

# Infrastructure Matters: A HOW and WOW of Innovative Growth, Simplified Operations, and Secure Access

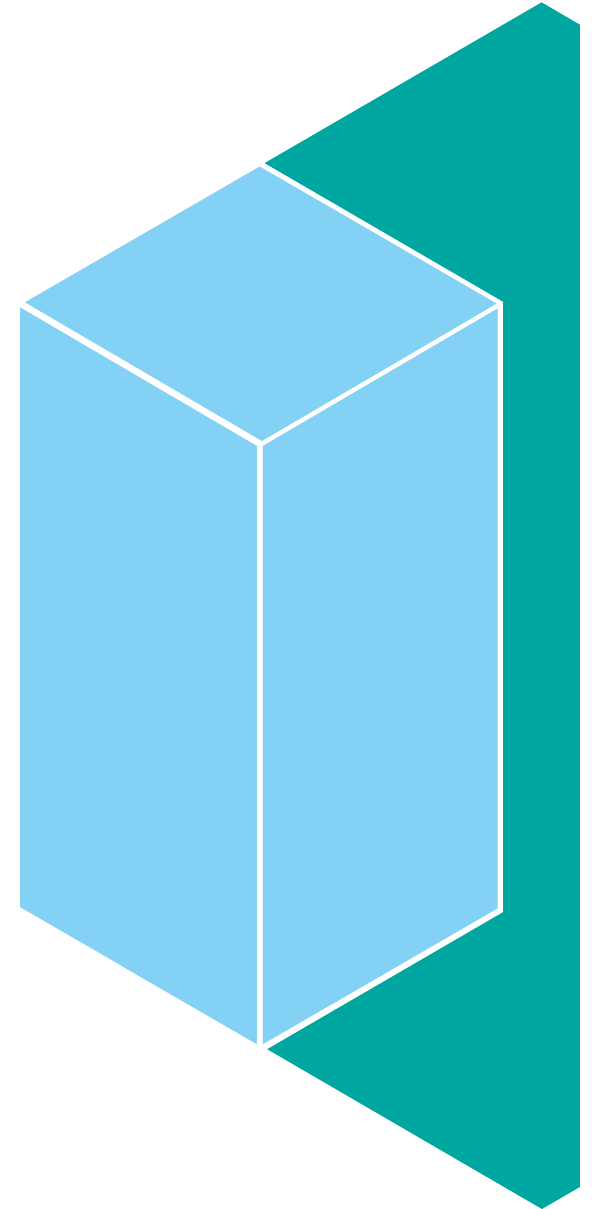
## Session A01

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Sharpen your competitive edge  
**2016 IMS Technical Symposium**  
March 7 – 10, 2016  
Wiesbaden, Germany

[www.ims-symposium.com](http://www.ims-symposium.com)



# 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**

**Myth**  
**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- **Myth 3 - IMS is old and outdated and not modern**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## ▪ **Myth 3 – IMS is old and outdated and not modern**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)
  - Today: 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.

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

# 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

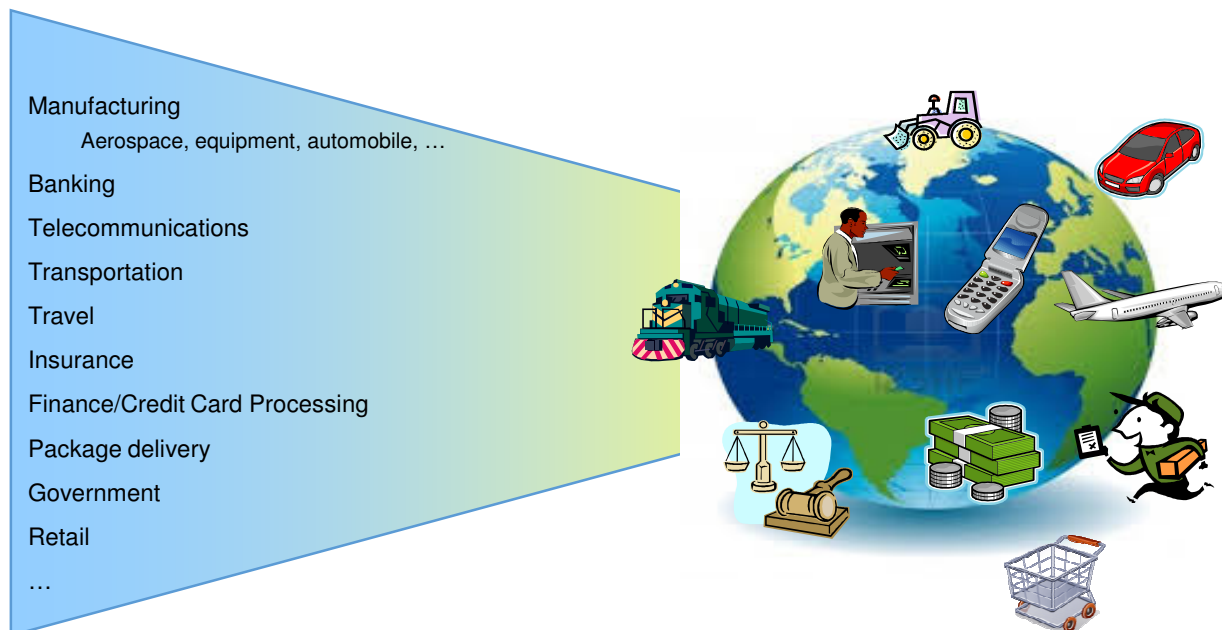
- **IMS, CICS and DB2**

- 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 **WOW**s of growth, innovation, and security  
as a function of  
The **HOW**s 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

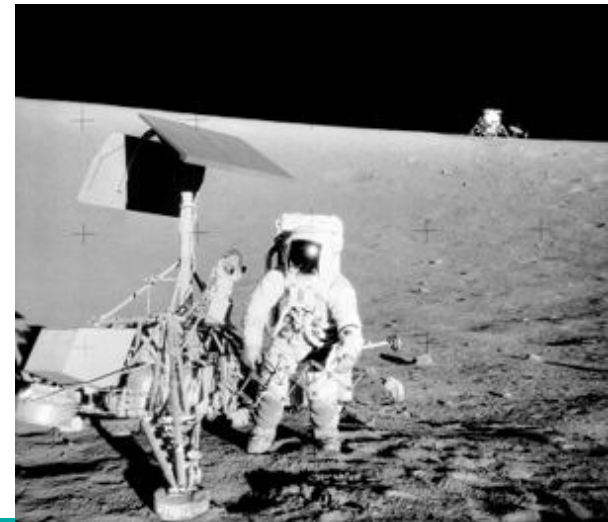
- ✓ Needed to track parts for the Apollo capsule
- ✓ Built on 1965 IBM/Rockwell project using IBM 7010

Caterpillar

- ✓ Needed to track parts for tractors and other products

Remember when...

3 2 1



# The WOW – Adaptability to constantly evolving technologies

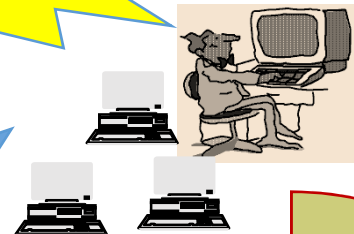
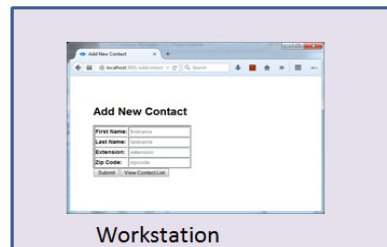
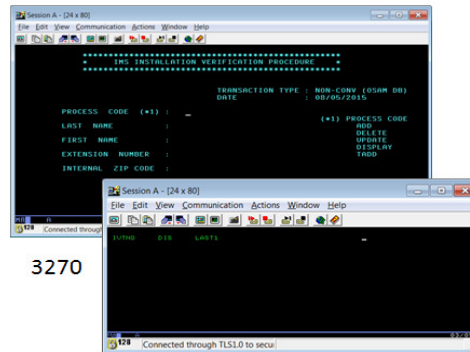
- And look at it now
  - Leveraging a continuing investment
    - Without changing the application

Field Name →	LL	ZZ	TRANCODE	COMMAND	LAST NAME	FIRST NAME	EXTENSION	ZIP CODE
HEX Value →	03	00	CEBDD44444	CCC44444	DCD444444	DDCD44444	FFF6FFFF44	FFFFF44
Readable Value →	59	0	IVTNO	ADD	DOE	JOHN	555-5555	95141



```

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



To the moon  
....and beyond



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

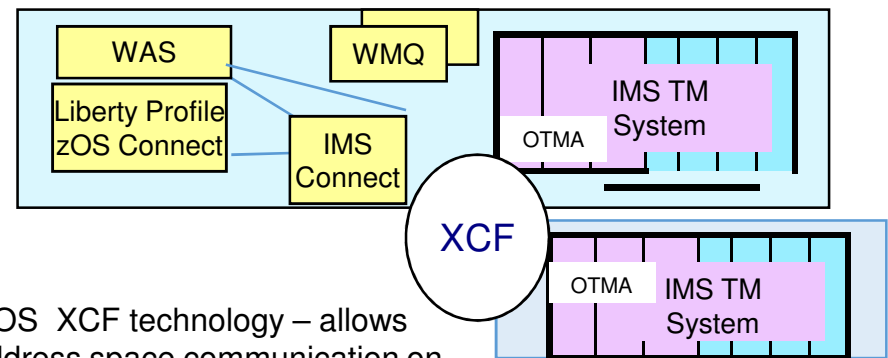
- Socket call to the IMS Connect
- Can take advantage of IMS-provided connectors

High Performance

100K  
IMS

IMS 13  
celebrating  
45 years

IBM

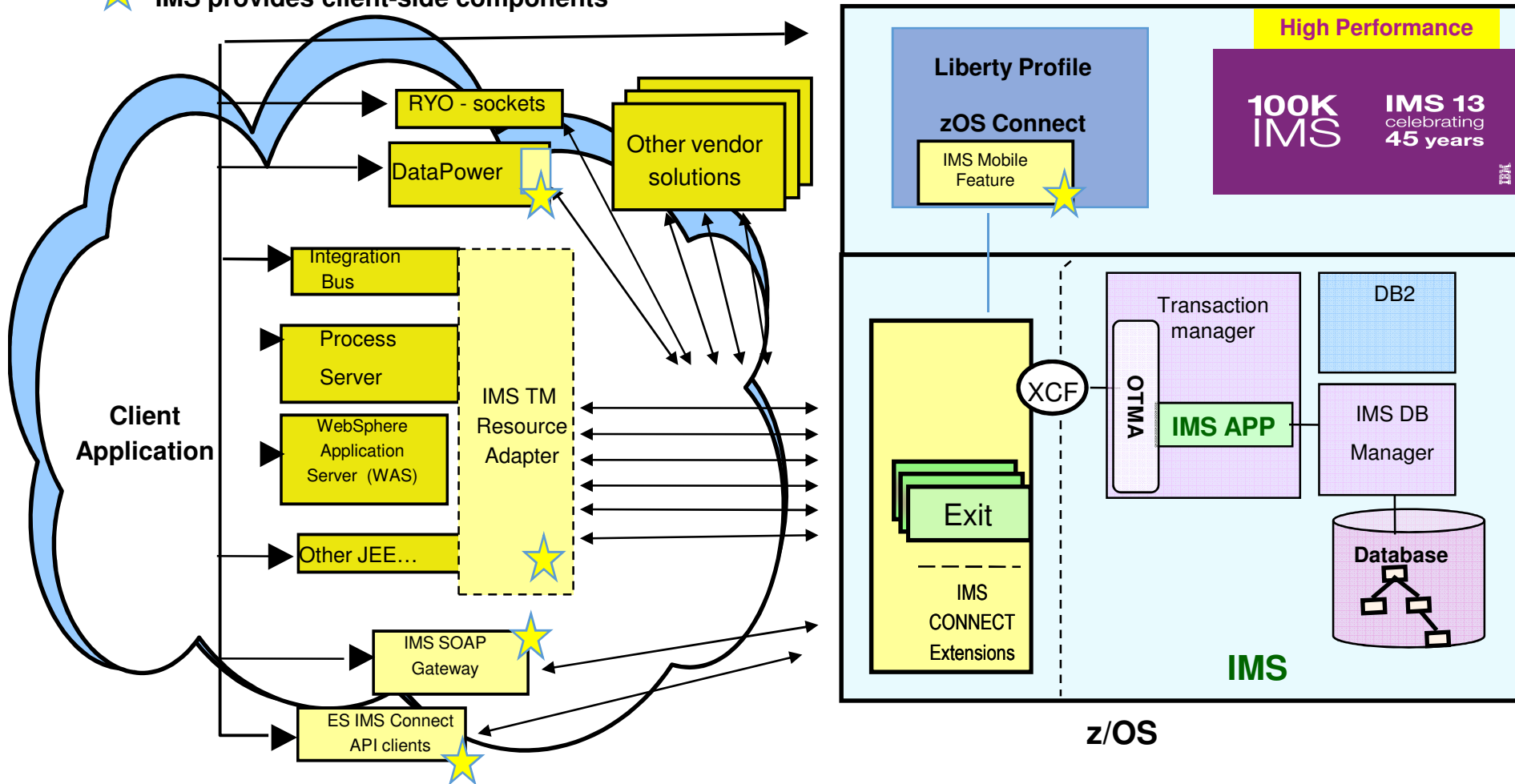


z/OS XCF technology – allows address space communication on the same or different LPARs

## Extending the Infrastructure

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

★ IMS provides client-side components

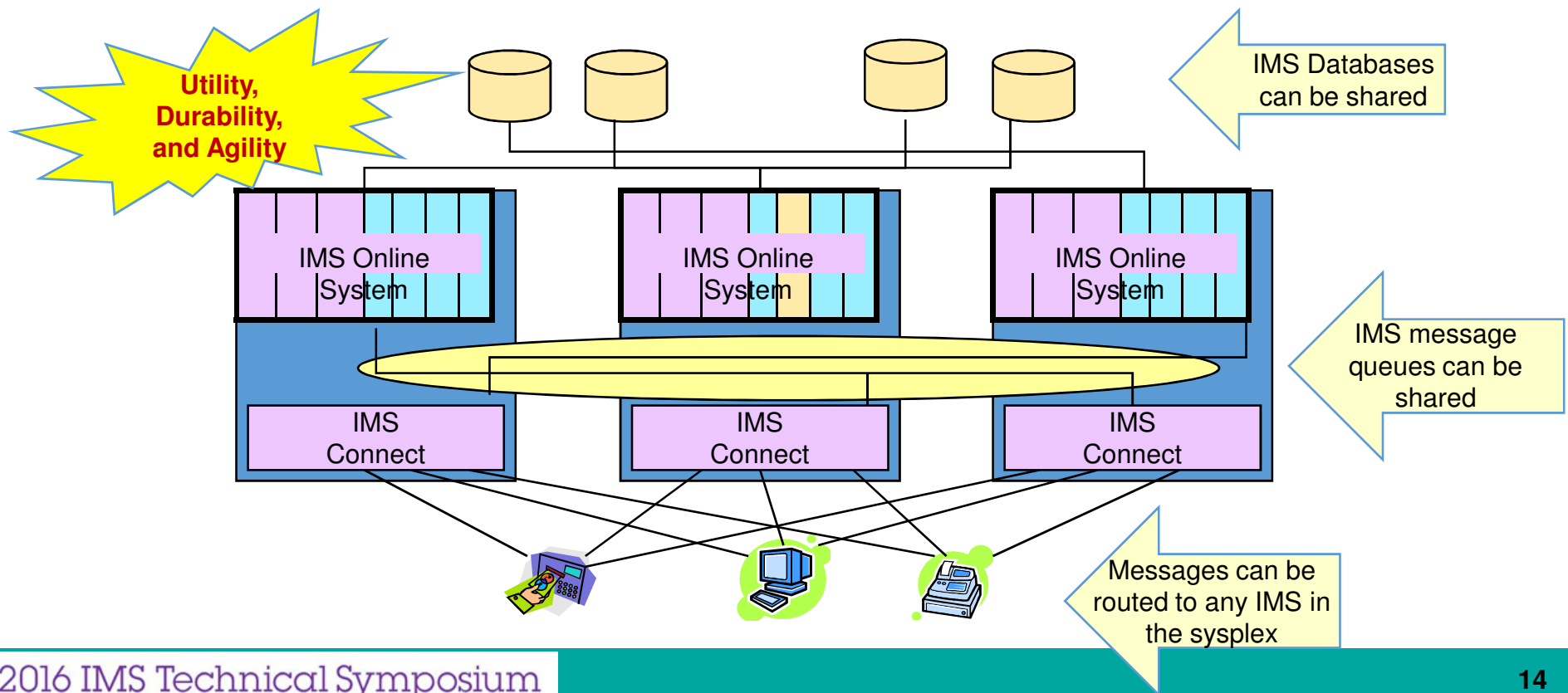


# The WOWs – Utility, Durability, and Agility

## ▪ 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

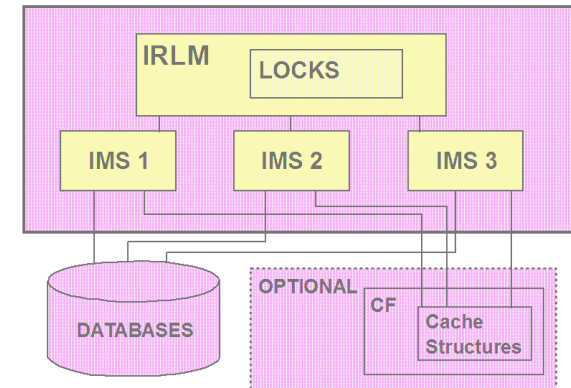
*Shared Queues and Datasharing*



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

## ▪ Data Sharing Group Infrastructure

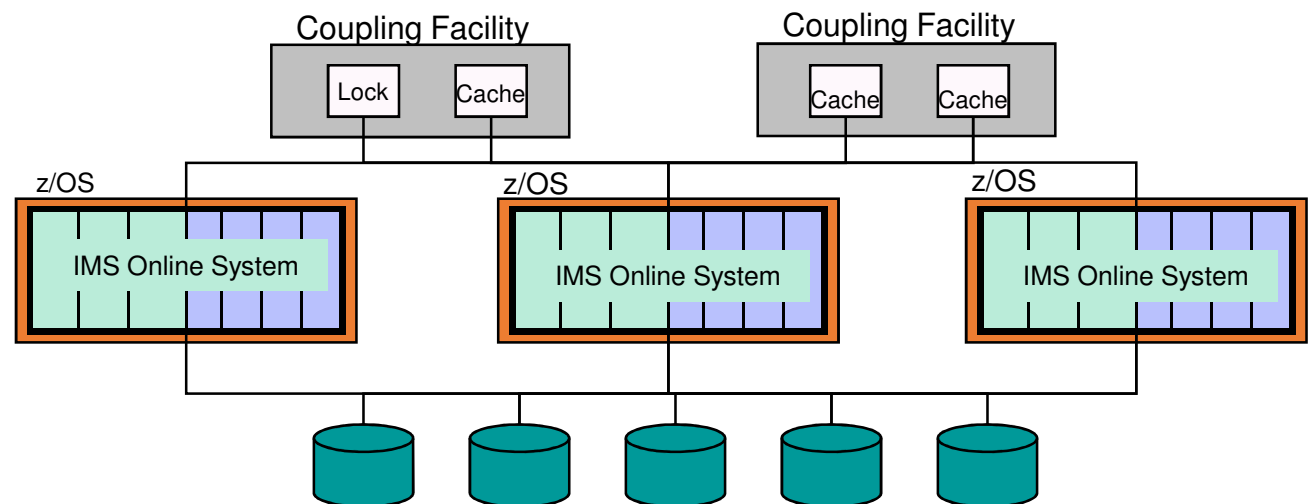
- All IMS subsystems sharing a set of databases
- Parallel sysplex and Coupling Facility (CF) exploitation
  - The **IRLMs** (IBM Resource Lock Manager): installation and setup
  - The **CF** (Coupling Facility): definition of the policies as well as the structures (type, name, size and location) used 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**

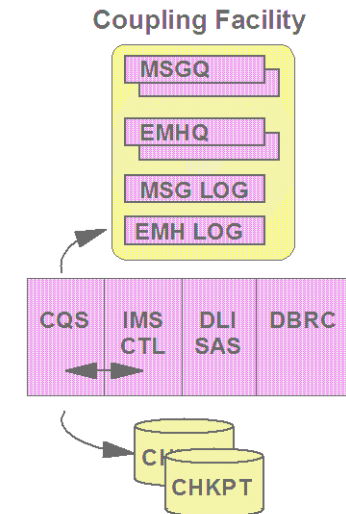
**Any IMS can access the database !**



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

## ▪ Shared Queues Infrastructure

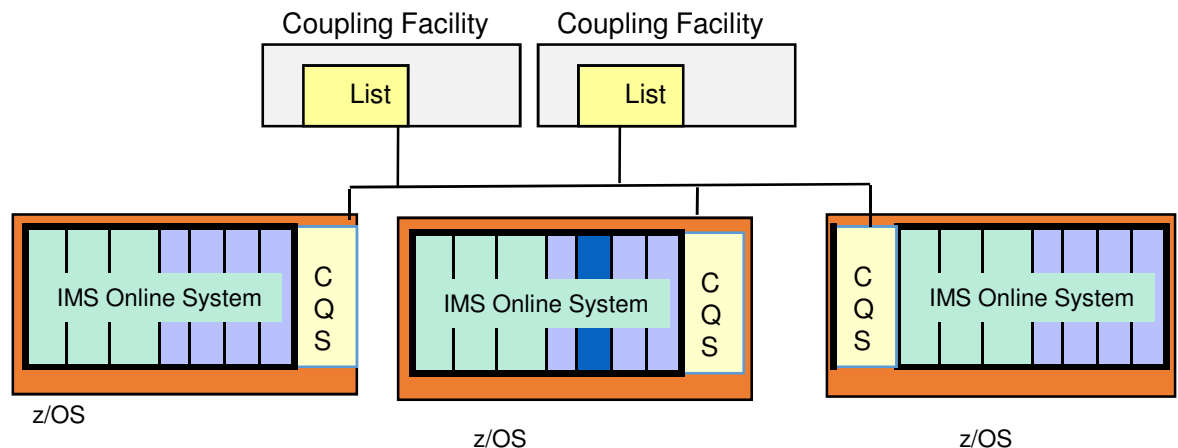
- All IMS subsystems sharing a set of message queues
- Parallel sysplex and Coupling Facility (CF) exploitation
  - IMS: define shared queues support (parameter or command) to identify the CQS to be invoked
  - One **CQS** (Common Queue Server) per IMS: Definition of the address space, CQS checkpoint 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

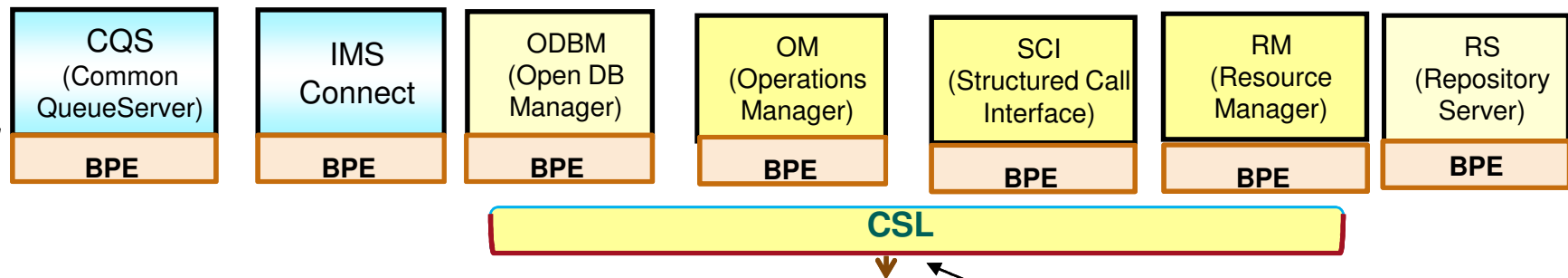
- And common services

- 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

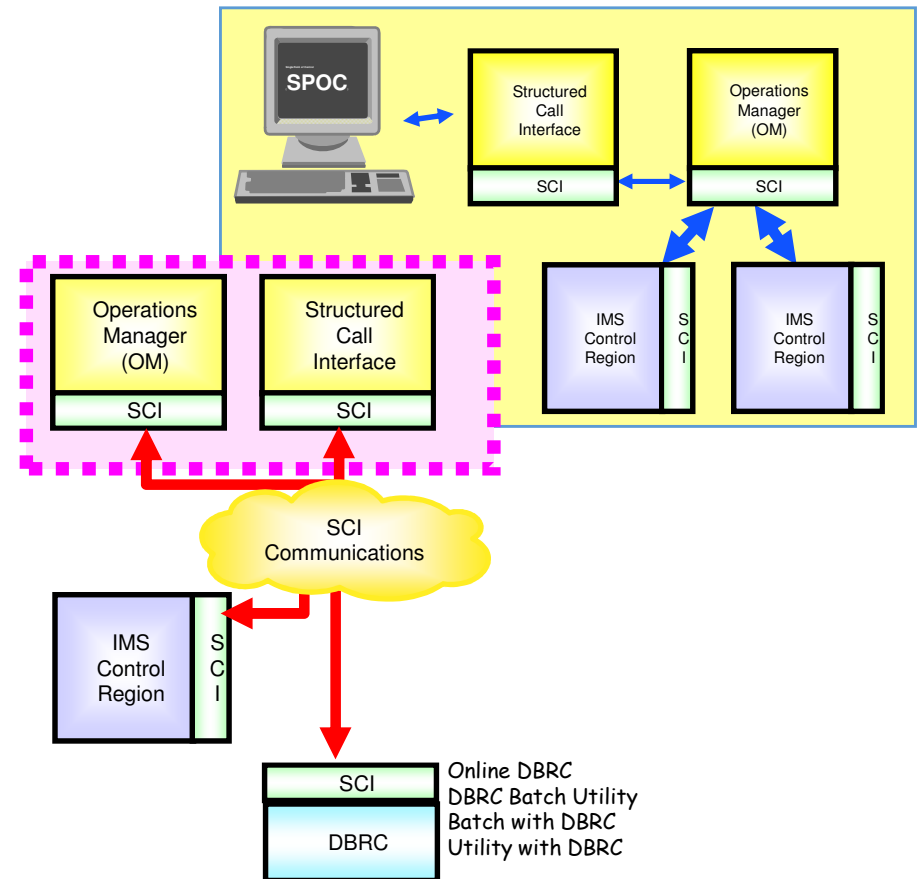
- **Structured Call Interface (SCI)** - standardizes intra-communications between IMSplex members
    - *Required in every z/OS image where CSL is active*
  - **Operations manager (OM)** - provides an enhanced interface (type-2 commands) to control resources
    - *Supports a SPOC (single point of control) 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

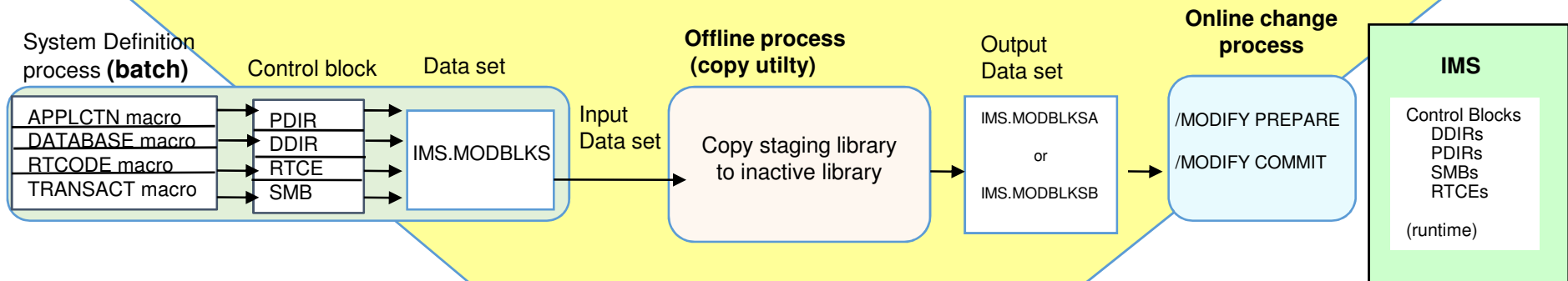
- Most new functions require OM type-2 commands

- 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

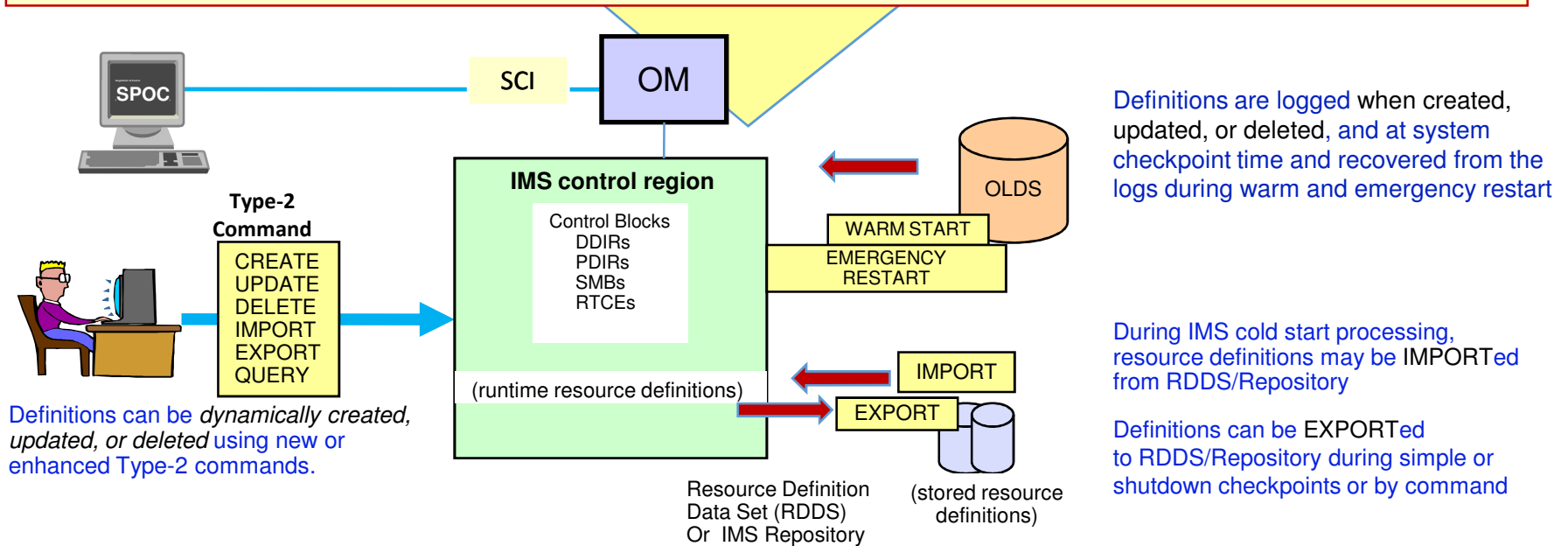


## CSL ...

- Facilitates the movement from a more restrictive system definition process

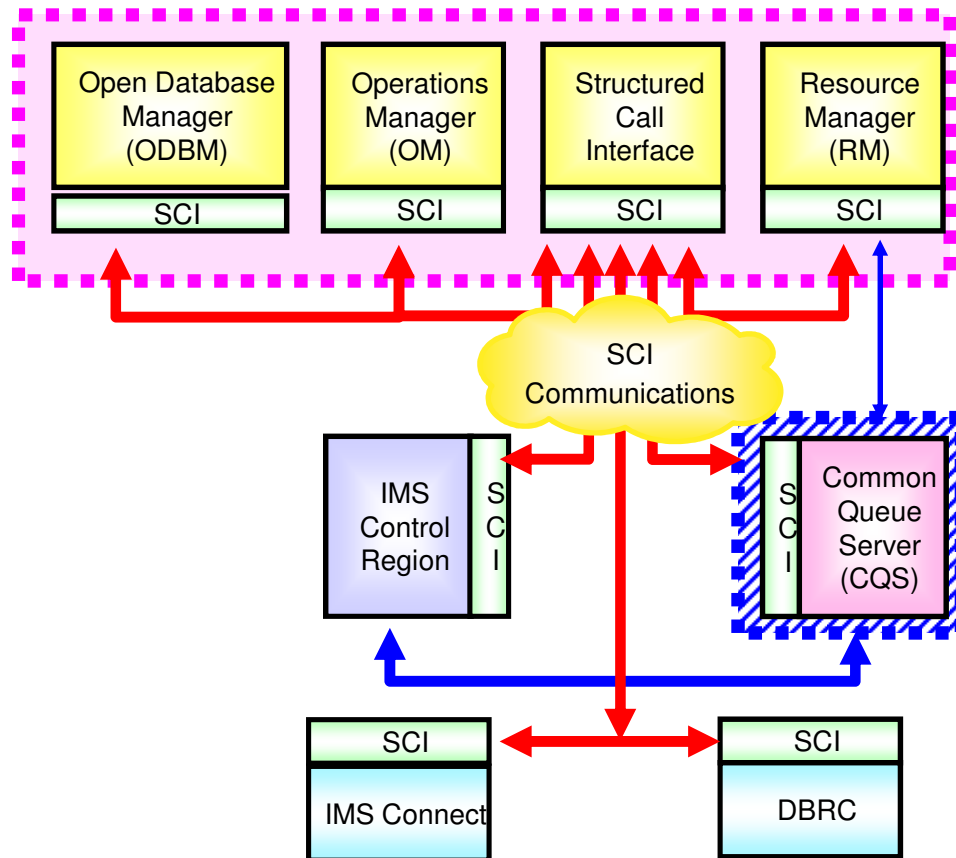


- To Dynamic Resource Definition – DRD (for modblks resources)



# CSL - the IMSplex

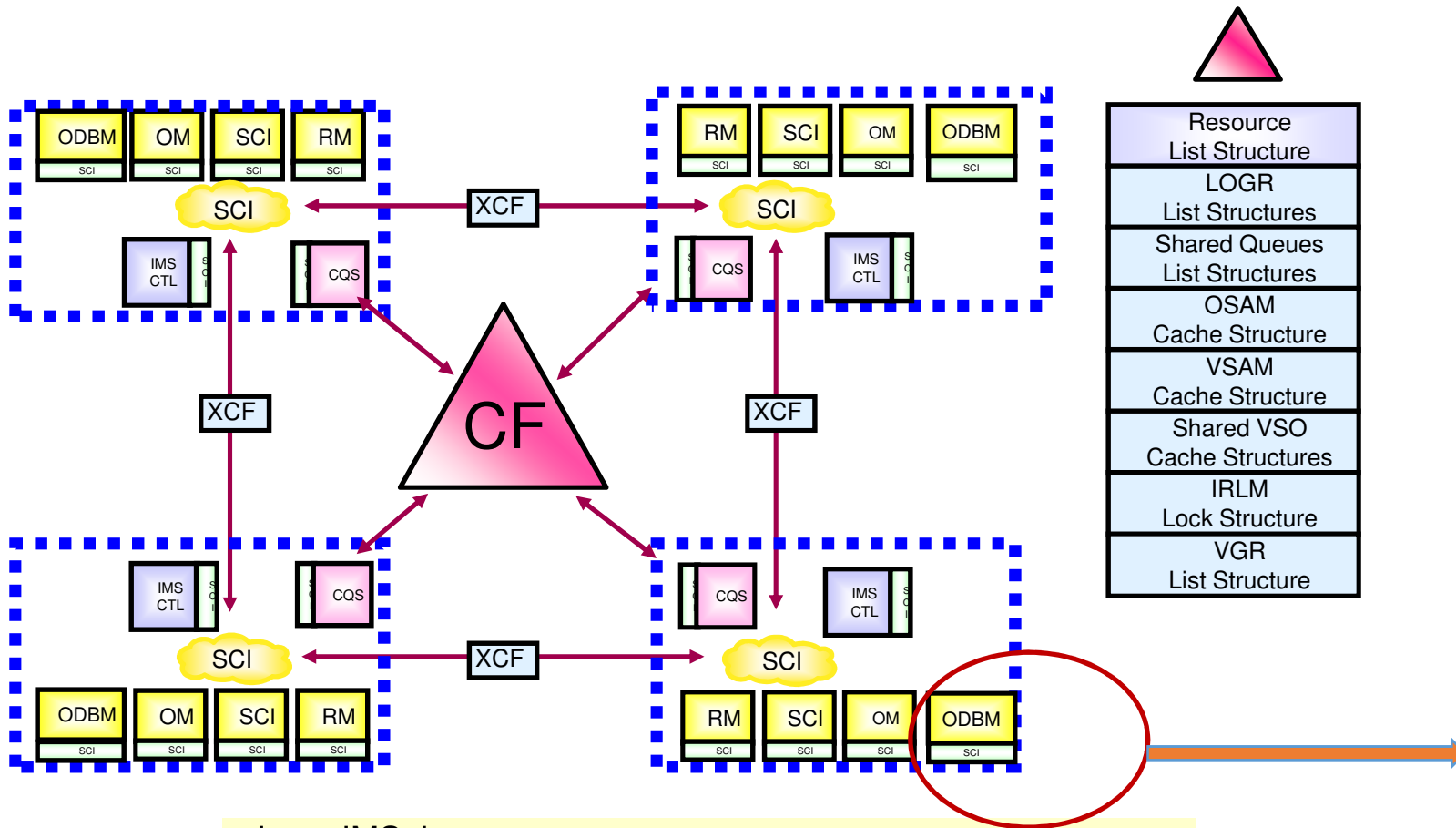
## CSL Architecture (Address Spaces)



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

# IMSpdex with Multiple IMS Systems Configuration



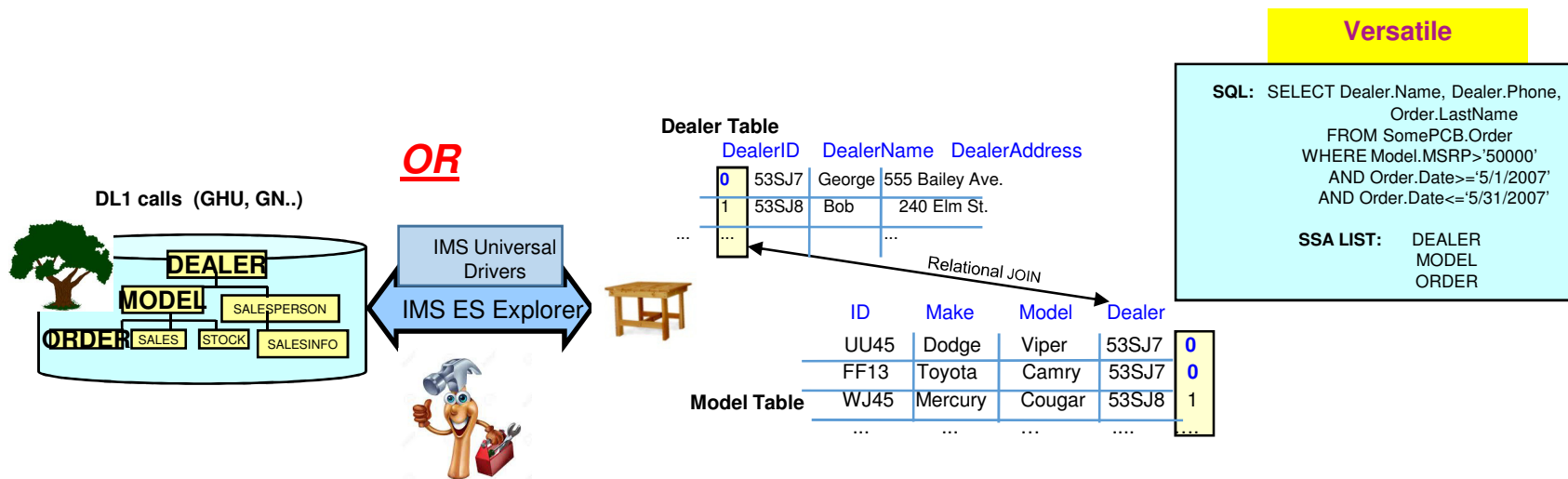
- In an IMSplex
  - All members share the same CF structures
  - Intra-IMSpdex communications is implemented by SCI
    - Uses XCF across z/OS images

# The WOW – 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

**Flexibility and Standardization**

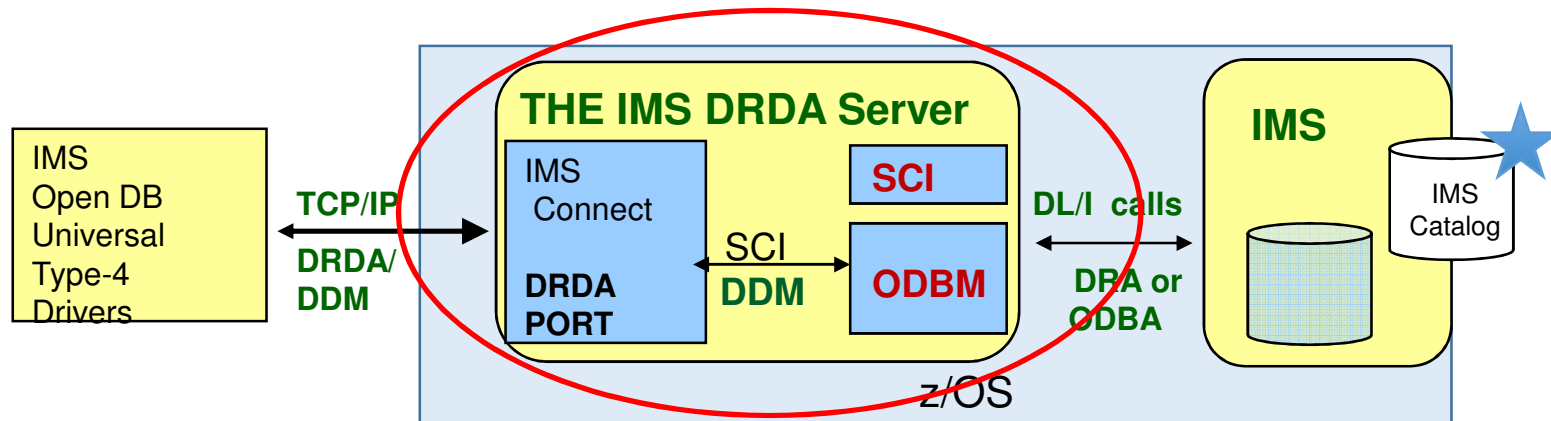


- May be accessed from IMS TM, CICS java, WAS, distributed applications and tools, ....



## The HOW of Flexibility and Standardization

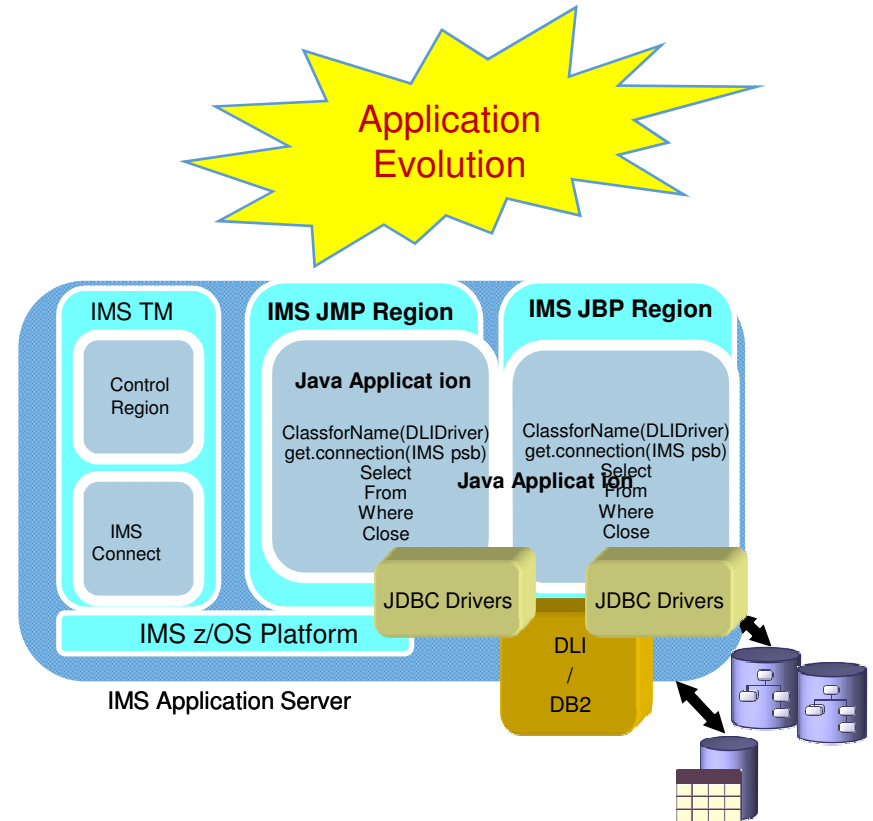
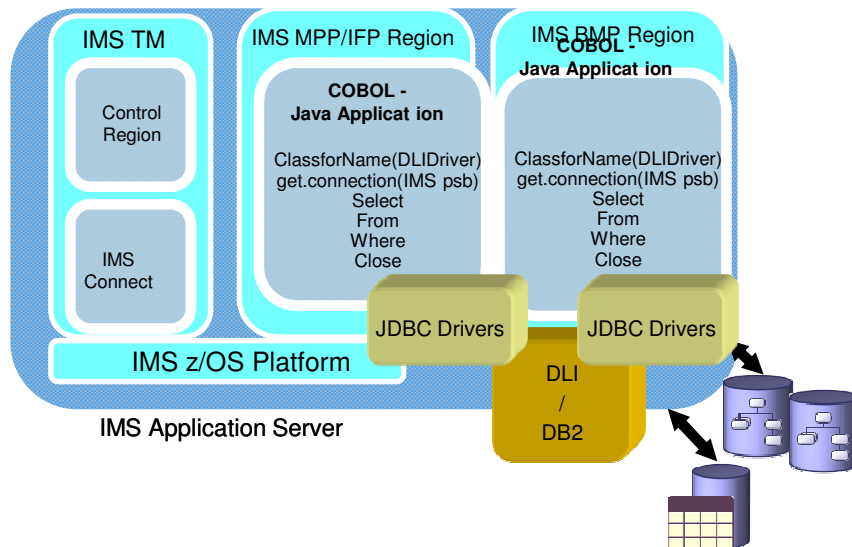
- Open DB - provides an environment that manages access to online IMS databases from anywhere in the enterprise
  - DRDA (Distributed Relational Database Architecture) implementation via TCP/IP, IMS Connect and ODBM
    - Open Data Base Manager (ODBM) – a CSL address space (Common Service Layer)
      - 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

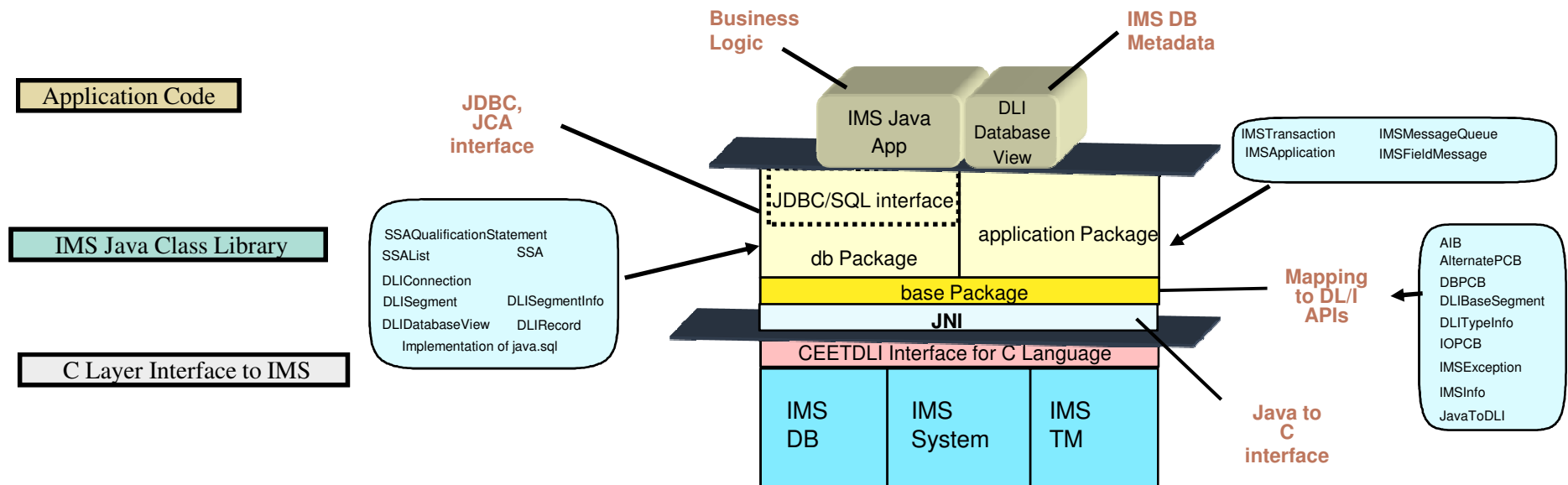


- Java – Offload to zAAP on zIIP

# The HOW of Application Evolution

Java programs use the APIs that are provided

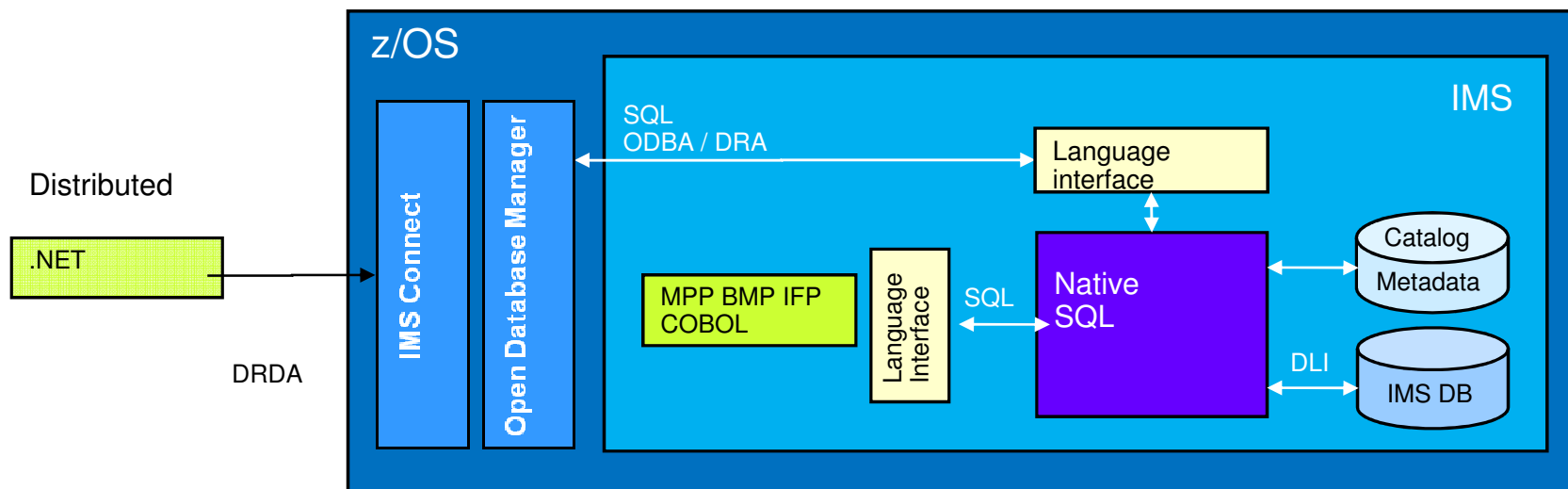
- application Package classes to
  - initialize and begin the program
  - get the input message from the message queue
  - put the output message on the message queue
  - commit
- JDBC interface or db Package classes to
  - access the IMS databases



## Extending the Infrastructure

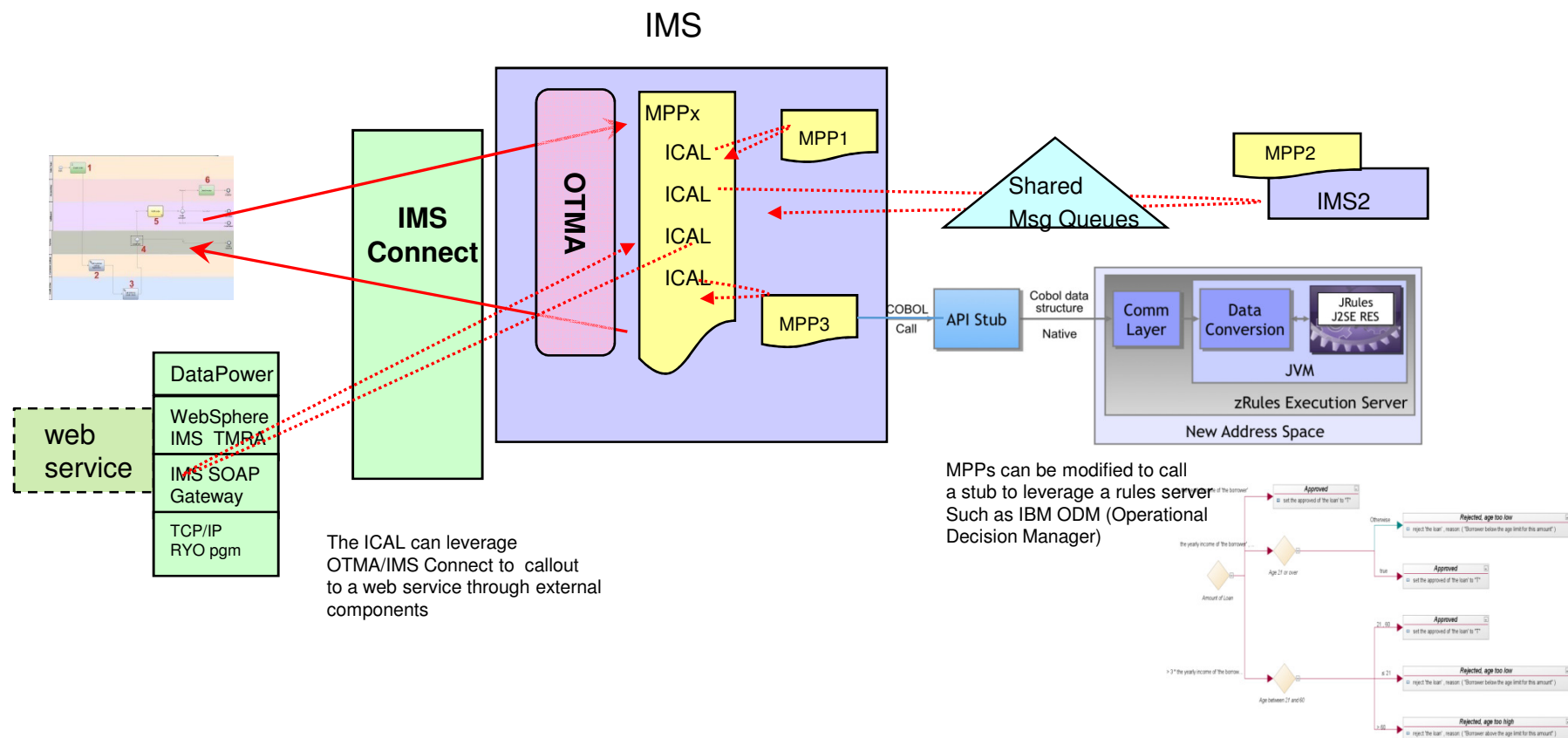
### ▪ IMS 13: native SQL COBOL and distributed applications (.NET/JDBC)

- 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



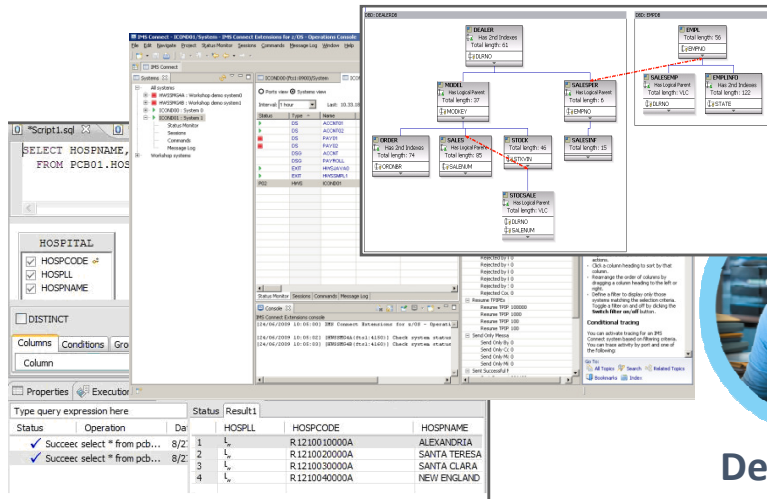
# Extending the Infrastructure... for Applications

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

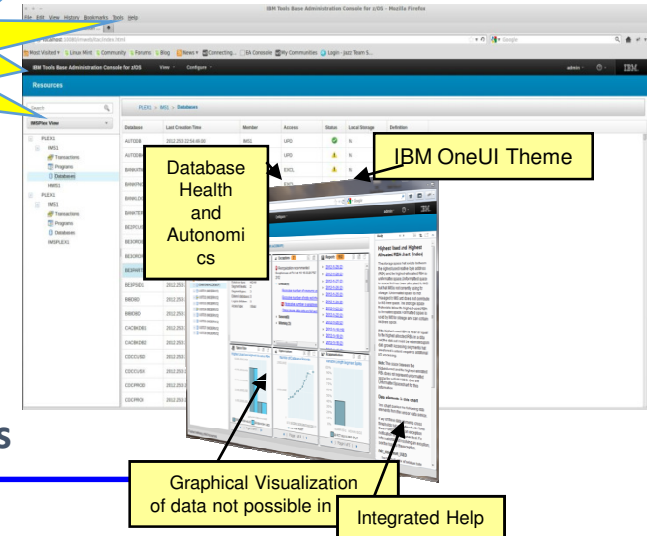


# The WOWs - GUIs/Tools make things simpler

## IMS Enterprise Suite Explorer for Development (*Eclipse*)



## IBM Management Console for IMS and DB2 (*Web Browser*)



Simplification

Developers,  
DBAs

Administrators

Graphical Visualization  
of data not possible in

Integrated Help

- 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

IMS



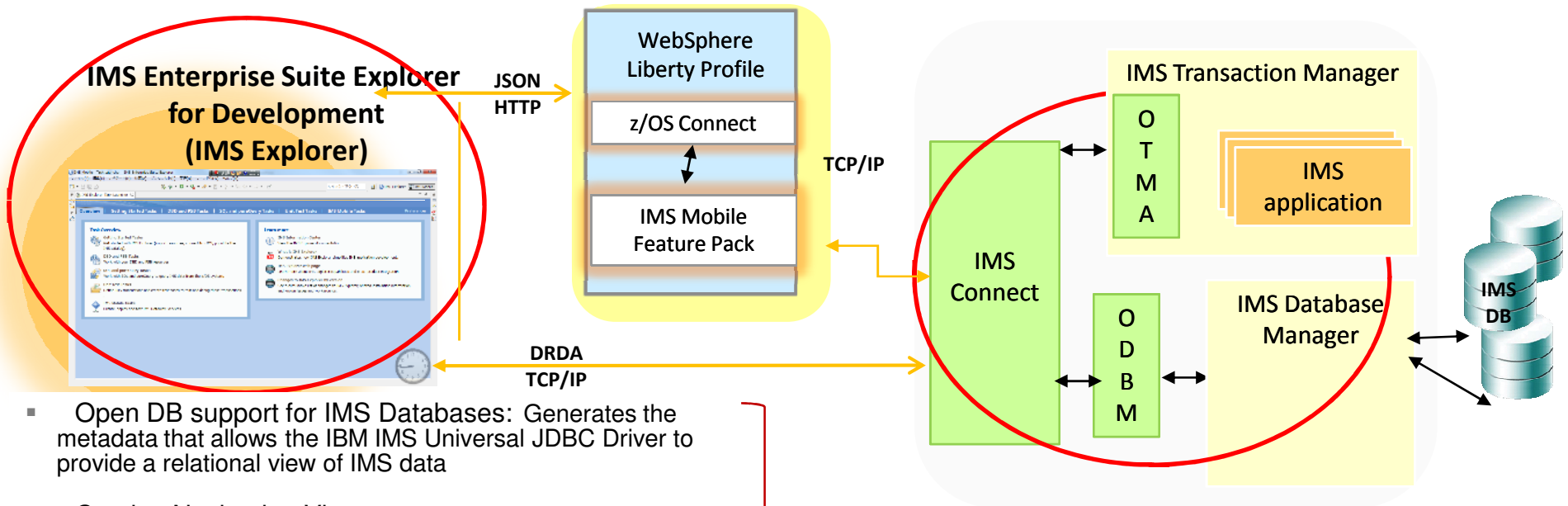
- Provides a single, holistic easy-to-use **web browser-based** interface
  - Consolidates information from various tools giving a more complete picture of IMS
  - Leverages the latest web technologies for a richer user experience
  - Access from anywhere via the Internet using standard web browsers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

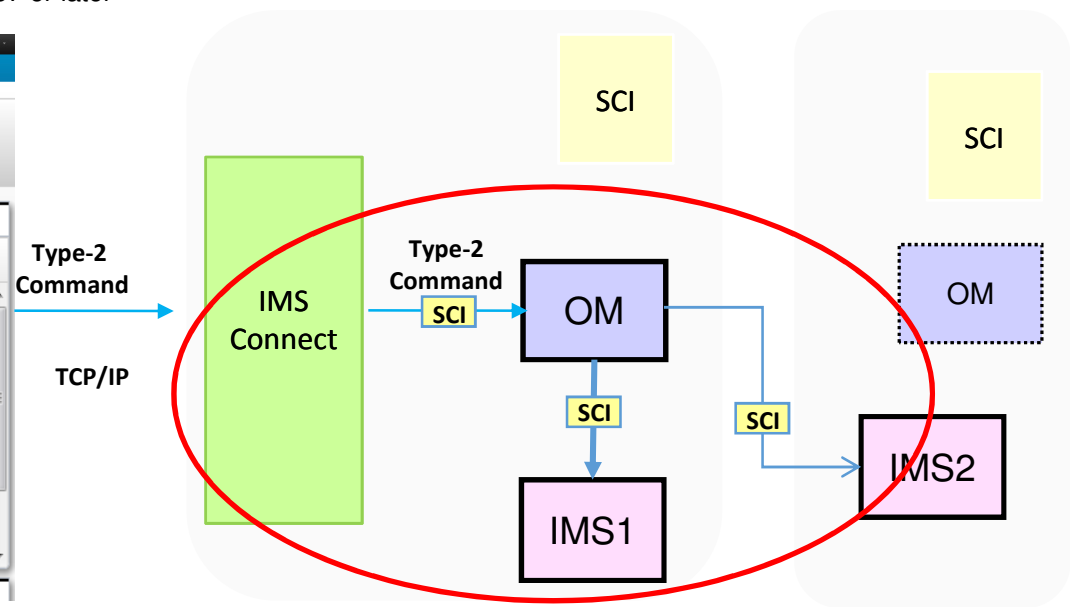
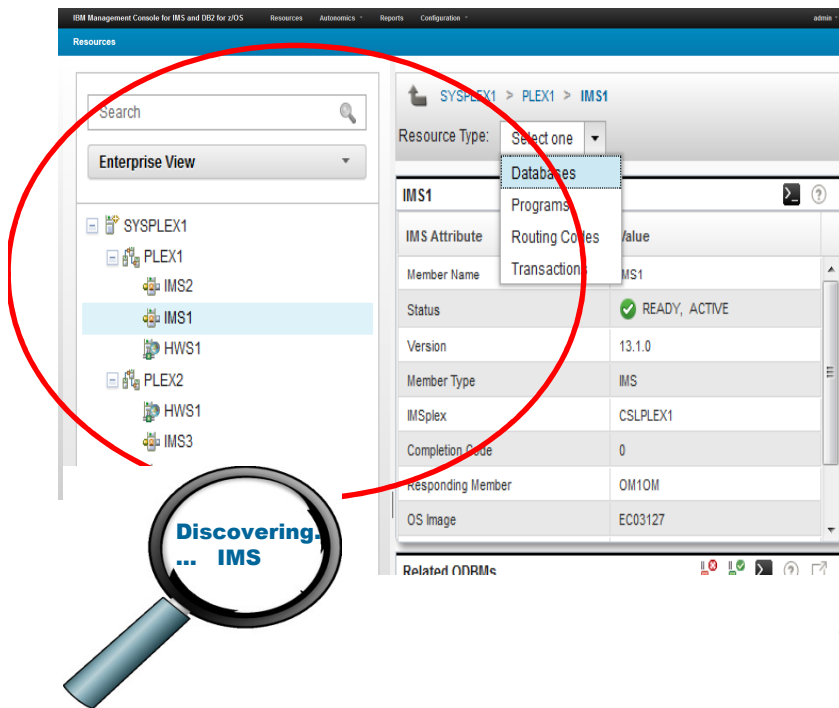
- IMS infrastructure includes
  - IMS Connect
    - And OTMA for transactions
    - And ODBM for databases



## 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)

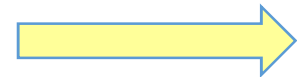
```
graph TD
    OM[OM] -- "OM routes command to one or more IMSs" --> IMSs[IMSs]
    IMSs -- "Each IMS responds to OM" --> OM
    OM -- "OM consolidates responses for SPOC" --> SPOC[SPOC]
```



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...**

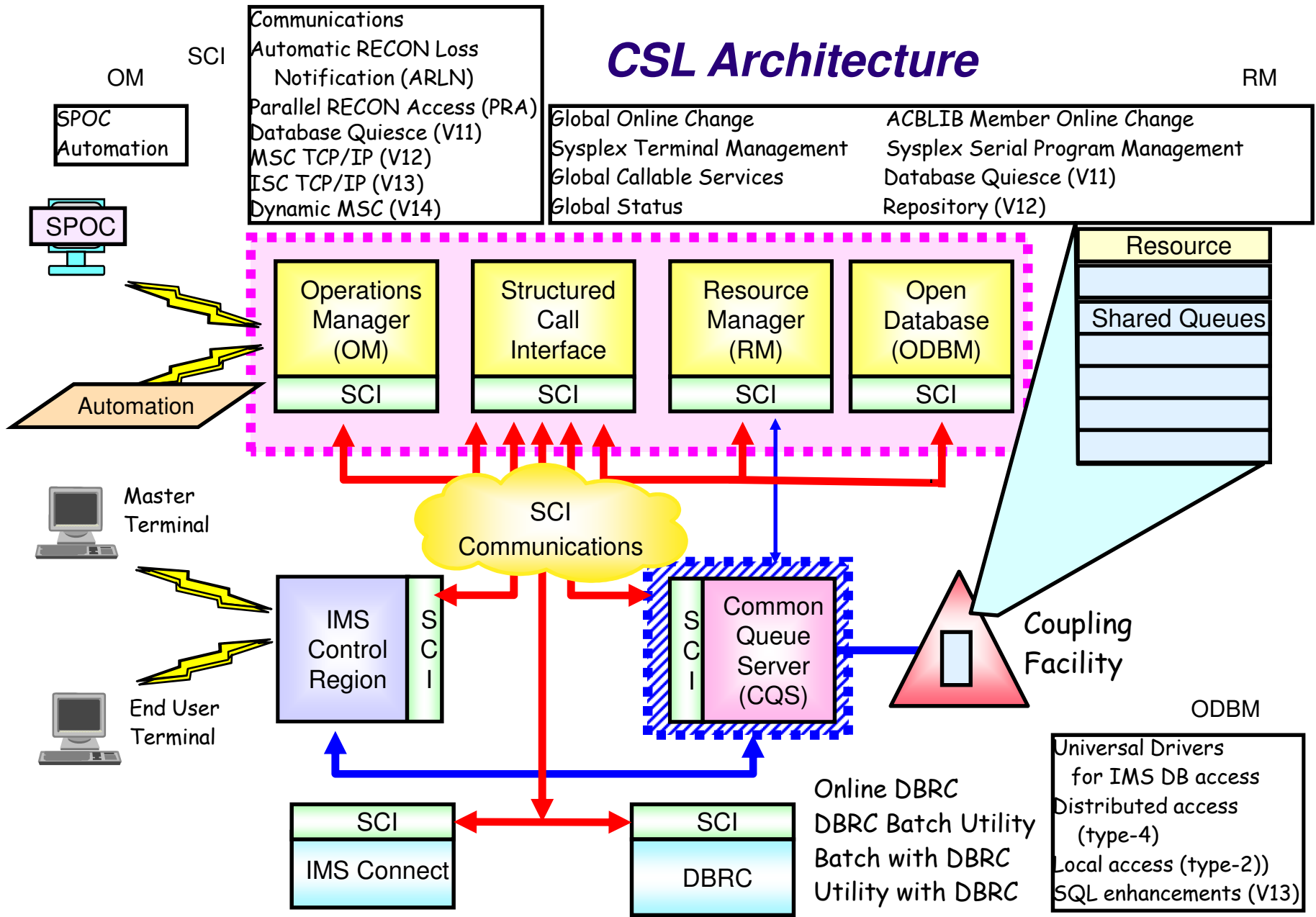
- FP 64-bit buffer manager (IMS 11)
  - Improves DEDB autonomic buffer management
- IMS Repository (IMS 12)
  - Enables multiple IMS systems in an IMSplex to manage, store, share, and retrieve resource definitions in a centralized manner via type-2 commands
    - Provides an alternative to using RDDSs 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



## And leveraging the z Platform – z13

### ▪ Lab testing showed:

- **IMS 13 Fast Path High Volume workload** (1-way IMS, non-data sharing) showed as much as a 25% increase in throughput at equivalent CPU as compared to zEC12
- **IMS 13 Full Function workload** (1-way IMS, non-data sharing) on IBM z13, showed as much as a 20% increase in throughput at equivalent CPU as compared to zEC12
- **IMS Shared Queues workload** (2-way IMS with data sharing) showed as much as 11% increase in throughput at equivalent CPU as compared to zEC12
- **IMS 13 Open Database DRDA workload**, showed as much as 29% increase in throughput at equivalent CPU as compared to zEC12
- **z/OS Connect IMS Mobile Feature Pack workload and IMS 13**, showed as much as 27% increase in throughput at equivalent CPU as compared to zEC12.
  - When using IBM z13 using zIIPs with multi-threading (SMT) enabled, showed as much as 22% increase in throughput at equivalent CPU as compared to z13 using zIIPs without multi-threading enabled
- **IMS 13 Java transaction processing workload (JMP)**, showed as much as a 38% increase in throughput at equivalent CPU as compared to zEC12.
  - When using IBM z13 using zIIPs with multi-threading (SMT) enabled, showed as much as an 8% increase in throughput at equivalent CPU as compared to z13 using zIIPs without multi-threading enabled.



## 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