CSI International®
Modernizing VSE

John Rankin

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CSI INTERNATIONAL

Overview

- z/VSE®, VSE^{n}: *a Solid Foundation*
- Twenty Years of IBM Mainframe Development
- The State of Cobol VSE/ESA
- z/Cobol™ for z Series
- Embracing the Power of the Hardware
- Performance Operation
- Embracing the Modernization of VSE
- z/Talent™ Apprentice and Educational Program
- CSI International® Commitment

z/VSE®, VSE^{n}: *The Foundation*

- z/VSE® is the *oldest operating system* still in use today
- While IBM no longer supports it, 21st Century Software continues
- IBM's World:
  - ✓ z/Series® :
    - VSE^{n}, z/VSE®, z/VM®, z/TPF®, z/OS®, and Linux on Z
  - ✓ Power10™
    - AIX®, IBM i, Linux
- z/Series® is the most advanced hardware in world
  - ✓ Designed for *data processing*, rather than just *computing*
  - ✓ The I/O Sub-system is unmatched
  - ✓ Customers committed to the technology can achieve more than on any other platform

Commitment to the Future

- z/VSE® is an amazing platform since 1964
- CSI will continue to support z/VSE® and advance VSEn
- Innovation, Invention, and Cutting-edge Advances
- Dozens of additional enhancements are in development specifically designed to:
  - ✓ Take advantage of the massive power of z/Series
  - ✓ Keep performance at the front of our efforts
  - ✓ Provide greater flexibility
  - ✓ Enhance the I/O subsystem that sets mainframes apart from all other platforms
  - ✓ Better support for z/Linux as a flexible client solution
  - ✓ Meet our significant commitment to the community
  - ✓ Embracing all IBM offerings

The State of Cobol VSE/ESA

- Hardware Support
  - ✓ ESA instructions, limited in their ability to use current facilities
  - ✓ Heavily designed towards memory to memory operation
- Software Support
  - ✓ Old design for code base
    - Built upon 1968 code structure
    - Limited ability to react to hardware changes
    - Designed for a stable architecture
    - Discarded and rewritten for Enterprise Cobol
  - ✓ Use of runtime and assembler objects
    - Internal routines are used from the 1968 version of Cobol
    - LE used for runtime, limits performance in exchange for support

z/Cobol™ for z Series

- z/Cobol™ for z Series is designed for all modern IBM Mainframes
  - ✓ 100% Compatible for IBM Cobol VSE/ESA 1.1, 21csw 1.2
  - ✓ Meets the National Institute of Standards and Technology
    - 100% Certified against ANSI 1985 Cobol Standard
    - 340,000 Lines of Cobol, Testing Code Suite with 500+ programs tests
  - ✓ Maximum Performance on all IBM z Series mainframe platforms
- Completely New
- Generates High Performance Code
- Built for z/VSE, VSE^{n} , z/VM, z/OS, Linux on z, and zCX

Compiler Operation

- Cobol Source code can be structured to match:
  - ✓ ANSI 1968, ANSI 1974, ANSI 1985, or ISO/IEC 1989:2023(E)
  - ✓ Enhancements specifically designed for z Series
    - TCP/IP for ANSI Communication Description Entries
    - Addition Operating System based file methods, and all IBM extensions
- Generated Object code:
  - ✓ Linked with provided library of non LE routines.
  - ✓ No LE environment required.
  - ✓ Object code can be executed anywhere in 24bit, 31bit, and 64bit space
- Supports fully functional export of assembler code as output
- Object code that runs on z/VSE, VSEn, z/VM zCMS, z/OS, Linux on z, and zCX

Code Generated

- 100% 64 bit.
  - ✓ Dynamically adjusts to the calling environment, and uses IBM z/OS save area structures
- Reentrant, no SIIS issues
- Optimized for non memory to memory operation
- Takes full advantage of Long Displacements and Relative Branching
  - ✓ Each storage section can be addressed 1 Megabyte at a time
  - ✓ Branching works with full word relative movements
- All supporting routines
  - ✓ Provided in linkable 64bit object decks
  - ✓ Designed to work with 24/31/64 objects where necessary
- Runtime error recovery, including vector displays

Intellectual Property z/Cobol™ for VSE

- U.S. Patents:
  - ✓ 10,901,739 Issued: January 26th, 2021
  - ✓ 11,429,390 Issued: August 20th, 2022
- COBOL Standards
  - ✓ CODASYL COBOL – Issued: July, 1968
  - ✓ X3.23-1974 ANSI COBOL, Issued: May 10th, 1974
  - ✓ X3.23-1985 ANSI COBOL, Issued: September 10th, 1985
  - ✓ ISO/IEC 1989/Amendment 1, Intrinsic function module

Embracing the Power of the Hardware

- Levels of Support
  - ✓ Basic z/Series support, Architecture level 5
    - 64 instructions, relative branching, and long displacements
  - ✓ Immediate Values, Architecture level 7
    - Reduces the use of literal pools, and moves literals into instructions
  - ✓ Decimal Floating Point, Architecture level 9
    - Moves binary coded decimal away from memory to memory operations
  - ✓ Vector Facility, Architecture 12
    - Uses all 32 Vector Registers
    - Completely eliminates binary coded decimal memory instructions
    - All math operations occur on the chip, storing only when necessary

Vector Code Generated

- As math operations occur when z/Cobol™ elements are loaded into Vectors
- All 32 Vectors are continually used
- Vectors are saved prior to call operations
  - ✓ Allows z/Cobol™ code to use vectors while in CICS
  - ✓ Interfaces with standard callable routines
- Perform Verb operations
  - ✓ Utilizes Vectors for comparisons, and increments
  - ✓ Operates with as much data loaded into Vectors
- High performance operation
- Maintaining maximum instructions and data on chip and not memory

Performance Improvements

- Machine Support
  - ✓ z Series - Support for 64bit register usage
  - ✓ z10 - Decimal Floating Point
  - ✓ EC12 and BC12 - Decimal Floating Point Zone Extension
  - ✓ z13 and z13s - 32 Vector Registers and Instructions
  - ✓ z14 and z14 ZR1 - Vector Packed Decimal Facility
  - ✓ z15 and z15 T02 - Enhanced Vector Facility
  - ✓ z16 - Advanced Vector Facility Packed Decimal
- Structural Support
  - ✓ Highly optimized code generation
  - ✓ Use of registers, and vector registers, for intermediate results
  - ✓ Persistent and compressed code generation

Embracing the Modernization of z/VSE® and VSE^{n}

- CSI International® Modernized VSE in 1995 with TCP/IP for VSE®
  - ✓ Original, and designed specifically for VSE
- z/Cobol™ is built in the model of TCP/IP for VSE®
  - ✓ Complete new build, new design, original and specifically for VSE
  - ✓ Customizable, extendable, modifiable
- Generates complete assembler code
  - ✓ Compatible with the High Level Assembler
  - ✓ LIST option displays complete assembler output during compilation
- Cobol Verb “ENTER ASSEMBLER” and “ENTER COBOL”
  - ✓ Allows for the programmer to drop into assembler and make custom code, including system macro calls.

z/Cobol File Elements

- ✓ Built in file support for
  - Console and specialized file systems
  - z/CMS File Systems, including Stack reading and writing
  - Completely integrates into z/CMS Pipes
  - z/OS QSAM, BSAM, VSAM, PDS, PDSe
  - Customer extensions available
- ✓ All forms of Sequential disk and tapes supported by VSE, VM, and MVS
- ✓ All forms of VSAM files supported by VSE, VM, and MVS
- ✓ Advanced printer support for 3800s
- ✓ Complete support for IBM preprocessors

VSE Memory Elements

- Support for three separate Working Storage Sections
  - ✓ Standard, in 31 bit above the line storage
  - ✓ Low, in 24 bit below the line storage
  - ✓ High, in 64 bit above the bar within 64bi virtual memory objects
- Support for Cobol extension LOCAL-STORAGE
  - ✓ 31 bit above the line storage
  - ✓ Reinitialized on multiple calls
  - ✓ Reentrant code produced
- Shared Working Storage Sections
  - ✓ Multiple z/Cobol™ program in the same partition
  - ✓ Cross partition sharing, with 64bit virtual memory objects

Cobol Extensions

- Working Storage
  - ✓ ABOVE THE BAR and BELOW THE LINE
  - ✓ Allows callable routines support for all three storage areas
- Communication Section
  - ✓ Compatible with ANSI 85 Standard, and fully support TCP/IP
- File Section
  - ✓ Support Directory Structured file, not just seq., relative, and indexed.
- Report Section
  - ✓ Compatible with ANSI 85/74/68
- Vector Control Verbs for loading, unloading, storing, and saving
- Printer Control Verbs for advanced functions
- Sub Program execution on second CPU

Compiler Extensions

- Assembler code output
  - ✓ Modifiable with macros, and direct code insertions
- Contains a full Assembler implementation
  - ✓ 64 bit code generation
  - ✓ Complete features and listing support
- File extensions
  - ✓ Customizable file routines
- Intrinsic extensions
  - ✓ 64bit z/Cobol™ Objects
  - ✓ Customer written

Modernization

- z/Cobol is a completely compatible base with IBM COBOL
- Structure:
  - ✓ Object code is 100% 64-bit operation
  - ✓ Working Storage section can be: 24, 31, or 64 bit in the same program.
  - ✓ Each working storage section can be 2G in size
- Modern Outreach:
  - ✓ Complete JSON control:
    - Building JSON and parsing Json string is built into the language.
    - Utilized for web interfacing and communication with applications
  - ✓ Entire Network Section and Control structure
    - Clean, simple, build in Network Communication
    - RESTful API, JSON-RPC, MCP, TCP/IP, Secure Communication
- Completely extendable language base

z/Cobol embraces the Modern High-tech World

- z/Cobol Extends beyond standard Cobol
- JSON Implementation
  - ✓ Places the definition of JSON objects in the data area
  - ✓ Adds extremely flexible verbs to the PROCEDURE DIVISION
    - GENERATE JSON, and PARSE JSON Verbs
- New NETWORK SECTION and NETWORK-CONTROL
  - ✓ Within the design form of COBOL
  - ✓ Defines Modern Networking connections
  - ✓ Identifies Methods for managing Protocols
  - ✓ Within the PROCEDURE DIVISION adds
    - SEND and RECEIVE Verbs
- Clean, Usable, Simple, and fits within COBOL

Compiler Development and Support

- Official Cobol Compiler Validation System
  - ✓ National Institute of Standards and Technology
- 459 Cobol Programs
- Legler Systems
  - ✓ Complete Accounting System
  - ✓ Standard Cobol 85
  - ✓ Eleven Modules
  - ✓ Over a million lines of Cobol code

The Future

- Complete interactive Debugging Facility
- Advanced Programming Guides
- Example software library
- Self guided course materials
- Onsite and Regional Cobol Classes

z/Cobol Debugging Facility

- Operates completely off platform
- Trades real-time encapsulated JSON strings from data
- Stop points
- Abend interception
- Complete displays of all real-time data
- Comparison to off platform library of source code to match with

New Updated Utilities

- BIM-Build Index
- BIM-Console
- BIM-Echo
- BIM-EDFman
- BIM-Fmap
- BIM-Fleet
- BIM-ICCF
- BIM-LMON
- BIM-P3270
- BIM-Pads

New Updated Utilities (cont)

- BIM-Scan
- BIM-Serv
- BIM-Spool
- BIM-Spool Laser
- BIM-Spoon
- BIM-Submit
- BIM-Window

z/Talent® Apprentice and Education Program

- Complete Training for z/Series Knowledge
  - ✓ z/VSE®, VSE^{n} Operating System Internals
  - ✓ Systems Programming Training
  - ✓ Assembler Beginning and Advanced
  - ✓ Cobol Programming and Advanced Methods
  - ✓ VSAM Development
  - ✓ CICS Operations and Development
  - ✓ TCP/IP Operations, Networking, and Development
- Specialized Educational Series
  - ✓ z/Cobol™ Beginning. Forty Hours. How to program in Cobol.
  - ✓ z/Cobol™ Intermediate. Forty Hours. How to use complex facilities.
  - ✓ z/Cobol™ Advanced. Forty Hours. Extensions and report writing.

CSI International Major Touchpoints

- Professional Software development provides:
  - ✓ Stability, professional management and control over software
  - ✓ Reliability, high quality technical support and correction distribution
  - ✓ Functionality, achieved by utilizing all available hardware options, and innovating through invention
- Open Source stagnates innovation and advancement.
  - ✓ IBM has achieved the world's most advanced hardware through being the largest producers of U.S. Patents in the world.
- Utilize IBM hardware to achieve maximum value for customers
  - ✓ IBM is a Hardware Company, making the finest computer equipment

Commitment to the Future

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  - ✓ Better support for z/Linux as a flexible client solution
  - ✓ Meet our significant commitment to the community
- Embracing all IBM and 21st Century Software offerings

Once and Future Cobol

- Current support and limitations
  - ✓ Hardware z15 and above
  - ✓ No floating point support implemented yet
  - ✓ No double byte character set support yet
  - ✓ Report writer not yet completed, full support for IBM preprocessor
  - ✓ Building a new runtime debugging facility
- Statement of Direction
  - ✓ z/Cobol™ Linux for z, and zCX
  - ✓ Cobol will continue to be the fastest, and most dependable language in the world

Thank You

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