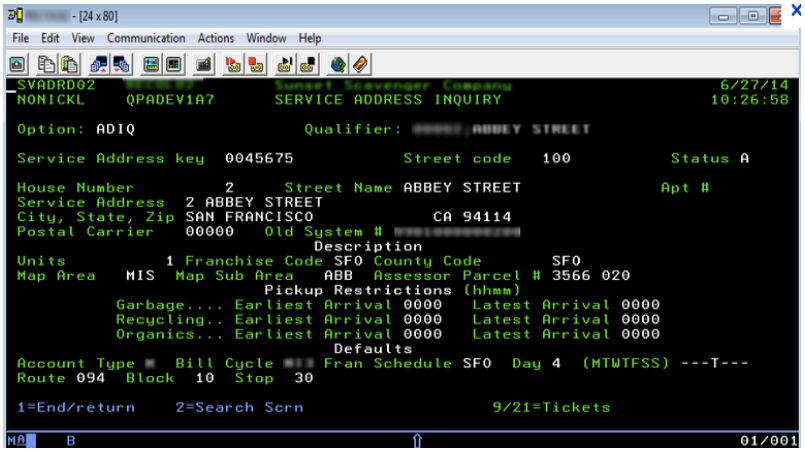
The Who, What and Why of Application Modernization

Alison Butterill
WW Offering Manager, IBM i

© 2018 IBM Corporation

Modern Interface?



© 2018 IBM Corporation

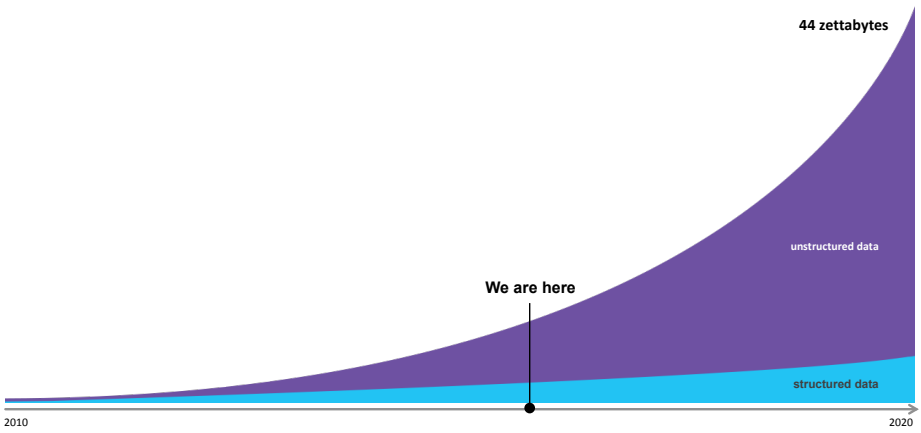
The World Looks Like This

© 2018 IBM Corporation

The Cloud

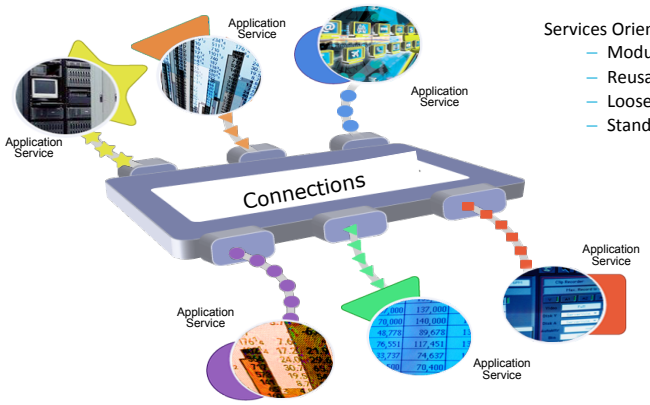
© 2018 IBM Corporation

Data growing exponentially & needs new approach



© 2018 IBM Corporation

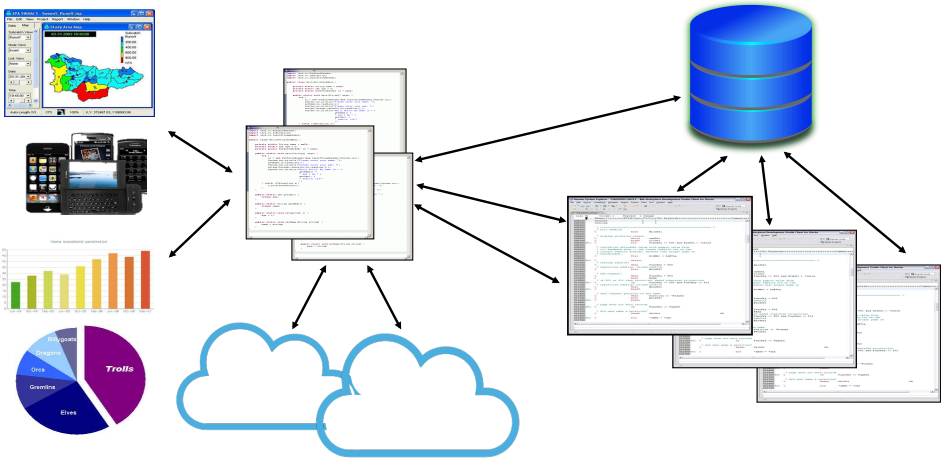
Industry Trends



Services Oriented
- Modular
- Reusable
- Loosely Coupled
- Standards based

© 2018 IBM Corporation

Modern Application Structure



© 2018 IBM Corporation

What is Modernization?

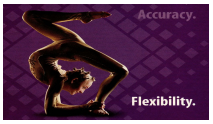
User Experience?

© 2018 IBM Corporation

What is Modernization?

User Experience?

Flexible Code?

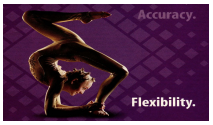


© 2018 IBM Corporation

What is Modernization?

User Experience?

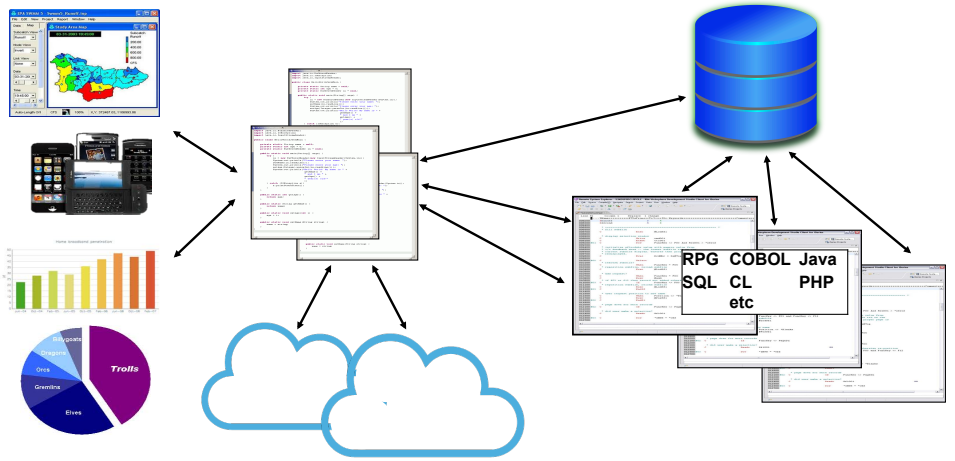
Flexible Code?



Environment and Tools?

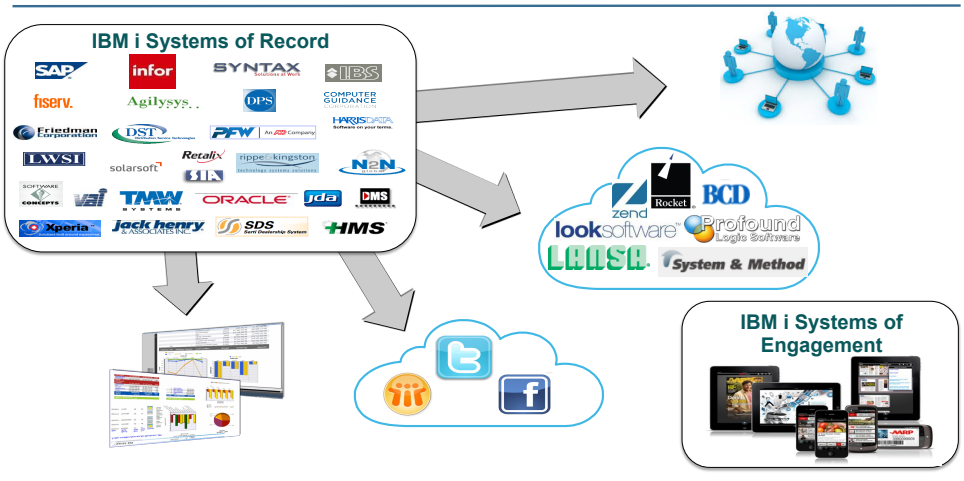
© 2018 IBM Corporation

Modern Application Structure for IBM i



© 2018 IBM Corporation

Partnering where Appropriate



© 2018 IBM Corporation

IBM i Application Languages Strategy

- RPG is the most commonly used language on IBM i so
  - Enable RPG as a powerful, modern procedural language
  - Partner for tools which transform older RPG to modern RPG
  - Work with partners & schools to teach RPG to non-RPG developers quickly
- Extensive skills and catalogs of solutions exist for business in other languages
  - Support key industry languages and programming models on IBM i
  - Ensure those new approaches can integrate with existing IBM i solutions
  - Enable tools for development, debug, lifecycle – from IBM and from partners

© 2018 IBM Corporation

Letter of Commitment for RPG

April 12, 2016

Dear IBM i clients and partners,

I would like to take this opportunity to reaffirm the commitment that IBM has made with regard to RPG, COBOL and the IBM i Development suite of tools. Recently, the team responsible for developing the compilers and tools for IBM i have moved into the IBM i Development organization. This will allow more synergy between the development of the languages and the development of the operating system.

As indicated by Dou… Systems is committe… the ILE RPG and ILE… commitment has be… Free Format RPG. Bo… and technologies an… enhancements suppo… parallel with our mos… languages were also…

We gather requirements for these Application Development environments for IBM i from a number of customer advisory councils and we balance those requirements with our study of industry trends. As the delivery of updates to the compilers and Rational Developer for i unfolds over the next several quarters you will see further evidence of our eagerness to listen, to collaborate, and to deliver the improvements you consider most valuable.

IBM Power is committed to your success - to helping you realize business value from your applications and to extend that value with new business opportunities. We thank you for your business and your confidence in the future of one of the world's most durable and productive platforms for business.

Sincerely,

Steve Sibley
Vice President, Business Line Executive
IBM Power Systems

As indicated in the IBM i Strategy Whitepaper, IBM Power Systems is committed to the success and ongoing development of IBM i. This includes the ILE RPG and ILE COBOL compilers and associated development tools.

© 2018 IBM Corporation

The New RPG

RPG IV
- Interoperability
  - Java
  - XML
  - SQL
  - Open Access
- Readability
  - Free form
  - Blank lines
  - Comments
  - Completely free format
- Functionality
  - Procedures
  - Data areas
  - Data structures
  - More data types

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

dcl-f custfile usage(*update);
dcl-ds custDs likerec(custRec);

read custfile custDs;
dow not %eof;
   if dueDate > %date(); // overdue?
      sendOverdueNotice();
   endif;
   read custfile custDs;
enddo;

dcl-proc sendOverdueNotice;
   sendInvoice (custDs : %date());
 end-proc;
```

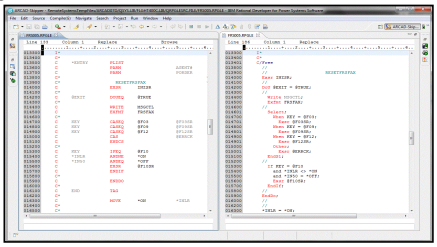
© 2018 IBM Corporation

Rational Open Access: RPG Edition

© 2018 IBM Corporation

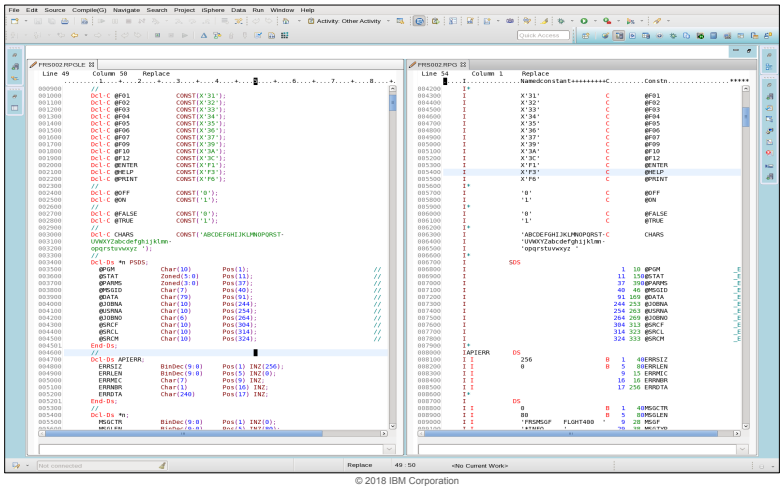
Arcad RPG Converter for i

- ARCAD-Transformer RPG (Converts to RPG Free Format)
  - ≈ 100 % of calculation specifications (C)
  - ≈ 100 % of declaration specifications (H, F, D, P)
  - (SQL)RPGLE : ≈ 100 % Free-Form
- ACVTRPGFRE batch command
- Plugs into RDi 9.0
- Single or multiple programs converted at one time



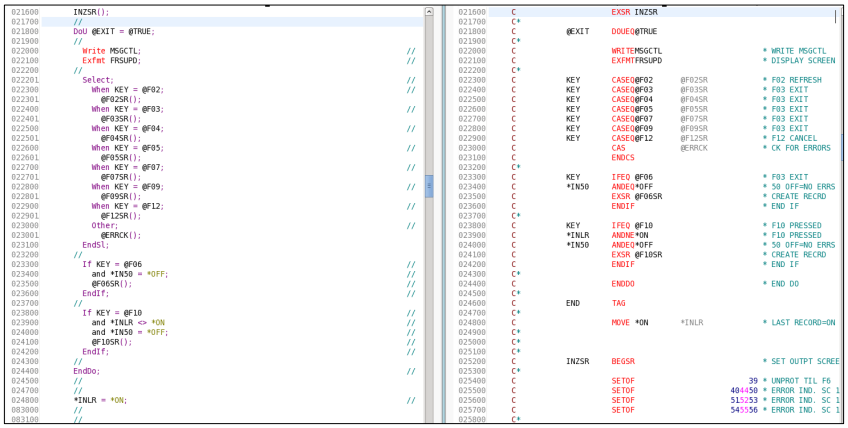
Forum utilisateurs Arcad, 19 Septembre 2013, Paris: Copyright Arcad Software 1992-2013

Input Specs and Data Structures -> Declarations



© 2018 IBM Corporation

Creates Case Statements



```
      INZSR();
      //
      DoU @EXIT = @TRUE;
      //
        Write MSGCTL;                                   //
        Exfmt FRSUPD;                                   //
      //
        Select;                                         //
          When KEY = @F02;                              //
            @F02SR();
          When KEY = @F03;                              //
            @F03SR();
          When KEY = @F04;                              //
            @F04SR();
          When KEY = @F05;                              //
            @F05SR();
          When KEY = @F07;                              //
            @F07SR();
          When KEY = @F09;                              //
            @F09SR();
          When KEY = @F12;                              //
            @F12SR();
          Other;                                        //
            @ERRCK();
        Endsl;
      //
        If KEY = @F06                                   //
          and *IN50 = *OFF;                             //
          @F06SR();                                     //
        Endif;                                          //
      //
        If KEY = @F10                                   //
          and *INLR <> *ON                              //
          and *IN50 = *OFF;                             //
          @F10SR();                                     //
        Endif;                                          //
      //
      EndDo;                                            //
      //
      //
      *INLR = *ON;                                      //
      //
      //
```

```
     C                   EXSR INZSR
     C*
     C           @EXIT   DOUEQ@TRUE
     C*
     C                   WRITEMSGCTL                    * WRITE MSGCTL
     C                   EXFMTFRSUPD                    * DISPLAY SCREEN
     C*
     C           KEY     CASEQ@F02     @F02SR           * F02 REFRESH
     C           KEY     CASEQ@F03     @F03SR           * F03 EXIT
     C           KEY     CASEQ@F04     @F04SR           * F03 EXIT
     C           KEY     CASEQ@F05     @F05SR           * F03 EXIT
     C           KEY     CASEQ@F07     @F07SR           * F03 EXIT
     C           KEY     CASEQ@F09     @F09SR           * F03 EXIT
     C           KEY     CASEQ@F12     @F12SR           * F12 CANCEL
     C                   CAS           @ERRCK           * CK FOR ERRORS
     C                   ENDCS
     C*
     C           KEY     IFEQ @F06                      * F03 EXIT
     C           *IN50   ANDEQ*OFF                      * 50 OFF=NO ERRS
     C                   EXSR @F06SR                    * CREATE RECRD
     C                   ENDIF                          * END IF
     C*
     C           KEY     IFEQ @F10                      * F10 PRESSED
     C           *INLR   ANDNE*ON                       * F10 PRESSED
     C           *IN50   ANDEQ*OFF                      * 50 OFF=NO ERRS
     C                   EXSR @F10SR                    * CREATE RECRD
     C                   ENDIF                          * END IF
     C*
     C                   ENDDO                          * END DO
     C*
     C           END     TAG
     C*
     C                   MOVE *ON      *INLR            * LAST RECORD=ON
     C*
     C*
     C*
     C           INZSR   BEGSR                          * SET OUTPT SCREE
     C*
     C                   SETOF                       39 * UNPROT TIL F6
     C                   SETOF                   404450 * ERROR IND. SC 1
     C                   SETOF                   515253 * ERROR IND. SC 1
     C                   SETOF                   545556 * ERROR IND. SC 1
     C*
```

© 2018 IBM Corporation

Subroutines converted to Procedures

```
Dcl-Proc INZSR;                                         //
//
  *IN39 = '0';                                          //
  *IN40 = '0';                                          //
  *IN44 = '0';
  *IN50 = '0';
  *IN51 = '0';                                          //
  *IN52 = '0';
  *IN53 = '0';
  *IN54 = '0';                                          //
  *IN55 = '0';
  *IN56 = '0';
//
  %Subst(MSGID:7:1) = ' ';
  MSGDTA = *Blanks;
  MSGQUE = @PGM;
//
  @EXIT = @FALSE;
  PGMQ = @PGM;
//
  ORDNUM = PORDER;                                      //
//
  Chain ORDNUM ORDNAME;
  *IN44 = not %Found;
//
  FILDPK = DEPART;
  DOFYR = %Dec(%XLate(' ':'0':
        FILYY):4:0);
  DOFMON = %Dec(%XLate(' ':'0':
         FILMM):2:0);
  DOFDAY = %Dec(%XLate(' ':'0':
         FILDD):2:0);
//
  CUSTKY = CNAME;
  CUSNAM = CUSTNM;
//
  CLASSK = CLASS;
//
  COSFIR = ' ';
  COSBUS = ' ';
  COSECO = ' ';
  If CLASSN = '1';                                      //
    COSFIR = 'X';
```

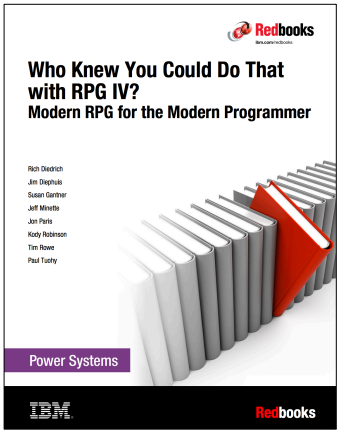
```
     C           INZSR   BEGSR                          * SET OUTPT SCREE
     C*
     C                   SETOF                       39 * UNPROT TIL F6
     C                   SETOF                   404450 * ERROR IND. SC 1
     C                   SETOF                   515253 * ERROR IND. SC 1
     C                   SETOF                   545556 * ERROR IND. SC 1
     C*
     C                   MOVE ' '      MSGID    7
     C                   MOVE *BLANKS  MSGDTA 80
     C                   MOVE @PGM     MSGQUE 10
     C*
     C                   MOVE @FALSE   @EXIT    1
     C                   MOVE @PGM     PGMQ
     C*
     C                   Z-ADDPORDER   ORDNUM                 ACTIVE
     C*
     C           ORDNUM  CHAINORDNAME              44
     C*
     C                   MOVE DEPART   FILDPK
     C                   MOVE FILYY    DOFYR
     C                   MOVE FILMM    DOFMON
     C                   MOVE FILDD    DOFDAY
     C*
     C                   MOVE CNAME    CUSTKY
     C                   MOVELCUSTNM   CUSNAM
     C*
     C                   MOVE CLASS    CLASSK
     C*
     C                   MOVE ' '      COSFIR
     C                   MOVE ' '      COSBUS
     C                   MOVE ' '      COSECO
     C           CLASSN  IFEQ '1'                       * RUN INTERACTIVE
     C                   MOVE 'X'      COSFIR
     C                   ENDIF
     C           CLASSN  IFEQ '2'                       * RUN INTERACTIVE
     C                   MOVE 'X'      COSBUS
     C                   ENDIF
     C           CLASSN  IFEQ '3'                       * RUN INTERACTIVE
     C                   MOVE 'X'      COSECO
     C                   ENDIF
     C*
     C                   Z-ADDTCKTNO   TCKETS                 ACTIVE
     C*
```

© 2018 IBM Corporation

Modern RPG

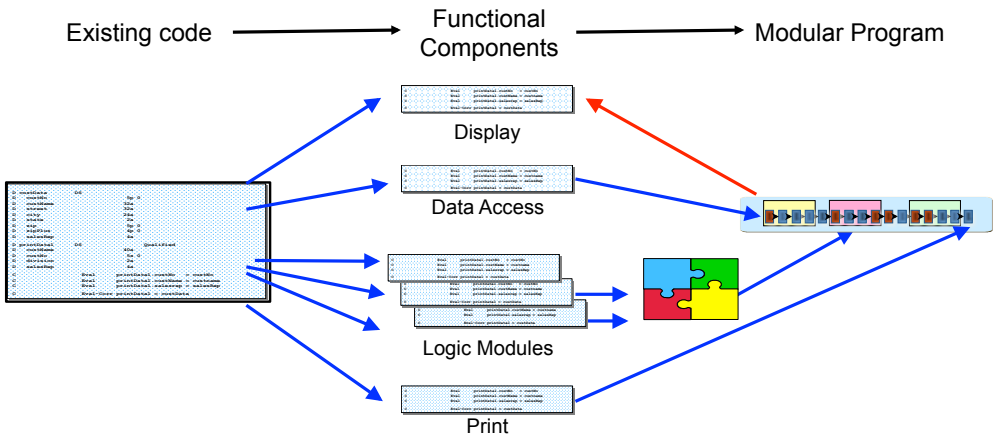
- Dec 2016
- Updated from the original book from 2000
- Many of the same expert Authors, plus a few New ones!
- https://www.redbooks.ibm.com/redbooks/pdfs/sg245402.pdf

9,000 + Downloads!!!!



© 2018 IBM Corporation

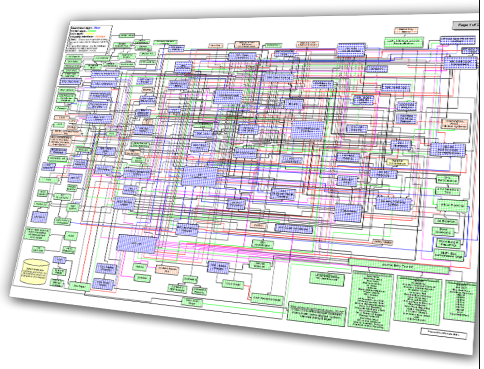
Modularizing The Code



© 2018 IBM Corporation

Understanding the Code

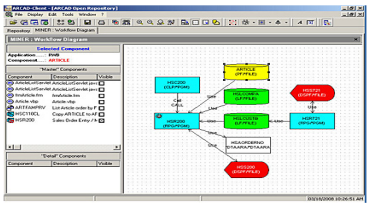
- Tools for Program Understanding
- Traditional Applications for IBM i
  - "It's all in there"
  - All code in few programs

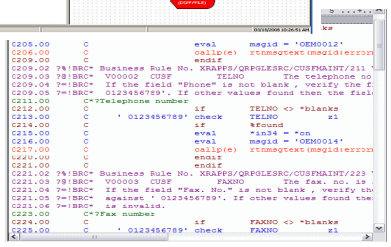


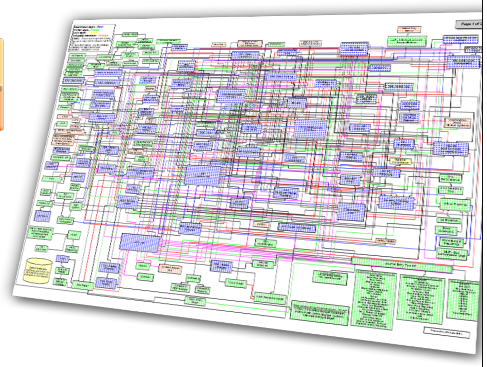
© 2018 IBM Corporation

Understanding the Code

- Tools for Program Understanding



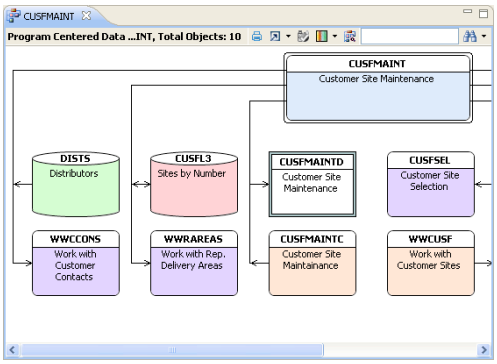




© 2018 IBM Corporation

Why a Tool for Analysis?

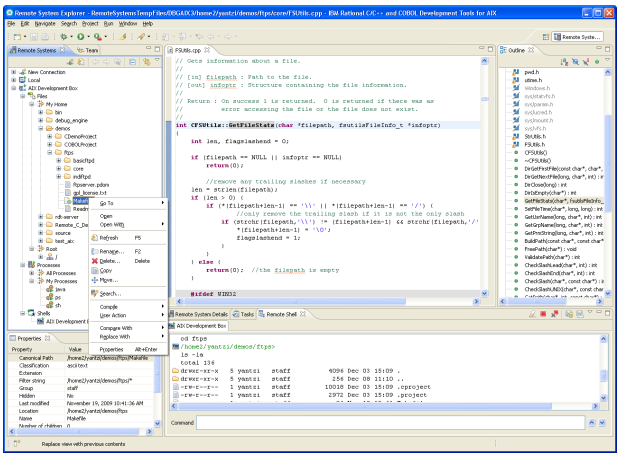
- Rapid analysis for hot fixes
- Application Change Studies (cost estimation)
- Redesign/re-architecting/SOA
- Extraction of business rules
- Application modernization
- Skill transfer
  - Help new people learn the application
- Generation of documentation required by regulatory constraints



© 2018 IBM Corporation

Rational Developer for i

- Modern
- Integrated
- Analysis
- Debugger
- Visual
- Supports RPG, COBOL, CL, C, C++, SQL, DDM

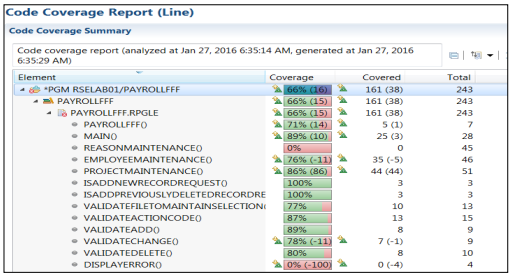


26

© 2018 IBM Corporation

What's new in RDi 9.6

- Compiler & program verifier messages – annotated
- Unused variables - annotated
- Rich ILE RPG hover showing all contributing definitions
- Shift/split free form ILE RPG using the Tab/Enter
- Compare/Merge of members with sequence numbers
- i Project improvements
- Upgrades: Eclipse 4.6.3, RAD 9.6.1, WAS 9, ACS 1.1.7.1, JTOpen 9.3
- Over 40 fixes and 7 RFEs
- Headless Code Coverage
- Refactor Rename improvements



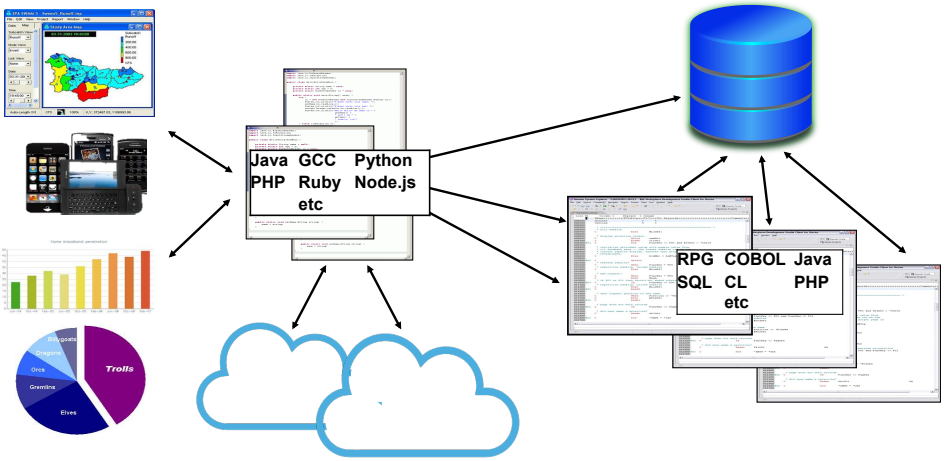
© 2018 IBM Corporation

Developer Productivity

- Return on Investment
- Better able to respond to the needs of the business
- Higher quality
- Positioned to adopt new talent

© 2018 IBM Corporation

Modern Application Structure for IBM i



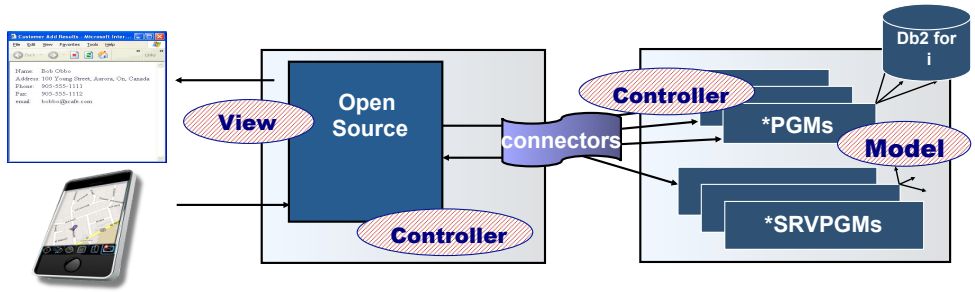
© 2018 IBM Corporation

Open Source Strategy

- Open Source Strategy
  - Encourage all vendors to port to IBM i
  - Provide the 'right' components
  - Provide 'support'

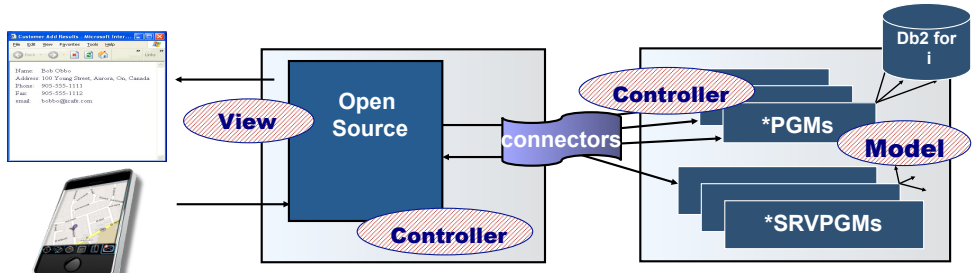
© 2018 IBM Corporation

Connecting IBM i to Open Source



© 2018 IBM Corporation

Connecting IBM i to Open Source

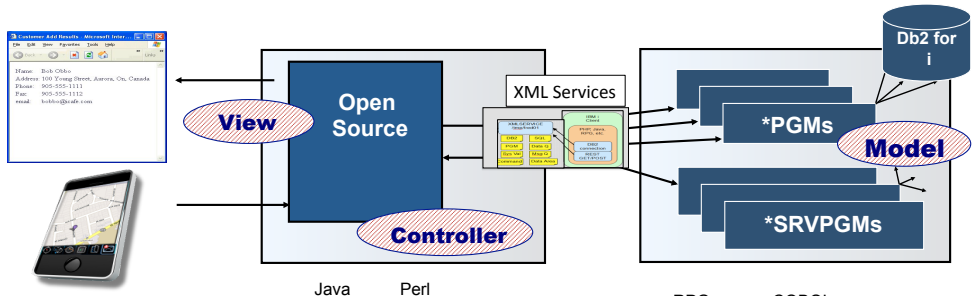


Java	Perl
PHP	Python
Ruby	etc

RPG	COBOL
SQL	CL
Java	PHP
etc	

© 2018 IBM Corporation

Better Connections



Java
PHP
Ruby

Perl
Python
etc

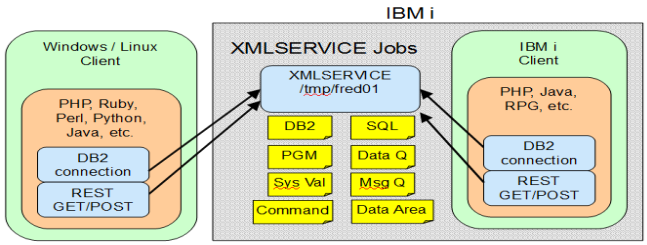
RPG
SQL
Java
etc

COBOL
CL
PHP

© 2018 IBM Corporation

Connecting with i – XML Service

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



- Local or Remote access

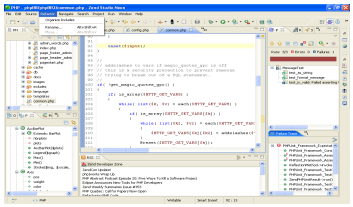
http://www.youngiprofessionals.com/wiki/XMLSERVICE

© 2018 IBM Corporation

Open Source Solutions for i

- Zend Server 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
Division of RogueWave



© 2018 IBM Corporation

Mixing RPG and Java

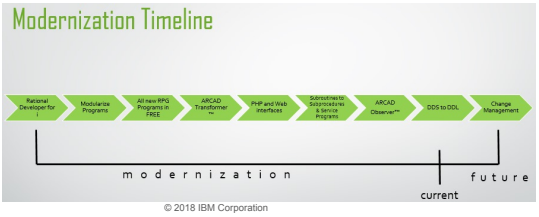
- RPG
  - Call APIs
  - Call Java Methods as RPG Procedures
  - Send / Receive parameters
  - Generate PCML from compiles
- Java
  - Java Native Interface
  - Java ToolBox for i
    - Included in JDE for IBM I
  - Open Source JTOpen
  - Open Source JTOpen Lite
  - XML Service

© 2018 IBM Corporation

Proof Points

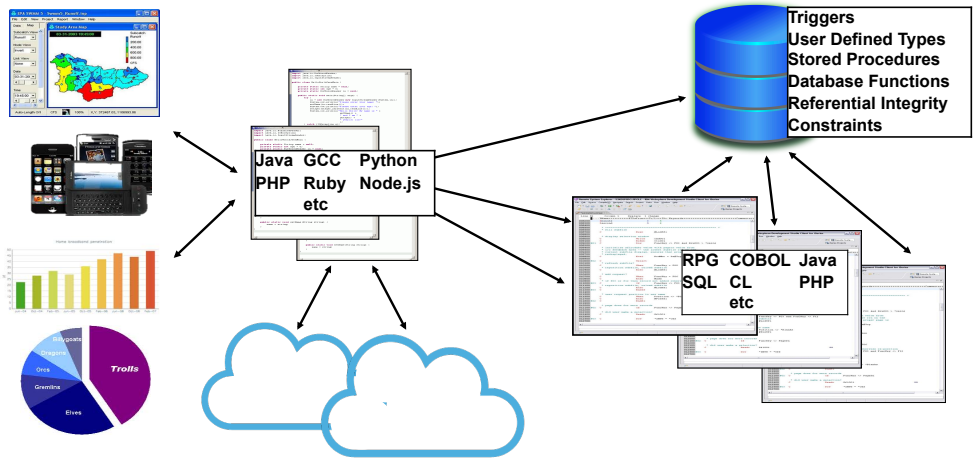
- Modern RPG and Tools allowed a 23 year old developer to be a success today!

http://bit.ly/1WhM7uT



© 2018 IBM Corporation

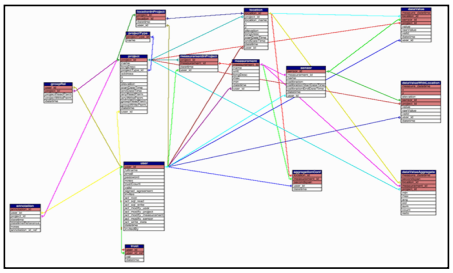
Modern Application Structure for IBM i



© 2018 IBM Corporation

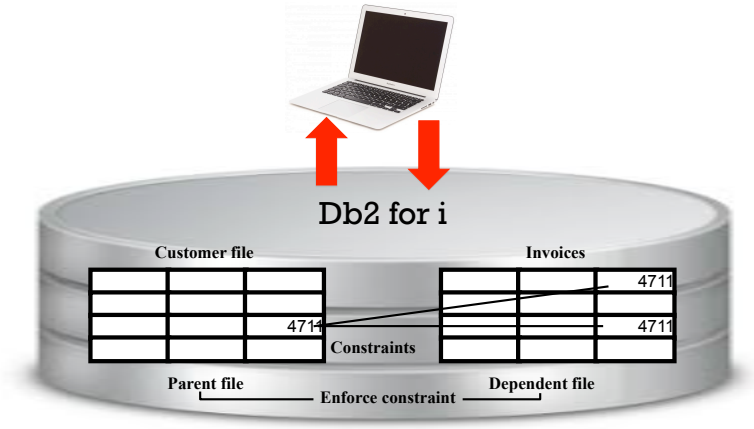
Database Design

- Referential Database Design
  - 3rd or 4th normal form
  - Appropriate indexes/views
  - Data located in correct place
  - SQL interfaces
- Clean data
  - Lack of anomalies
  - Correct rules in place to maintain clean data



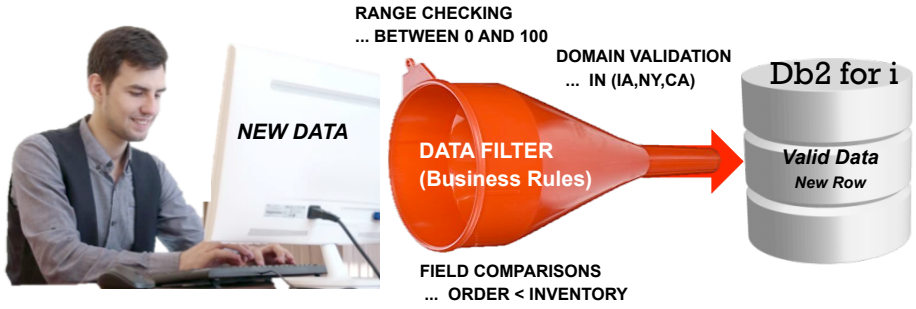
© 2018 IBM Corporation

Referential Integrity



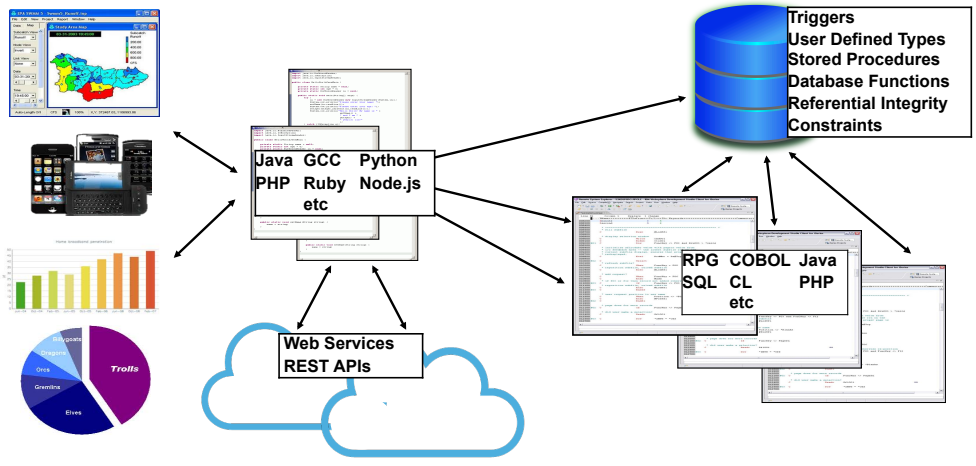
© 2018 IBM Corporation

Check Constraints



© 2018 IBM Corporation

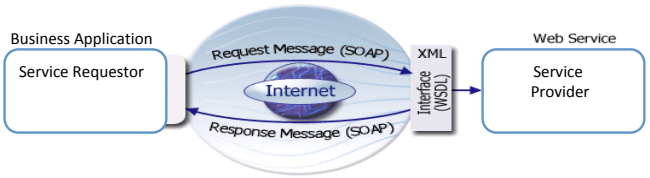
Modern Application Structure for IBM i



© 2018 IBM Corporation

Web Services Made Easy

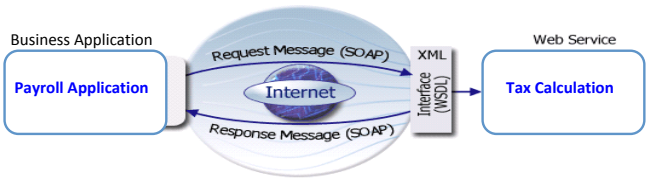
- Software Application requiring some additional components
- Exposed Services; published and available
- Web Service = Self-Contained function with well-defined interfaces that provide functionality that is accessible over the Internet/Intranet
- Industry Standard Connection protocol
- SOAP or REST



© 2018 IBM Corporation

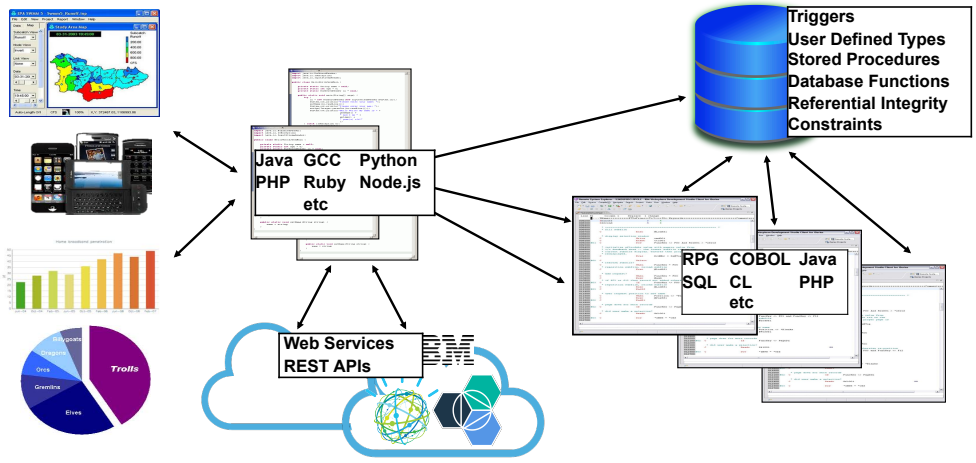
Web Services Made Easy

- Software Application requiring some additional components
- Exposed Services; published and available
- Web Service = Self-Contained function with well-defined interfaces that provide functionality that is accessible over the Internet/Intranet
- Industry Standard Connection protocol
- SOAP or REST



© 2018 IBM Corporation

Modern Application Structure for IBM i



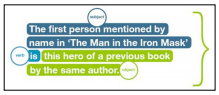
© 2018 IBM Corporation

Leverage Watson APIs to apply cognitive

50 Underlying Technologies

Entity Extraction	Document Conversion
Sentiment Analysis	Language Translation
Emotion Analysis (Beta)	Natural Language Classifier
Keyword Extraction	Personality insights
Concept Tagging	Relationship Extraction
Taxonomy Classification	Retrieve and Rank
Author Extraction	Tone Analyzer
Language Detection	Emotive Speech to Text
Text Extraction	Text to Speech
Microformats Parsing	Face Detection
Feed Detection	Image Link Extraction
Linked Data Support	Image Tagging
Concept Expansion	Text Detection
Concept Insights	Visual Insights
Dialog	Visual Recognition
	AlchemyData News
	Tradeoff Analytics

Retrieve and Rank

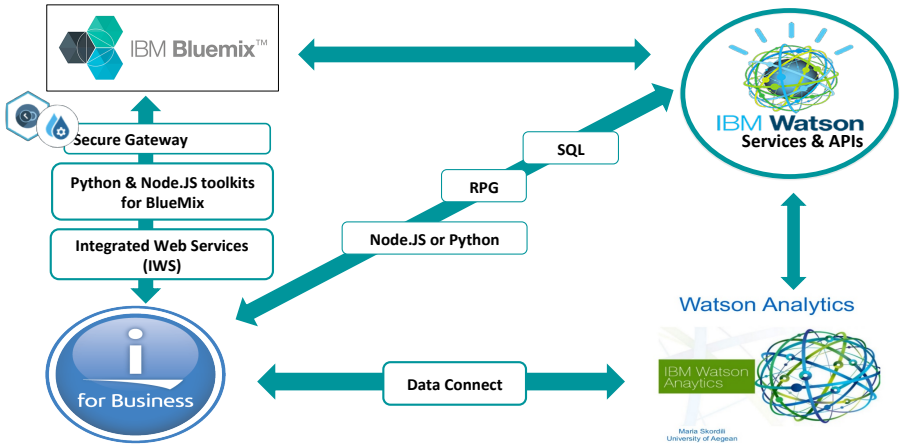


Natural Language Classifier

Tone Analyzer

© 2018 IBM Corporation

Connecting IBM i to Watson



© 2018 IBM Corporation

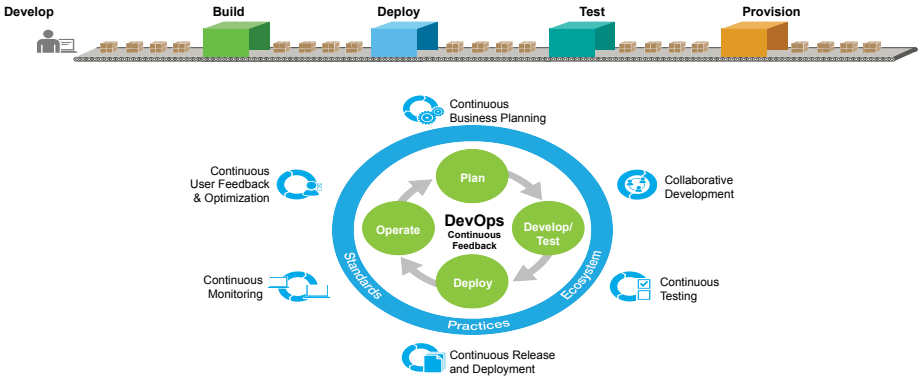
Let's Talk About ...

for Business

What's Next?

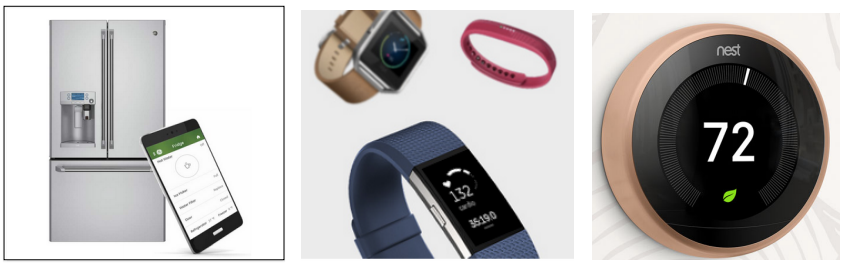
© 2018 IBM Corporation

DevOps = Evolution to Continuous Delivery



© 2018 IBM Corporation

Interconnected Devices



© 2018 IBM Corporation

"Wearables" ?

© 2018 IBM Corporation

Redbook

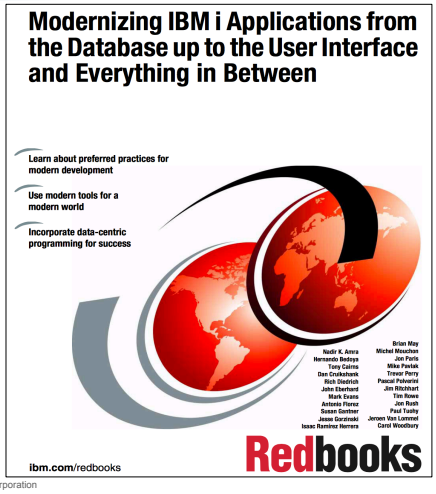
Modern IBM i Application from the Database up to the User Interface and Everything in Between

June 2014

Authors are Leading Experts from the IBM i Community

http://www.redbooks.ibm.com/redbooks/pdfs/sg248185.pdf

More than 22,000 Downloads



© 2018 IBM Corporation

Moving IBM i Applications into the Modern World

Alison Butterill
WW Offering Manager, IBM i

© 2018 IBM Corporation

Special notices

Cognitive Systems

This document was developed for IBM offerings in the United States as of the date of publication. IBM may not make these offerings available in other countries, and the information is subject to change without notice. Consult your local IBM business contact for information on the IBM offerings available in your area.

Information in this document concerning non-IBM products was obtained from the suppliers of these products or other public sources. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. Send license inquires, in writing, to IBM Director of Licensing, IBM Corporation, New Castle Drive, Armonk, NY 10504-1785 USA.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

The information contained in this document has not been submitted to any formal IBM test and is provided "AS IS" with no warranties or guarantees either expressed or implied.

All examples cited or described in this document are presented as illustrations of the manner in which some IBM products can be used and the results that may be achieved. Actual environmental costs and performance characteristics will vary depending on individual client configurations and conditions.

IBM Global Financing offerings are provided through IBM Credit Corporation in the United States and other IBM subsidiaries and divisions worldwide to qualified commercial and government clients. Rates are based on a client's credit rating, financing terms, offering type, equipment type and options, and may vary by country. Other restrictions may apply. Rates and offerings are subject to change, extension or withdrawal without notice.

IBM is not responsible for printing errors in this document that result in pricing or information inaccuracies.

All prices shown are IBM's United States suggested list prices and are subject to change without notice; reseller prices may vary.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

Any performance data contained in this document was determined in a controlled environment. Actual results may vary significantly and are dependent on many factors including system hardware configuration and software design and configuration. Some measurements quoted in this document may have been made on development-level systems. There is no guarantee these measurements will be the same on generally-available systems. Some measurements quoted in this document may have been estimated through extrapolation. Users of this document should verify the applicable data for their specific environment.

Revised September 26, 2006

© 2017 IBM Corporation

Special notices (cont.)

IBM, the IBM logo, ibm.com AIX, AIX (logo), AIX 5L, AIX 6 (logo), AS/400, BladeCenter, Blue Gene, ClusterProven, Db2, ESCON, i5/OS, i5/OS (logo), IBM Business Partner (logo), IntelliStation, LoadLeveler, Lotus, Lotus Notes, Notes, Operating System/400, OS/400, PartnerLink, PartnerWorld, PowerPC, pSeries, Rational, RISC System/6000, RS/6000, THINK, Tivoli, Tivoli (logo), Tivoli Management Environment, WebSphere, xSeries, z/OS, zSeries, Active Memory, Balanced Warehouse, CacheFlow, Cool Blue, IBM Systems Director VMControl, pureScale, TurboCore, Chiphopper, Cloudscape, Db2 Universal Database, DS4000, DS6000, DS8000, EnergyScale, Enterprise Workload Manager, General Parallel File System, , GPFS, HACMP, HACMP/6000, HASM, IBM Systems Director Active Energy Manager, iSeries, Micro-Partitioning, POWER, PowerExecutive, PowerVM, PowerVM (logo), PowerHA, Power Architecture, Power Everywhere, Power Family, POWER Hypervisor, Power Systems, Power Systems (logo), Power Systems Software, Power Systems Software (logo), POWER2, POWER3, POWER4, POWER4+, POWER5, POWER5+, POWER6, POWER6+, POWER7, System i, System p, System p5, System Storage, System z, TME 10, Workload Partitions Manager and X-Architecture are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. If these and other IBM trademarked terms are marked on their first occurrence in this information with a trademark symbol (® or ™), these symbols indicate U.S. registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries.

A full list of U.S. trademarks owned by IBM may be found at: http://www.**ibm.com**/legal/copytrade.shtml.

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.
AltiVec is a trademark of Freescale Semiconductor, Inc.
AMD Opteron is a trademark of Advanced Micro Devices, Inc.
InfiniBand, InfiniBand Trade Association and the InfiniBand design marks are trademarks and/or service marks of the InfiniBand Trade Association.
Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.
IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency which is now part of the Office of Government Commerce.
Java and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.
Linear Tape-Open, LTO, the LTO Logo, Ultrium, and the Ultrium logo are trademarks of HP, IBM Corp. and Quantum in the U.S. and other countries.
Linux is a registered trademark of Linus Torvalds in the United States, other countries or both.
Microsoft, Windows and the Windows logo are registered trademarks of Microsoft Corporation in the United States, other countries or both.
NetBench is a registered trademark of Ziff Davis Media in the United States, other countries or both.
SPECint, SPECfp, SPECjbb, SPECweb, SPECjAppServer, SPEC OMP, SPECviewperf, SPECapc, SPEChpc, SPECjvm, SPECmail, SPECimap and SPECsfs are trademarks of the Standard Performance Evaluation Corp (SPEC).
The Power Architecture and Power.org wordmarks and the Power and Power.org logos and related marks are trademarks and service marks licensed by Power.org.
TPC-C and TPC-H are trademarks of the Transaction Performance Processing Council (TPPC).
UNIX is a registered trademark of The Open Group in the United States, other countries or both.

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

Revised December 2, 2010

© 2017 IBM Corporation