

# What's New with DL/I for VSE?

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## Abstract and References

### ■ Abstract:

Many users of the DL/I data base subsystem have been using its facilities for many years. In the past few years, enhancements to DL/I have been made that can greatly improve its performance and make DL/I managed data available across more platforms.

Failing to exploit these newer features (which require no application changes) can be costing your system significant performance penalties or loss of useful functionality.

In this presentation, we'll highlight a few of these with the most impact on your system's performance.

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## Abstract and References

### ■ Bibliography:

Book title	Order number
DL/I Application and Database Design	SH24-5022
DL/I Application Programming: CALL and RQDLI Interface	SH12-5411
DL/I Application Programming: High-Level Programming Interface	SH24-5009
DL/I Database Administration	SH24-5011
DL/I Diagnostic Guide	SH24-5002
DL/I General Information	GH20-1246
DL/I Guide for New Users	SH24-5001
DL/I Interactive Resource Definition and Utilities (Note -- Feature no longer available)	SH24-5029
DL/I Resource Definition and Utilities (Note -- R.8, available on CD or Internet)	SH24-5021
DL/I Library Guide and Master Index	GH24-5008
DL/I Licensed Program Specifications	GH24-5031
DL/I Low-level Code and Continuity Check Feature	SH20-9046
DL/I Library Guide and Master Index	GH24-5008
DL/I Messages and Codes (Note -- R.8, available on CD or Internet)	SH12-5414
DL/I Recovery and Restart Guide	SH24-5030
DL/I Reference Summary: CALL Program Interface	SH24-5103
DL/I Reference Summary: System Programming	SH24-5104
DL/I Reference Summary: HPLI Interface	SH24-5120
DL/I Release Guide (Note -- R.10 & R.11, available on CD or Internet)	SC33-6211
VSE/ESA e-business Connectors User's Guide V2R7	SC33-6719-04

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## New DL/I Features

### ■ New features

- ◆ Data Set Groups
- ◆ Larger CI Sizes
- ◆ VSE/ESA e-business Connector access to DL/I managed data

### ■ Misused (or underused) features

- ◆ Compression
- ◆ Buffer Pools
  - ◆ Sequential (VSAM KSDS)
    - Potential savings by larger pools, bigger CIs
  - ◆ Direct (DL/I managed buffers for VSAM ESDS)
    - Potential savings by larger pools, bigger CIs
- ◆ Too small data CI sizes
- ◆ Reorganization
- ◆ Space Management Utilities (DL/I SMU)

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## From the Top --

- DL/I was originally developed during the 1960s as part of the Apollo Moon-landing program
- North American Aviation was the prime contractor for the Apollo Command Module and the overall program
- The Moon-landing program was a national priority
- NASA required destructive failure testing of samples of all component lots before flight use
- Waiting for test results would significantly delay the program, but IBM and NAA developed IMS to control and track the usage of every nut, bolt and other part so that if a lot of parts failed their test, the exact location of all members of that lot could be identified.
- The first DL/I production application at NAA was General Ledger, of course!
- IMS was one of IBM's first program products, released in mid-1969. The VSE variants first became available in 1970 (VANDLI, followed by DL/I Entry and DL/I-DOS/VS by 1972)

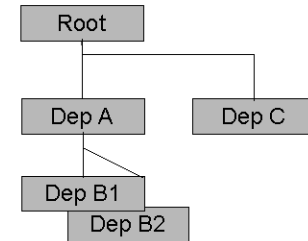
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## From the Top --

- DL/I (the data base component of IMS) uses a heirarchical data model

- ◆ Root
  - ◆ Dependent A
    - ▶ Dependent B1
    - ▶ Dependent B2
  - ◆ Dependent C
  - ◆ ...



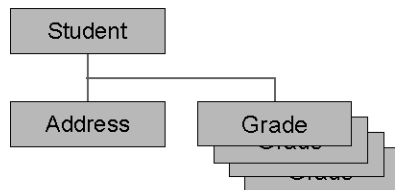
- The logical view(s) presented to application programs do not expose DL/I's internal pointer structures and block layouts
- The logical view of data can be greatly different from its physical storage

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## Hierarchical Data Model

- Each data base record is composed of one Root Segment and potentially many Dependent Segments arranged in a hierarchical fashion

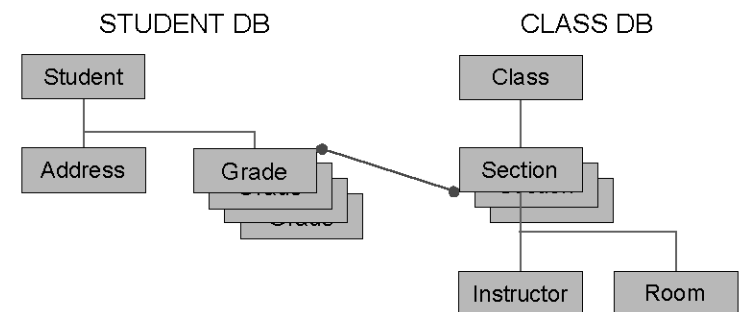


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## Hierarchical Data Model

- Different data base records can be logically related into complex networks, but the application still sees a simple, hierarchical view...



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## Hierarchical Data Model

- Different data base records can be logically related into networks, but the application still sees a simple, hierarchical view... showing instructor, room and class information when viewing SCHEDULE VIEW

```

graph TD
    Student --> Address
    Student --> Grade
    Student --> Section
    Section --> Class
    Section --> Instructor
    Section --> Room
  
```

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## Hierarchical Data Model

- The same data base records can be also viewed from the CLASS side... showing student information when viewing COURSE VIEW

```

graph TD
    Class --> Section
    Section --> Grade
    Section --> Student
    Section --> Instructor
    Section --> Room
    Student --> Address
  
```

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## Hierarchical Data Model

- The Grade intersection data could have been physically stored with the Class and Section data, if desired

STUDENT DB

CLASS DB

- The same two logical views could have been constructed from this... but performance would differ

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## Data Sharing Features

- DL/I provides data sharing facilities
  - ◆ Multiple on-line applications can use data bases
    - ◆ Potentially each with its own unique view
      - Allows views to be tailored to application need
      - Permits unique security options
        - Segment sensitivity
        - Field sensitivity
  - ◆ Data bases can be concurrently accessed
    - ◆ On-line users
    - ◆ Multiple batch users (Multiple Partition Support)
- Exploits CICS Journal support for
  - ◆ On-line
  - ◆ MPS batch

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## Data Integrity Features

- **DL/I provides data integrity facilities**
  - ◆ Change Logging
    - ◆ Before images for backout
    - ◆ After images for forward recovery
  - ◆ Change Accumulation
  - ◆ Image Copy
  - ◆ Forward Recovery
  - ◆ Backout
    - ◆ Batch and On-line
- **Exploits CICS Journal support for**
  - ◆ On-line
  - ◆ MPS batch

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## Data Security Features

- **DL/I provides data security facilities**
  - ◆ Customized views for each application
    - ◆ External to application
    - ◆ Controls access by application
    - ◆ For each segment type
    - ◆ Each application's sensitivity
      - for each segment type --
      - can be limited to
        - ▶ Get
        - ▶ Update
        - ▶ Insert
        - ▶ Delete

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## New Features

- **DL/I exploitation of VSE/ESA e-business connectors**
  - ◆ Permits enterprise-wide sharing of DL/I data
  - ◆ Uses JAVA Beans capabilities wherever available
  - ◆ Use VSE provided JAVA Beans to implement applications
  - ◆ Applications implemented using JAVA Classes
    - ◆ VSEDli - represents the DL/I subsystem on VSE/ESA. It provides methods to get a list of PSBs.
    - ◆ VSEDliPsb - represents a DL/I PSB with its corresponding PSB name. It provides methods to schedule or terminate a PSB, to take a checkpoint or to do a rollback. It also provides a list of PCBs.
    - ◆ VSEDliPcb - represents a DL/I PCB which can be used to execute DL/I requests like GN, GNP, GU, GHU, GHN, GHNP, DLET, ISRT, REPL.
  - ◆ This is now available for DL/I Release 1.11 with VSE/ESA Release 2.7 and CICS TS 1.1.1

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## New Features

- **Larger data bases**
  - ◆ Avoids former 4 GB data base size limit
  - ◆ Up to 5 ESDS now can contain a data base
    - ◆ An ESDS contains a subset of the segment types
  - ◆ Up to 20 GB, approximately
  - ◆ No application changes
  - ◆ Change implemented through
    - ◆ DBD change
    - ◆ ACB Generation
    - ◆ DB Load or Reorganization
  - ◆ This has been available since DL/I Release 1.11
    - ◆ Pre-requisites:
      - ▶ VSE/ESA 2.4 or later
      - ▶ CICS TS 1.1 or later

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## New Features

- **Larger block (VSAM CI) sizes for ESDS**
  - ◆ Formerly limited to 4 KBytes
  - ◆ Now up to 30 KBytes
  - ◆ Transparent to applications
  - ◆ Change implemented through
    - ◆ DBD change
    - ◆ ACB Generation
    - ◆ DB Load or Reorganization
  - ◆ Exploitation can significantly reduce I/O activity
    - ◆ High probability all DB record segments in a block
    - ◆ For HDAM, increase RILIM parameter significantly to fully exploit this feature
  - ◆ This has been available since DL/I Release 1.8

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## New Features

- **Larger block sizes for Image Copy and Recovery**
  - ◆ Now up to 31444 Bytes
  - ◆ Transparent to applications and jobstreams
  - ◆ Change implemented through
    - ◆ Utility control statement parameter (nnCI or MAX)
    - ◆ MAX is recommended
  - ◆ Exploitation can reduce I/O activity
    - ◆ Speeds backup and recovery jobs dramatically
    - ◆ Default was 4112 Bytes
    - ◆ MAX is the size of as many blocks as will fit in 31444 bytes
  - ◆ This feature has been available since DL/I Release 8

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## New Features

- **Larger block (VSAM CI) sizes for Index Databases**
  - ◆ Formerly limited to 4 KBytes
  - ◆ Now up to 30 KBytes
  - ◆ Transparent to applications
  - ◆ Change implemented through
    - ◆ DBD change
    - ◆ ACB Generation
    - ◆ DB Load or Reorganization
  - ◆ Exploitation can reduce I/O activity
    - ◆ Especially when using HIDAM Get Next Root
  - ◆ This has been available since DL/I Release 1.10 with APAR PN68583

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## New Features

- **Proper handling of dates (Y2K changes)**
  - ◆ Internal dates kept as 2-digit year values
    - ◆ Logs
    - ◆ Utility control records
  - ◆ Now windowed --
    - ◆ 50 - 99 = 1950 - 1999
    - ◆ 00 - 49 = 2000 - 2049
  - ◆ No application change
  - ◆ No DB change -- only interpretation of DL/I dates
  - ◆ Reports show 4-digit year values
  - ◆ This has been available since DL/I Release 10 with APAR PN87288

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## New Features



### ■ Program Isolation Enqueue Element Storage

- ◆ Formerly kept in GETVIS-24
- ◆ Now storage request is GETVIS ANY
- ◆ No application change
- ◆ No DB change
- ◆ Change implemented automatically
- ◆ Exploitation reduces 24-bit GETVIS requirement
  - ◆ Particularly valuable for long running
    - ▶ MPS batch jobsteps
    - ▶ On-line transactions with batch-like access characteristics
- ◆ This has been available since DL/I Release 10 with APAR PN88972

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## New Features



### ■ Larger HDAM buffer pools

- ◆ Formerly a pool was limited to 32 buffers
- ◆ New limit is 255 buffers -- still 24-bit storage
- ◆ No application change
- ◆ No DB change
- ◆ Change implemented by
  - ◆ DLI statement for batch and utilities
  - ◆ DLZACT table for on-line applications
- ◆ Exploitation can reduce I/O activity
  - ◆ Additional buffers contain more segments
  - ◆ Monitor statistics -- if more buffers don't reduce I/Os, return to a smaller number (e.g. sequential only processing)
- ◆ This has been available since DL/I Release 10 with APAR PN89468

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## New Features



### ■ On-line PSB pool can be loaded into 31-bit storage

- ◆ Formerly PSBs were loaded into 24-bit storage
- ◆ No application change
- ◆ No DB change
- ◆ Change implemented by
  - ◆ DLZACT table for on-line applications  
PSBLOC=ANY|BELOW
- ◆ Exploitation reduces 24-bit DSA storage need
  - ◆ Active used PSB copies are made in 24-bit storage
- ◆ This has been available since DL/I Release 10 with APAR PQ09904

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## New Features



### ■ Miscellaneous Enhancements:

- ◆ PROCOPT N and T (handling of certain errors) now available for batch as well as on-line processing
  - ◆ Available since DL/I Release 10 with APAR PN30337
- ◆ Change Accumulation with Selected Logfiles
  - ◆ Accumulation of only some log tapes, saves time in recovery
  - ◆ Available since DL/I Release 10 with APAR PN43036
- ◆ DUMP Macro with RC=12 instead of RC=0
  - ◆ Improves JCL control of subsequent jobsteps
  - ◆ Available since DL/I Release 10 with APAR PN47959
- ◆ Control of Unload of Tape Work Files
  - ◆ DLZURG10/DLZURGP0 intermediate tape workfiles
  - ◆ Permits jobstream processing without operator intervention
  - ◆ Available since DL/I Release 10 with APAR PN56301

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## New Features

- **Miscellaneous Enhancements (continued):**
  - ◆ Support for DL/I 31-Bit Applications
    - ◆ DL/I applications can run in 31-bit mode and above the 16 MB line without restriction.
    - ◆ Compilers, which may be used to create DL/I 31-bit applications are:
      - ▶ PL/I for VSE/ESA
      - ▶ COBOL for VSE/ESA
      - ▶ COBOL II
      - ▶ High Level Assembler
    - ◆ 31-bit execution for DL/I online and batch/MPS applications, with the DL/I CALL or HLPI interface.
    - ◆ DL/I call parameters can reside above the 16 MB line.
    - ◆ Available since DL/I Release 10 with APAR PN67649

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## New Features

- **Miscellaneous Enhancements (continued):**
  - ◆ Support for Language Environment -- LE
    - ◆ TRAP runtime option
      - ▶ LE diagnostics followed by proper DL/I termination
      - ▶ DL/I dumps can be suppressed
    - ◆ CEETDLI callable interface
      - ▶ Equivalent to ASMTDLI, CBLTDLI, etc.
      - ▶ Only available for LE conforming programs
  - ◆ Command Code U implemented in HLPI
    - ◆ New HLPI search option KEEP, similar to FIRST and LAST
    - ◆ Equivalent to CALL command code U
    - ◆ Available since DL/I Release 10 with APAR PN73378
  - ◆ New System Call QURY - returns status of DL/I Databases
    - ◆ Available since DL/I Release 10 with APAR PN85936

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## New Features

- **Features new with DL/I Release 10**
  - ◆ 31-bit Application Programs
    - ◆ The initial level of support for 31-bit applications has been enhanced greatly by APAR service since the initial release of DL/I 1.10
  - ◆ HS (KSDS) buffers in 31-bit storage
    - ◆ HSMODE=ANY can be specified (below is the default)
    - ◆ DLI statement for batch
    - ◆ ACB specifications for on-line
  - ◆ Greatly improved statistics -- separate data for
    - ◆ Databases
    - ◆ Buffer Pools

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## New Features

- **Features new with DL/I Release 10 (continued)**
  - ◆ Virtual Disk Exploitation
    - ◆ DL/I utilities can allocate work files on virtual disk
    - ◆ Only JCL changes to address virtual disk
    - ◆ Virtual disk greatly improves performance by reducing I/O
    - ◆ These DL/I utilities can profit from virtual disk utilization:
      - ▶ Initial Load and Partial Load
      - ▶ DLZURGL0 HD Reorganization Reload
      - ▶ DLZURPR0 Data Base Pre-reorganization
      - ▶ DLZURGS0 Data Base Scan
      - ▶ DLZURG10 Data Base Prefix Resolution
      - ▶ DLZURGP0 Data Base Prefix Update
      - ▶ DLZPRCTn Partial Data Base Reorganization
      - ▶ DLZUCUM0 Data Base Change Accumulation
    - ◆ Virtual disks are not permanent -- use for files that can be recovered in case of loss

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## New Features

- **Multiple MPS Systems now supported**
  - ◆ DL/I Databases can be controlled by different CICS-DL/I subsystems
  - ◆ A batch DL/I job specifies which CICS-DL/I subsystem it wishes to connect with
  - ◆ A given jobstep may only connect with one CICS-DL/I subsystem
  - ◆ CICS-DL/I subsystems can connect with each other (remote DBs)
  - ◆ Specification of CICS-DL/I subsystem by
    - ◆ Partition ID
    - ◆ CICS Application ID
  - ◆ DL/I Release 11 only

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## New Features

- **CICS Transaction Server related changes**
  - ◆ CICS-DL/I macro level programs have to be converted to the CICS command level.
  - ◆ Adaptions are also required for CICS-DL/I online programs
    - ◆ written using the DL/I CALLDLI interface
    - ◆ using the CICS TCA to
      - ▶ check return codes (TCAFCR)
      - ▶ retrieve the PCB address list (TCADLPCB)
    - ◆ The CICS TCA can no longer be accessed.
    - ◆ Equivalent fields are in the DL/I UIB control block.
  - ◆ DL/I Table related entries have to be updated.
    - ◆ See the applicable DL/I Release Guide documentation
  - ◆ DL/I Release 11 only

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## New Features

- **CICS Transaction Server related changes**
  - ◆ DL/I Release 10 needed for CICS/VSE 2.3
  - ◆ DL/I Release 11 needed for CICS Transaction Server
  - ◆ SVA issues -- different modules with identical names
  - ◆ Coexistence Feature, like that for CICS
    - ◆ CICS-DL/I MRO access to remote PSBs and Databases
    - ◆ SVA=NO option (for DL/I 1.11)
      - ▶ Force loading modules into partition
    - ◆ Load DL/I 1.10 in SVA as before while co-existing
    - ◆ MPS Batch Controller (DLZMPC00) must match the MPS On-line Controller (DLZMPI00) release level
    - ◆ Separate sublibraries are used for DL/I 1.10 and 1.11
      - ▶ LIBDEF sequences are critical to ensure right levels are used

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## Underused Facilities

- **DL/I Space Management Utilities**
  - ◆ Pointer Checker
    - ◆ Broken Pointer identification
    - ◆ Fix Pointers if data is available
  - ◆ Randomizer Testing
    - ◆ Physical loading of data base not needed
  - ◆ Performance Evaluation
    - ◆ Reduce probability of I/O operations
  - ◆ Space mapping
- **BMC marketed utilities with similar capabilities**
  - ◆ They've withdrawn their marketing of these utilities, as far as I know.

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