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# Reducing Planned Outages

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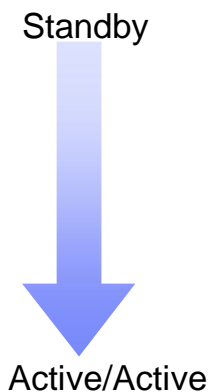
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## Agenda

- Overview/Cost of outages
- Capabilities that can reduce planned outages
  - Related to Database
  - Related to Transaction Management
  - Related to general System functions
- Other considerations



# How Much Interruption can your Business Tolerate?

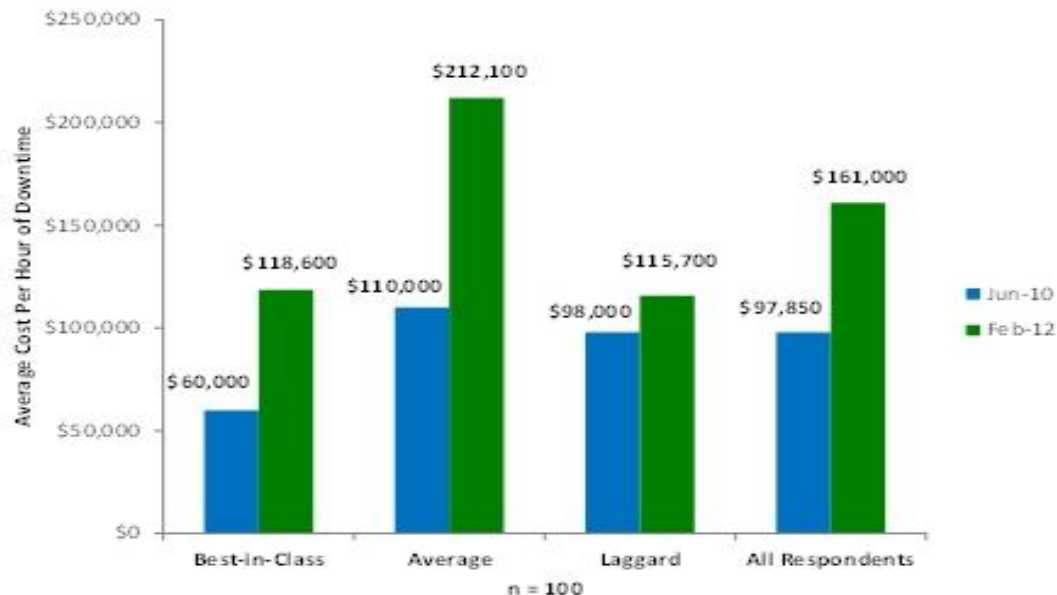


## Ensuring Business Continuity:

- Disaster Recovery – **Restore business after an unplanned outage**
- High-Availability – **Meet Service Availability objectives e.g., 99.9% availability or 8.8 hours of down-time a year**
- Continuous Availability – **No downtime (planned or not)**

*Global Enterprises that operate across time-zones no longer have any 'off-hours' window. Continuous Availability is required.*

*What is the cost of 1 hour of downtime during core business hours?*



Source: Aberdeen Group, February 2012

## Business Continuity

- The Top Causes of Business Interruption:
  - Planned Maintenance
    - System and Software Upgrades or Reconfiguration
    - Database Administration
  
  - Component Failure
    - Caused by Operator Errors, Software defects, Disk Failure, Subsystems, Hardware, Power Grid
    - Data is recoverable
    - But, changes might be stranded until component is restored
  
  - Disaster
    - Flood, Earthquake, Fire, Hurricane, ..., Loss of a site
    - Data is not recoverable

### Establishing the Objectives:

- *Recovery Time Objective (RTO)* = How much time is needed to restore business operations?
- *Recovery Point Objective (RPO)* = How much data could we afford to *lose*?

## Considerations

- Redundancy
  - Spare components - Avoid Single Points of Failure
- Isolation
  - Minimize disturbances from other systems
- Concurrency
  - Perform maintenance and support concurrently with ongoing operations
- Automation
  - Automate operations as much as possible
- Scope
  - Determine availability needs for single IMS, Sysplex and/or multiple sites

# Database

## Topics

- Datasharing/Sysplex
- Dynamic LOCKTIME
- DB Quiesce
- Database Utilities
- Dynamic DB buffers
- CA Reclaim
- Database versioning
- HALDB Alter
- DEDB Alter



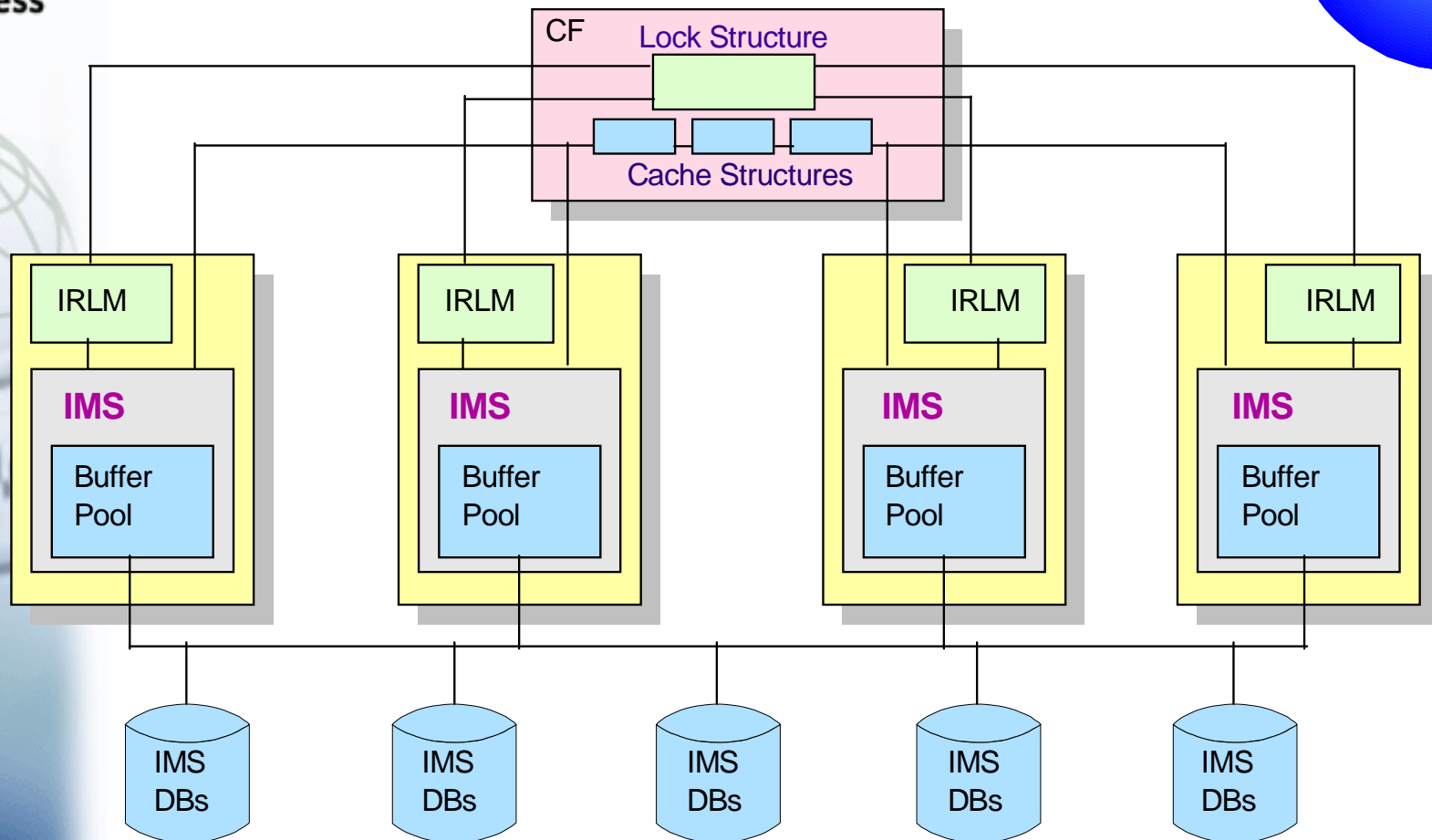
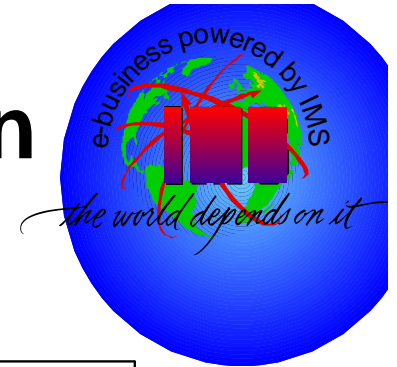
## Parallel Sysplex

- High Performance Data Sharing
  - Database and/or Shared Message Queues
- Dynamic workload balancing
- Single system image
- Platform for continuous availability applications
  - Fewer planned outages
  - Redundancy for unplanned outages



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# Database Sharing Configuration



**IMS systems include TM/DB, DBCTL, and IMS batch jobs.**

## Dynamic LOCKTIME (IMS 10)

- Allows you to dynamically change the LOCKTIME value with a command  
–UPDATE IMS ..... SET(LCLPARM (LOCKTIME(...)) )
- The IMS LOCKTIME feature is used to set how long tasks will be allowed to wait on a request for a lock before being timed out
- No longer need to update the specification in DFSVSMxx and restart IMS.
- Allows you to address changing contention due to periodic stress. (e.g quarterly statement processing)

## Database Quiesce (IMS 11)

- Enhanced UPDATE command to quiesce a database or area
  - UPDATE DB ..... START(QUIESCE) ... OPTION(HOLD | NOHOLD)
  - UPDATE AREA
  - UPDATE DATAGRP
- Quiesced database or area remains open and allocated
- Coordinates creation of a single common recovery point across an IMSplex
- A single IMS coordinates the quiesce when the command is routed to multiple IMS systems in an IMSplex
- **Allows consistent image copy to be taken while the database or area is online**
  - No /DBR or /DBD required

## ■ Database Reorganization

- *FP DEDB Alter*
- HALDB Online Reorganization, *HALDB Alter*
- IBM Tools Offering – Online Reorganization Facility
- All offer ability to reorganize your DBs with **no or minimal outages.**

## ■ Image Copies use of DFSMS Fast Replication

- IMS Image Copy 2 (DFSUDMT0)
- IBM Tools offering in IMS Recovery Solution Pack
- Use of SLB (system level backup with IMS Recovery Expert)
  - ability to use DFSMS to create a backup of an entire IMS System
- **Can use in conjunction with QUIESCE and HOLD to create clean image copies with minimal impact to the end user.**

## ■ Point in Time Recovery

- No need to create a recovery point
- IBM Tools offering in IMS Recovery Solution Pack

# Fast Path 64 Bit Buffer Manager (IMS 11)



- Fast Path buffers moved above the 2GB bar in control region address space
  - Multiple subpools with different buffer sizes
    - Subpools expand and compress
  - Enabled through parameters in DFSDFXxx PROCLIB member
    - Default maintains buffers in ECSA (FPBP64=N)
    - Changing to 64-bit buffers requires a cold start of IMS
    - User does not specify the number of buffers
      - DBBF, BSIZ, and DBFX are ignored when FPBP64=Y is specified
- Benefits
  - ECSA constraint relief
    - Can eliminate U1011 abends due to ECSA fragmentation
  - Self tuning
    - IMS automatically allocates and manages the subpools
    - User does not specify the number of buffers
  - Supports multiple buffer sizes
    - Better use of buffers when using areas with different CI sizes
  - **IMS restart is not required to add more Fast Path buffers**
    - New dependent regions or threads may be added
      - New regions or threads may have higher NBA and/or OBA values

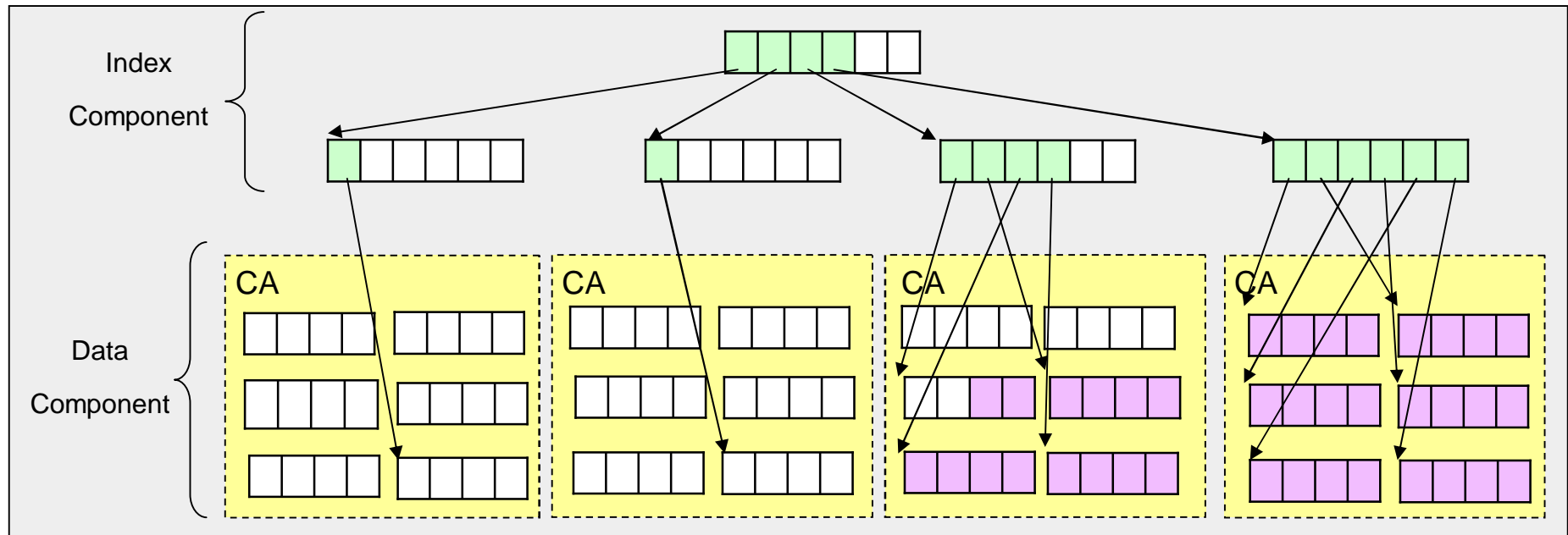
## Full Function Dynamic Database Buffer Pools (IMS 12)

- Provide for dynamic change to an OSAM or VSAM buffer pool without recycling IMS systems to pick up the change
- Commands are used to Add, Change, or Delete FF Database Buffer Pools
  - UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx,VSAMxxx)
- Benefits
  - For buffer pool management, eliminate systems down time and improve systems availabilities
  - Flexibility with the ability to adjust DB buffers to business needs
  - **Availability by being able to adjust DB buffers without stopping IMS**

# CA Reclaim Support (z/OS 1.12, IMS 11)



- VSAM KSDSs must be reorganized on a regular basis
  - To reclaim space previously used by deleted records
  - Deleting a range of keys can result in or “empty” CAs if the new records inserted have higher key values
  - Over time the “empty” CAs can cause performance issues due to fragmentation and extended data sets
- The problem without CA reclaim
  - Typically occurs with increasing key values and deletion of old records
  - Empty CAs cannot be reused
  - Index points to empty CAs
    - Reorganization is required to use the empty space and optimize the index
- Benefits
  - Fewer reorganizations required
  - Improved disk space usage
  - Especially useful when new keys have increasing values





## Database Versioning (*IMS 13*)

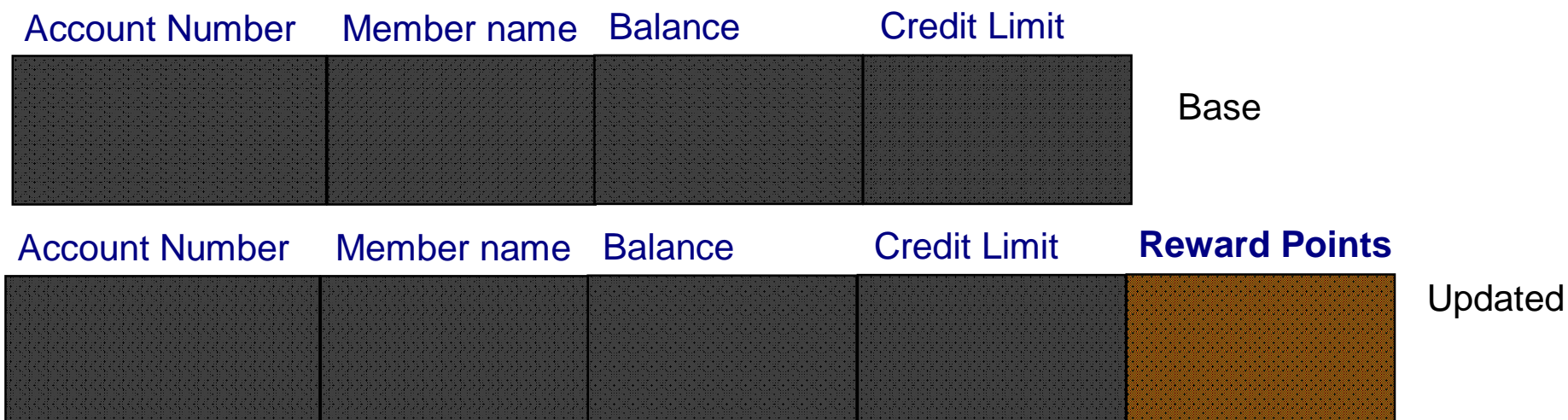
- Allows application programs to use different versions of the same physical database
- Provides the ability to assign user-defined version identifiers to different versions of an IMS database structure
- Enables structural changes to a database while providing multiple views of the physical IMS data to various applications
  - Applies to **Full Function DB, HALDB, Fast Path DEDB**
  - Supports database types: **HDAM, HIDAM, PHDAM, PHIDAM, DEDB**
- Database Versioning supports the following database structure changes
  - Increasing the length of a segment
  - Adding a new field (or fields) to space at the end of a segment

### Benefits

- Physical database structure can be changed without having to modify all the existing application programs using the database
- Applications referencing a new physical database structure can be brought online without affecting applications that use previous database structures
- Applications not requiring sensitivity to the new physical database structure can continue to access the database without any modifications or recompilation

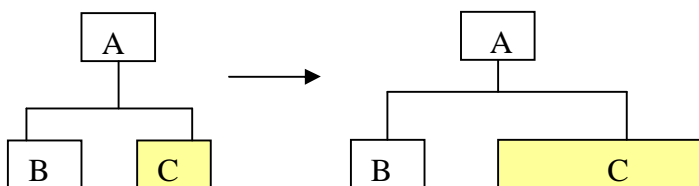
## Database Versioning Example

### Customer Account – fixed length segment



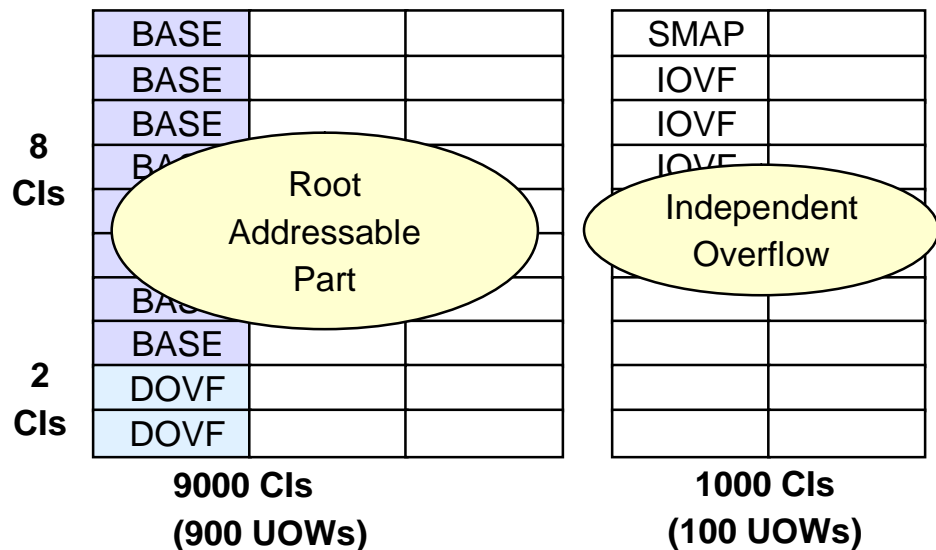
- Segment length increased and new field “Reward Points” defined
- Existing applications do not need to be updated
  - Existing applications do not have to know new field exists
  - Existing applications do not update the new field

- Change the structure of an IMS HALDB without a DB outage
  - Add a new field (or fields) to space at the end of an existing segment
  - Increase the length of an existing segment
- After changes are made to segment definitions in a DBD
  - Online Reorganization process is used to alter the online database from the current structure to the new structure
    - INITIATE OLREORG NAME(masterdb) OPTION(ALTER)
  - Online Change process is used to activate the changed ACBLIB members in the IMS online system
    - Application programs can start using the new database structure
- Benefits
  - Improves IMS HALDB availability by providing structure changes without taking the database offline
  - Provides flexibility in rolling database changes into the system



- Allows dynamic change to DEDB Area without unload/reload of the area
  - Alter physical attributes of DEDB Area: SIZE, UOW and/or ROOT parameters
  - Change the randomizer used for a DEDB Area
  - DBs with SDEPs not supported
  - Runs as a standard Fast Path IFP utility
  - Area remains online
  
- Requires the use of a two-stage randomizer allowing Areas to be processed individually
  
- Benefits
  - Improves DEDB Area availability by providing definitional modifications without taking the Area offline
  - Improved management of DEDBs

# DEDB Alter Example (ALTERAREA)



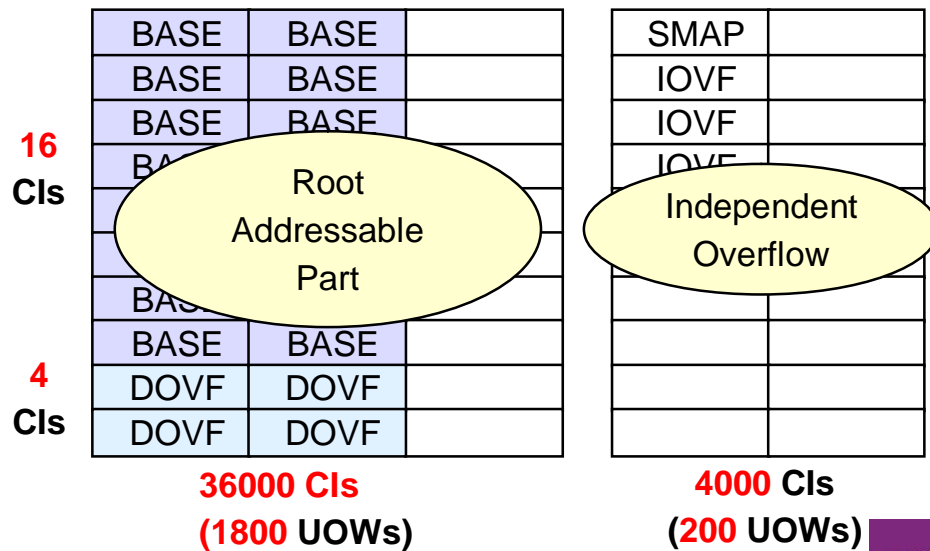
```

DBD      NAME=FPDEDB,ACCESS=DEDB,RMNAME=DEDBRAND
AREA     DD1=AREA1,...
AREA    DD1=AREA2,SIZE=4096,UOW=(10,2),ROOT=(1000,100)
AREA     DD1=AREA3,...
    
```

## ALTERAREA

UOW = (20,4)

ROOT = (2000,200)



```

DBD      NAME=FPDEDB,ACCESS=DEDB,RMNAME=DEDBRAND
AREA     DD1=AREA1,...
AREA    DD1=AREA2,SIZE=4096,UOW=(20,4),ROOT=(2000,200)
AREA     DD1=AREA3,...
    
```

# Transaction Manager/Connectivity

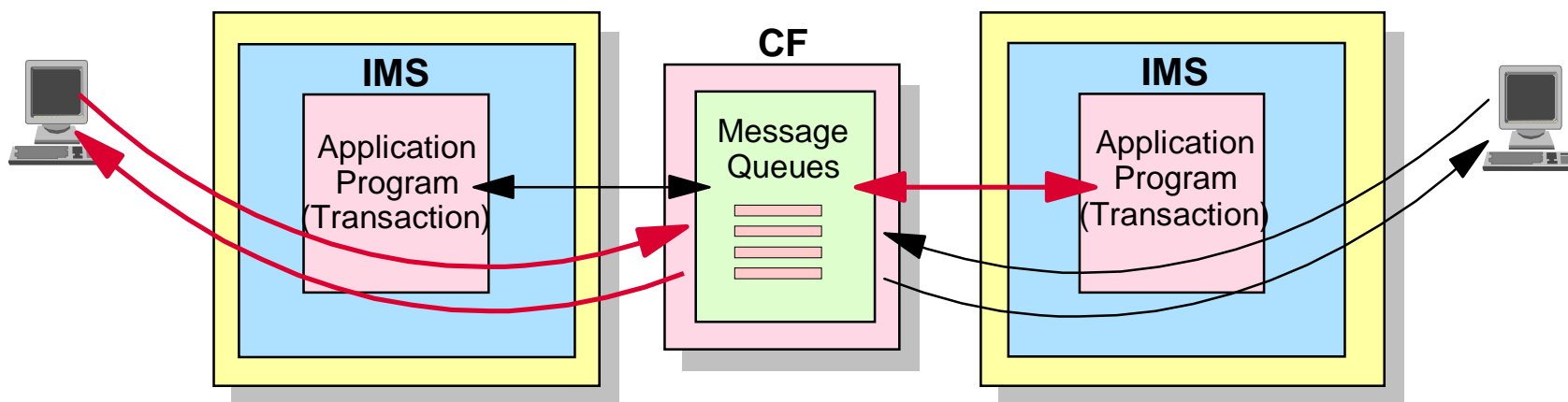
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## Topics

- Shared Message Queues
- Dynamic Change of OTMA descriptors
- Dynamic IMS Connect configuration
- MSC Considerations

## Shared Message Queues

- Shared Message Queues
  - Message queues moved to coupling facility list structures
- Single set of queues
  - Multiple IMS systems share one set of queues
  - IMS systems place messages in common queues
  - IMS systems retrieve messages from common queues
  - Any IMS can process messages on the queues
  - Is not dependent on where end user is logged on





- Dynamically modify and query OTMA descriptors
  - Affect destination routing decisions
    - Without having to restart IMS to change the descriptors
  - Type-2 Commands
    - CREATE | UPDATE | DELETE | QUERY OTMADESC
- Changes to descriptors
  - Persistent across warm and emergency restarts
    - Internal table of destination routing descriptors is automatically rebuilt using checkpoint and log records
  - Cold starts
    - DFSYDTx member has to be manually updated with changes
- Benefits
  - Dynamic capability to request information and monitor the OTMA Transaction Instances
    - Identify potential problems that may result in outages such as storage shortages
    - Diagnose potential problems that may arise and respond pro-actively to avoid or circumvent such problems
  - Availability of IMS when adding, updating, or deleting descriptors
    - Provides the ability to workload-balance outbound transactions without restarting the IMS.
  - Consistent command interface for OTMA by using a single point of control for commands

## IMS Connect Enhancements (*IMS 13*)

### ■ Enhancements for ALL users

- Dynamically CREATE IMS Connect resources through commands
  - For PORT and DATASTORE
- Reporting of overall health to Workload Manager (WLM)
- Configurable TCP/IP backlog (queue) size
- Automatically refresh cached userids by listening to RACF events (ENF signals)
- Expanded Recorder Trace Records for external trace
  - For TCP/IP and SCI interactions

### ■ Benefits

- Provide better resiliency, and make IMS Connect easier to use and manage
- Provide higher availability by not needing to restart IMS Connect to make definition changes.

## MSC Considerations

- Static MSC definitions require an outage to change
- Can make manage aspects of network dynamically – with planning
- Define dummy “spare” links in your sysgen
  - Can dynamically add logical sessions and create connections as needed to an IMS
- Dynamically modify and activate dummy definitions
  - UPDATE MSPLINK, MSLINK, MSNAME
  - Allows you to change most MSC configuration characteristics

# Systems

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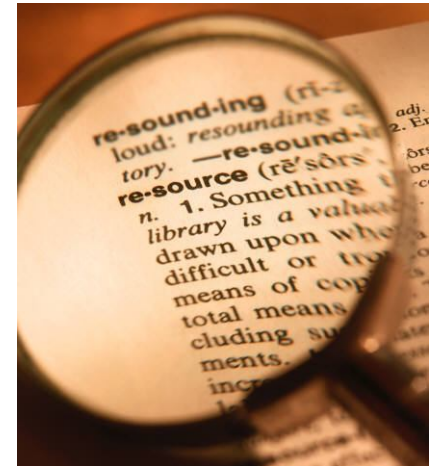
## Topics

- Dynamic Resource Definitions (DRD)
- Member OLC
- ACB enhancements
- Refreshable User Exits

# Dynamic Resource Definition (DRD) (IMS 10)



- Allow user to dynamically define and enable MODBLKS resource definitions
  - Databases
  - Programs
  - Transactions
  - Fast Path Routing Codes
  - And associated descriptors introduced with DRD
- Commands: CREATE, DELETE, UPDATE, QUERY, EXPORT, IMPORT
- Transactions can also be defined dynamically via the DFSINSX0 user exit
- IMS Repository provides an optional single centralized store for resource definitions for an IMSplex (IMS 12)
  - Across multiple IMSs or for a single standalone IMS
  - Can make changes when an IMS is down
  - Provides definitions when IMS cold start is required
- Benefits
  - Improve the availability of the IMS online environment
  - No requirement for MODBLKS SYSGEN
  - **No requirement for IMS restart/MODBLKS online change**
    - Limitations associated with these methods eliminated



## ACBLIB Member Online Change (IMS 10)

- Add or Update one or more ACB members without the need to perform an online change on the entire library
  - IMS 12 added NAMEONLY option to further reduce the impact of the OLC by only processing the ACB members named in the command
- Only the resources that are affected by the member online change are quiesced, allowing for more concurrent activity during the online change process than the current full library online change
- Provides improved availability during online change process by limiting quiesced resources to only those being changed by specified ACBs
- Complements DRD MODBLKS capability
  - Add new database definition or application definition via DRD
  - Activate associated DBDs/PSBs/ACBs via ACBLIB Member Online Change
    - In any sequence

## Dynamic Allocation for ACBLIB (IMS 11)

- Dynamic allocation of ACBLIB data sets
  - Allows the user to create DFSMDA members for the dynamic allocation of the ACBLIB data sets
  - Eliminates IMS outages in order to
    - Increase the size of the ACBLIB data sets
    - Correct errors with the inactive ACBLIB
    - Add data sets to the ACBLIB concatenation



## ACBLIB Cache (IMS 11)

- Caching of ACB members into 64-bit storage
  - Provides an option to load the ACB members into 64-bit storage
  - At application scheduling time, the ACB members are retrieved from 64-bit storage and not from the ACBLIB data set.
  - Provides a performance improvement by reducing the amount of read I/O required to the ACBLIB data set
- Reduces need to recycle IMS to resize PSB pools

- Refresh user exits without an IMS system outage
  - REFRESH USEREXIT command
  
- IMS 13 *adds* following exit “*types*” to support a list of exit names
  - *BSEX*            *Build Security Environment Exit (DFSBSEX0)*
  - ICQSEVNT    IMS CQS Event user exit
  - ICQSSTEV    IMS CQS Structure Event user exit
  - INITTERM    Initialization/Termination user exit
  - *LOGEDIT*    *Log Edit Exit (DFSFLGE0)*
  - *LOGWRT*    *Log Write Exit (DFSFLGX0)*
  - *NDMX*        *Non-Discardable Message Exit (DFSNDMX0)*
  - PPUE        Partner Product user exit (DFSPPE0)
  - *OTMAIOED*    *OTMA Input/Output Edit Exit (DFSYIOE0)*
  - *OTMARTUX*    *OTMA Resume Tpipe Security Exit (DFSYRTUX)*
  - *OTMAYPRX*    *OTMA Destination Resolution Exit (DFSYPRX0)*
  - *RASE*        *Resource Access Security Exit (DFSRAS00)*
  - RESTART    Restart user exit
  
- Benefits
  - Improves availability
  - Simplifies user exit management

# Other Considerations

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## Topics

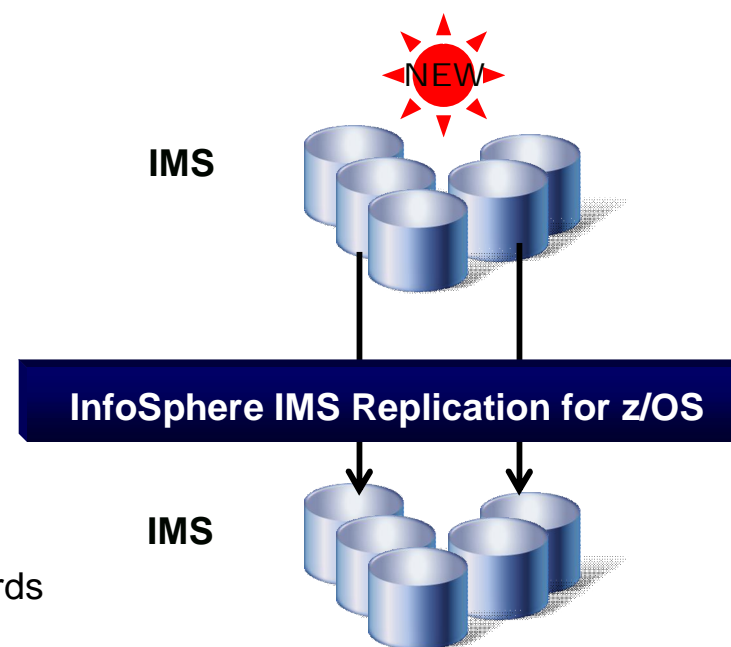
- DBRC
- Planned Site Outages

## DBRC

- Upgrade does not require IMSs to be shutdown
  - Best practices is to 'clean' RECONS before upgrade to minimize duration
    - DELETE.LOG INACTIVE
      - Clean up old PRILOG information
    - CLEANUP.RECON
      - Clean up recovery related records up to a specified timestamp
  - Can then upgrade each IMS individually so no total outage
  
- IMS does not need to be shutdown during time change
  - Understand you may still have applications that cannot tolerate the time change and may require an outage

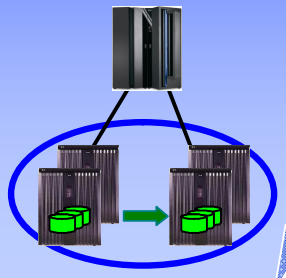
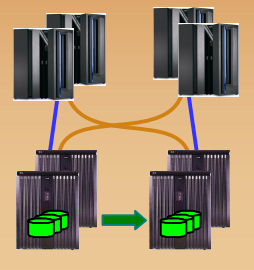
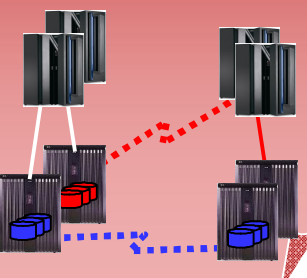
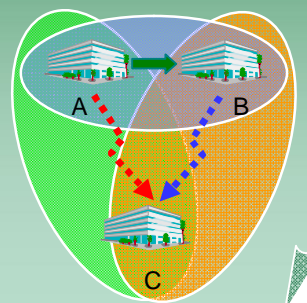
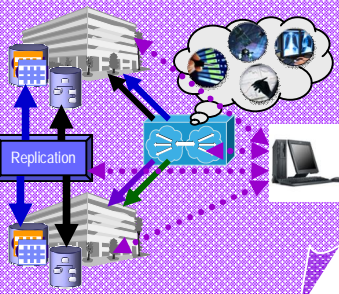
## IMS Software-Based Data Mirroring InfoSphere IMS Replication

- Unidirectional Replication of IMS data
  - All or nothing at DB level
  - Conflicts will be detected
    - Manual resolution will be required
  - External initial load of target DB
  - Basic replication monitoring
  - TCP/IP for data transmission
- IMS “Capture”
  - DB/TM, DBCTL, Batch DL/I
  - Capture x'99' log records
    - Increase in log volume due to change data capture records
- IMS “Apply”
  - Uses IMS Database Resource Adapter interface
  - Serialization based on resources updated by unit of recovery
  - Uses bookmark DB for restart support
- Administration via Classic Data Architect & z/OS console commands





# The GDPS " Family "

<p><b>Continuous Availability of Data within a Data Center</b></p>	<p><b>Continuous Availability w/ Disaster Recovery within a Metropolitan Region</b></p>	<p><b>Disaster Recovery at Extended Distance</b></p>	<p><b>Regional Continuous Availability w/ Disaster Recovery @ Extended Distance</b></p>	<p><b>Continuous Availability, Disaster Recovery, and Cross-site Workload Balancing at Extended Distance</b></p>
<p><b>GDPS/HyperSwap Mgr</b></p> <p>RPO = 0 / RTO = 0</p>	<p><b>GDPS/PPRC</b></p> <p>RPO = 0 / RTO &lt;1hr (&gt;20 km) RPO = 0 / RTO = 0 (&lt;20 km)</p>	<p><b>GDPS/GM &amp; GDPS/XRC</b></p> <p>RPO secs / RTO &lt;1 hr</p>	<p><b>GDPS/MGM &amp; GDPS/MzGM</b></p>	<p><b>GDPS Active-Active Sites</b></p> <p>RPO seconds / RTO seconds</p>
<p><b>Single Data Center</b> Applications remain active</p> <p>Continuous access to data in the event of a storage subsystem outage</p> 	<p>Multi-site workloads can withstand site and/or storage failures</p> 	<p><b>Two Data Centers</b> Rapid Systems Disaster Recovery with "seconds" of Data Loss</p> <p>Disaster recovery for out of region interruptions</p> 	<p><b>Three Data Centers</b> High availability for site disasters</p> <p>Disaster recovery for regional disasters</p> 	<p>Two or More Data Centers</p> <p>All sites active</p> 
<p><b>Components</b></p> <p>Tivoli – NetView, SAz System z, DS8K, PPRC GDPS control code, Services</p>	<p>Tivoli – NV, SAz, SA-IMP, AppMan System z, DS8K, VTS PPRC GDPS control code, Services</p>	<p>Tivoli – NV, SAz System z, DS8K, Global Mirror, XRC GDPS control code, Services</p>	<p>Tivoli – NV, SAz System z, DS8K, MGM, MzGM GDPS control code, Services</p>	<p>Tivoli – SA, NetView Multi-site Workload Lifeline DB2 &amp; IMS replication System z, DS8K, Global Copy GDPS control code, Services</p>

# Thank You!