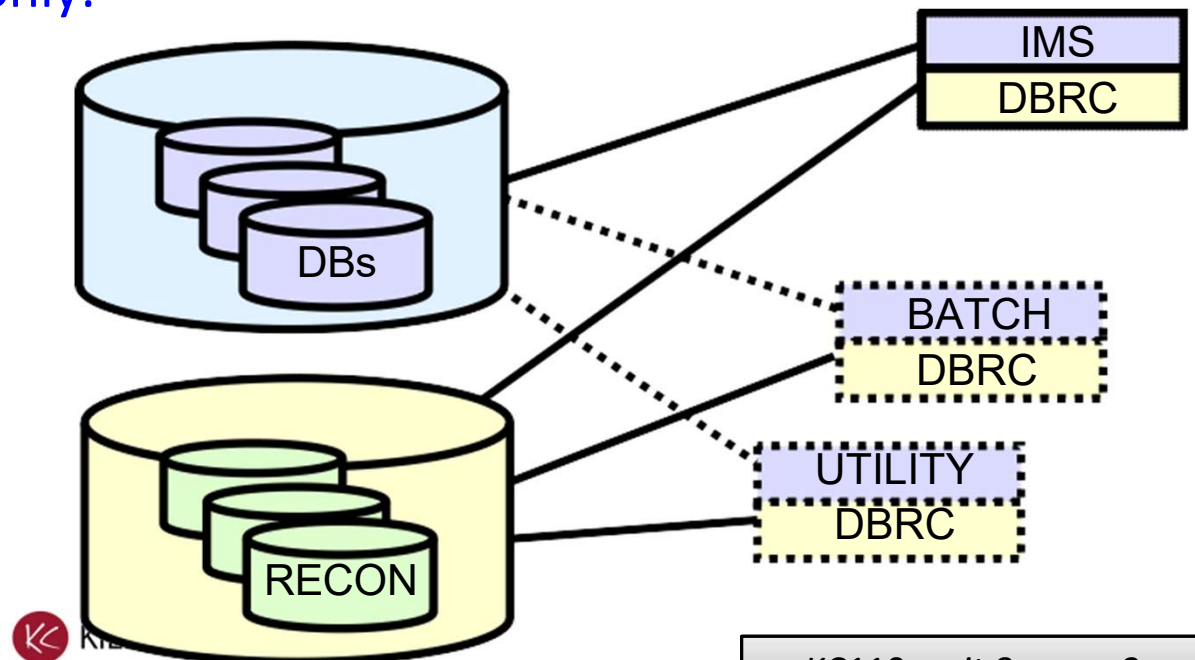


Unit 8 – IMS Data Sharing, Shared Queues and the Common Services Layer

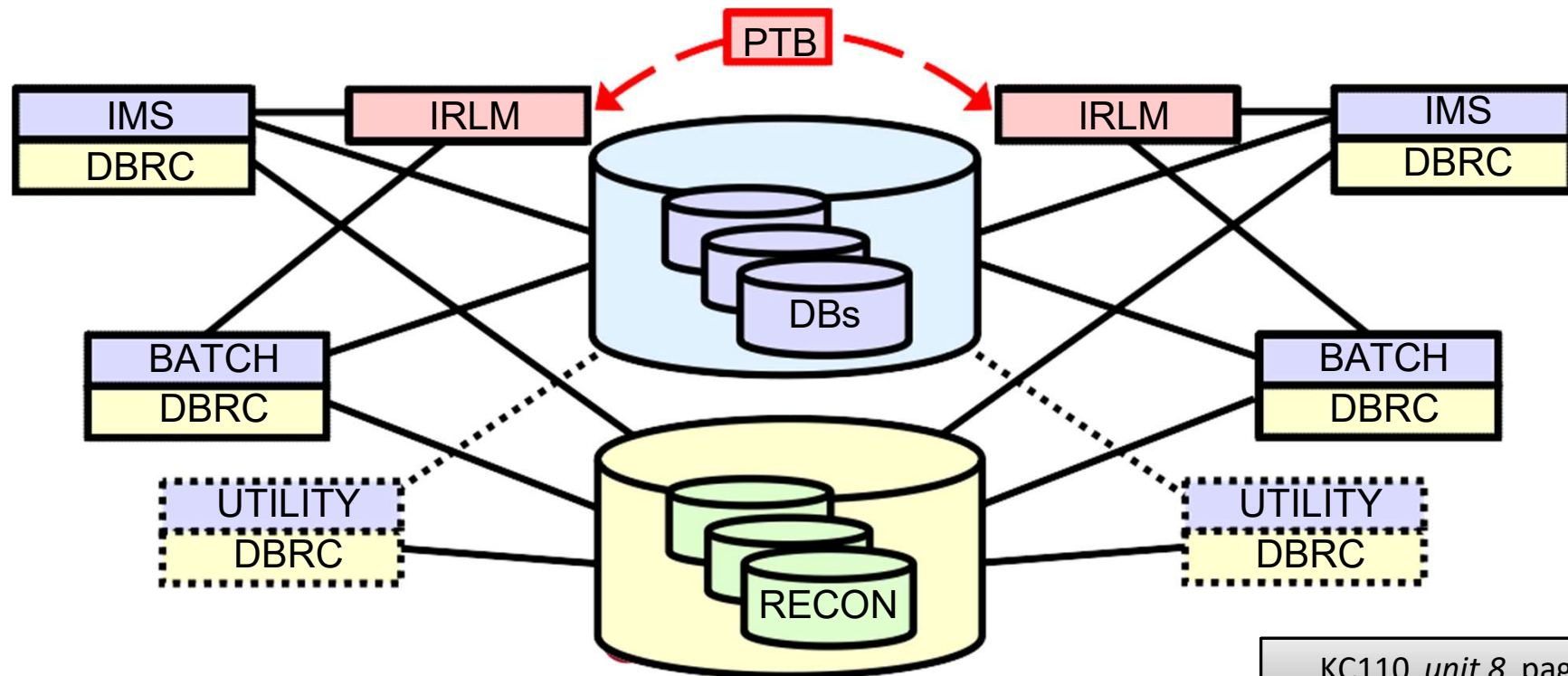
IMS before Data Sharing

- Before IMS/VS V1 R2:
 - No data sharing:
 - Only one IMS at a time could access the data
 - This limited capacity to what would run on the largest processor available
 - Databases protected by user (DISP=OLD)
 - To process database in batch or utility region
 - /DBR database - PROCESS - /START database online
 - DBRC used for recovery only:
 - No authorization processing



DataSharing introduced in IMS/VS 1.2

- Block-level data sharing introduced:
 - DBRC added database authorization processing
 - IRLM added as global lock manager (maximum of two IRLMs)
 - IMS used IRLM for lock management and buffer invalidation
 - IRLMs did communicate using Pass-the-Buck processing
 - PTB processing required significant overhead for lock requests and Buffer Invalidate requests



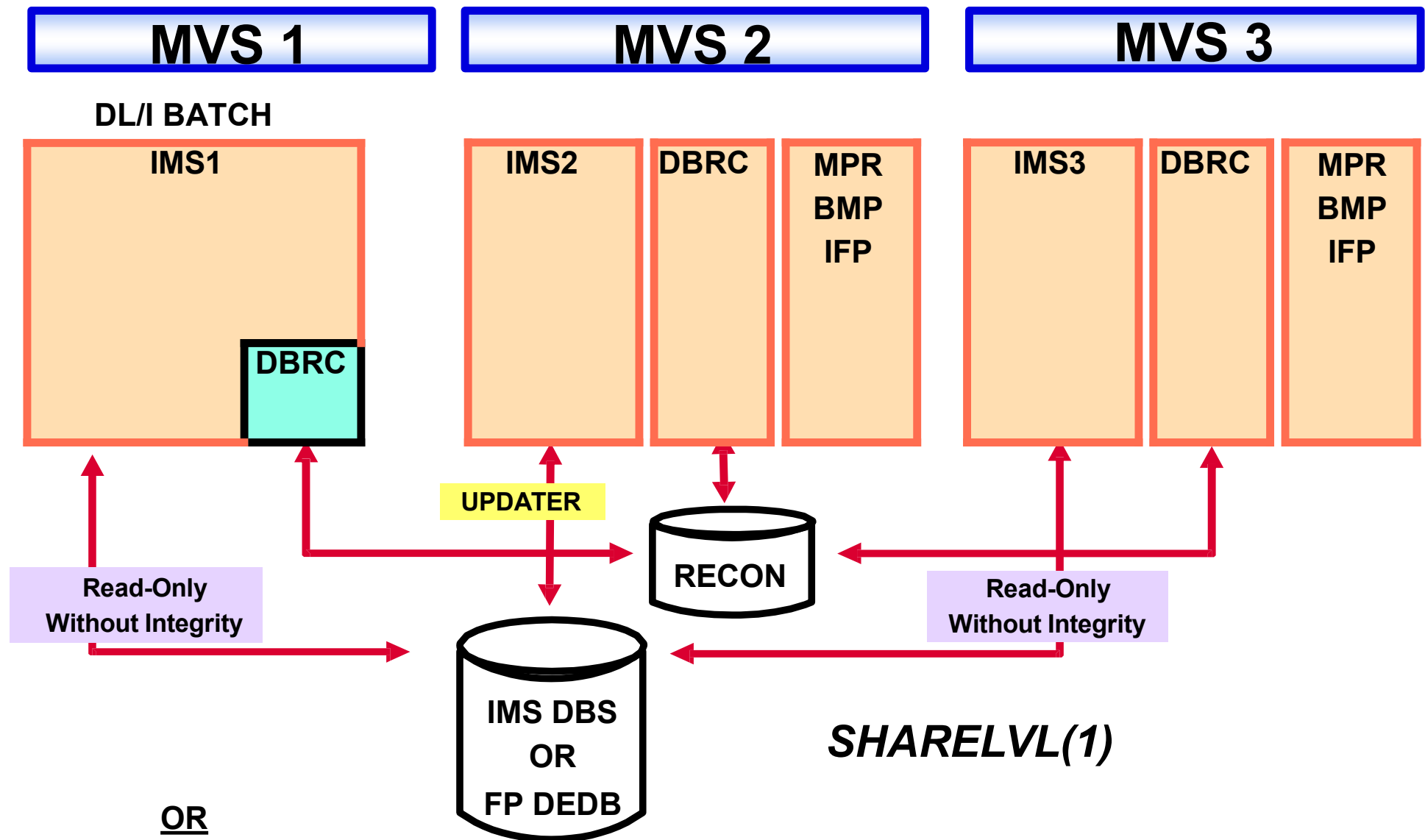
IRLM

- IRLM is required to enable IMS Data Sharing:
 - Since PI ENQ/DEQ tables exist in the DLISAS, sharing of lock information between IMS systems is not possible
 - When IRLM is used, lock tokens are in IRLM EPA
 - When data sharing is performed between processors, lock information is stored and commonly accessed from a Coupling Facility Lock Structure
- IRLM can be used in place of PI as IMS's Lock manager
 - This choice is made by specifying "IRLM=Y" and an irlmname on the *IRLMNM*= IMS startup parameters
 - There are no other parameters that control IRLM in the IMS startup JCL
- IRLM uses Detection instead of Prevention to address deadlocks
 - In the IRLM Startup, a Deadlock Detection Time is specified
- Non-Data Sharing IMS systems can use IRLM in place of PI:
 - However in most cases, PI uses less CPU than IRLM
 - Granularity of locking with IRLM is slightly different than with PI
 - PIMAX= should not be 0, even when IRLM is used
 - PI is still used for some HD Space Management functions

DBRC Share-Level Options

- IMS/VS 1.2 (and all versions since) require that a database be *registered* to DBRC in order to be shared between IMSs
 - A database's *SHAREVL* controls its ability to be shared
- Database-level Sharing:
 - *SHAREVL(0)*
 - Guarantees EXCLUSIVE use
 - *SHAREVL(1)*
 - One updater; multiple Read-Only (RO)
 - Multiple readers, RO and/or Read w/Integrity (RD)
- Block-level Data Sharing:
 - *SHAREVL(2)*
 - Multiple UP/RD/RO
 - Maximum one MVS system image
 - INTRA-system, DBRC, one IRLM
 - *SHAREVL(3)*
 - Multiple UP/RD/RO
 - Multiple MVS system images
 - INTER-system, two IRLMs, VTAM *connection*

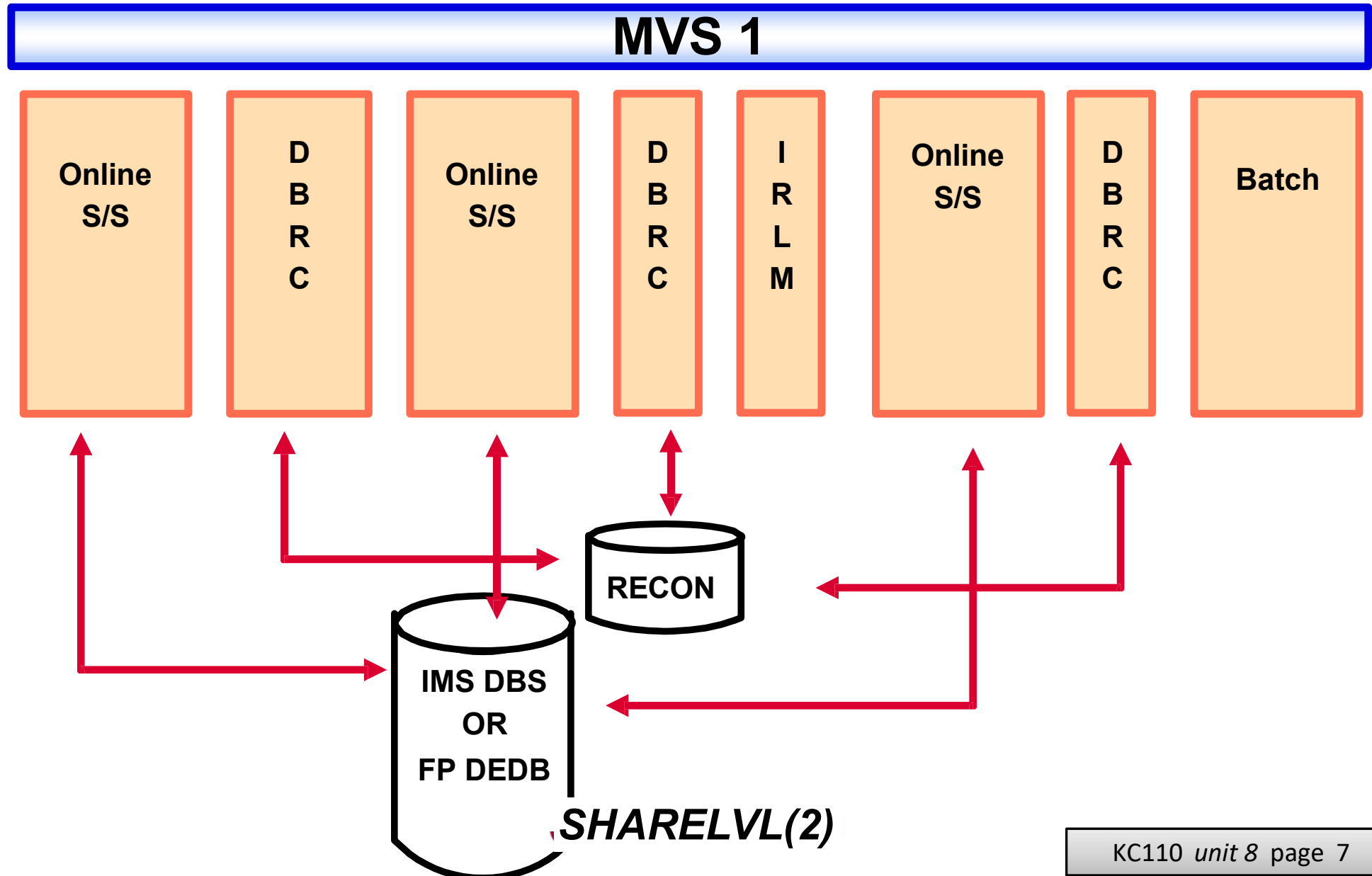
Database Level Sharing: SHARELVL(1)



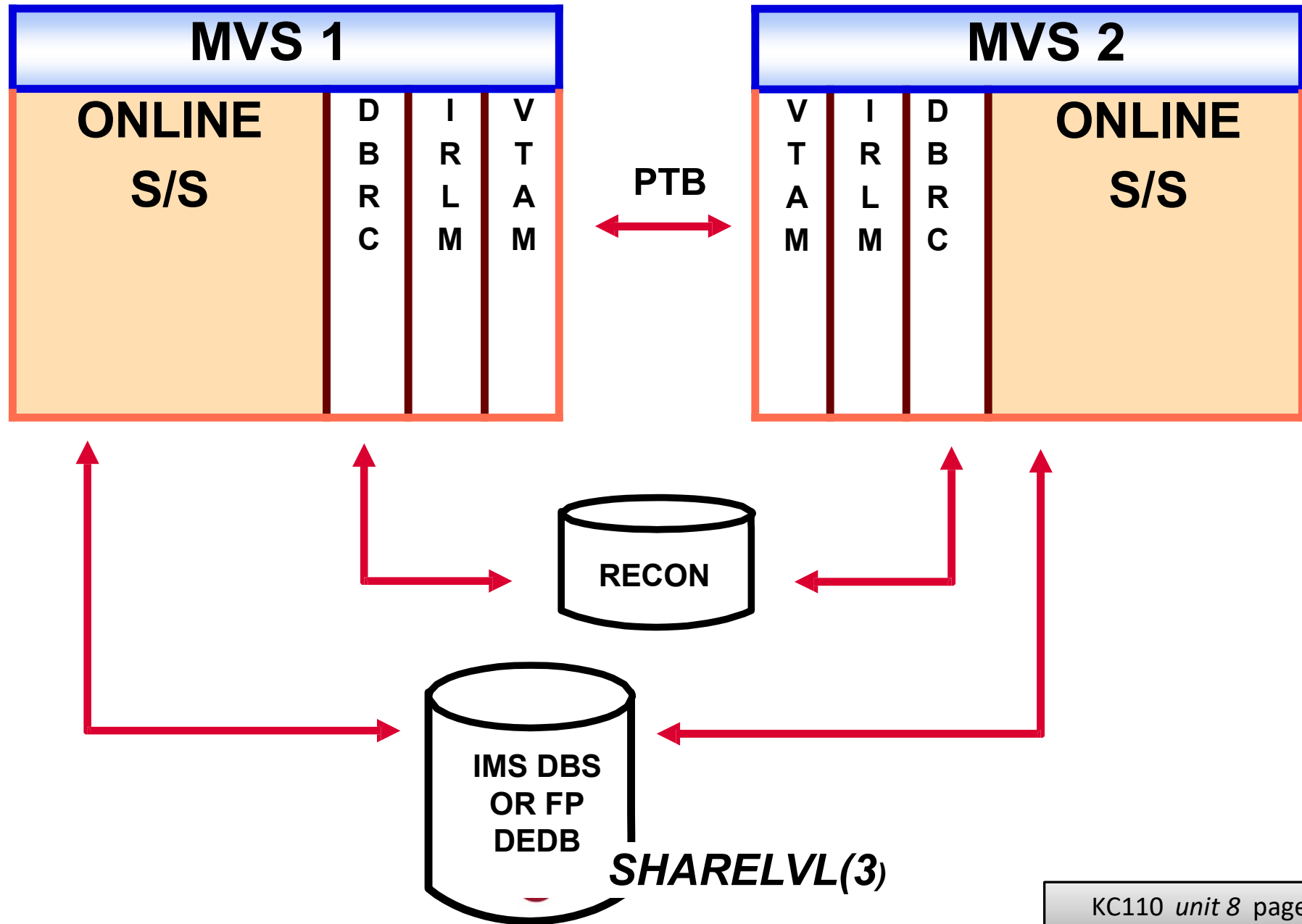
- All subsystems can *READ WITH INTEGRITY*
 - With no updaters, there is no integrity exposure

Block Level Data Sharing *Intra*-System: SHARELVL(2)

ONE MVS SYSTEM:

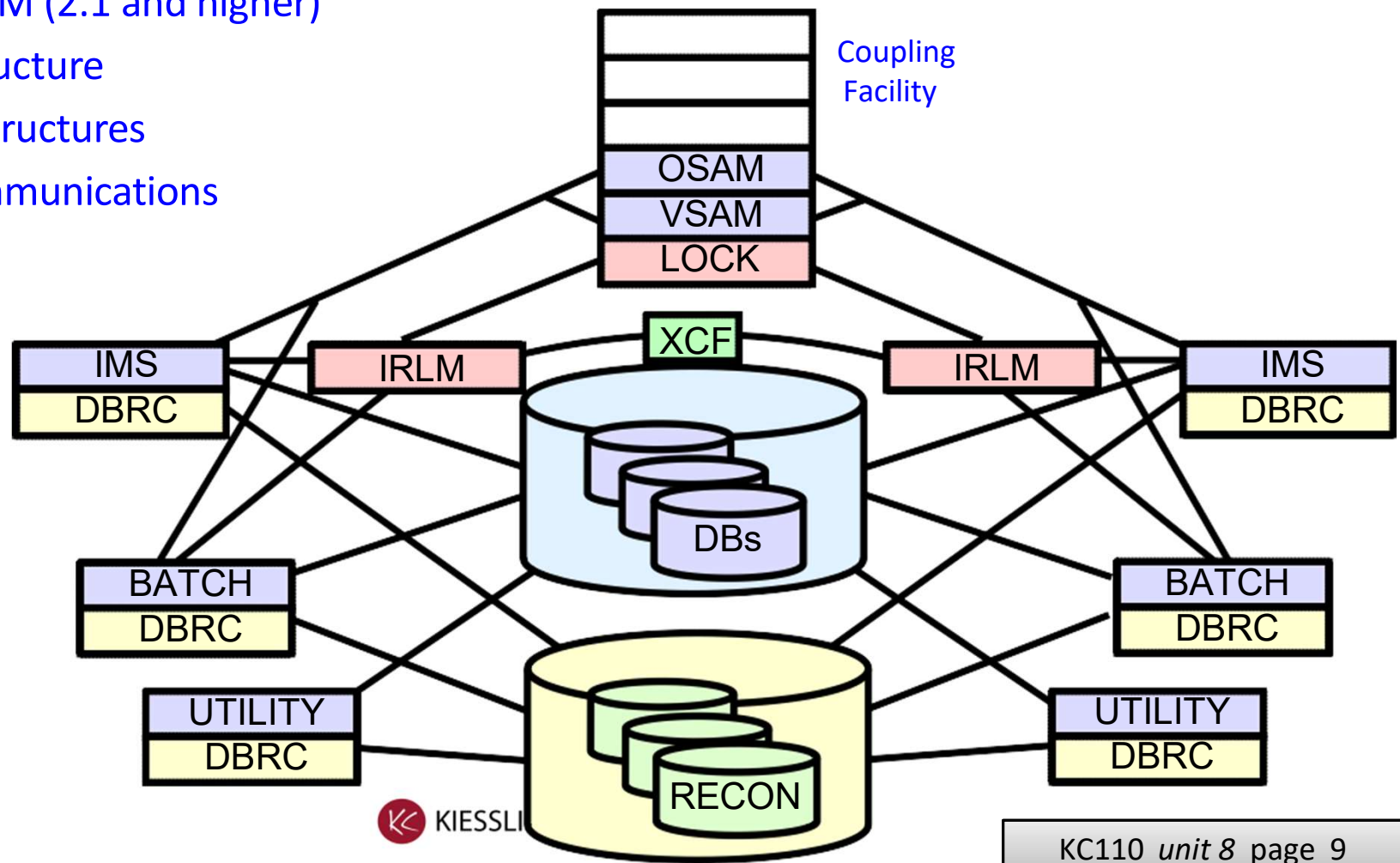


Block Level Data Sharing *Inter*-System: SHARELVL(3)



IMS/ESA V5 : *N-way Data Sharing* with improved capacity and performance

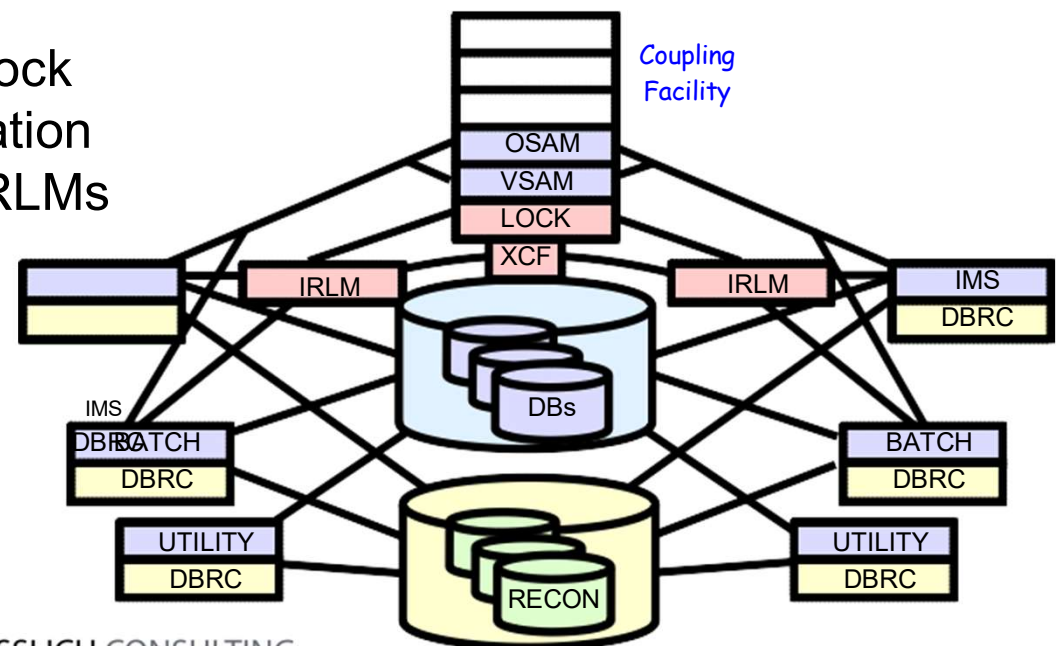
- IMS/ESA V5 started to exploit XCF, the Parallel Sysplex, and Coupling Facility structures:
 - New IRLM (2.1 and higher)
 - Lock structure
 - Cache structures
 - XCF communications



IMS/ESA V5: *N-way Data Sharing* with improved capacity and performance (2)

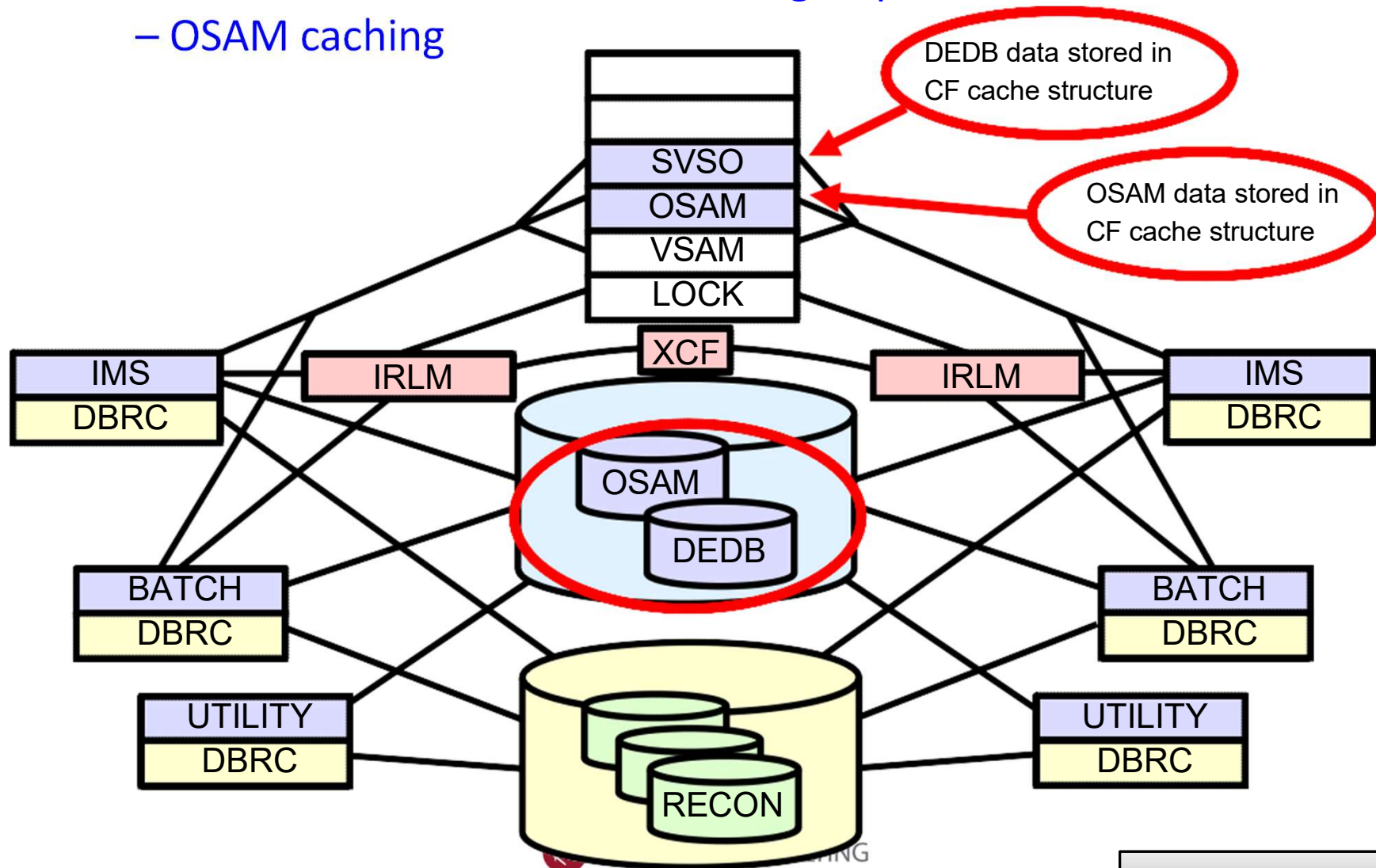
- Issues addressed in IMS/ESA V5:
 - Increased capacity
 - More IMSs could participate in data sharing:
 - Up to 32 IRLMs
 - > Current limit is 64
 - Up to 256 IMSs
 - Improved performance:

- CF access faster than PTB for lock management and buffer invalidation
- XCF communication between IRLMs faster than PTB for contention resolution, and so on



IMS/ESA V6: DB and TM resource sharing (1)

- IMS/ESA V6 added additional data sharing support:
 - Shared DEDBs with Virtual Storage Option
 - OSAM caching



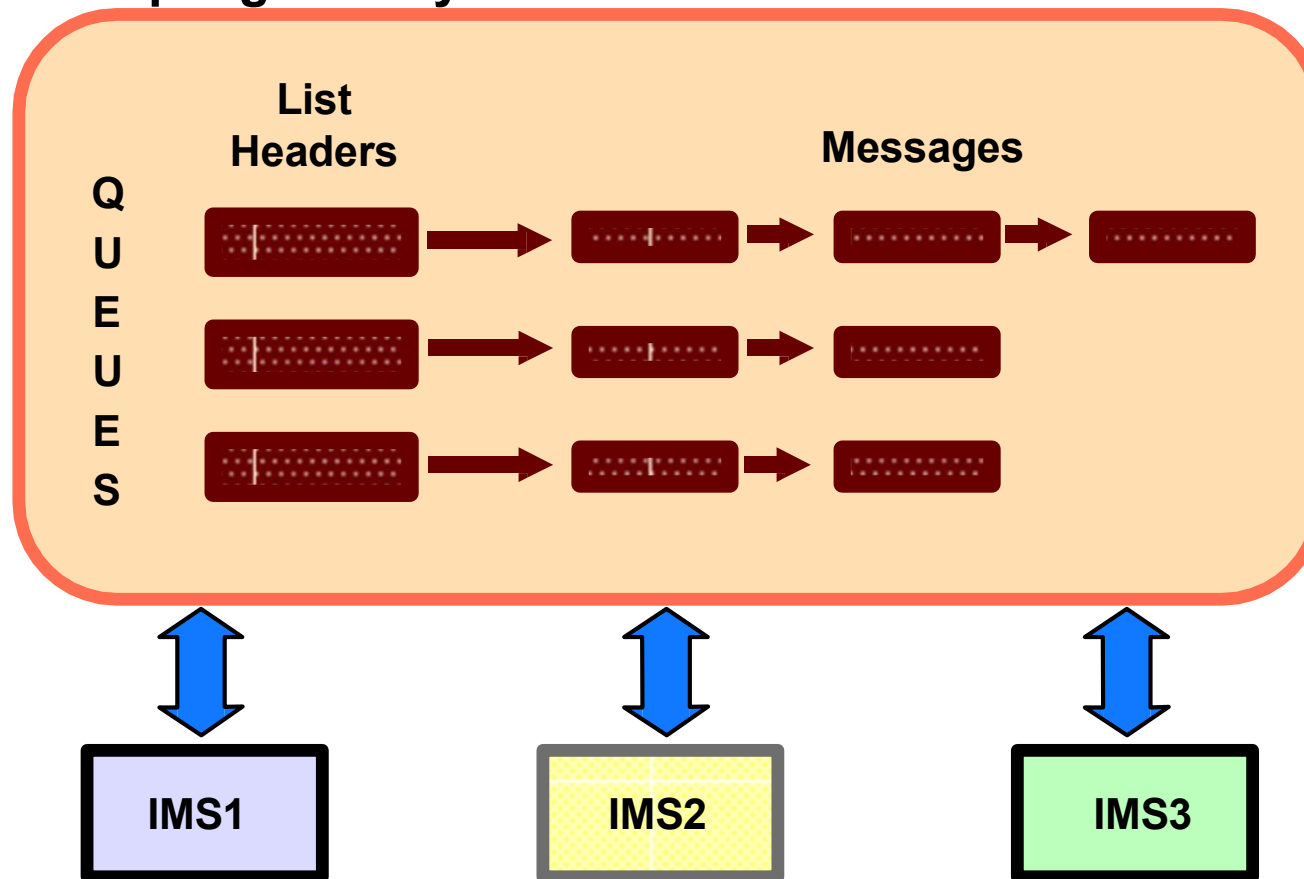
IMS/ESA V6: DB and TM resource sharing (2 of 2)

- IMS/ESA V6 added additional transaction manager and operations support:
 - Shared message queues for Full Function and Fast Path EMH:
 - Single set of message queues for all IMSs
 - Queues stored in CF list structures
 - New Common Queue Server (CQS) address space to manage the queue structure
 - CQS uses system logger to log updates to queue structure
 - VTAM Generic Resource support
 - Single-system image to end user (LOGON IMS)
 - Sysplex communications
 - Use of CRC from E-MCS console to send commands to all IMSs in Sysplex and receive responses
 - Automatic Restart Manager support
 - Restart IMS following IMS or MVS failure

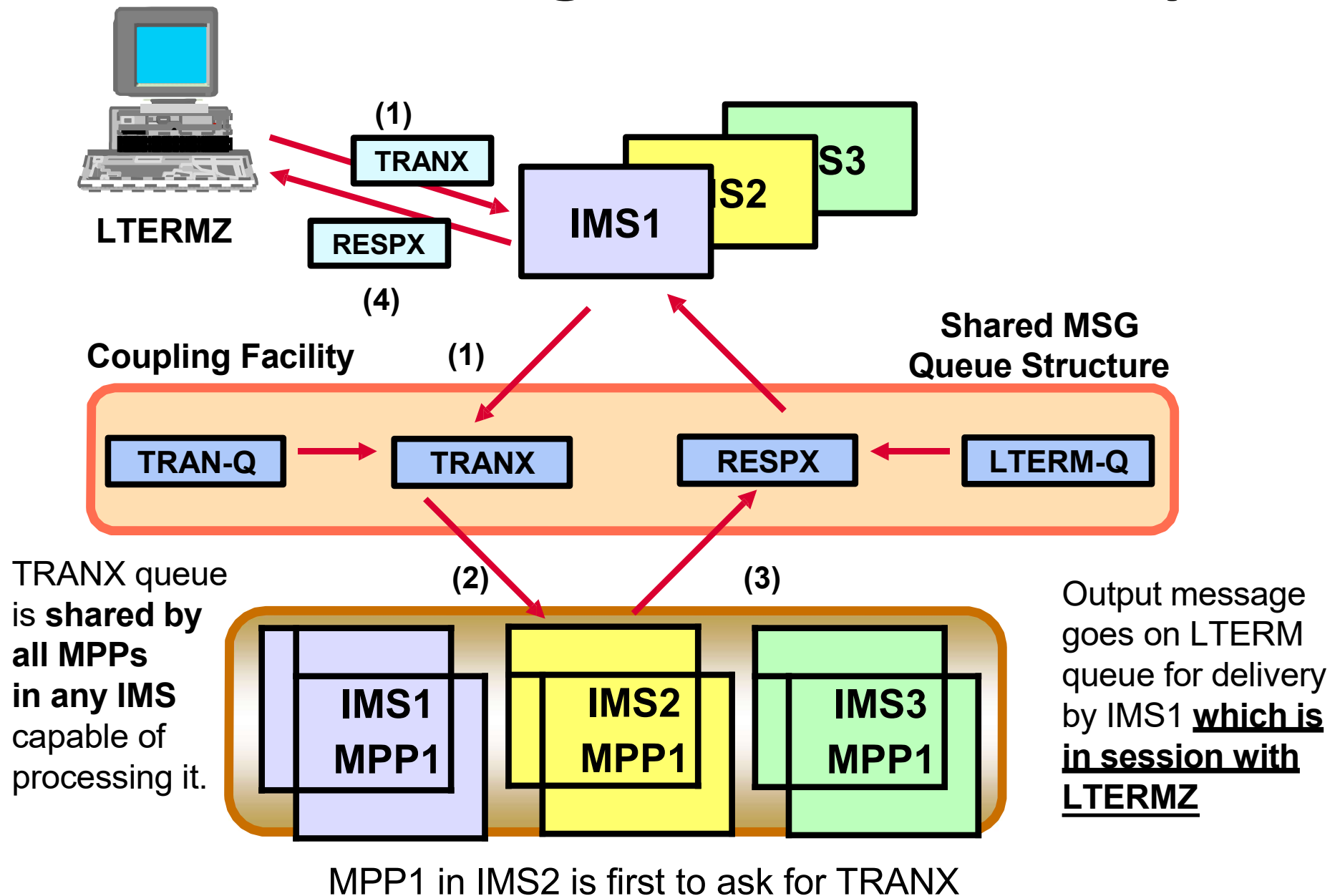
What are Shared Queues?

A set of input and output message queues which can be shared by multiple IMSs in a Parallel Sysplex.

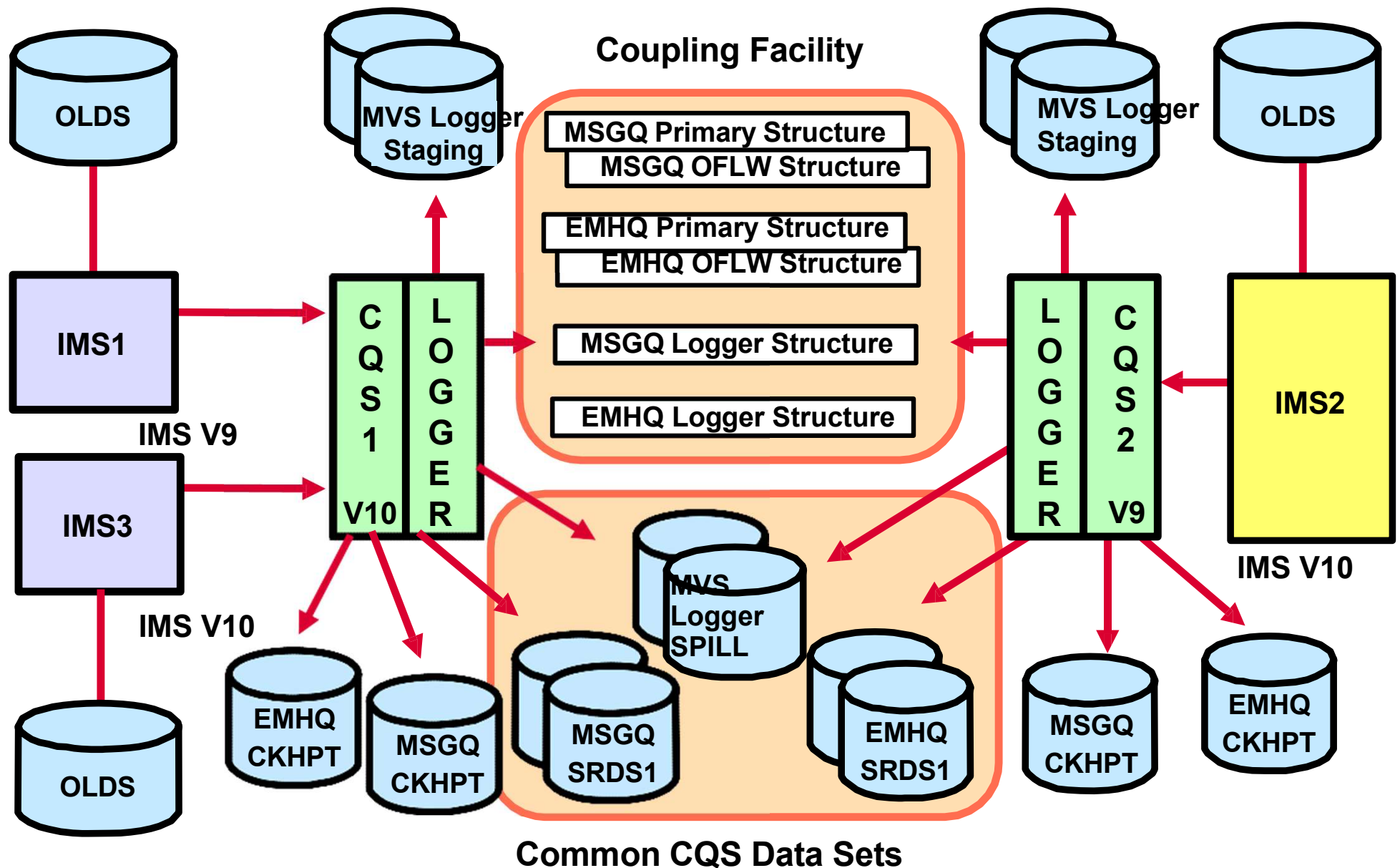
Coupling Facility



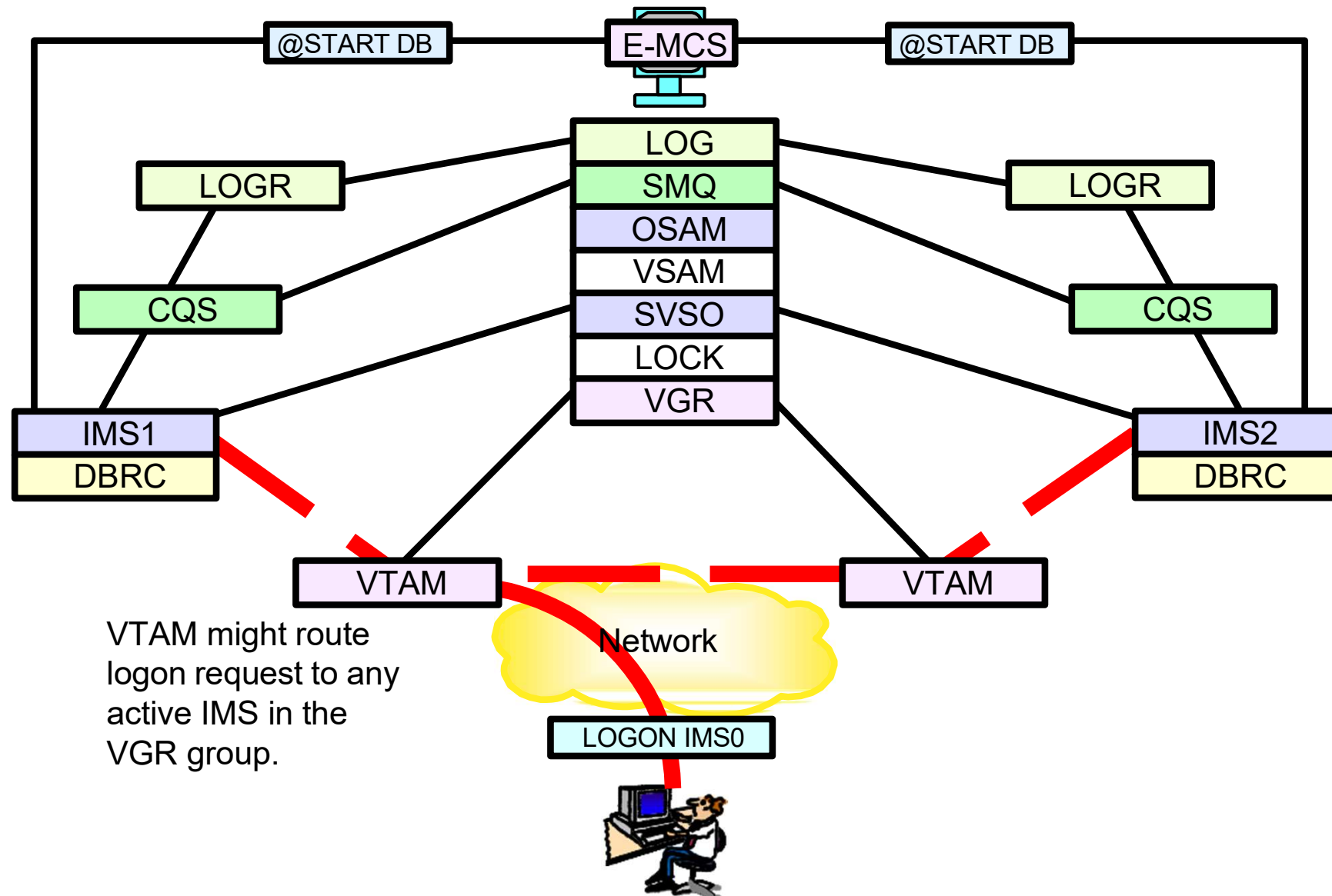
Shared Message Queues: Example



Shared Queues Components



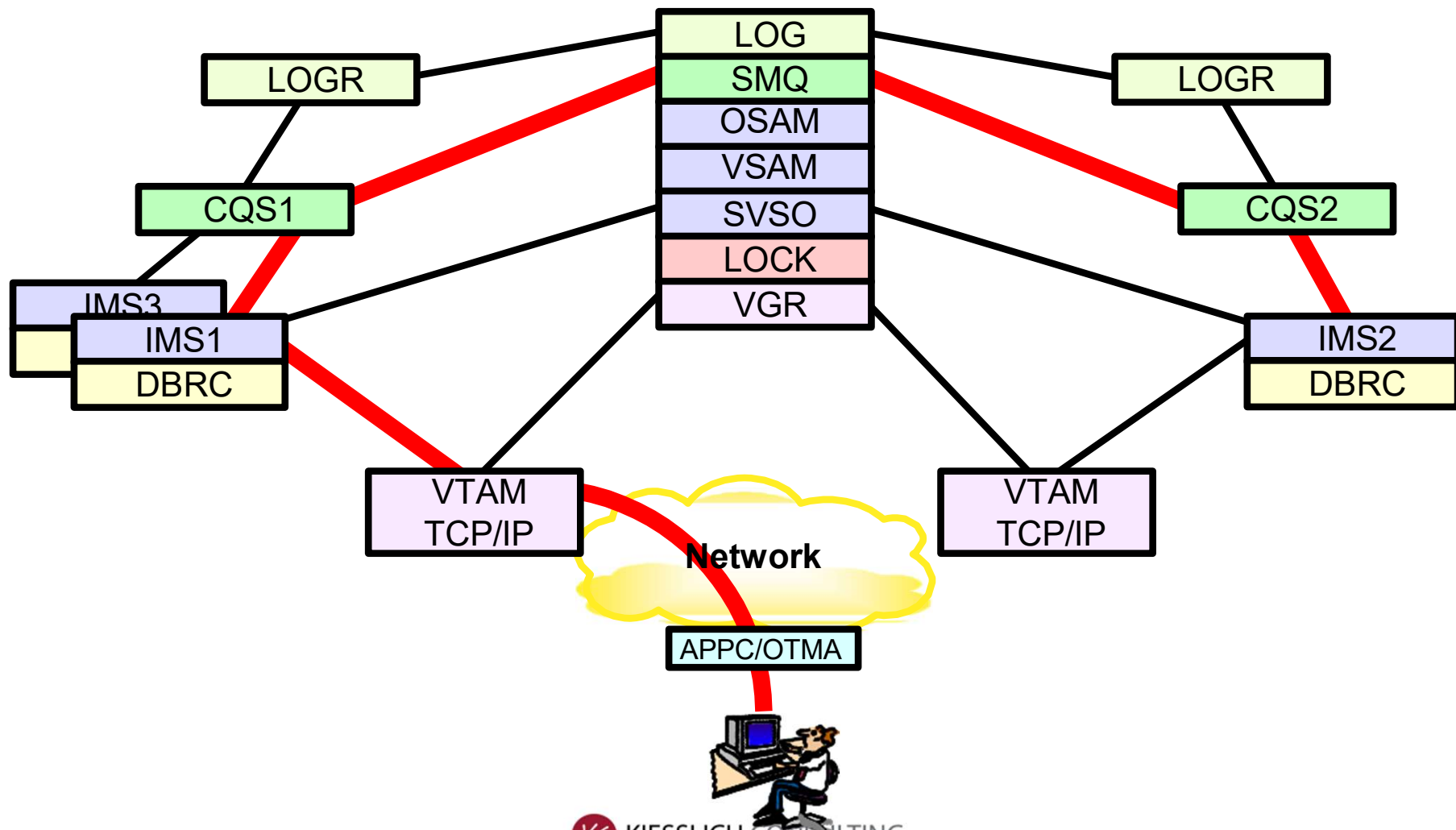
Additional Resource Sharing (Since V6)



VTAM might route
logon request to any
active IMS in the
VGR group.

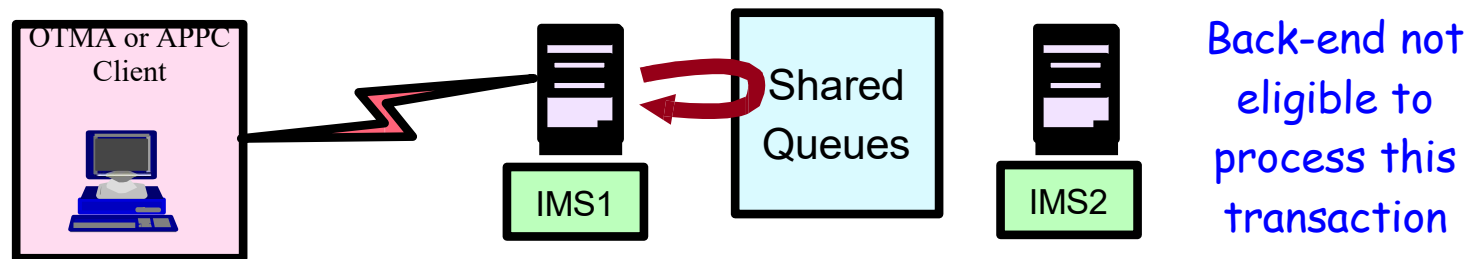
IMS7+ Added Enhanced SharedQ Support

- Asynchronous APPC and OTMA transactions became eligible for Sysplex-wide processing

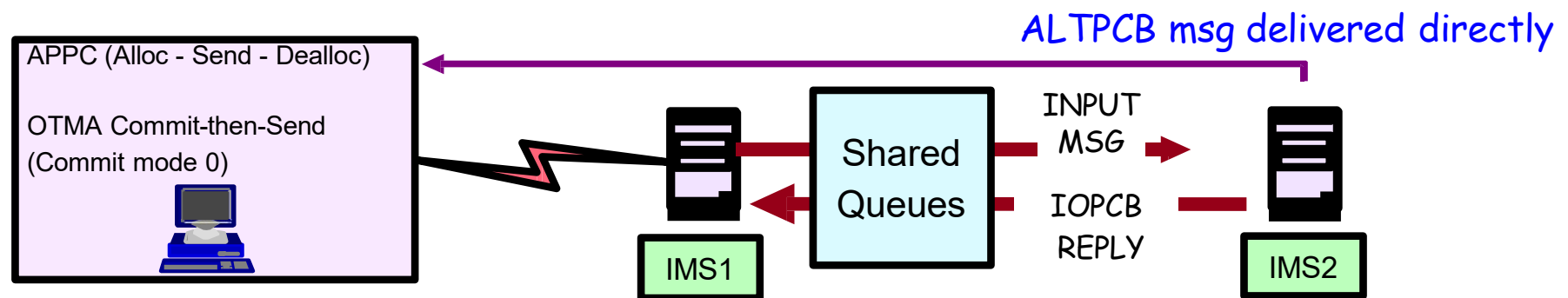


IMS V7+ Enhanced SharedQueues support for asynch APPC/OTMA msgs

- IMS V6: Introduced Shared Queues support
 - All APPC and OTMA messages processed on SQ *front-end*



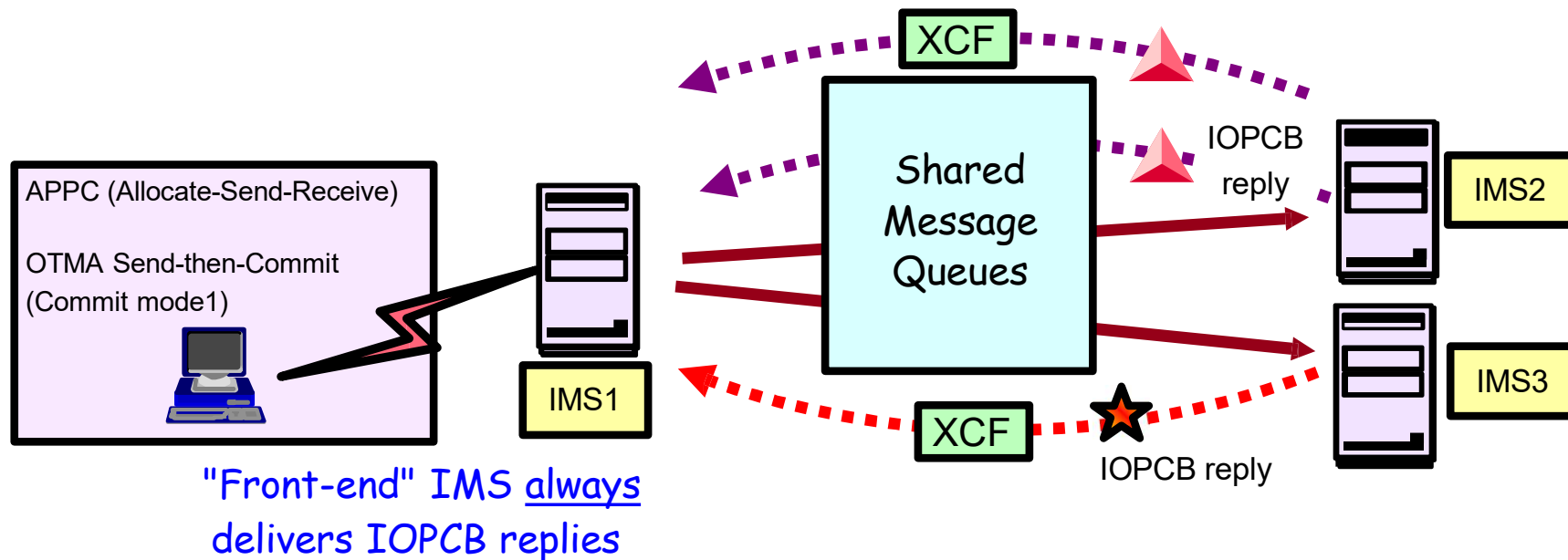
- IMS V7: Enhanced SharedQueues support
 - Asynchronous APPC/OTMA messages could process on any system in the SharedQueues group (*front- or back-end*)



Front-end IMS always
delivers IOPCB replies

Any system can pull message from
queue and process it

IMS V8+ Shared Queues Support for Synchronous APPC/OTMA msgs



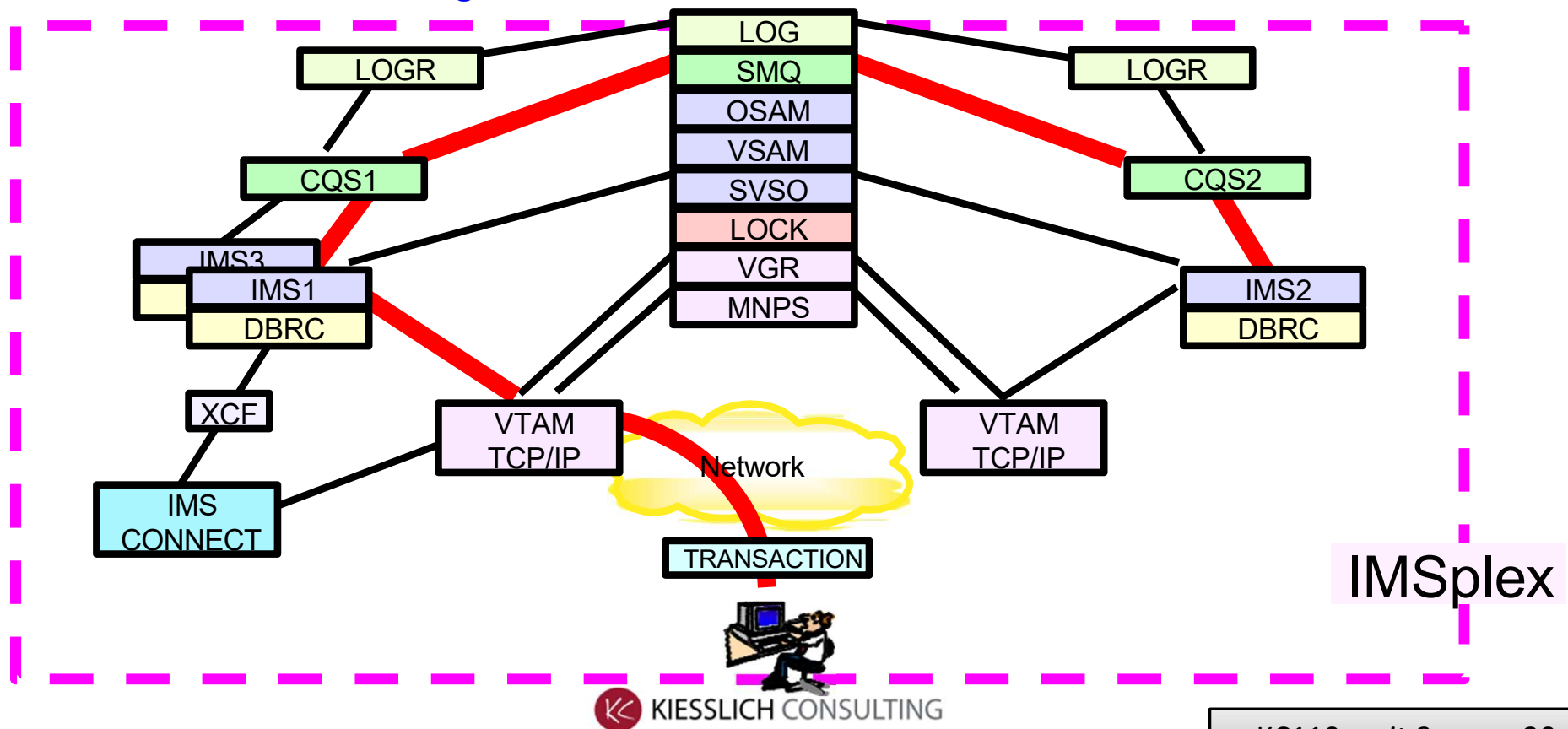
Non-conversational IOPCB reply messages (less than 61K) are sent to the front-end using XCF services.



Conversational IOPCB reply messages or any messages greater than 61K are sent to the front-end using Shared Queues along with a special NOTIFY message that is sent using XCF.

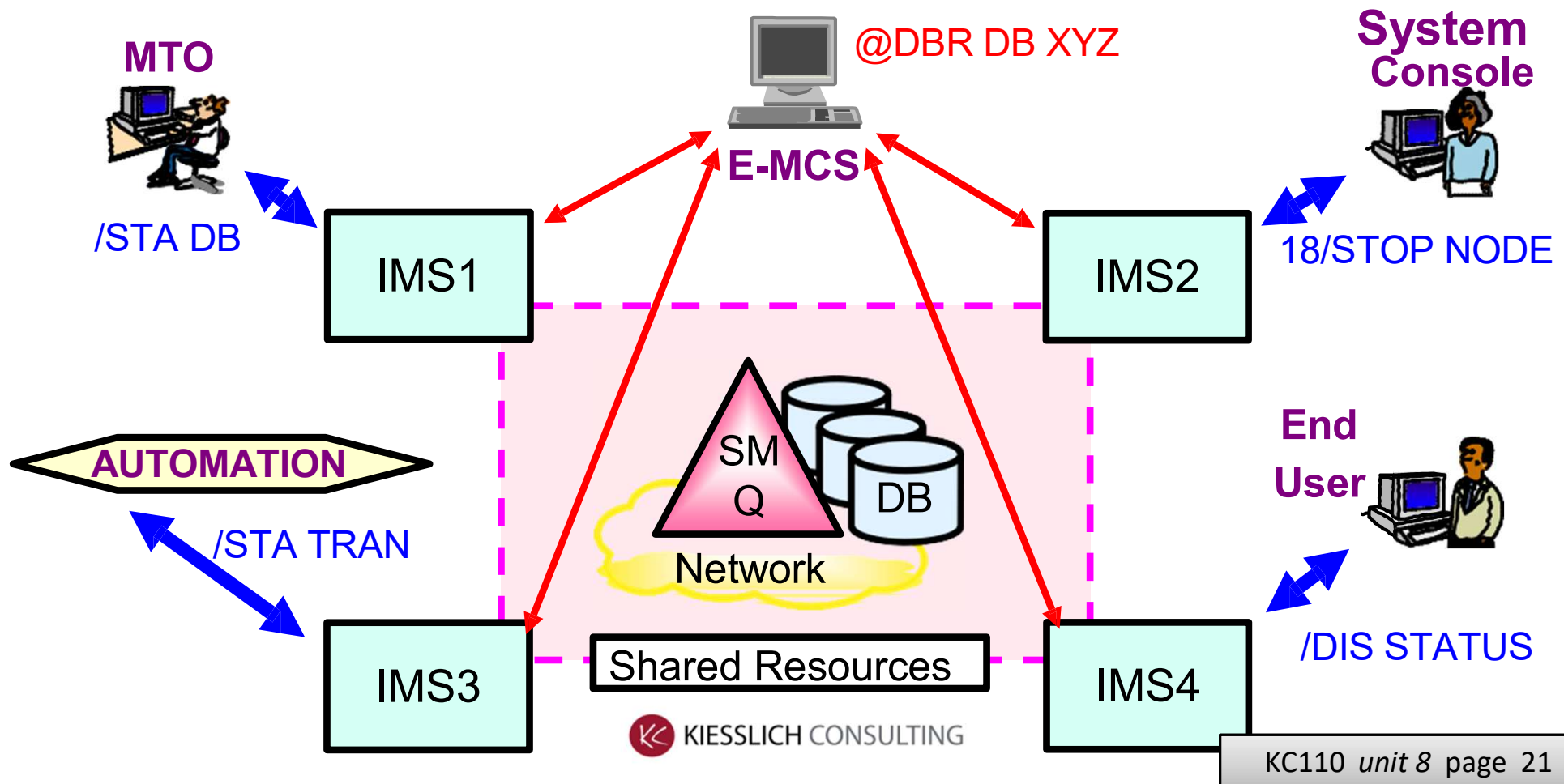
Widespread IMS Resource Sharing evolves towards *The IMSplex*

- Additional features in IMSV7 did allow to exploit many parallel sysplex functions to share resources as an **IMSPLEX**
 - Data sharing, shared queues
 - VTAM generic resources, multinode persistent sessions
 - Automatic restart management, XCF communications



Managing Shared IMS Resources

- Although IMS systems increasingly shared resources and processing, managing these resources became more difficult:
 - The sharing IMS systems persisted in being individually controlled
 - Systems management functions needed to be more robust



Better Systems Management was clearly needed

- Better resource management:
 - Address the management of terminals, transactions and users throughout an IMSplex. Inconsistent definitions should also be prevented:
 - Sysplex terminal management
 - Coordinate the online change process across all IMSplex members
 - Global process management
 - Give exits the ability to determine terminal/user status globally
 - Global callable services
- Better operations management
 - Facilitate operational control of IMSplex members:
 - Single Point of Control
 - Global automation

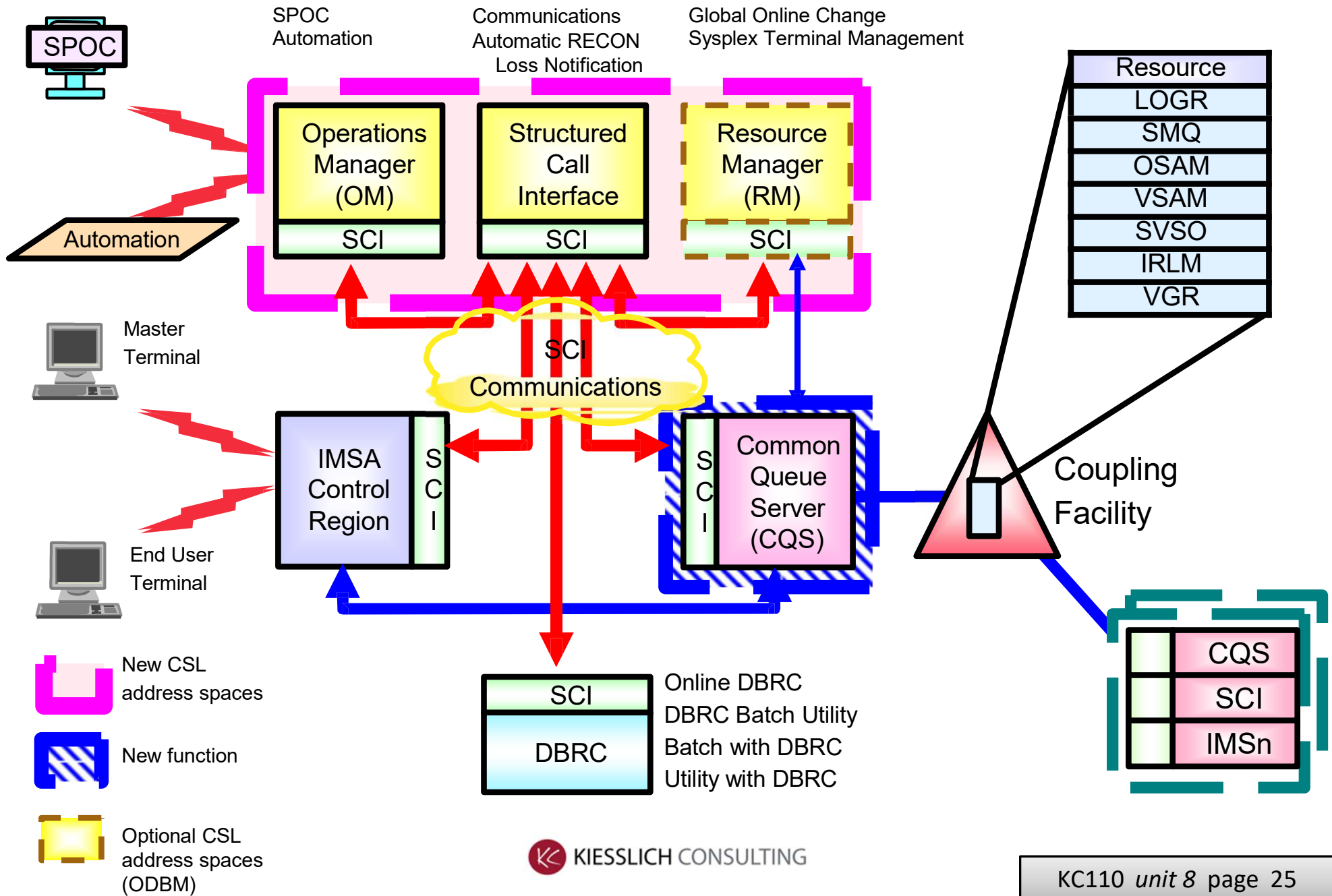
The IMSPLEX

- Definition of an IMSplex:
 - An IMSplex is a set of IMS address spaces that are working together as a unit and are most likely running in a parallel sysplex hopefully with a Common Service Layer (CSL) to assist in its management
 - **Note:** The concept of the IMSplex was not new; however the term was first formalized at the time of IMS V8.
 - Examples of an IMSplex include ...
 - A set of IMS control regions at the V8 and/or V9 and/or V10 level without a CSL that are data sharing or message queue sharing
 - This is arguably the worst case; we still have all the management complexity but without a CSL to assist us
 - A set of IMS control regions at the V8 and/or V9 and/or V10 level with a CSL that are data sharing or message queue sharing
 - A single IMS control region at the V8, V9 or V10 level with a CSL
 - This configuration makes sense especially for an IMS V10 (or higher) system since a CSL is required for the Dynamic Resource Definition (DRD) function

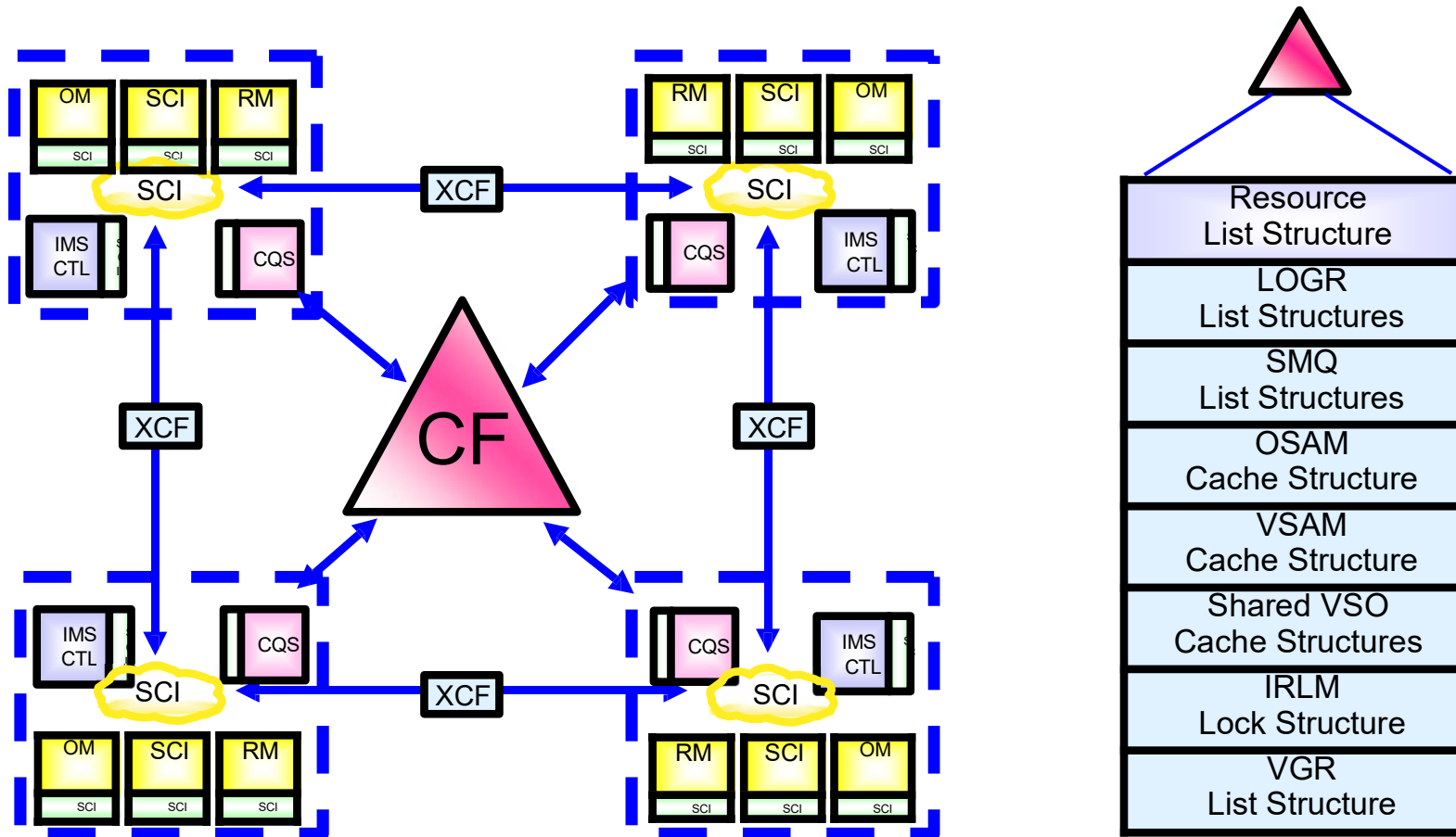
Common Service Layer

- New IMS address spaces built on Base Primitive Environment:
 - Structured Call Interface (SCI)
 - IMSplex member registration
 - Communications between IMSplex members
 - Operations Manager (OM)
 - IMSplex-wide command entry and response
 - Resource Manager (RM)
 - Global resource and process management
 - Optional CSL Address Space since IMS V9
 - VTAM terminal/user status recovery
- Enables new systems management functions in IMSplex:
 - Sysplex Terminal Management (STM)
 - Uses SCI and RM
 - Single point of control (SPOC) and user-provided automation (AOP)
 - Uses SCI and OM
 - Coordinated Online Change (Global Online Change)
 - Uses SCI, OM, and RM
 - Dynamic Resource Definition (DRD)
 - Uses SCI, and OM

CSL Architecture



IMSplex Configuration



- In an IMSplex:
 - All members share the same CF structures
 - Intra-IMSplex communications is implemented by SCI using XCF across OS images

The CSL Operations Manager component

- Provides an API supporting common point of command entry
 - Focal point for operations management and automation
 - Command responses from multiple IMSs are consolidated
- Provides the following services to members and clients of an IMSplex
 - An API for IMS Commands submitted from outside IMS
 - *Type 1* (Classic) IMS commands (/cmd ...)
 - *Type 2* (New) IMSplex commands (QRY, INIT, TERM, DEL, UPD)
 - Command Registration to support any command processing client
 - Clients tell OM which commands it can process
 - Command Security
 - Perform authorization within OM - before sending to IMS
 - RACF or user-written command security exit
 - Command Routing to IMSplex members registered for the command
 - Command Response Consolidation from multiple individual IMSplex members into a single response to present to the command originator

Type2 IMSPLEX commands

- INIT (INITiate process)
 - INIT OLC: Starts a global online change (G-OLC) process
- TERM (TERMinate process)
 - TERM OLC: Stops a global online change that is in progress
- CRE (CREate resource): Command added in V10 for DRD
 - CRE DB NAME(name) <other attributes for DRD defined DB>
 - CRE PGM NAME(name) <other attributes for DRD defined APPL>
 - CRE RTC NAME(name) <other attributes for DRD defined FP RCTE>
 - CRE TRAN NAME(name) <other attributes for DRD defined TRAN>
- UPD (UPDate resource):
 - UPD LE: Updates dynamic LE runtime options
 - UPD TRAN: Updates selected TRAN attributes
 - UPD <DB | PGM | RTC > Added and *UPD TRAN* enhanced for DRD
- DEL (DElete resource):
 - DEL LE: Deletes dynamic runtime LE options
 - DEL <DB | PGM | RTC | TRAN> Added for DRD

Type2 IMSPLEX QueRY command

- QRY IMSPLEX: Returns information about one or more members of the IMSplex
- QRY MEMBER: Returns status and attributes of the IMS members in the IMSplex
- QRY LE: Returns runtime LE options
- QRY OLC: Returns OLC library and resource information
- QRY TRAN: Returns TRAN info similar to /DIS TRAN
- QRY DB|PGM|RTC|TRAN command added or enhanced to provide information similar to /DISplay command
- QRY STRUCTURE: Returns structure information for the RM resource structure

UPD / QRY TRAN example

```
UPD TRAN NAME(PART) SCOPE(ALL) STOP(Q,SCHD)
      START(TRACE) SET(CLASS(4))
```

TRANCODE	MBRNAME	CC
PART	IMS1	0
PART	IMS2	0
PART	IMS3	0

Actual response is in XML format.
Formatting for display is the
responsibility of the command
originator.

```
QRY TRAN NAME(PART) SHOW(CLASS,STATUS)
```

TRANCODE	MBRNAME	CC	CLS	STATUS
PART	IMS1	0	4	STOQ,STOSCHD,TRA
PART	IMS2	...		

IMS Type1 *Classic* commands and OM

- Most classic IMS commands (/cmd ...) can be entered through OM API
 - IMS commands specific to an input LTERM or NODE are not supported from OM
 - For example
`/SIGN ON|OFF, /EXIT, /REL, /RCL, ...`
- If resource structure exists, some commands have global impact, for example:
`/STOP NODE ABC`
 - Node ABC is flagged as stopped in resource structure
 - Node ABC cannot log on to any IMS in IMSplex

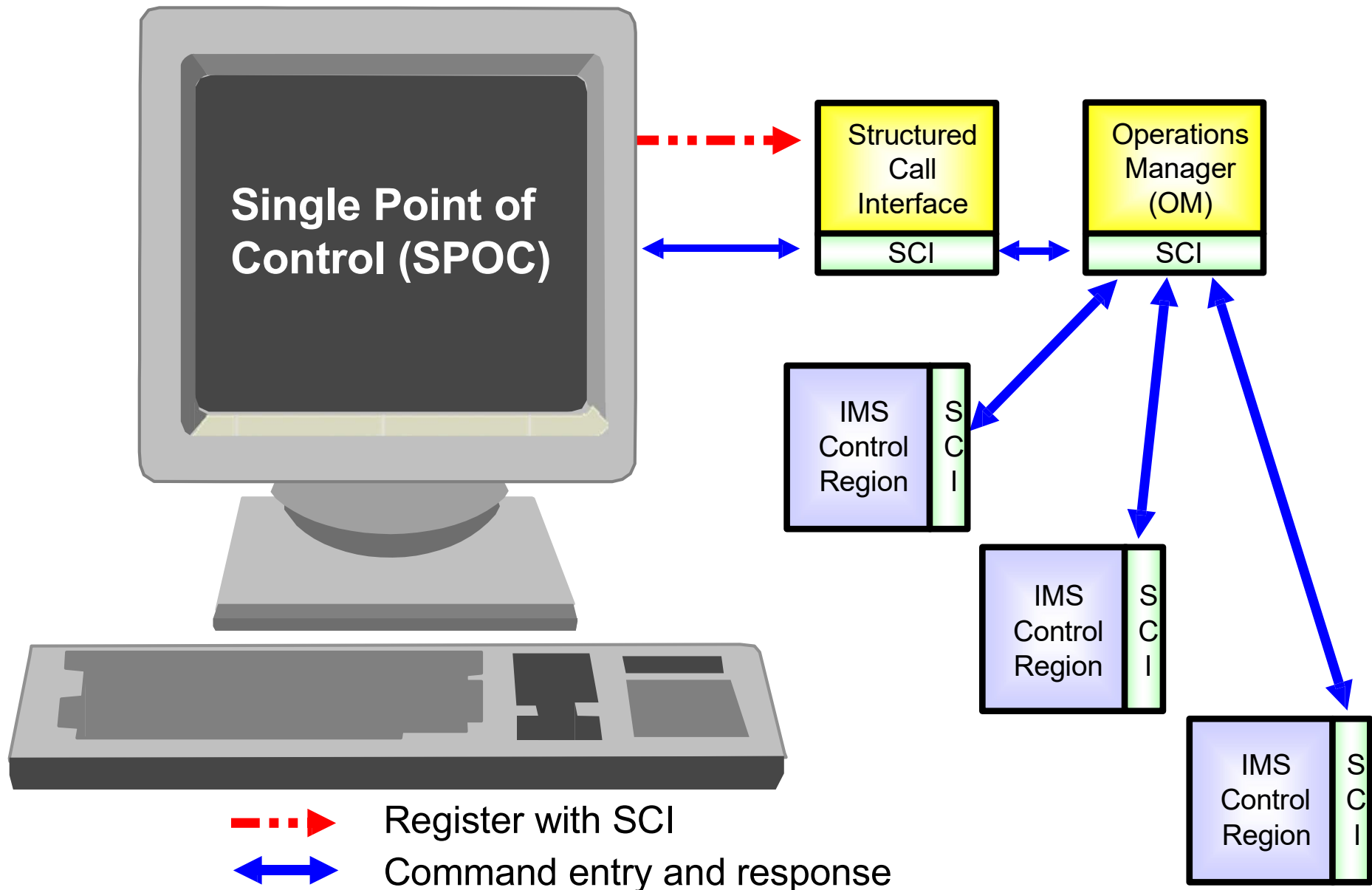
IMS Type1 *Classic* commands and OM (2)

- Some commands execute in every IMS where command sent
 - Not aware of IMSplex
 - /DIS TRAN TRX1 QCNT
 - Will execute in each IMS where command is routed
 - All will return same value (global queue count)
- Most commands depend on several factors
 - Command source, RM active with structure, affects significant status, resource exists on structure, resource owned by this IMS, resource owned by another IMS, display or update, ...
- Command differences documented in *Command Reference* manual in the *Usage Notes* section for commands:
 - As noted earlier, *The IMS V10 IMSplex Administration Guide* (SC18-9709-00) should be also be used when establishing or supporting an IMSplex
 - Both these manuals are worth studying!!

IMS SPOC - Single Point Of Control an OM client

- Runs under MVS and TSO
 - ISPF Application (DFSSPOC)
- Might or might not be on the same z/OS image as OM:
 - Must be on same MVS as an SCI in the IMSplex
 - Uses SCI to communicate with OM
 - As noted earlier, there are performance and availability benefits in having an OM on all Z/OS systems that host IMSplex participants
- Although called *Single* Point Of Control, a more descriptive word would be *centralized*:
 - SPOC provides a terminal from which IMS commands can be entered by a person to one or more members of an IMSplex
 - There can be multiple SPOC concurrent sessions in an IMSplex
- Formats command responses to be read by a person
 - OM response is encapsulated in XML
- TSO SPOC uses OM for security
 - OM provides security checking interface to RACF
 - TSO userid is used to determine RACF authorization

SPOC registers with local SCI



IMS SPOC features

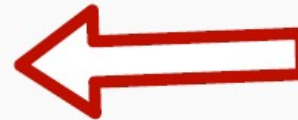
- The SPOC allows tailoring by each user to set individual preferences:
 - Users are allowed to specify shortcuts and set default command parameters
 - Groupings of IMSplex members can be specified
 - Users can come up with their own abbreviations for long, and complex, commands
- The SPOC can provide flexibility in the form and the routing of commands:
 - Classic and IMSplex commands can be processed in a SPOC session
 - It also allow the user to enter commands to one or more IMSs
- Command output is enhanced compared to output provided to the tradition MTO or System console:
 - Display consolidated IMSplex and classic IMS command responses
 - A history of commands is maintained
 - Allows the user to restrict IMSplex command output and to sort the IMSplex command response by column

IMS SPOC Command Entry panel

File Display View Options Help

IMS Single Point of Control

Command ==>



command line

Plex . _____

Route . _____

Wait . _____

Response for: QRY IMSPLEX

IMSplex	MbrName	CC	Member
PLX0	OM1	0	IMS5
PLX0	OM1	0	IMS4



command
response

F13=Help F15=Exit F16=Showlog

Command Entry from IMS SPOC

File Display View Options Help

PLX0 IMS Single Point of Control

Command ==> QRY TRAN NAME(A*) SHOW(ALL)

----- Plex . _____ Route . IMS13 _____ Wait . _____

Response for:

Override Preferences



F13=Help F15=Exit F16=Showlog F18=Expand F21=Retrieve F24=Cancel

Type 2 Command Response example

```
File Action Manage resource SPOC View Options Help
=====
PLEXi                      IMS Single Point of Cont
Command ==: _____

Response fo: QRY TRAN NAME(A*) SHOW(ALL) More: >
=====
Trancode MbrName      CC LPSBname LClS      LQCnt  LLCT  LPLCT  LPLCTTime L
ADDINV   IMSA         0 DFSSA   1         0      2 6553 6553500    7    7
ADDPART  IMSA         0 DFSSA   1         0      2 6553 6553500    7    7
AUTRAN11 IMSA         0 AUTPS   1         0      2 6553 6553500    7    7
AUTRAN12 IMSA         0 AUTPS   1         0      2 6553 6553500    7    7

F1=Help      F3=Exit      F4=Showlog   F6=Expand    F9=Retrieve  F12=
Doppelt klicken, um IBM Personal Communications zu star
```

Display formatted by SPOC from
XML response from OM.

Type1 Command and response

File Action Manage resources SPOC View Options Help

[illegible]

PLEXA	IMS Single Point of Control
-------	-----------------------------

Command ==>

```

ssssssssssssssssssssssssssssssssssss    Plex . .

```

Route . .

Wait . .

Log for . . : /DIS STATUS DATABASE

More: +

IMSpIex : PLEXA

Routing :

```
Start time. . . . : 2013.230 00:08:45.38
```

```
Stop time . . . . : 2013.230 00:08:45.38
```

```
Return code . . . : 00000000
```

Reason code . . . : 00000000

Reason text . . . :

Command master. . : IMSA

Command message log can be shown at top or bottom of display.

Member Name	Messages
-------------	----------

```

IMSA          * * DATABASE * *

```

IMSA ABTEILDB NOTOPEN

IMSA AUTODB NOTOPEN

IMSA CALLUPDB NOTOPEN

Display formatted by SPOC as received from IMS. Each line is one XML tag.

F1=Help F3=Exit F4=Showlist F6=Expand F9=Retrieve F12=Cancel