

IMS Infrastructure and the CSL: *The HOW and WOW of Innovative Growth, Simplified Operations, and Evolving Architectures*

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Agenda

- Myth versus Reality
 - Dispelling the 9 myths
- First things first
- Beyond the Myths
 - The Wows and Hows: Infrastructure
 - Adaptability to constantly evolving technologies
 - Flexibility, standardization, and speed
 - Application evolution
 - GUIs and tooling
- The continuing value of infrastructure

M **y** **t** **h**

VERSUS

REALITY

Nine Myths

- Myth 1 - Mainframe is not strategic
- Myth 2 – IMS is not strategic
- Myth 3 - IMS is old and outdated and not modern
- Myth 4 – IMS is proprietary and is difficult to integrate
- Myth 5 – IMS is not flexible enough to handle emerging datacenter requirements
- Myth 6 – IMS requires very large amounts of costly server and storage resources
- Myth 7 – IMS is too complex
- Myth 8 – IMS is not well supported outside of IBM
- Myth 9 – IMS costs too much

Bartlett, the Clipper Group: “IBM’s IMS – Myths, Realities, and Opportunities” (July 23, 2013)
<ftp://public.dhe.ibm.com/software/data/ims/pdf/TCG2013015LI.pdf>

Dispelling the Myths – Exposing the Truth

- **Myth1 – Mainframe is not strategic**
 - Supposed basis: Fewer mainframes today versus decades ago

- **Myth 2 – IMS is not strategic**
 - Supposed basis: No perceived investment in IMS

- **Myth 3 – IMS is old and outdated and not modern**
 - Supposed basis: Many enterprises adopted DB2 and moving away from hierarchical data structures

- **The Reality: continuing reliance on the mainframe by global businesses whose core operations depend on mainframes**
 - Corporate economic behaviors: consolidations and elimination of redundancies
 - z Systems customers continue to expand
 - More efficient processing power
 - 1960s: S/360 - 800K instructions/sec, 512K memory,
 - 1990s: S/390 – 1644 MIPS, 12 cores (microprocessors)
 - z13 – 111,000 MIPS, 141 cores running @5GHz and up to 10TB memory
 -

- **The Reality: continuing investment as shows by an aggressive 2-year cycle for new releases**
 - Many enterprise customer around the world consider IMS essential and strategic to their business

- **The Reality: Customer base shows the use of IMS and DB2**
 - DB2 customers use IMS TM for transactions
 - CICS customers use IMB DB for databases
 - IMS DB has been enhanced e.g., supports both DL/I and now SQL access
 - Not all data management solutions are appropriate for the relational model

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Dispelling the Myths – Exposing the Truth...

- **Myth 4 – IMS is proprietary and is difficult to integrate**
 - Supposed basis: It is not “open” and is difficult to integrate

- **Myth 5 – IMS is not flexible enough to handle emerging datacenter requirements**
 - Supposed basis: IMS is old and not modern enough to provide IT solutions that can adapt quickly to new demands and growth

- **Myth 6 – IMS requires very large amounts of costly server and storage resources**
 - Supposed basis: Perception that IMS is only needed by large companies with huge data and transaction volumes.

- **The Reality: the IMS TCP/IP gateway, IMS Connect, is a gateway for IMS resources that is reliable, secure, and scalable**
 - Provides support for new and evolving standards, e.g., Mobile and RESTful services, SOAP (Simple Object Access Protocol), XML web services, JAVA standards, SQL, etc...
 - Without requiring changes to the application or database
 - IMS supports/provides Eclipse-based tooling

- **The Reality: IMS provides efficient CPU and storage utilization while providing the highest performance (117K txn/sec)**
 - The highest performance, most resilient applications in several industries are built on the IMS TM/ IMS DB framework because no other solutions have been shown to meet the required standards effectively at an acceptable cost.
 - Access to transactions from a variety of evolving environments; access to databases using standard APIs from distributed environments and tools

- **The Reality: IMS is the most efficient messaging, transaction, database and batch manager commercially available**
 - Shown to consume less than 100 MPS for a million transactions – handles a wide range of workloads
 - IMS physical data takes less storage capacity compared to relational DB managers for equivalent amount of data
 - Makes sense for any size customer that needs an optimized, well-integrated, and cost effective platform on z/OS.

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Dispelling the Myths – Exposing the Truth...

- **Myth 7 – IMS is too complex**
 - Supposed basis: It takes many skilled technicians to design, support, enhance and maintain the environment and these skills are not easy to find

 - **Myth 8 – IMS is not well supported outside of IBM**
 - Supposed basis: Perception that there are only a few ISVs that provide IMS solutions

 - **Myth 9 – IMS costs too much**
 - Supposed basis: When compared to distributed environments, mainframe solutions appear to be more expensive
- **The Reality: IMS has actually focused on simplification through APIs, infrastructure changes, and tooling**
 - IMS supports many open standards including java for application programmers; the IMS Enterprise Suite provides solutions for an easier end-to-end application development lifecycle.
 - The IMS Catalog and Open Database support allows participation in solutions that require metadata exchange while Dynamic capabilities simplify system programming tasks
 - Free IMS workshops are delivered annually across multiple geographies and IMS education is included in the IBM Academic Initiative

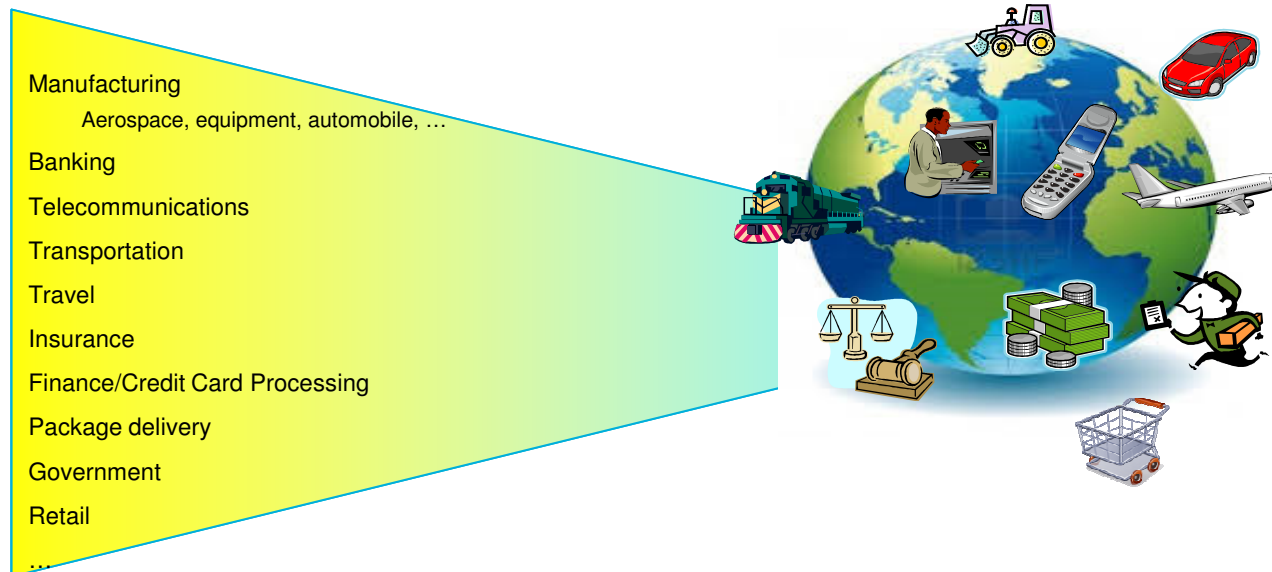
 - **The Reality: Vendor support of IMS continues to be aggressive through tools and integration products**
 - There are over 25 active business partners that are involved in release to release migrations to ensure their products support and are enhanced.
 - A robust ecosystem of over 20 regional user groups as well as a very active Share project continually provides customer requirements as well as a dynamic exchange of experiences and ideas

 - **The Reality: Comparisons do not always take into consideration all the factors that could come into play**
 - IBM Eagle Studies (TCO studies) conducted at hundreds of customer sites with a wide range of application scenarios have demonstrated superior , often dramatically lower ,total cost of ownership. Only a small number, about 4%, were an exception

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Beyond the Myths

- Resources on the z System run the world and are critical to business processes
 - **IMS, CICS and DB2**
 - IMS TM is a transaction server
 - Accesses both IMS DB (hierarchical) and DB2 (relational) databases
 - IMS DB is a database management system
 - Accessed by both IMS TM and CICS

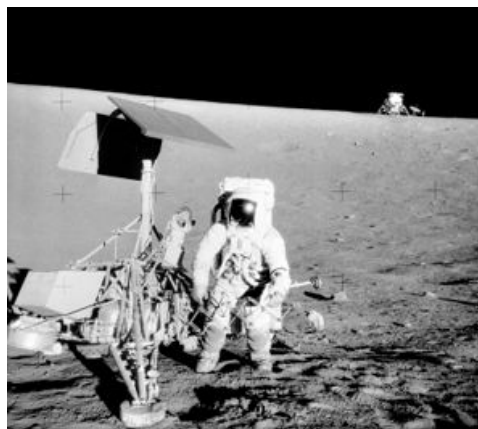


More about
REALITY

The **WOWs** of growth, innovation, and security
as a function of
The **HOWs** of Infrastructure

First Things First

- IMS (Information Management System)
 - Was originally created for the NASA Apollo project to put a man on the moon
 - Announced 1968; delivered in 1969
 - Result of joint project by IBM, Rockwell, and Caterpillar
 - Rockwell was contractor for NASA Apollo project
 - ✓ Needed to track parts for the Apollo capsule
 - ✓ Built on 1965 IBM/Rockwell project using IBM 7010
 - Caterpillar
 - ✓ Needed to track parts for tractors and other products



The WOW – Adaptability to constantly evolving technologies

- And look at it now
 - Leveraging a continuing investment
 - Without changing the application

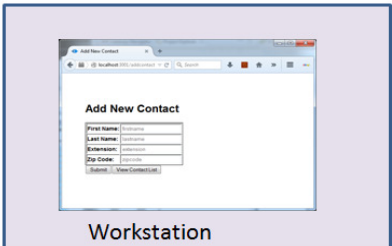
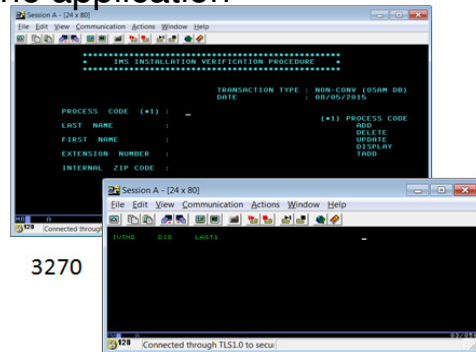


Field Name →	LL	ZZ	TRANCODE	COMMAND	LAST NAME	FIRST NAME	EXTENSION	ZIP CODE
HEX Value →	03	00	CBEEDD44444	CCC44444	DCD444444	DDCD44444	FFF6FFFF44	FFFFF44
	0B	00	9535600000	14400000	4650000000	1685000000	5550555500	9514100
Readable Value →	59	0	IVTNO	ADD	DOE	JOHN	555-5555	95141



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JSON Formatted Data
{
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    "IVTNO_INPUT_MSG" : {
      "IN_FIRST_NAME" : firstName,
      "IN_EXTENSION" : extension,
      "IN_ZIP_CODE" : zipCode,
      "IN_LAST_NAME" : lastName
    }
  }
}
    
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Workstation

SNA



To the moon
....and beyond

TCP/IP



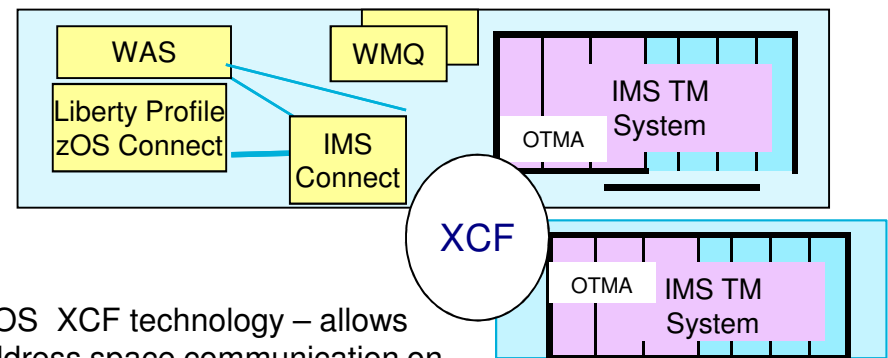
Compiled programs written in accordance with the System/360 Principles of Operation in the 1960's continue to execute today → and be accessed from mobile devices which did not exist when the program was created

The HOW of Adaptability - Infrastructure

- Components that are delivered as part of the product
 - OTMA (Open Transaction Manager Access)**
 - Provides standardization of access to IMS transactions
 - Clients: IMS Connect, WMQ, WAS, etc.
 - Enabled by starting the support (parameter or command)
 - IMS Connect (IMS TCP/IP Socket server)**
 - Enabled by configuring and starting the address space
 - Configuration definitions and BPE (Base Primitive environment definitions)
 - IMS applications and existing IMS architecture**
 - Through the use of message queues, applications are decoupled from communications methods - **no change to applications!**
 - Distributed requestors
 - Socket call to the IMS Connect
 - Can take advantage of IMS-provided connectors

High Performance

IMS 13...14

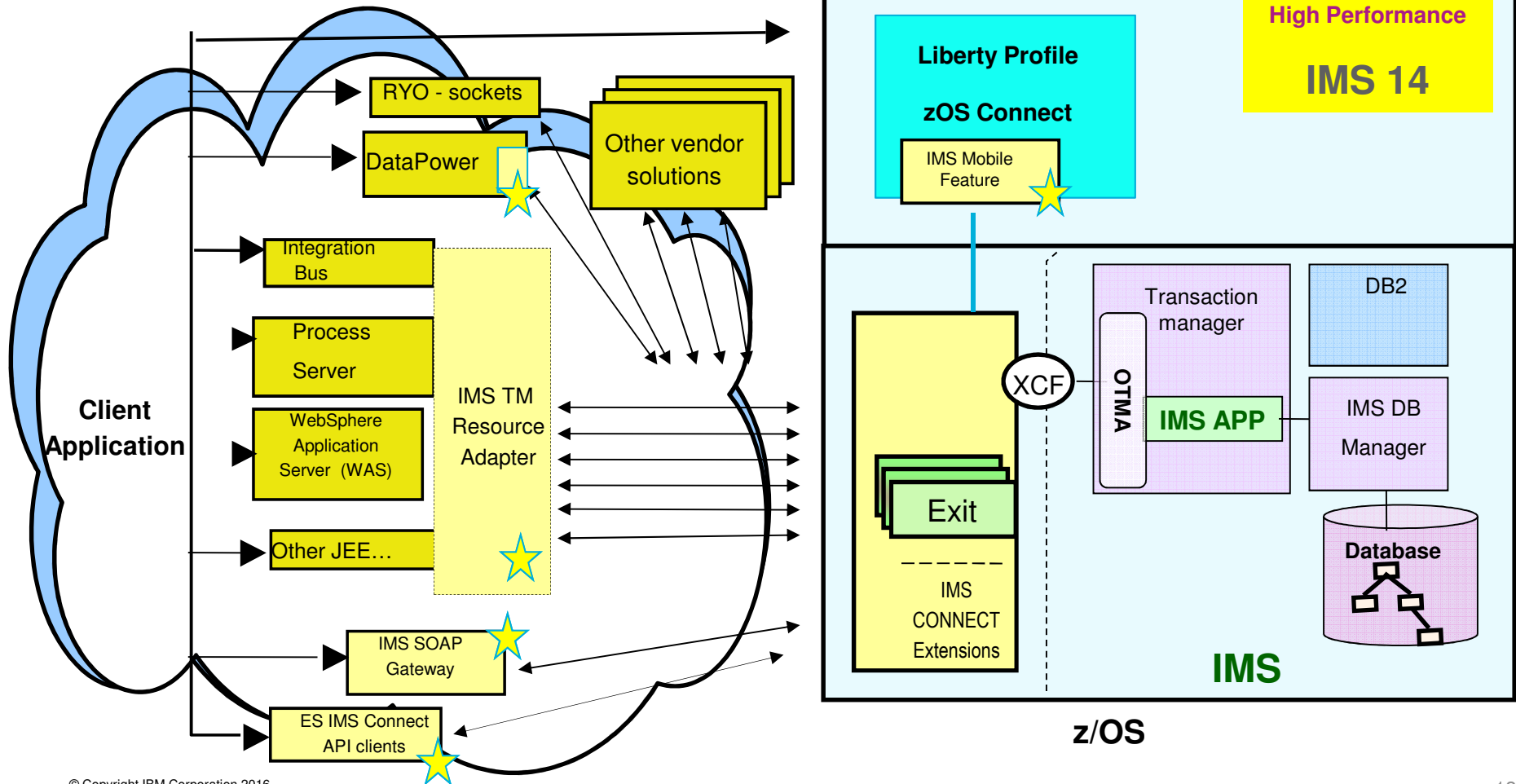


z/OS XCF technology – allows address space communication on the same or different LPARs

Extending the Infrastructure

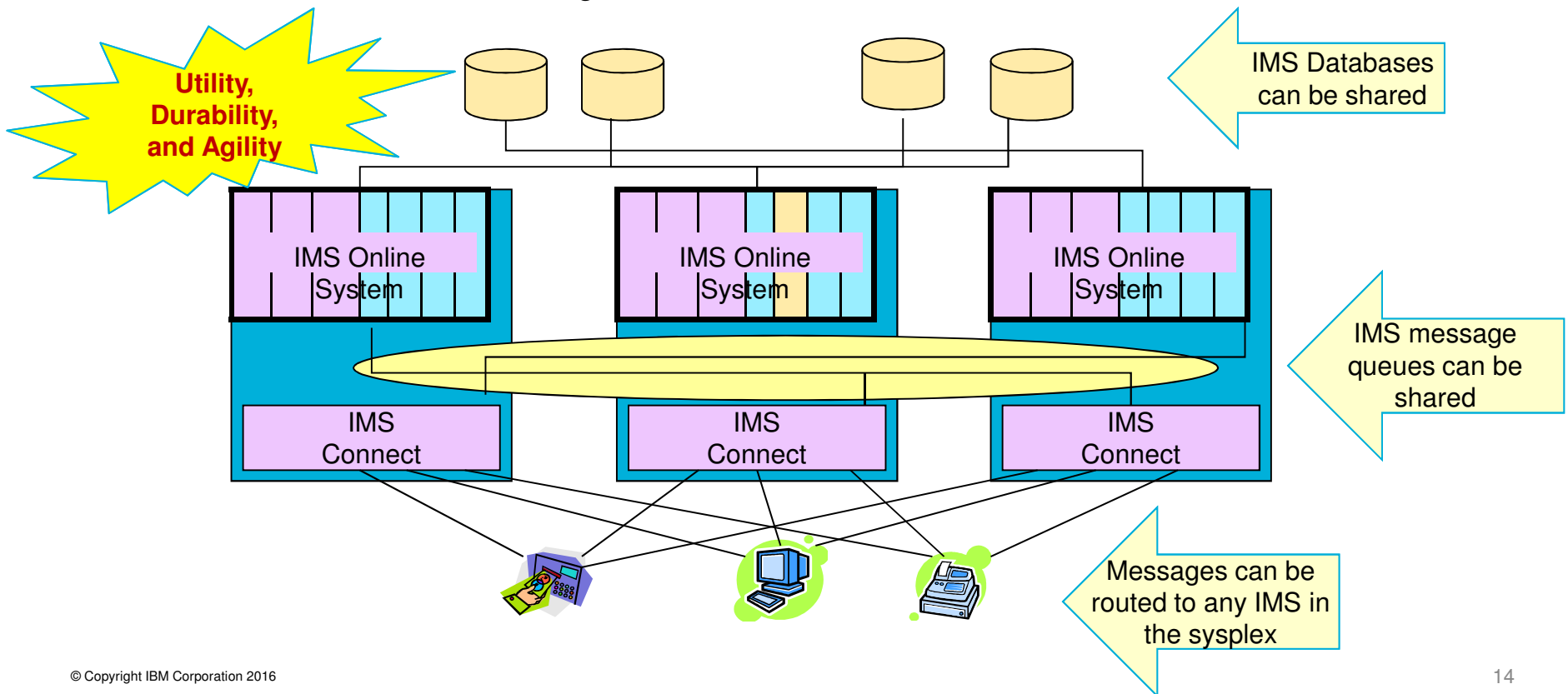
- IMS Connect – OTMA for Transaction access (DB on later slides)

★ IMS provides client-side components



The WOWs – Utility, Durability, and Agility

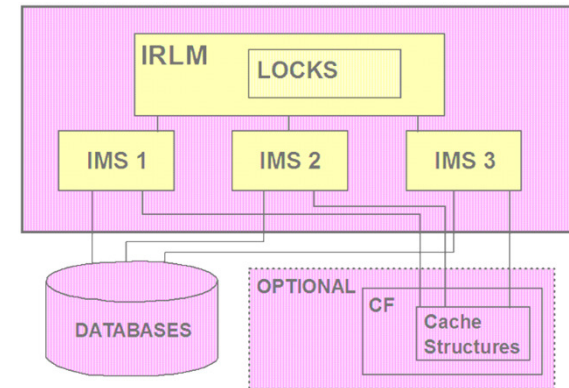
- But what happens when you have pent-up demand or need to add or remove systems as your business fluctuates?
 - The IMSplex – a set of IMS address spaces that are working together as a unit and are most likely running in a parallel sysplex (but not required)
 - Provides the ability to share resources and expand/contract systems as needed
 - Shared Queues and Datasharing



The HOW of Utility, Durability, and Agility...

■ Data Sharing Group Infrastructure

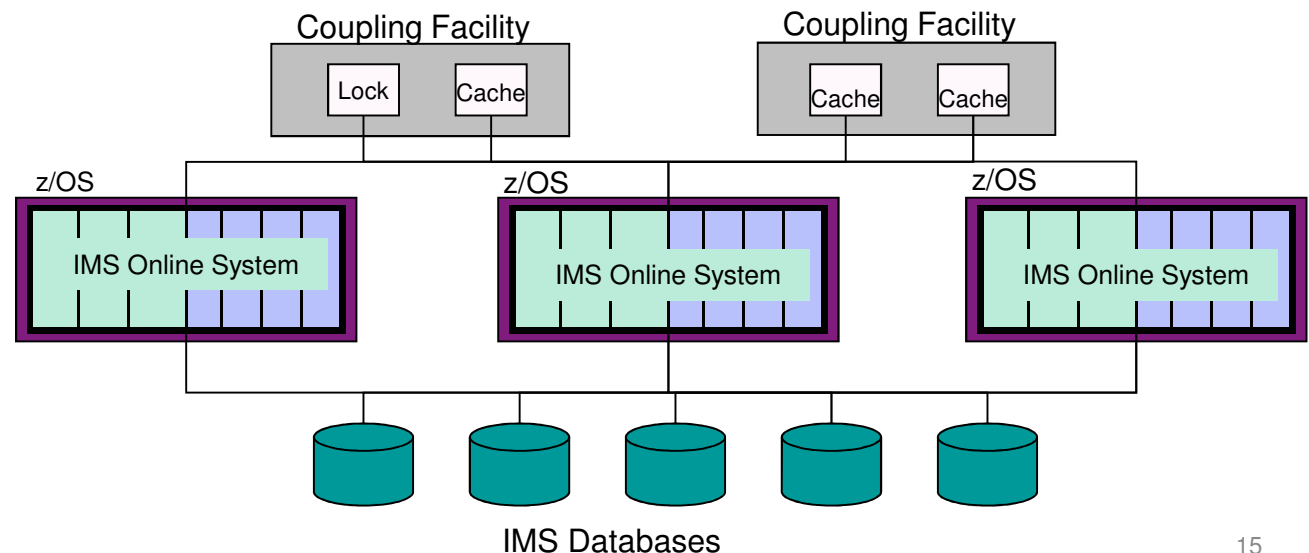
- All IMS subsystems sharing a set of databases
- Parallel sysplex and Coupling Facility (CF) exploitation
 - The **IRLMs** (IBM Resource Lock Manager): installation and setup
 - The **CF** (Coupling Facility): definition of the policies as well as the structures (type, name, size and location) used by the IRLMs and subsystems
 - IMS: definition of the IRLM, database access, CF structure names, caching
 - A single set of **DBRC RECONS**



No changes to application programs !

Even though they cause new locks to be acquired and released and buffers to be invalidated

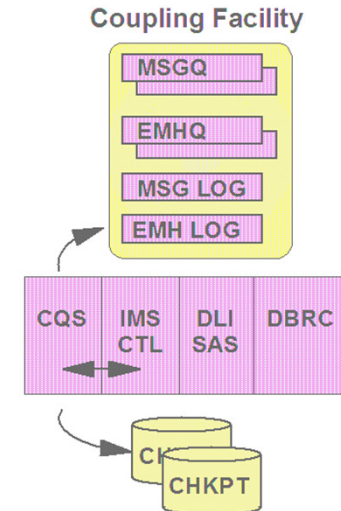
Any IMS can access the database !



The HOW of Utility, Durability, and Agility...

Shared Queues Infrastructure

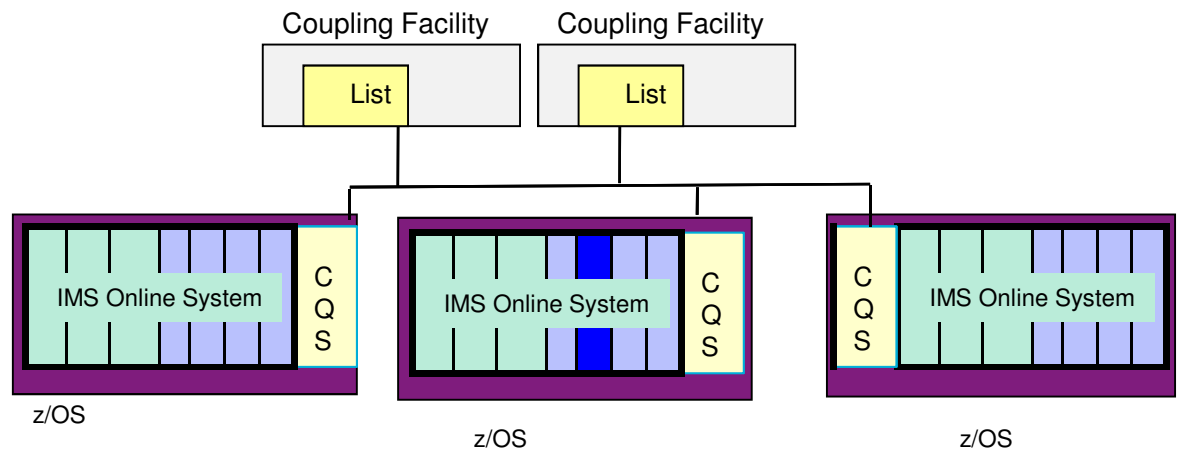
- All IMS subsystems sharing a set of message queues
- Parallel sysplex and Coupling Facility (CF) exploitation
 - IMS: define shared queues support (parameter or command) to identify the CQS to be invoked
 - One **CQS** (Common Queue Server) per IMS: Definition of the address space, CQS checkpoint datasets for restart, and the BPE (Base Primitive Environment)
 - The **CF** (Coupling Facility): definition of policies, share queues list structures (primary and overflow) and Logger structures



No changes to application programs !

IMS systems use CF list structures for the messages instead of local message queues

Any IMS can process the message !



Extending the Infrastructure

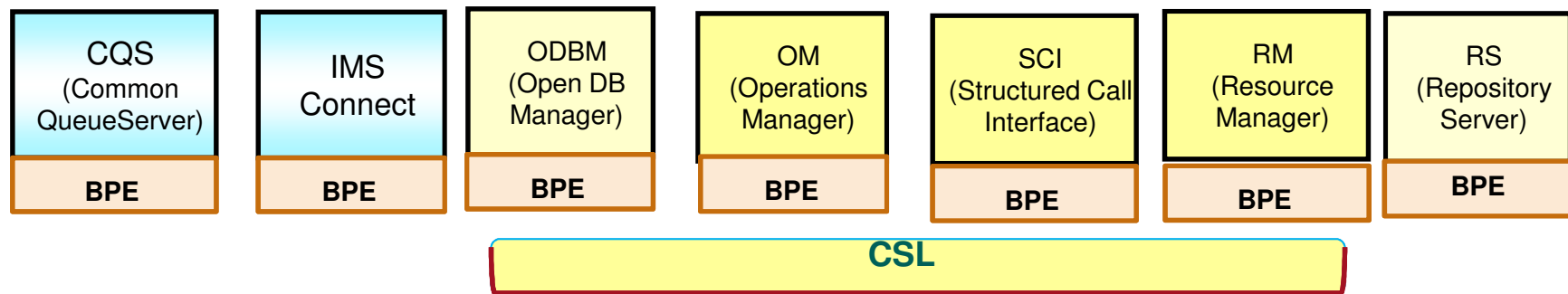
- And common services

- **Base Primitive Environment (BPE)**

- A common system service base

- Provides services such as tracing, message formatting, parsing, storage management, sub-dispatching, and serialization

- » Hidden layer in the address spaces but externalized through traces, commands, exits, messages/abends



- And... a **Common Service Layer (CSL)**

- a collection of IMS *manager* address spaces that provide the infrastructure needed for systems management tasks in an *IMSplex*

Extending the Infrastructure ...

- The Common Service Layer (CSL)
 - Provides the base for new functions
 - Reduces complexity of managing multiple IMS systems
 - Through an architecture to improve the systems management capabilities
 - Implemented through 'managers'
 - Provides support for expanding the processing environment through
 - A single system image (IMSplex)
 - Ease of use through a single point of control
 - Coordination of shared resources across all IMS systems

Extending the Infrastructure ...

- CSL managers

- **Structured Call Interface (SCI)** - standardizes intra-communications between IMSplex members
 - Required in every z/OS image where CSL is active
- **Operations manager (OM)** - provides an enhanced interface (type-2 commands) to control resources
 - Supports a SPOC (single point of control) for operations management and automation
 - TSO, Batch, TCP/IP client through IMS Connect
- **Resource manager (RM)** - provides the infrastructure for managing global resources and coordinating IMSplex-wide processes
 - IMS is the exploiter of these services

- **Open Database Manager (ODBM)** - supports open standards for distributed and local Java application program connectivity to IMS databases

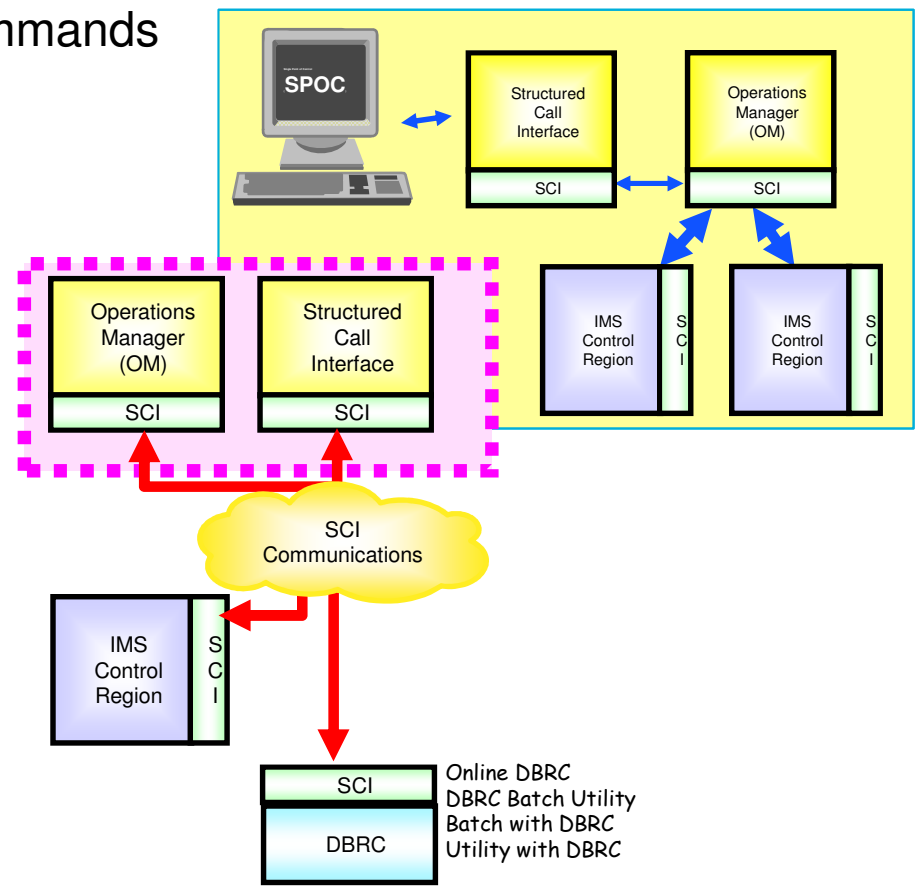
CSL – at Minimum

- At minimum, implement the ***‘enhanced command environment’***

- OM and SCI

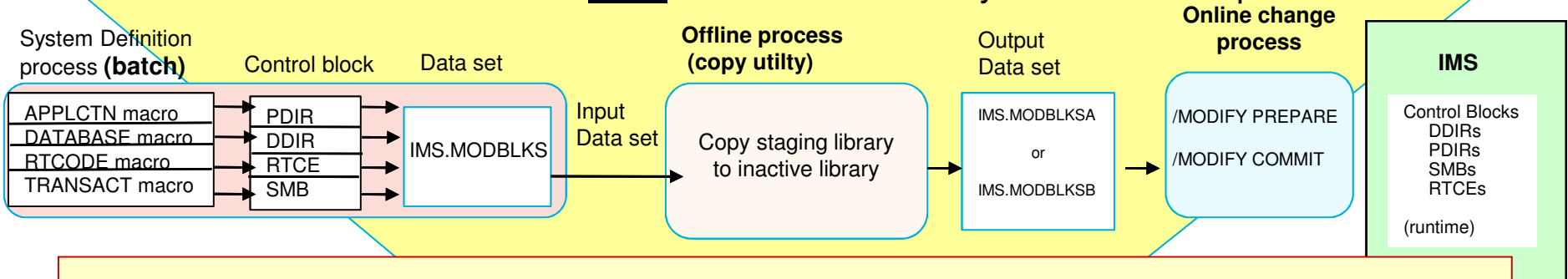
- Most new functions require OM type-2 commands

- INIT (INITiate Process)
- TERM (TERMinate Process)
- UPD (UPDate Resource (IMS 10), Quiesce (IMS 11),
FF Buffer Pools (IMS 12))
- UPD (UPDate IMSCON) (IMS 12)
- DEL (DELeTe Resource)
- CRE (CREate Resource) (IMS 10)
- EXP (EXPort Resource) (IMS 10)
- IMP (IMPort Resource) (IMS 10)
- QRY (QueRY Resource)
- QRY (QueRy IMSCON) (IMS 12)
- QUE (QUEue Message) (IMS 10)
- REFRESH (REFRESH USEREXIT) (IMS 12)
- ...Additional resources for subsequent IMS releases
 - HALDB alter (IMS13)
 - Dynamic MSC, refresh (P)WFI regions (IMS14)

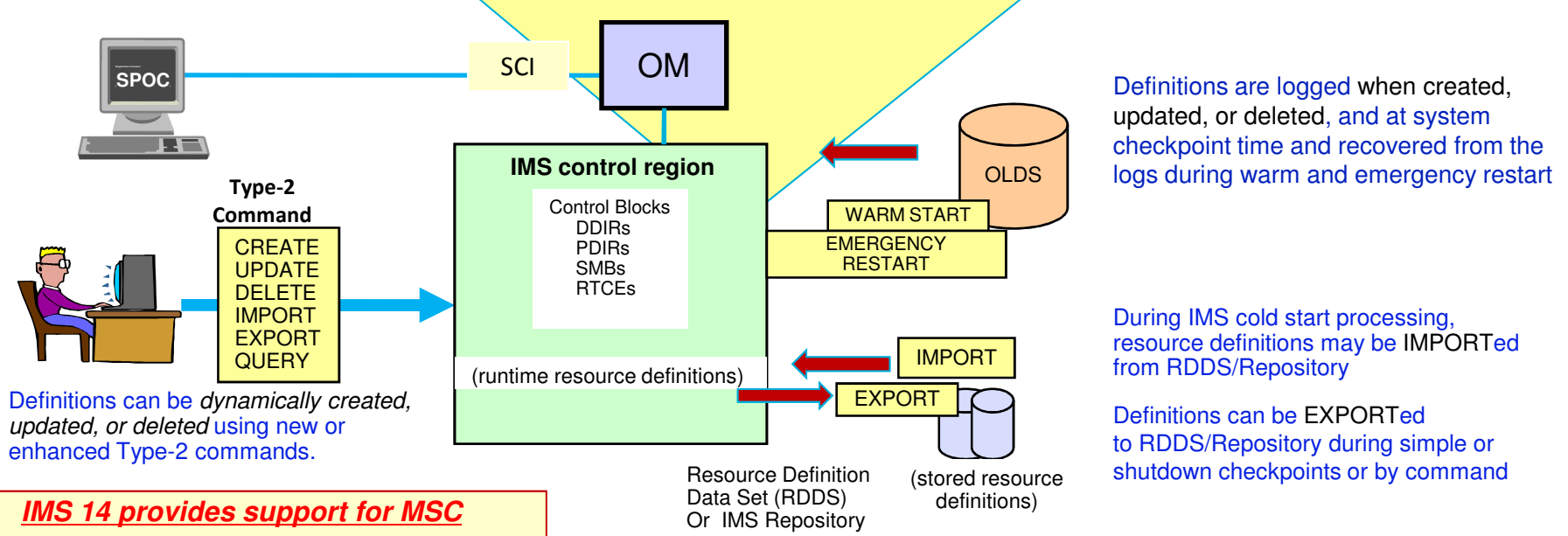


CSL ...

- Facilitates the movement **from** a more restrictive system definition process



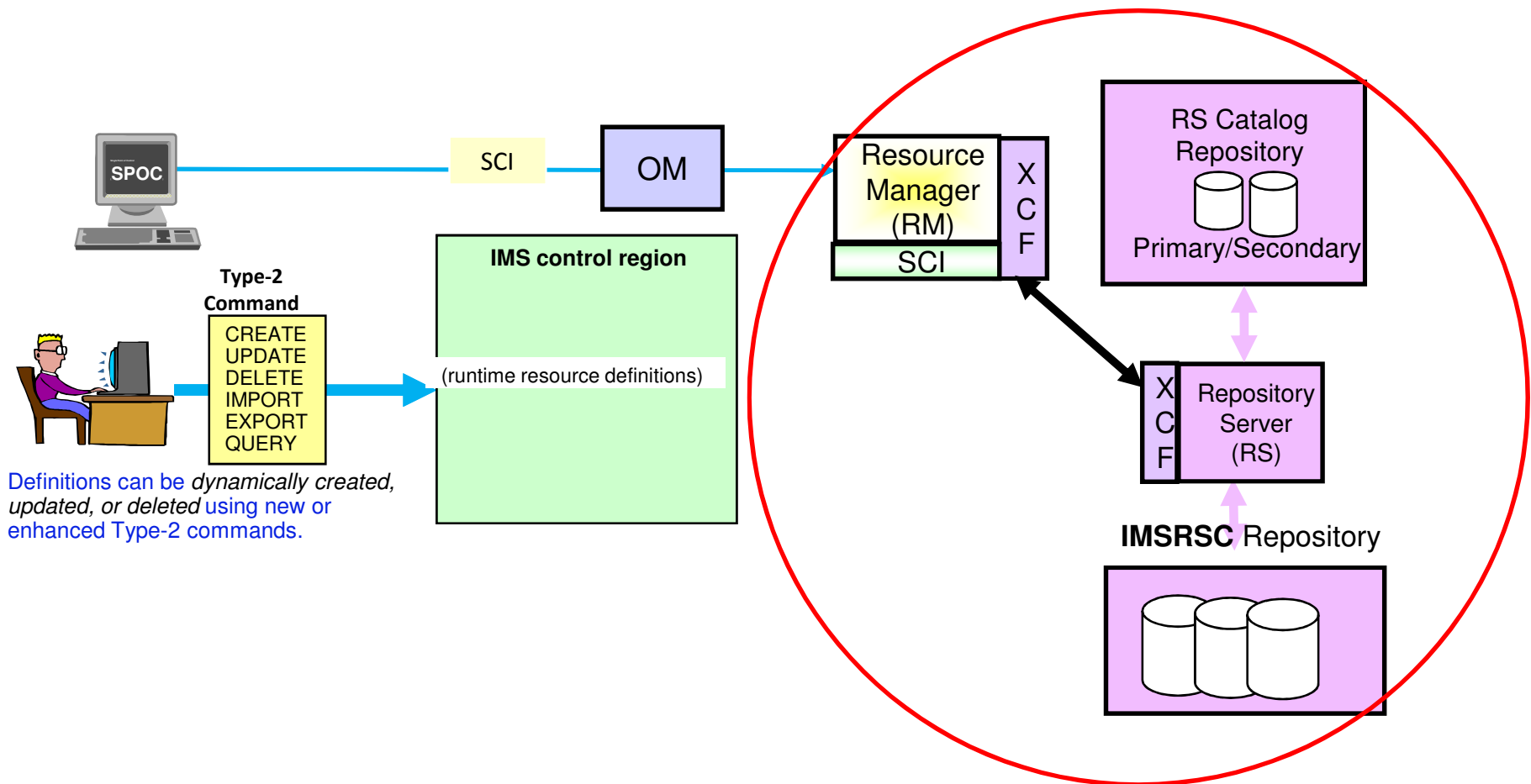
- To** Dynamic Resource Definition – DRD (for modblks resources)



- IMS 14 provides support for MSC**

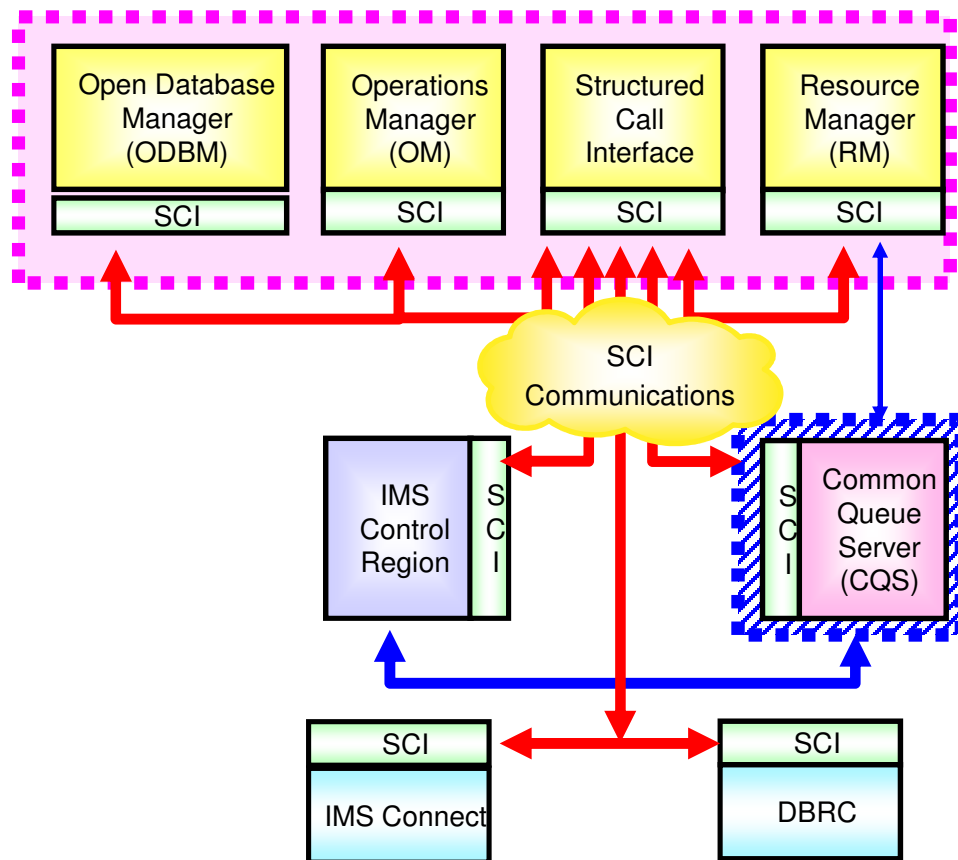
CSL ...

- **And for DRD ... the ability to harden resources for COLDSTART**



CSL - the IMSplex

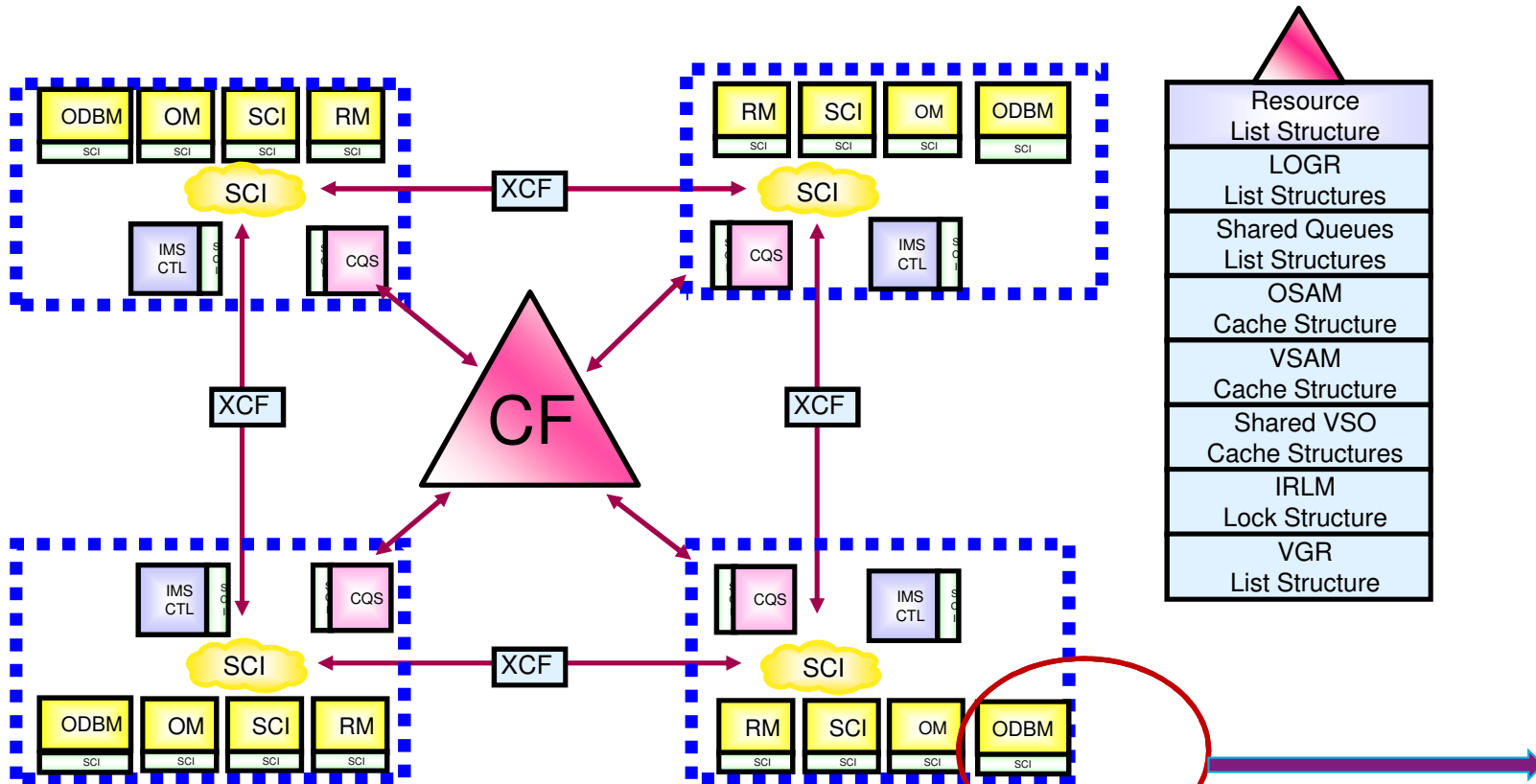
CSL Architecture (Address Spaces)



IMSplex components are:

- IMS subsystems (TM/DB, DBCTL, DCCTL, XRF active, XRF alternate)
- IMS Connect
- CQS (can be used for RM functions, e.g., access resource structure to maintain global information)
- CSL components (OM, RM, SCI, ODBM)
- A batch or DB utility region using DBRC
- DBRC batch utility

IMSplex with Multiple IMS Systems Configuration



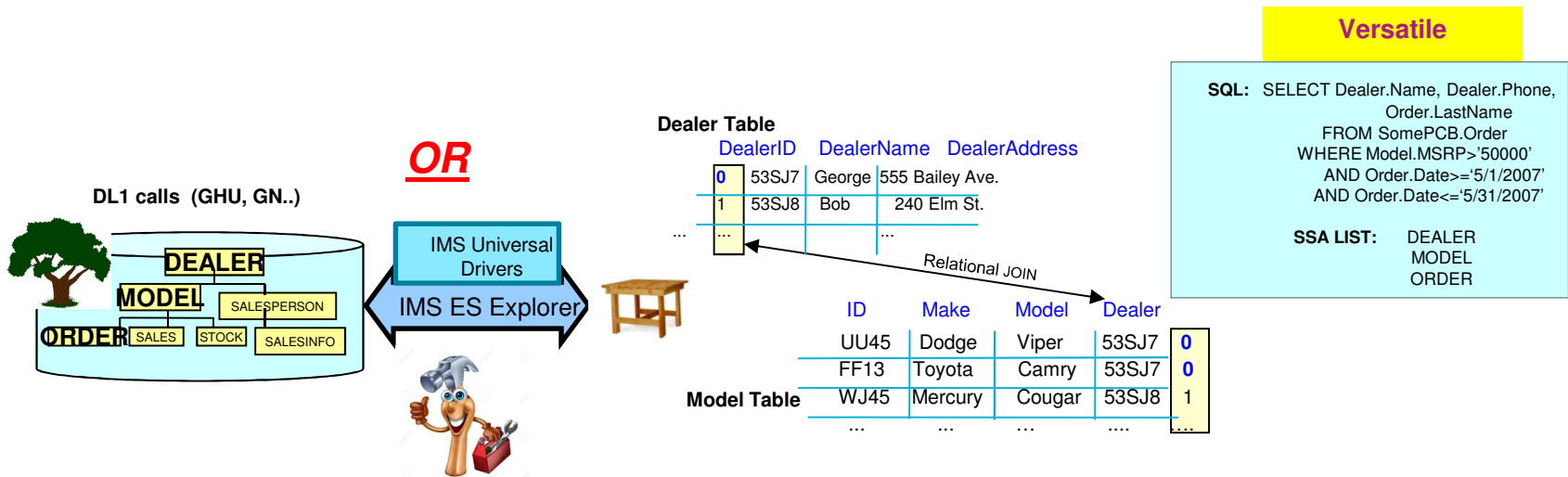
- In an IMSplex
 - All members share the same CF structures
 - Intra-IMSplex communications is implemented by SCI
 - Uses XCF across z/OS images

The WOW – Flexibility and Standardization

Flexibility and Standardization

- The IMS database manager

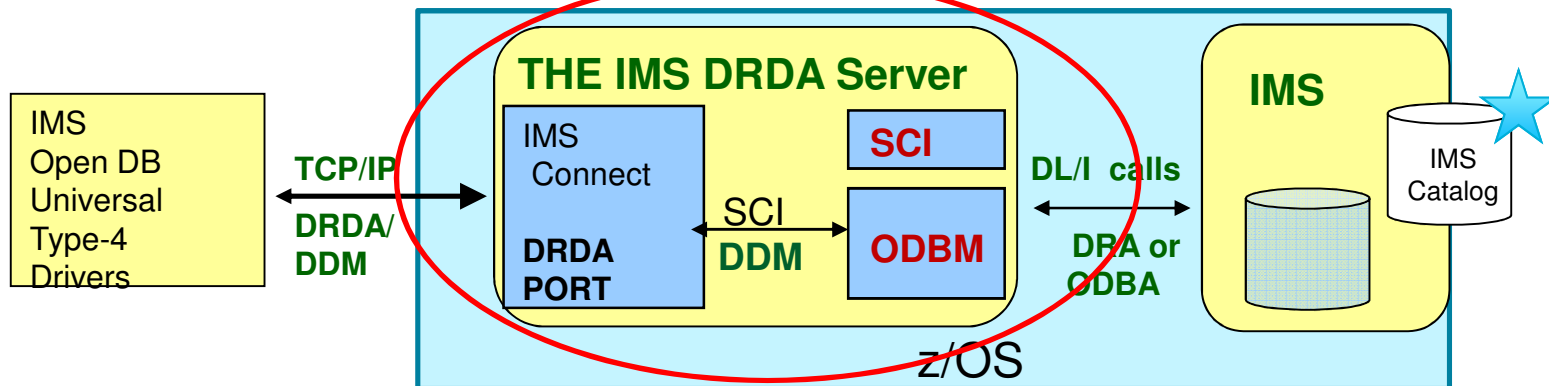
- Hierarchical databases (tree structure versus DB2's relational table structure)
 - Can be processed using **IMS calls (hierarchical DL/1)** *or* **SQL calls (relational)**
 - For SQL, the IMS universal drivers interpret the SQL to DLI



- May be accessed from IMS TM, CICS java, WAS, distributed applications and tools,

The HOW of Flexibility and Standardization

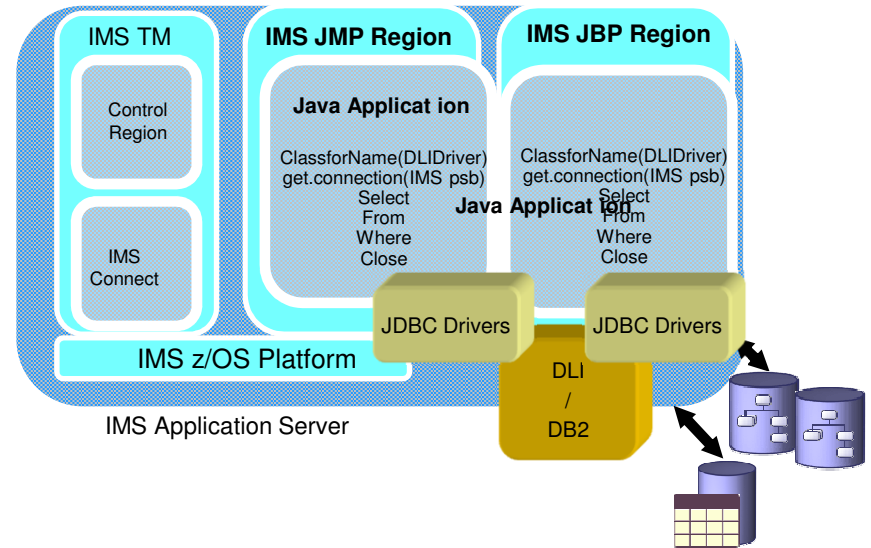
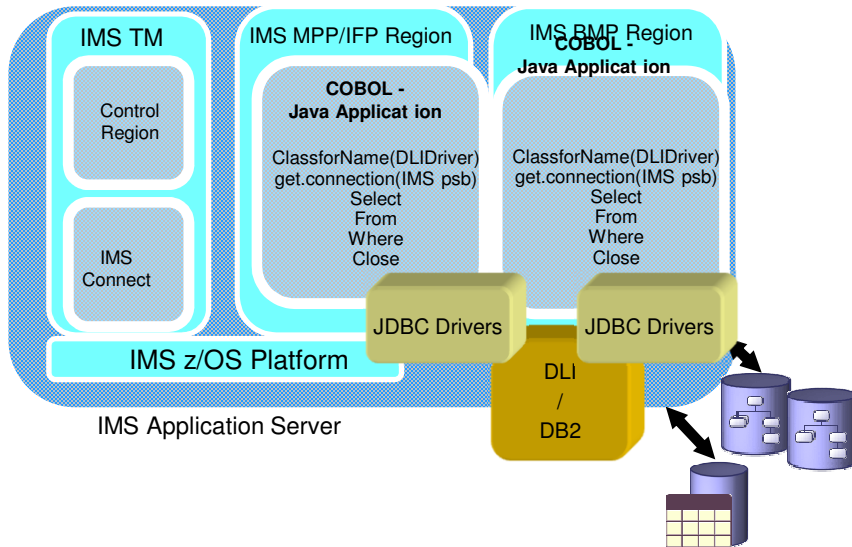
- **Open DB** - provides an environment that manages access to online IMS databases from anywhere in the enterprise
 - DRDA (Distributed Relational Database Architecture) implementation via TCP/IP, IMS Connect and ODBM
 - **Open Data Base Manager (ODBM)**
 - ❖ Works with IMS Connect to provide distributed access to IMS databases
 - **IMS Connect**
 - Accesses ODBM via SCI (Structured Call Interface which is implemented by another CSL address space also called the SCI)
 - Can be used in a DBCTL environment



The WOWs – Application Evolution

Java

- Programming standard across the industry
 - All platforms
- Skills readily available
 - Taught in universities



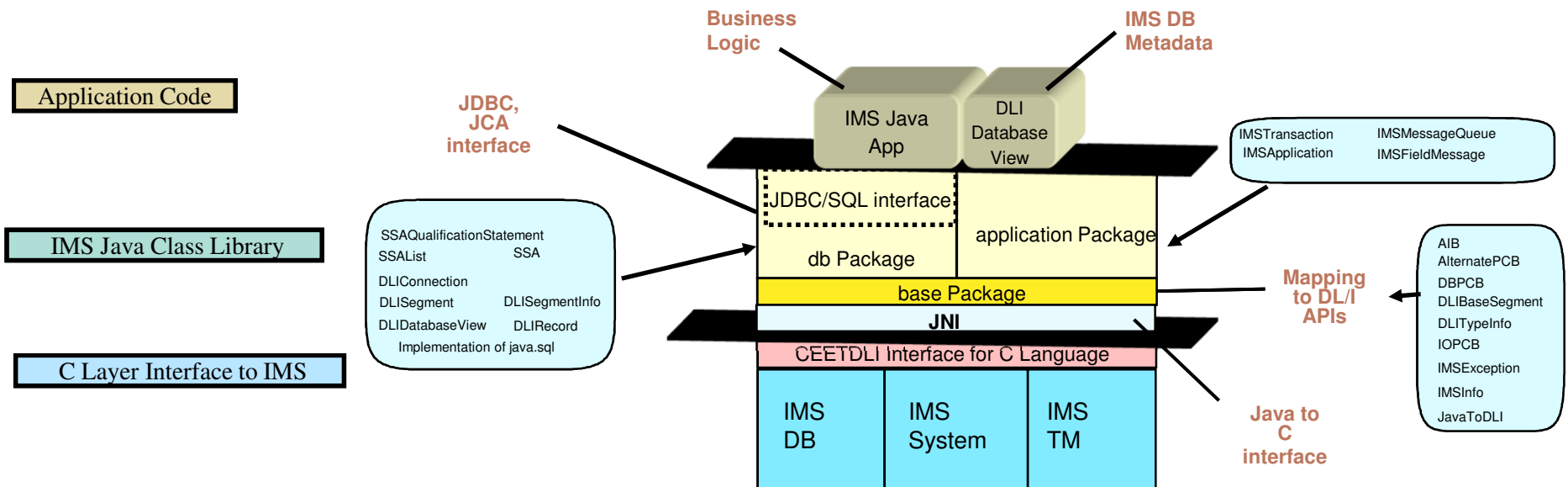
- Java – Offload to zAAP on zIIP



The HOW of Application Evolution

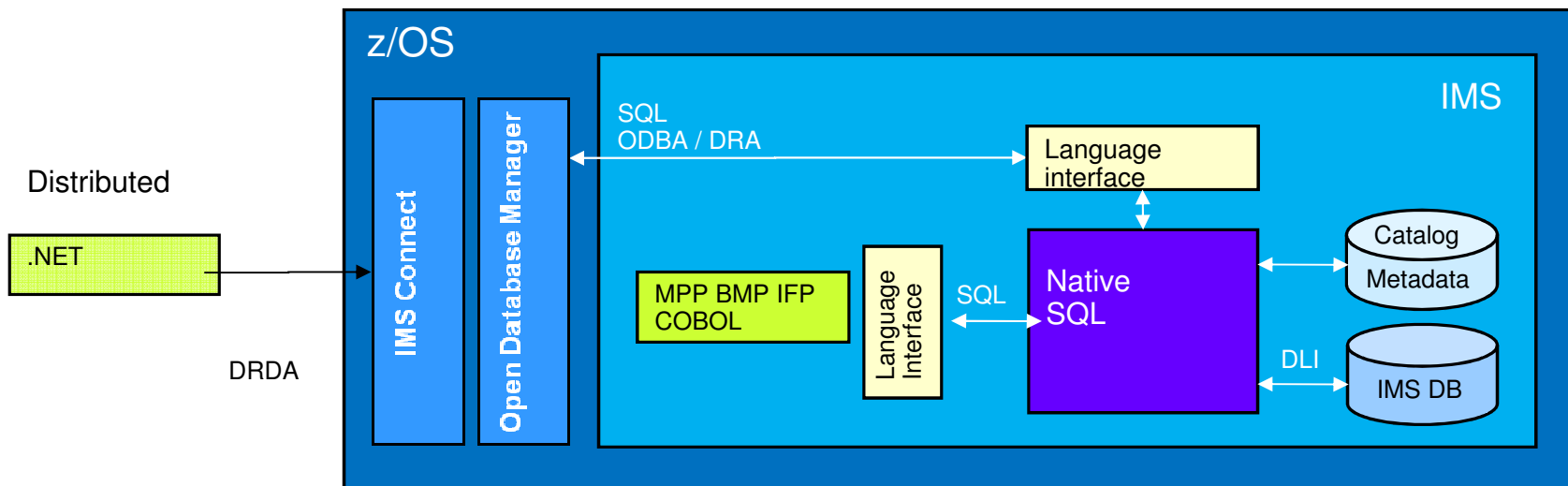
Java programs use the APIs that are provided

- application Package classes to
 - initialize and begin the program
 - get the input message from the message queue
 - put the output message on the message queue
 - commit
- JDBC interface or db Package classes to
 - access the IMS databases



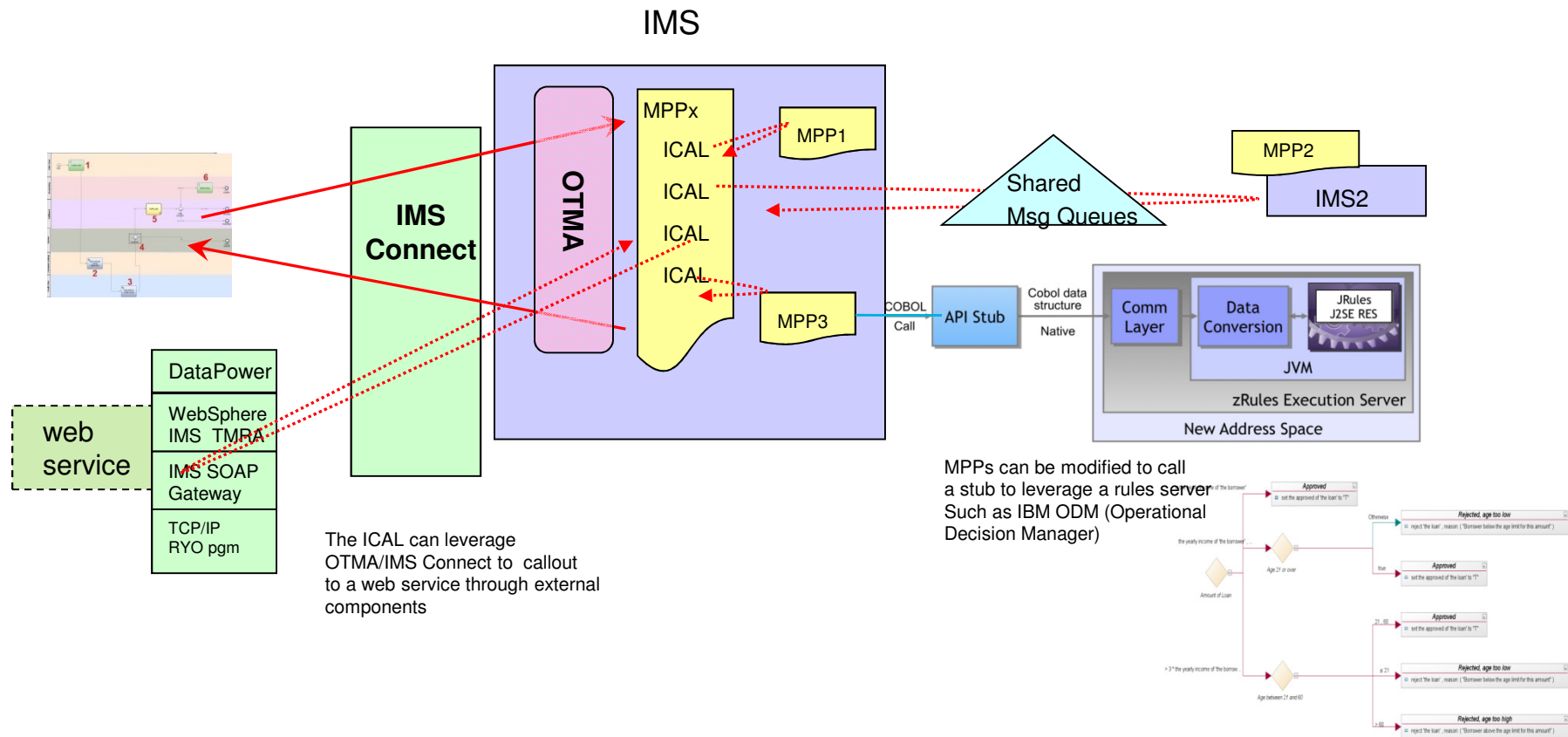
Extending the Infrastructure

- **IMS 13: native SQL COBOL and distributed applications (.NET/JDBC)**
 - Provides standard SQL keywords to easily access IMS data
 - SELECT, INSERT, UPDATE, DELETE
 - Uses Dynamic SQL programming model
 - Converts SQL statements to DL/I calls
 - Supports a subset of SQL keywords that are currently supported by IMS Universal JDBC driver
 - Uses database metadata in IMS Catalog
 - No need to generate metadata for use in applications



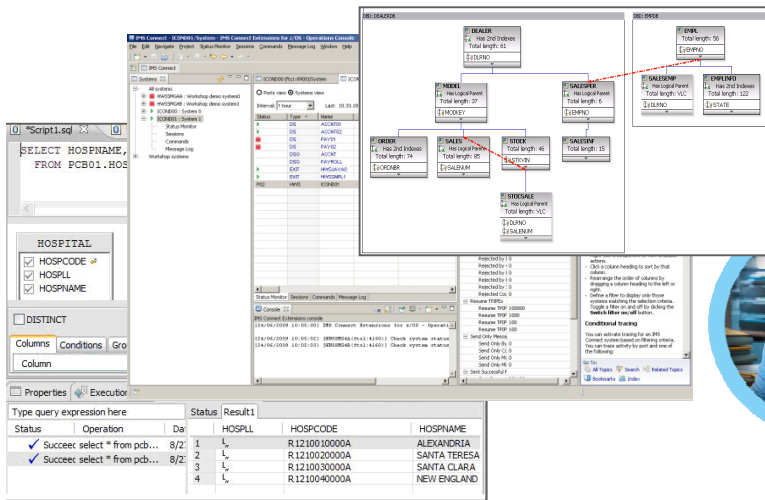
Extending the Infrastructure... for Applications

- Introduction of the DL/I ICAL provided synchronous callout access to external web services as well as internal IMS transactions

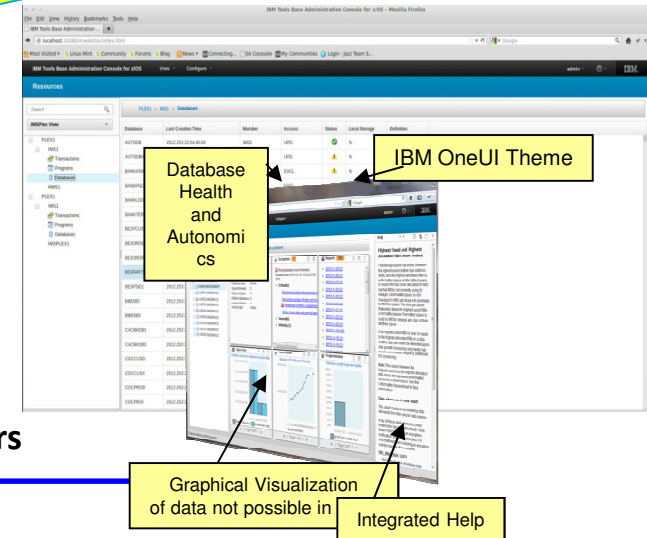


The WOWs - GUIs/Tools make things simpler

IMS Enterprise Suite Explorer for Development (*Eclipse*)



IBM Management Console for IMS and DB2



Simplification



Developers, DBAs



Administrators

IMS



- Visualize IMS database structure as defined by DBD source
 - Change IMS Database and Program Definition source
 - Graphically access IMS data using SQL
- View your mainframe datasets
 - Submit JCL and inspect output in JES
- New: extension of the tool for transaction access**
 - Generate and deploy mobile services as Mobile services**

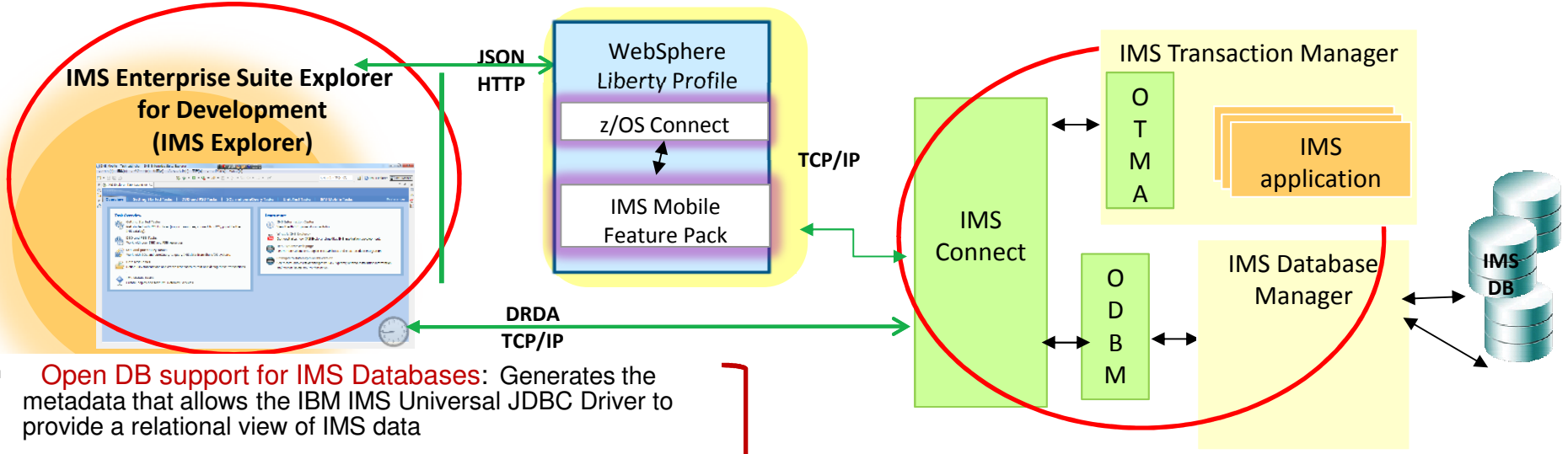
- Provides a single, holistic easy-to-use **web browser-based** interface
 - Consolidates information from various tools giving a more complete picture of IMS
 - Leverages the latest web technologies for a richer user experience
 - Access from anywhere via the Internet using standard web browsers
 - Integrates a context sensitive help system
- Extends integration to IMS Tools and DB2

The HOWs of simplification with GUIs/Tools

- IMS Mobile support for IMS transactions**
 - Provides service creation, automatic deployment, administration and testing
- IMS Transaction Unit Test support:** Ability to import COBOL or PLI data structures that map input and output messages, and invoke those transactions in support of their unit testing process.

Expansion
of infrastructure
and support

Even with tooling,
infrastructure is built
and leveraged



- Open DB support for IMS Databases:** Generates the metadata that allows the IBM IMS Universal JDBC Driver to provide a relational view of IMS data
- Catalog Navigation View:** This view allows you to browse all of their PSBs/DBDs and launch "read only" editors to view details
- DCLGEN:** Based on DBD metadata in either the IMS Catalog or IMS Explorer projects, allows automatic generation of COBOL or PLI data structures source code that map their database segments

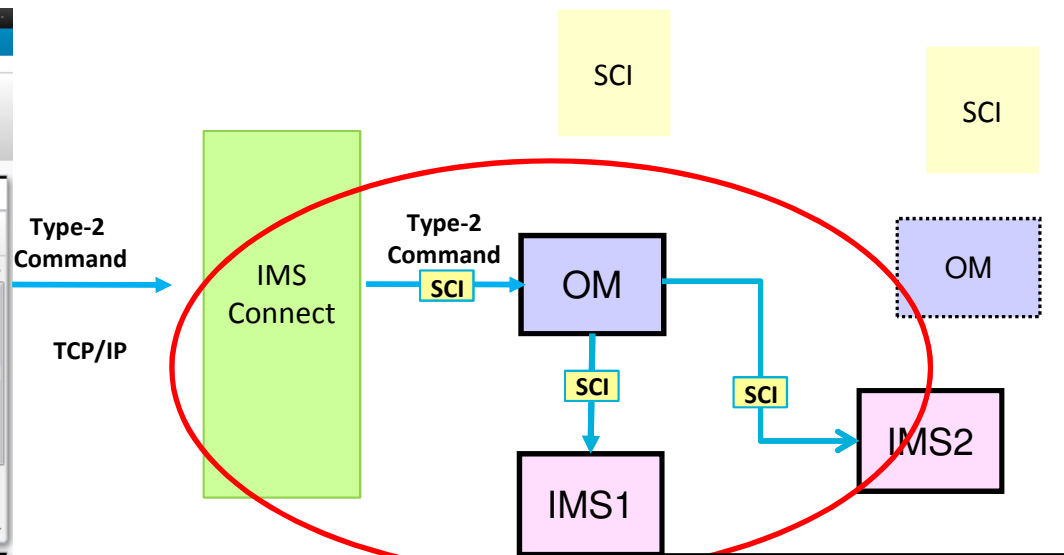
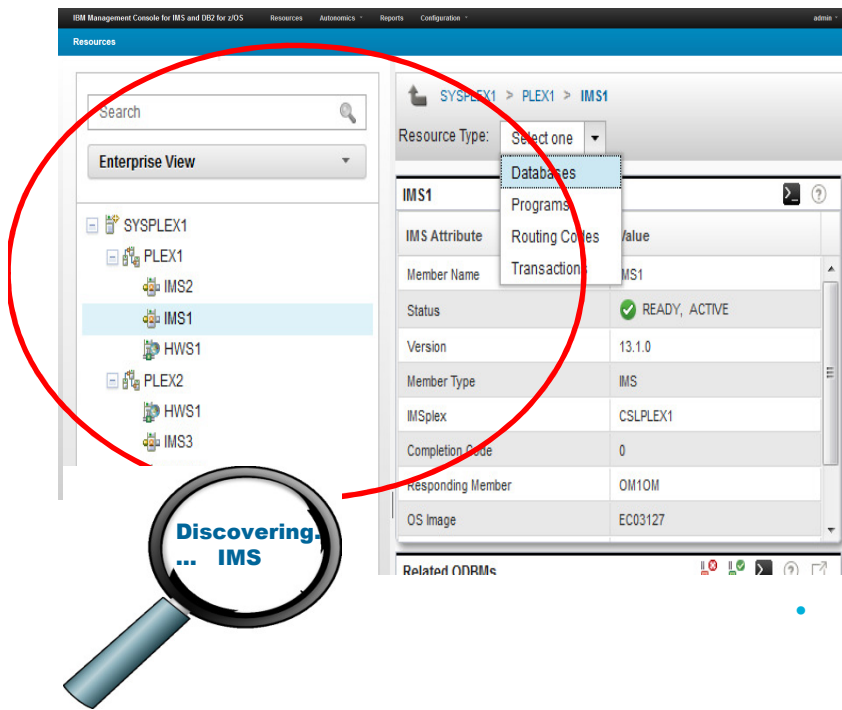
Original
infrastructure
and support

- IMS infrastructure includes
 - IMS Connect
 - And OTMA for transactions
 - And ODBM for databases

The HOWs of simplification with GUIs/Tools ...

IBM Management Console for IMS and DB2 for z/OS

Web Browser: Firefox ESR 31 or later Google Chrome 37 or later



- IMS infrastructure includes:
 - IMS Connect
 - Operations Manager (OM)
 - For Type-2 Commands
 - Structured Call Interface (SCI)

OM routes command to one or more IMSs

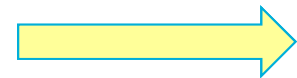
Each IMS responds to OM

OM consolidates responses for SPOC

As functionality expands and demand grows...

The implementation of the base infrastructure becomes more important

... back to the Common Service Layer and the IMSplex



Common Service Layer (CSL) Extensibility

- Many features use CSL
 - Global Online Change (GOLC)
 - Coordinates online change across multiple IMSs in an IMSplex
 - Optional alternative for local online change
 - Sysplex Terminal Management (STM)
 - Enables improved systems management in an IMSplex by sharing resource status information
 - Applies to VTAM terminal and user resources only
 - Single Point of Control (SPOC)
 - Provides 'single point of control' for command entry into an IMSplex
 - Focal point for operations management and automation
 - Global Status (IMS 10)
 - Maintains global command status for database, area, or transaction resources
 - Provides consistent status for these resources across restarts in an IMSplex

Common Service Layer (CSL) Extensibility

- Many features use CSL...
 - Dynamic Resource Definition -DRD (IMS 10)
 - Dynamic definition via type-2 commands for program/database/transaction/FP routing code resources
 - Allows for a quicker reaction to changes
 - ACBLIB Member Online Change (IMS 10)
 - Allows dynamic additions/changes of ACBLIB members while IMS is active via type-2 commands
 - Complements DRD for adding/changing ACBs for programs and databases
 - Parallel RECON access (IMS 10)
 - Improves the technique for RECON serialization
 - Transaction level statistics (IMS 10)
 - Improves log statistics for understanding transaction characteristics

Common Service Layer (CSL) Extensibility

- Many features use CSL...
 - Operations Manager Audit Trail (IMS 10)
 - Improves auditability for OM environment
 - MSC Bandwidth (IMS 10)
 - Improves MSC buffer management
 - Database Quiesce (IMS 11)
 - Creates a coordinated recovery point via type-2 commands across an IMSplex for an IMS database or set of IMS databases within an IMSplex without taking databases offline
 - Reduces outages required for creating recovery points
 - Open Database (IMS 11)
 - Allows access to IMS DB from distributed and local environments for Java applications
 - DRDA protocols ease application development

Common Service Layer (CSL) Extensibility

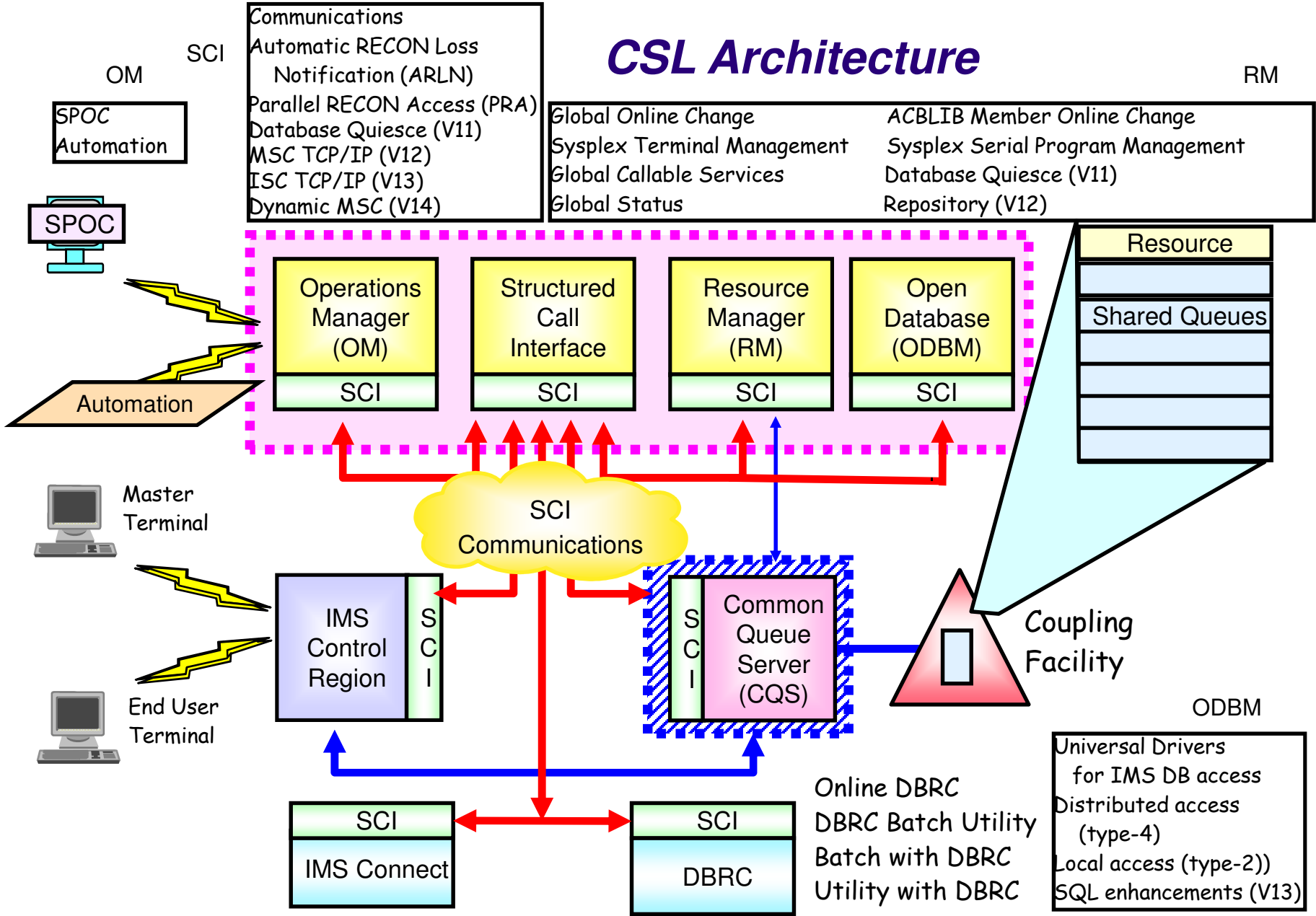
- Many features use CSL...
 - FP 64-bit buffer manager (IMS 11)
 - Improves DEDB autonomic buffer management
 - IMS Repository (IMS 12)
 - Enables multiple IMS systems in an IMSplex to manage, store, share, and retrieve resource definitions in a centralized manner via type-2 commands
 - Provides an alternative to using RDDs for DRD
 - Dynamic full function database buffer pool enhancements (IMS 12)
 - Support dynamic changes to the OSAM/VSAM buffer pool specifications
 - MSC TCP/IP support (IMS 12)
 - Supports a new type of physical MSC link that uses TCP/IP
 - ISC TCP/IP support (IMS 13)
 - Allows ISC IMS to CICS communications via TCP/IP
 - Dynamic MSC support (IMS 14)

Common Service Layer (CSL) Extensibility

- Many features use CSL...
 - Dynamic refresh of P(WFI) regions (IMS 14)
 - UPDATE command enables dynamic refresh for all instances of a specified application program running in (P)WFI dependent regions
 - Data Definition Language – DDL support (IMS 14)
 - DDL generation and editing with the IMS Explorer for Development / ODBM

- And many more

CSL Architecture



Summary – Infrastructure Matters

- Many infrastructure components are ***optional***
 - But are oftentimes ***required*** for new functionality
- By proactively implementing infrastructure, your system is positioned for:
 - New and evolving technologies
 - Dynamic and rapid change
 - Expanding processing requirements
 - Competitive business advantage