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# LE/390 Migration and Consolidation

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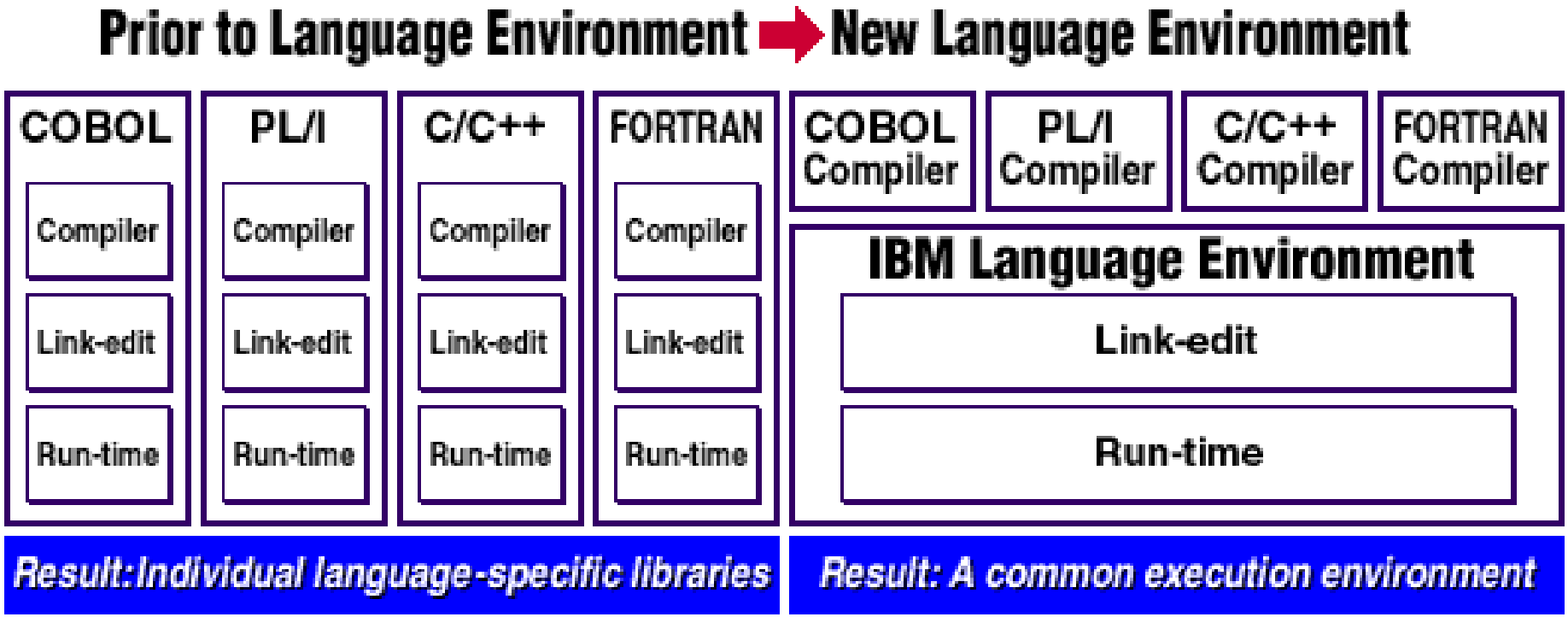
# Initial situation



# The current software standard for application development

- Welcome to Language Environment LE/390 and its using Compilers
  - Since 1996 Language Environment provides a common run-time environment which establishes a new way and standard of processing for
    - C, C++, COBOL, PL/I, Fortran, Java, and Assembler applications
    - all z/OS system components
    - most third party software components
  - Language Environment is the current and future direction for application development, playing a vital role within the operating system z/OS
  - Enterprise Compilers provide new functions, facilities, and language extensions. They require and use LE/390 run-time.
  - Programs should be compiled with IBM Enterprise Compilers for z/OS and run with the supported LE/390 run-time library.

    You can reach this ideal state gradually, by starting with a run-time migration followed by a compiler migration (quoted from Migration Guides).

# Important terms and definitions

- Language Environment-Enabled

  An application that can run with the Language Environment run-time library, which may also run with previous run-times. A Language Environment Enabled application may not make use of Language Environment callable services. A load module includes previous run-times modules. Out of support and maintenance for a long time, meets not the z/OS standards.

- Language Environment-Conforming

  An application that can only run with the Language Environment run-time library. A Language Environment-Conforming application may make use of Language Environment callable services. A load module includes only Language Environment run-times modules. This is z/OS standard.

- Language Environment-Conforming Compiler

  An Enterprise Compiler that generates Language Environment linkage conventions and requires Language Environment libraries.

# What you risk and what happens when you wait . . .

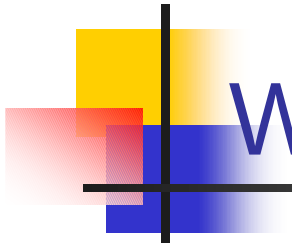
- What may happen if you delay the necessary LE/390 migration or consolidation for your applications
  - An application won't work if a software problem related to previous compiler or run-time versions occurs in one of the programs
  - An application may not work any longer because programs compiled with previous compiler versions and with its linked-in run-time are not supported by newer versions of system components (e. g. next release of CICS TS requires programs to be LE/390-compliant and compiled with newer versions)
  - An application will not run when a software problem related to previous compiler or run-time versions cannot be solved because no maintenance and know-how are still available

# What you risk and what happens when you wait

- Just one application or program can block an upgrade to newer versions of z/OS and/or system components when it is compiled with a previous compiler version which need an old run-time version and which cannot be migrated to LE/390 run-time.

  After a while the system then will run out of maintenance.
- Current LE/390-compliant Enterprise compiler versions with new functions, facilities, and language extensions are not usable.

  Their savings and simplifications for application development are not usable.
- Forgo benefits of LE/390 features for improved performance supplied for each program in a job (LPA), IMS, CICS and IDMS. These LE/390 performance features save CPU and I/O costs.
- Third party software components may not find its system and software environment requirements and cannot be installed.



# Warning of a fatal misconception

- A successful test of an old application, program or load module with an assigned LE/390 run-time library SYSx.SCEERUN (in STEPLIB or LNKLIST) confirms only “Language Environment-Enabled” but states nothing about “Language Environment-Conforming”.
- A Language Environment-Enabled application, program or load module uses special run-time modules in the LE/390 run-time library which are simulating an LE/390 environment. This configuration meets not the conditions for current LE-conforming compilers, z/OS standards, support, and maintenance and has no future.

# What IBM strongly recommends for Cobol (List is not complete)

- After you add an Enterprise COBOL program to an existing application, that application must run under Language Environment
- When you have an OS/VS COBOL NORES program or a VS COBOL II NORES program that is part of a (mixed) multiprogram load module with Language Environment, the COBOL library routines in the load module must be replaced with the Language Environment library routines. Failure to do so can cause unpredictable results.
- Under both CICS and non-CICS, you need the appropriate level of the VS COBOL II bootstrap IGZEBST in an Enterprise COBOL program that uses static CALL statements to call a VS COBOL II program. If you do not have the correct level of IGZEBST, you will encounter a program check.
- In summary IBM strongly recommends in the Migration Guide: Replace all prior COBOL run-time components by the current LE library routines to avoid unexpected problems in the future.

# What IBM strongly recommends for PL/I (List is not complete)

- After you add an Enterprise PL/I program to an existing application, that application must run under Language Environment.
- For old code compiled with OS PL/I V2R3 or earlier:
  - An old MAIN not linked with LE cannot FETCH a new module.
  - A new MAIN cannot CALL or FETCH an old module unless either the old or new module is linked with LE run-time library and with INCLUDE SYSLIB(CEESG010).
- FILE variables and constants cannot be shared between old and new code with one exception: SYSPRINT, when written to SYSOUT, can be shared by old and new code if the old code was linked under LE.
- In summary IBM strongly recommends in the Migration Guide:
  Replace all prior PL/I run-time components by the current
  LE library routines to avoid unexpected problems in the future.

  We can confirm this strategy for Cobol, PL/I, Fortran and C/C++
  by our extensive migration experience.

# The software state which must be achieved

- All application programs have to be compiled with an LE/390-compliant compiler
- All application programs and third party components have to run in an LE/390 run-time environment
- All application programs compiled and linked with previous compiler and run-time versions have to be migrated for running in an LE/390 run-time environment before Enterprise compilers are used
- Application development has to use current or still maintained versions of Enterprise compilers and of LE/390 run-time environments
- An LE/390 migration and/or consolidation is a periodically necessary maintenance action to keep alive the operating environment

This is comparable with an oil change at a motor that also must be maintained periodically to keep it for running.

# What each programmer has normally to do for migration

- Each programmer re-compiles and links all his existing application programs to assure their LE/390 compatibility, so he
  - reads the new compiler and migration guide manuals
  - analyzes all his load modules in all his libraries
  - searches the correct source version with its compile and linkage options
  - creates and runs new compile and link jobs for each load module
  - tests the new generated load modules in a new LE/390-compliant test application environment
  - releases all his tested LE/390-compliant load modules for production
  - does maintenance twice and parallel for old language-specific and LE/390-compliant environments
- This decentralized procedure causes high costs, risks and need for time
  - for overall programmers work
  - for administration and coordination

# What we can do to guarantee running applications . . .

- A central migration or consolidation of all applications for running in a current version of an LE/390 run-time environment with following steps
  - Taking a complete and comprehensive analysis over all found load module libraries of the enterprise (to know where you are going, you must know where you have been, so you must know what you have to migrate)
  - Based on the analysis data, building up a detailed and powerful Load Module Repository (LMR) database over all load modules with its linked-in components, with its used compiler versions, with its used compile and run-time options, and etc.

    This LMR database provides you with all kinds of XREFs over all your enterprise load module libraries
    Later on LMR is usable as a Configuration Management System

# What we can do to guarantee running applications . . .

- Examination which aged applications or programs need migration to LE/390 run-time and need re-compile and link to run in an LE/390 run-time environment

  This allows a prediction of quantities, migration problems, time period, and cost

- Implementation of central migration or consolidation of all applications and programs to LE/390 run-time

  All application modules and its functionality remain unchanged, therefore no test and release procedure is necessary

  This migration meets the prerequisites for the future transition to LE/390-compliant Enterprise Compilers

# What we can do to guarantee running applications

The central migration or consolidation to LE/390-compliant applications needs

+ “only one weekend”
+ no intervention of application development
+ no re-compile and link of all application programs

Our central migration method and procedure minimizes costs, risk, and time period

Before Enterprise compilers will be used an LE/390 migration has to be carried out to minimize problems with old code from the start

- Thereafter it is possible to implement a transition concept to LE/390-compliant Enterprise compilers with high compatibility and coexistence to existing modules compiled with previous compiler versions. Depending on the analysis the new Enterprise Cobol and PL/I compilers get special adjusted compile and link-edit options for cooperation with old code (e.g. compiled with OS/VS Cobol I, VS Cobol II, PL/I V1.x or V2R3, . . .)

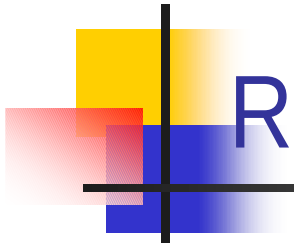
# The Language Environment Challenge

- Managing the LE environment encompasses 4 areas
  - LE migration with cooperative support for running mixed-language applications without the overhead of multiple libraries and run-time environment initialization
  - Ongoing operating system and LE maintenance: Updates to LE are now a regular part of z/OS maintenance, so each new release or maintenance upgrade can present new challenges, e. g. some PTFs make changes to run-time modules that are incompatible with other run-time modules from earlier releases
  - Compiler upgrades: Compilers are no longer static, but are regularly updated and require coordination with LE
  - Subsystem migration such as CICS, IMS, and DB2: New versions of these subsystems have restrictions on language levels they support and may not work with older compilers, e. g. the forthcoming version of CICS will no longer run programs compiled by the OS/VS COBOL I or PL/I V1 compiler

# LE/390-compliant compiler and run-time versions with maintenance

- COBOL for OS/390 and VM V2R2, out of maintenance from 12/2004
- Enterprise Cobol for z/OS and OS/390 V3R2[1)] and V3R3
- Enterprise PL/I for z/OS and OS/390 V3R2[1)], V3R3 and V3R4
- VS Fortran V2.5 and V2.6
- C/C++ for OS/390, C/C++ for z/OS and OS/390
- z/OS V1R4 C/C++, z/OS V1R5 C/C++
- Java for OS/390 at SDK 1.1.8
- Developer Kit for OS/390, Java 2 Technology Edition, V1.3.1
- SDK for z/OS, Java 2 Technology Edition, V1.4
- High Level Assembler for MVS and VM and VSE V1.4
- LE/390 run-time for z/OS V1.3 until V1.6
  (z/OS V1.3 is out of maintenance from 3/2005)

[1)] out of maintenance from 10/2005



# References

- DaimlerChrysler AG Stuttgart with 24 LPARs
  - LE/390 migration for applications programmed in OS/VS Cobol I, VS Cobol II, PL/I, old Fortran, C/C++, and Assembler, for TSO and ISPF, and for many third party products
  - Migration to IBM Enterprise Cobol compiler V3R2
- Airbus GmbH Hamburg with 2 LPARs
  - LE/390 migration and consolidation for applications programmed in PL/I V1 and V2, VS Cobol II, Enterprise Cobol V3Rx, old Fortran, C/C++, and Assembler, for TSO and ISPF, and for many third party products
  - Transition concept to IBM Enterprise PL/I compiler V3R2, migration to IBM Enterprise PL/I compiler V3R3 is planned this year (Enterprise PL/I compiler V3R4 requests z/OS V1R3 or later)

# Please don‘t hesitate to contact us

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