------------------------------
065300      // SUBROUTINE: WrtDtaQ
065400      //
065500      // Write an entry to the data queue
065600      //
065700      //----------------------------------------------------
065800      CSR   WrtDtaQ      BEGSR
065900      //    ----------
066000      //
066100      C               MOVE    CID         CustomerID
066200      C               MOVE    $District   DistrictID
```

- Unlimited undo / redo inside of LPEX editor
  - Undo changes right back to when member was originally opened
  - Even if editor was saved during the editing period
  - Edit > Undo | Redo or use more common keyboard shortcuts Ctrl + Z | Ctrl + Y

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IBM

Outline View and Content Assist

```
/FREE

a = %
    %status
    %str(pointer:max-length)
    %subarr(array:start-index|numeric-field)
    %subarr(array:start-index|numeric-field:number-of-el
    %subdt(date|time|timestamp:*ms|*s|*mn|*h|*d|*m|*
    %subst(string:start-index)
    %subst(string:start-index:length)
```

%SUBARR(array:start-index | numeric-field:number-of-elements | numeric-field)

%SUBARR (Set/Get Portion of an Array) returns a section of the specified array starting at start-index. The number of elements returned is specified by the optional number-of-elements parameter. If not specified, the number-of-elements defaults to the remainder of the array.

```
    //   ... prompt for an order
    WHEN DspPnl = $Pane12;
```

Content assist helps jog your memory (opcodes, BIFs, fields)

```
%SUBARR
(
    array
    start-index | numeric-field
    number-of-elements | numeric-field
)
/FREE

a = %subarr(b:c)
```

```
/free

    select
        select
        SELECT_group - The select group conditionally processes
        SELECT_OTHER_group - The select group conditionally pro
        SELECT_FROM_JOIN_WHERE - The SQ
        SELECT_FROM_WHERE - The SQL SEL
        SELECT_INTO_FROM_WHERE - The SQ
/er
```

```
EXEC SQL
SELECT ${CURSOR}col1, col2
    INTO :var1 :var2
    FROM table1
```

Templates provide a quick way to insert common code patterns (free form and SQL). Predefined or define your own!

Outline

Global Definitions
  Files
    CSTMR : DISK (Externally Described)
    DSTRCT : DISK (Externally Described)
    ITEM : DISK (Externally Described)
    ORDENTD : WORKSTN (Externally Described)
      PROMPT
      ORDSFL
      ORDCTL
      ALTORDER
        *IN04

Cross reference information

        *IN84
        PARTNBR : Character (6)
        PARTDSC : Character (24)
        PARTQTY : Zoned Decimal (5,0) INTFL
        429
      FKEY
    ORDERS : DISK (Externally Described)
    ORDLIN : DISK (Externally Described)
    stock : DISK (Externally Described)
  Data Structures
  Constants
  Fields
  Indicators
  Key Lists
    CustKey : KLIST
    DstrctKey : KLIST
    ItemKey : KLIST
    StockKey : KLIST
  Main Procedure
    Subroutines
      *INZSR

New Dynamic refresh!!

      AddOrdHdr
      AddOrdHdr
      ChgOrder

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RDi 9.0.1 - Free Format RPG Tooling Support

- Outline View
- Hover/Hyperlink
- Syntax Checker
- Program Verifier
- Language-sensitive help
- Enter key behavior
- Format Line/Prompt View
- Show Nesting
- Show Fields
- Content Assist

```
: %SIZE(custArray));
(fullAddress :1
                dcl-ds custArray DIM(maxCustomers) QUALIFIED;
                    id      int(10);
.tFile;             name    LIKE(CustomerName);
                    dcl-subf select bindec(2);
                end-ds;
```

```
dcl-s name
E An assign        bindec(digits(: decimal-positions))     CHAR(length)
dcl-s Custo        char(length)
dcl-c  maxC        date(format{separator})                 The CHAR keyword indicates that the item is a fixed-length charac
dcl-ds cust        float(bytes)                             type.
       id          graph(length)
       name        ind
       dcl-sub     int(digits)
end-ds;             object({(*java:class-name)})
dcl-pr cust        packed(digits(: decimal-positions))
       custId      pointer({(*proc)})
       custNam
end-pr;
```

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RD i V9.1   Code Coverage Report

- After running code coverage, a report is shown as an editor.
- You can drill down through programs, modules and procedures and see the coverage statistics for each

Code Coverage Report (RBC4NNF1C_2014_04_23_123357_0632)

Code Coverage Report (Line)

Code Coverage Summary

Code coverage report (analyzed at Apr 23, 2014 12:34:22 PM, generated at Apr 29, 2014 10:55:30 AM)

Element	Coverage	Covered	Total
*PGM MKWAN/RBC4NNF1C	88%	617	699
RBC4NNF1C	88%	617	699
RBC4NNF1C.RPGLE	88%	617	699
GPHPRCCMP10()	0%	0	6
UCSPRCCMP8()	0%	0	6
INDPRC1()	0%	0	6
CHRPRCCMP12()	0%	0	6
PUT_TC_MSG()	0%	0	13
finish_tc()	78%	7	9
chk_result()	89%	8	9
show_error()	90%	18	20
RBC4NNF1C()	91%	406	444
chk_subres()	92%	24	26
DATPRCISO()	100%	3	3
DATPRCUSA()	100%	3	3
DATPRCEUR()	100%	3	3
DATPRCYMD()	100%	3	3

Report

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Coverage annotated in the editor

- Drilling down from the report, the editor will be opened on the related member with green and red annotations showing which lines were


```
Code Coverage Report (RBC4NNF1C_2014_04_23_115425_0227)        RBC4NNF1C.RPGLE
  Line 1490    Column 50    Replace              Browse
  .....PName+++++++++++..B.................Keywords+++++++++++++++++++++++++++++Comments++++++++++++
     P finish_tc      b              export
     D finish_tc      pi
     D   tc                          likeds(tc_t)
      /free

          // If all variations passed, set the test case status to successful
          if tc.succ_v = tc.run;
             RptTest (tc.testname: tc.succ_v: tc.fail_v: SUCCESS);
             return;
          endif;

          // Otherwise, write a summary line and close the output file
          VarFail ('*CLOSE': tc.succ_v);
          RptTest (tc.testname: tc.succ_v: tc.fail_v: FAILURE);

          close qprint;

      /end-free
     P finish_tc      e


     P put_tc_msg     b              export
     D put_tc_msg     pi
     D   msgPtr                  *   value options(*string)
     D MAX LINE       c              52
```

Rational Developer for i V9.1.1 - RPG, COBOL, C, C++, SQL, DDS

Push to Client

- Update all RDi client workspaces from a central IBM i server
  - Automated client updates
- RSE Connections
- Filters   • Database Connections
- Eclipse Preferences   • RSE Compile Actions
- Update Templates   • RSE User Actions
  - RPG Free-form
  - SQL Free-form
  - Cobol   **Check out the YouTube video!!**
  - C/C++   **https://www.youtube.com/watch?v=jEBKyl8QjTA**

Templates RPG, SQL, COBOL, C/C++

Eclipse Preferences

Push to Client

Filters

RSE Connections
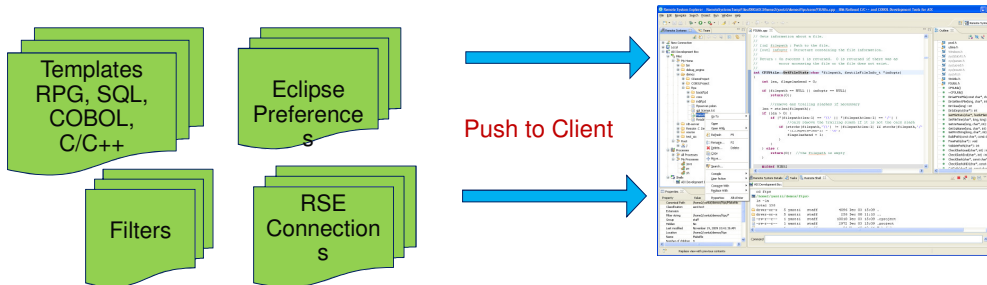
Rational Developer for i V9.1.1 - Free Format Ready

IBM Rational Developer i
RPG and *COBOL* Tools

5733- RDW feature 0037
Passport D0C5FLL

IBM Rational Developer for i
RPG and *COBOL* Tools + Modernization
Tools – **Java** Edition

5733- RDW feature 0031
Passport D0ZN3LL

IBM Rational Developer for i
RPG and *COBOL* Tools + Modernization
Tools – **EGL** Edition

5733- RDW feature 0025
Passport D0ZN5LL

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Power Systems

Tools for Program Understanding

ARCAD – Observer

Fresche– xAnalysis

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Modernization of Applications and Data

1. Database considerations
2. Language, Tools, Methodologies
3. User Interface

Web Services

**RPG III,
COBOL/400,
CL/400**

**RPG Free Format
Open Access**

**RPG IV
ILE COBOL
ILE CL**

Tools

UI

Graphical
Web
Mobile

Database

DB Constraints

Stored Procedures

DB Triggers

RCAC
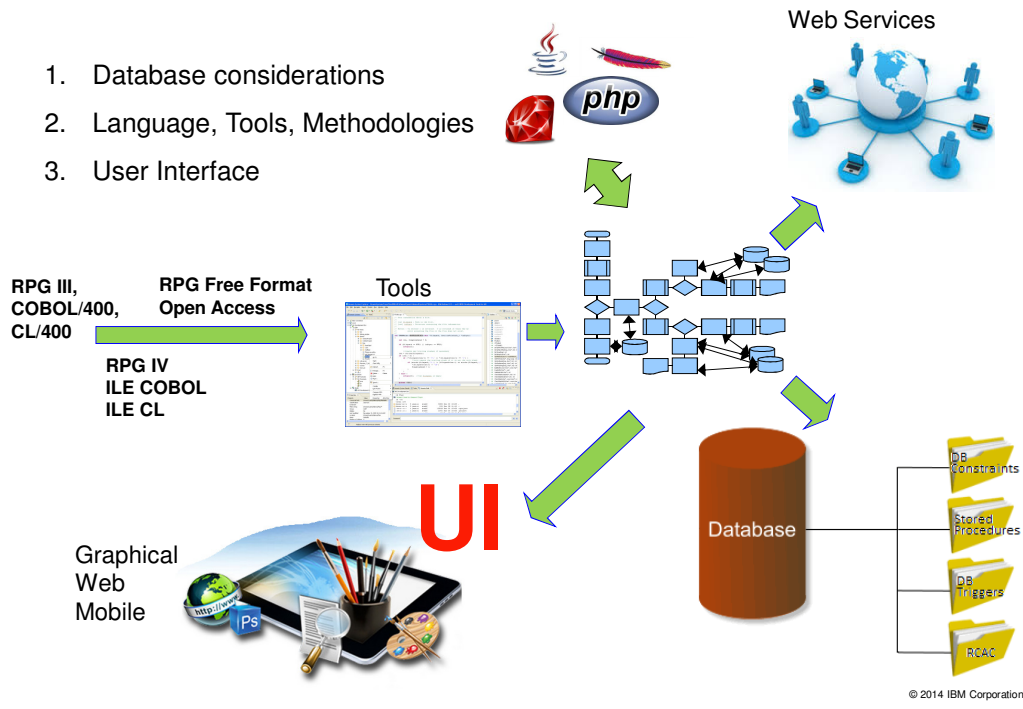
Why Modernize the UI

- Looks new
- Removes the 'old' machine from the conversation
- Allow you to focus on running your business
- Reduce training
- Improve productivity
- Flexibility of UI devices

www.shutterstock.com · 117393691

What does Open Access do for you ?

Traditional Model

*PGM

User Interface Logic

New UI Control data

Business Logic

DB Logic

Data Buffer

Open Access

Data & Screen Control

UI Engine
Web
5250
Mobile

GUI
IDE
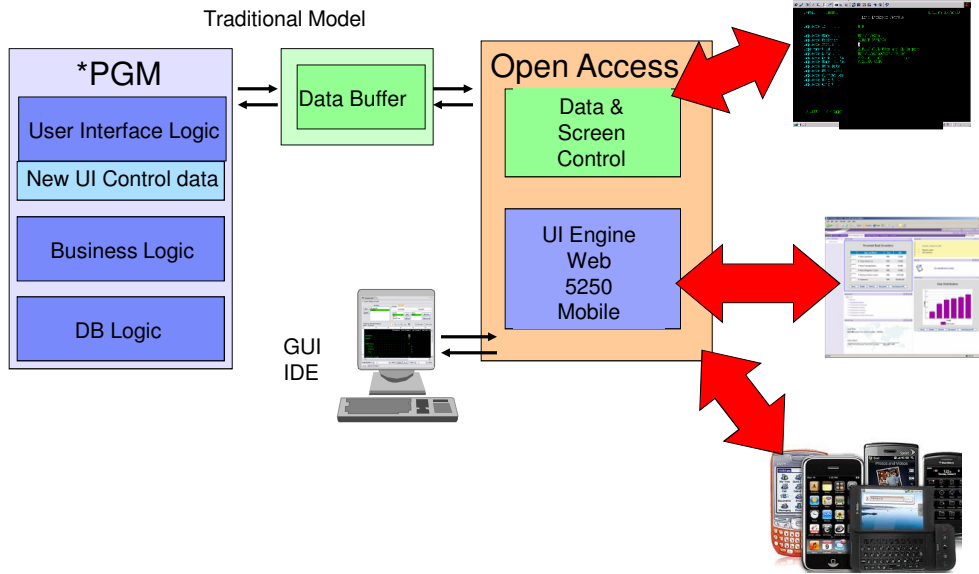
What is Open Source

What is Open Source

- **Open-source software** (OSS) is computer software with its source code made available with a license in which the copyright holder provides the rights to study, change and distribute the software to anyone and for any purpose. Open-source software is often developed in a public, collaborative manner.

Why do this at all ?

- **Work Force – this is what they know!**
- **Modernization**
- **Contribute form the community accelerate progress**
- **IBM i is the safest place to do this**
- **Get the apps to interact in a natural way with the DB**
- **Lots of data and existing business logic that can be married with these new languages**
- **Community training**
- **If IBM delivers, its already 'integrated' for you**
- **Open many other outside applications and vendors**

PHP Ecosystem

- Encourage Open Source vendors to port to Power
- Encourage Open Source vendors to provide support
- Opens Power Solutions to include new applications and tools

SUGARCRM.
COMMERCIAL OPEN SOURCE

MANTIS
Help Desk

dōjō

XOOPS
powered by you
Portal

php

Joomla!
...because open source matters
Portal

mambo
power in simplicity
Portal

MySQL

moodle
Course Management System

zen cart
the art of e-commerce
e-Commerce

MediaWiki
Wiki

Magento
eCommerce Platform for Growth

phpbb
creating communities
Bulletin Board

Drupal

APACHE

Dragonfly
Content Management System

WORDPRESS

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Open Source Solutions for i

- Zend Server Community Edition for i
  - Preloaded with IBM i 7.1 and 6.1
  - One year of Silver Support from Zend

- Zend Server for i
  - Available from Zend

- Zend Studio for i
  - Eclipse-based development environment
  - One year of Silver support from Zend

- Zend DBi
  - MySQL implementation for IBM i
  - DB2 Storage Engine enables data storage in DB2

zend

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23
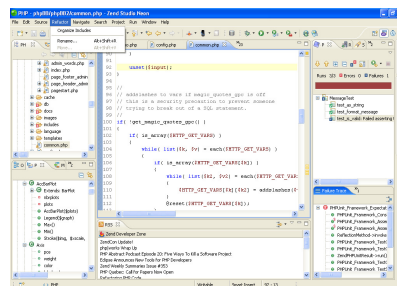
PHP Integration with i – PHP Toolkit

IBM

IBM i 7.1: TR5

Easy access to IBM i data and resources from PHP

  (similar to IBM ToolBox for Java)

- DB2 for i – SQL and Native
- Program call
- Procedure call
- Data Area
- Data Queue
- Message Queue
- Commands
- System values
- Spool files

IBM i

Windows / Linux Client	XMLSERVICE Jobs	IBM i Client
PHP, Ruby, Perl, Python, Java, etc.	XMLSERVICE /tmp/fred01	PHP, Java, RPG, etc.
DB2 connection	XMLSERVICE /tmp/sally42	DB2 connection
REST GET/POST	many more ...	REST GET/POST

- http://www.youngiprofessionals.com/wiki/index.php/XMLSERVICE/XMLSERVICE

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PowerRuby   →   **Ruby** + **RAILS** + **IBM i for Business**
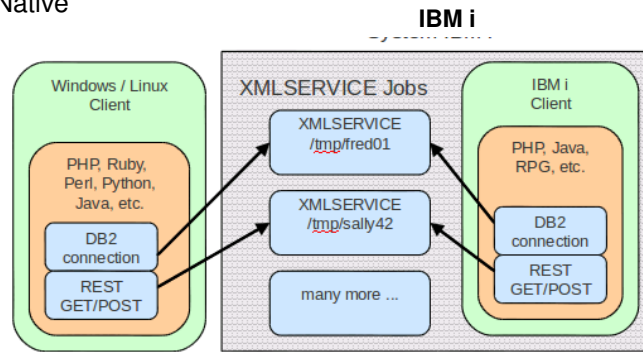
- ## What is PowerRuby?
  - Freely available and commercially supported port of the Ruby language
  - Includes supporting infrastructure (i.e. Rails) for running Ruby web applications on IBM i
  - Available for download from PowerRuby.com
  - Includes native DB2 database driver – MySQL not necessary
  - Integrates with XMLSERVICE for access to IBM i programs and objects

- ## Components
  - Ruby 2.0.0 and 1.9.3 (MRI implementation, a.k.a CRuby)
  - ibm_db (IBM supported - http://rubyforge.org/projects/rubyibm/)
  - Apache + Thin ← the web server stack (more Ruby app servers options coming)
  - Rails 3.2.x and 4.0.0 (Coffeescript support in the works)

- ## Learn more
  - PowerRuby.com for updates and news
  - twitter.com/rubyonpower

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Open Source for IBM i

– New LPO – 5733OPS Open Source for IBM i

- New license program option
- Designed for Open Source offerings on IBM i
- Provides a safe way for Open Source to be delivered on IBM i
- Option 1 – Node.JS
- Other options to follow this year with other offerings

Node.js

- **What's node.js**
  – Node.js is a platform for server-side and networking applications.
  – Node.js applications are written in JavaScript but run without browsers.
  – Node.js is based on Google Chrome V8 Engine.
- **Why node.js**
  – High Performance

  Node.js is designed to maximize throughput and efficiency.
  – Easy to use

  JavaScript has already been a widely used language. Leverage existing skills to create server-side application.
  – Increasing popularity:

  More than 70,000 third-party extensions are available on www.npmjs.org now.

Node.js

New
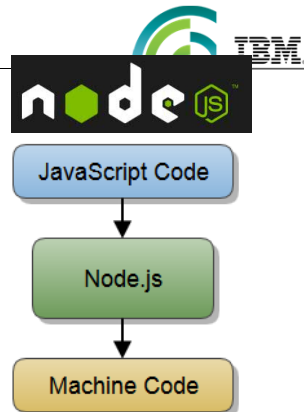
- **IBM i specific extensions**
  - Besides the existing function, two import IBM i specific extensions are also created.

  - **DB2 for i extension**
    - Based on standard DB2CLI and supports Stored Procedure.

  - **Node.js toolkit for IBM i extension**
    - Allow Javascript to access IBM i native objects, such as programs, commands, message queues, data areas, spool files, user spaces, jobs, system values, environment values, and more.

- Delivered as part of the 5733OPS product

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Other Components We Support Today

What does Mobile on IBM i look like….

Plumbing
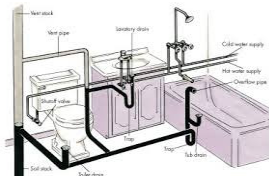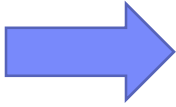
Tools for Mobile
Enablement

Applications for a
Mobile World

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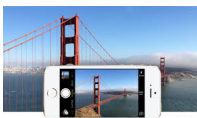
Why Consider one of these Products ?

- Use existing RPG/COBOL and DDS skills
- Intuitive development environment
- Leverage your existing IBM i applications
- Transform in days not years
- No need to learn new languages
- Incorporate features of the mobile device into your backend app
    - Camera, GPS location, Maps, etc
- Write once, deploy to many devices
    - Put the need to chase devices on someone else
- Cost effective
    - Compare cost of re-writing vs transforming

FAST

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How these Solutions Work — New Graphical Interface

Rich GUI Development Environment

Run Time Engine
Interfaces between
Mobile / Web Interfaces

Backend RPG / COBOL
Mostly unchanged

"IBM HATS gave us everything we were looking for in our Enterprise as a stepping stone into the future. It gave us efficiency, accessibility, and rich GUI's for ease of work and excellent look & feel."
Hussein Tarhini, Zahid Tractor

"LANSA's LongRange product allows us to create stunning native mobile apps for Apple or Android devices and keep the business logic running on IBM i. Our mobile project was so successful it won the 2013 Power Systems Innovation Award."
Jay Kamradt, IS Supervisor
Kawasaki Motors Manufacturing

"We could see that mobile was going to change the way our out-of-office workers would work, so we started investigating what we could do with mobile on the IBM i."

Nancy Lorch, Manager, SANDIS, San Diego Regional Centerc

3500 hours saved per month across 175 users

Users and customers that love the new application

10 days from start of project to iPad application delivery

29

We Services Using IBM i Web Services Environment
Web Service enable RPG and COBOL Source Code

- Integrated Wed Services Server – now powered by WAS Liberty & Jax-WS
    - Running on Liberty
        Faster and better compliance
    - JAX-WS SOAP web service container
        Latest industry standard support

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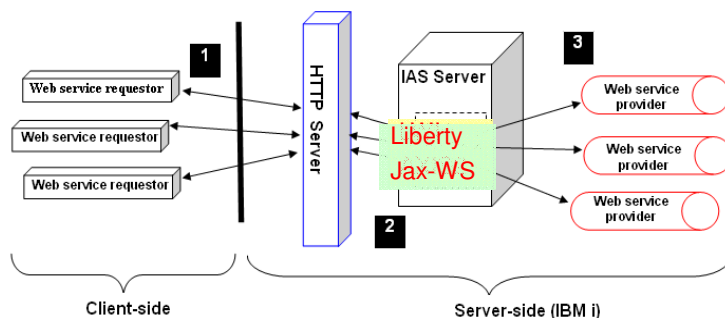
REST Web Services
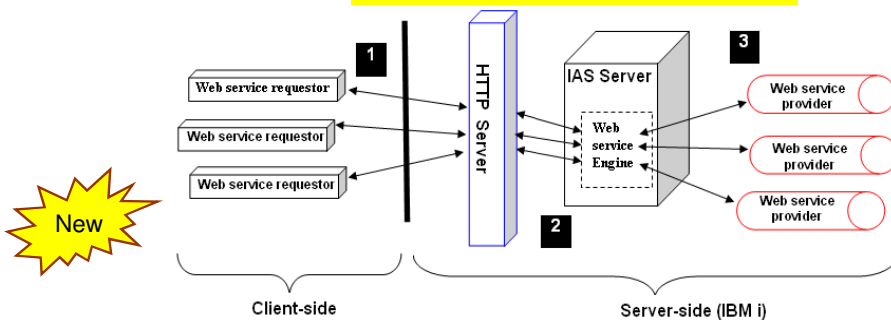*Web Service enable RPG and COBOL Source Code*

- Integrated Wed Services Server – now powered by WAS Liberty & Jax-RS
    - Running on Liberty
        Faster and better compliance
    - JAX-RS REST web service container
        JSON leveraged for the communication

60   60

30

Integrated Application Server for i
Now built on WebSphere Liberty

- Light weight portable Web container
- Upward compatible to full WebSphere
- Auto detect application updates
- PCI compliant
- Fast startup time
- Integrated into IBM i
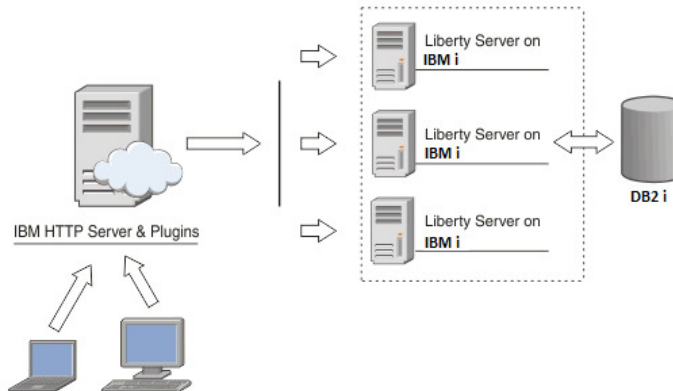
JVM Improves Java Performance

- IBM 32-bit & 64-bit Java™ Virtual Machine
  - Technology shared with AIX, IBM i and Linux
  - Improves performance & portability
- Exceptional Java environment and performance. Built by IBM for Power
  - Fully compatible with other industry standard Java applications
  - Can be called by APIs or directly from other languages
- IBM Java ToolBox for IBM i
  - Pre-coded Java classes to access native IBM i artifacts – files, data queues, etc

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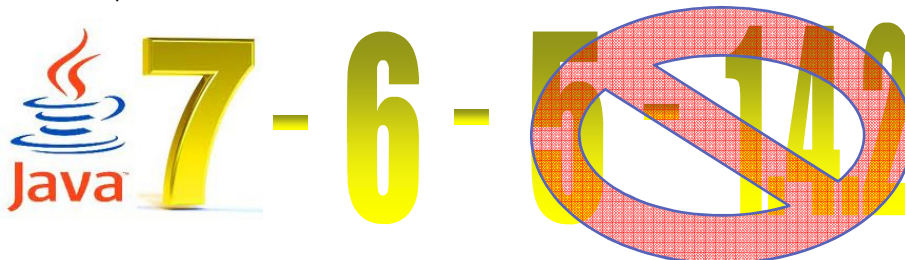
Java Security discussion

- Developer Works Java on IBM i
- Page to show delivery of Java SR & CVE solutions
  - What IBM i Java PTF Group

https://www.ibm.com/developerworks/ibmi/techupdates/java

Modernization of Applications and Data

1. Database considerations
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3. User Interface

Web Services

RPG III, COBOL/400, CL/400 → **RPG Free Format Open Access**

RPG IV ILE COBOL ILE CL

Tools

Graphical Web Mobile

Database

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When it comes to
modernization there is only
one mistake you can make…

When it comes to
modernization there is only
one mistake you can make…

Do Nothing!