

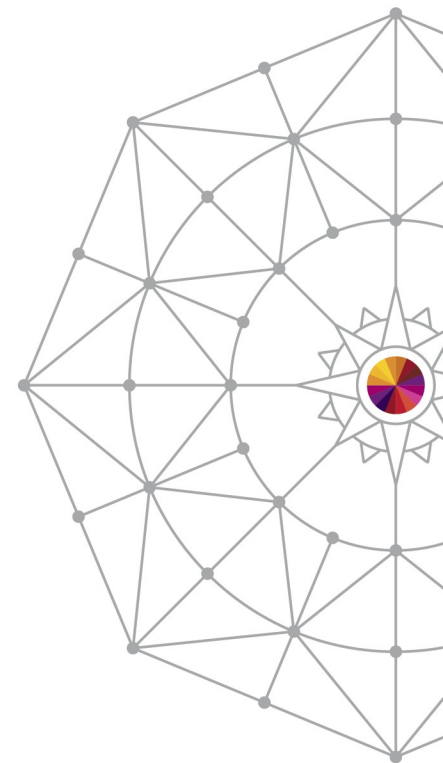
## *DFSMS Basics: VSAM*

# VSAM RLS Best Practices

*How to leverage VSAM RLS best practices and performance tweaks*

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*Session : 16125*



#SHAREorg

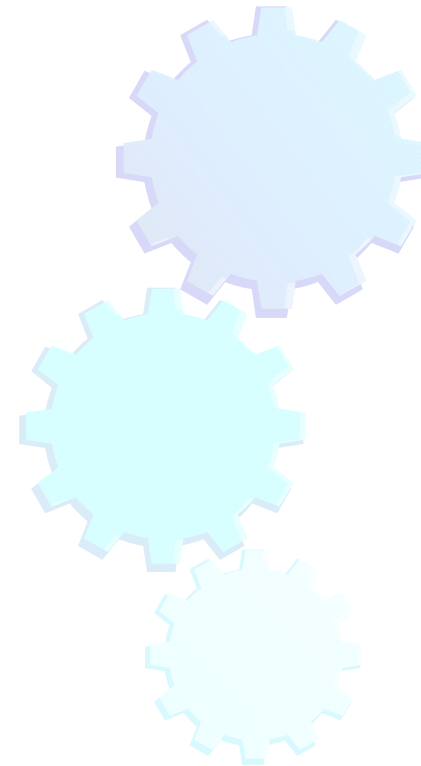


# Introduction

- VSAM RLS is highly configurable
- These settings can drastically influence how SMSVSAM runs
- **Goals:**
  - Explain available configuration options
  - Give helpful guidance in setting options
  - Demonstrate useful measurements
  - Some guidance for troubleshooting / error reporting

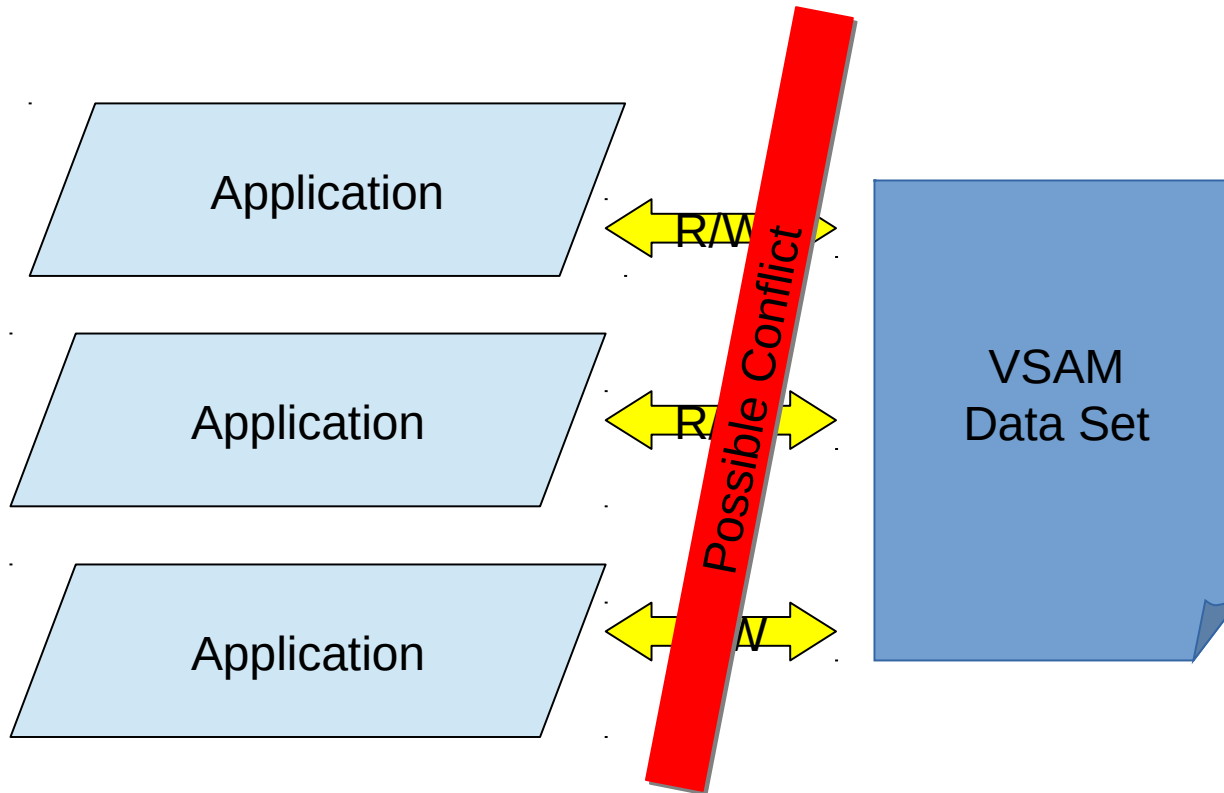
# Agenda

- **Overview of RLS**
- Measurements Overview
- Locking and Structures
- Buffering
- Caching
- Data set parameters
- Request-level Parameters
- Diagnostics



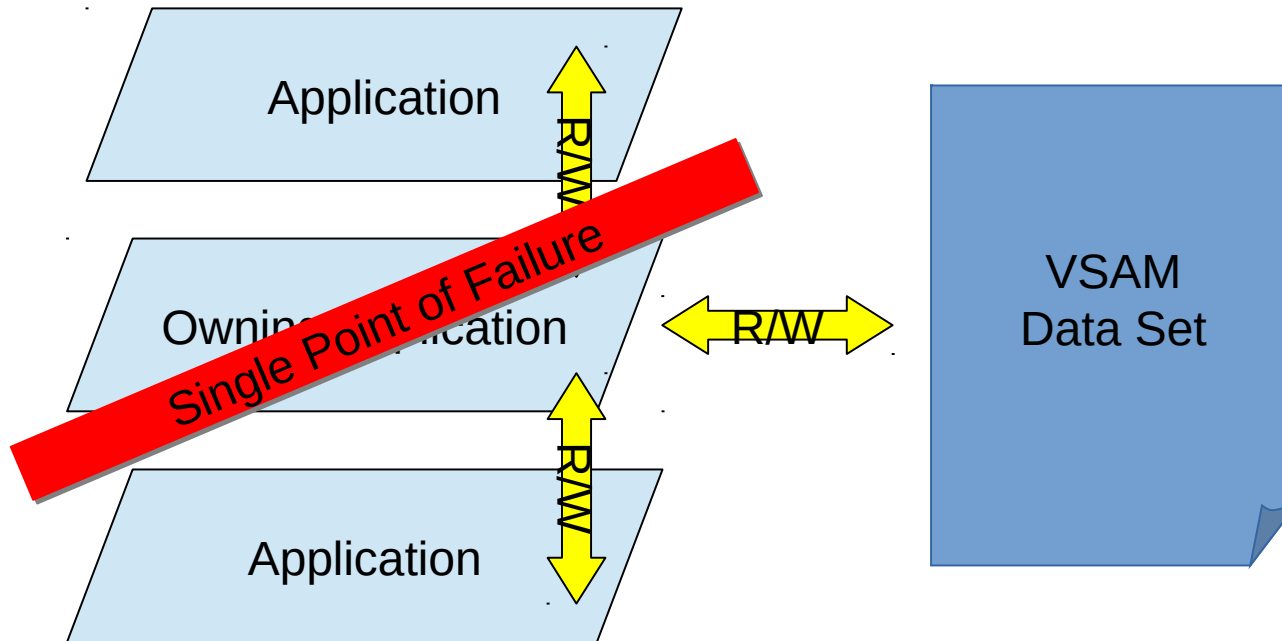
# *RLS Overview*

# Regular VSAM Access



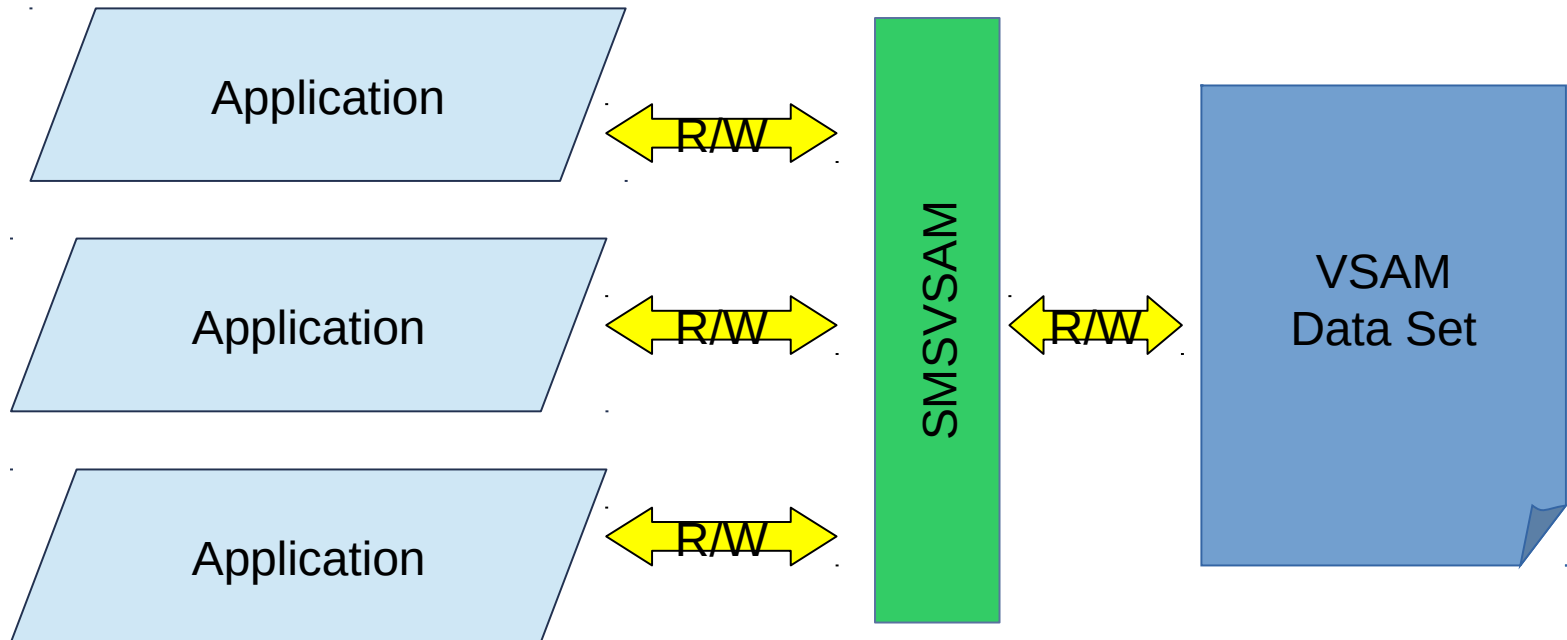
***Applications are responsible for serialization (SHR >3)***

# Single-owner model



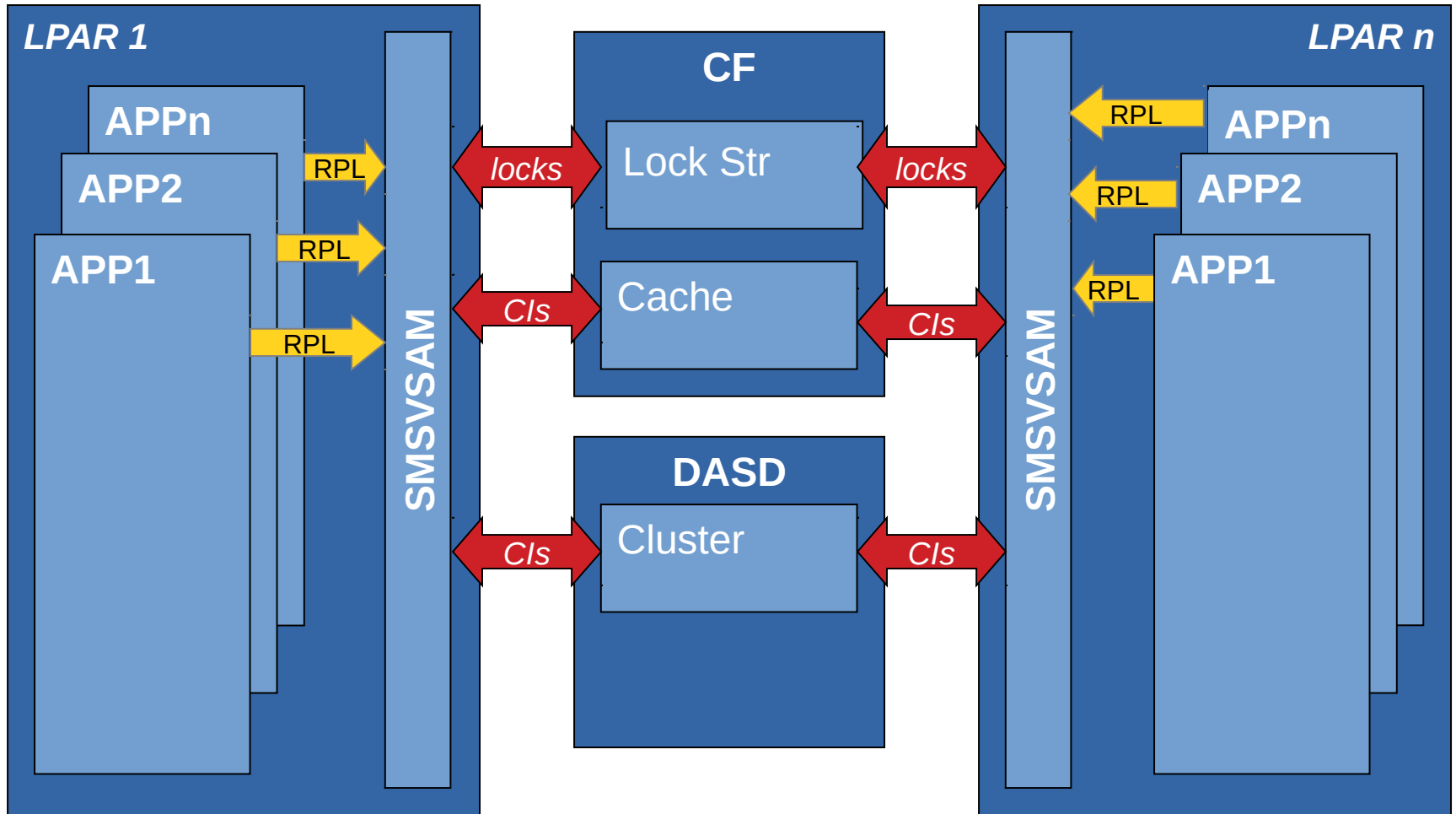
***Applications are responsible for serialization (SHR >3)***

# RLS VSAM Access



***SMSVSAM is responsible for serialization.***

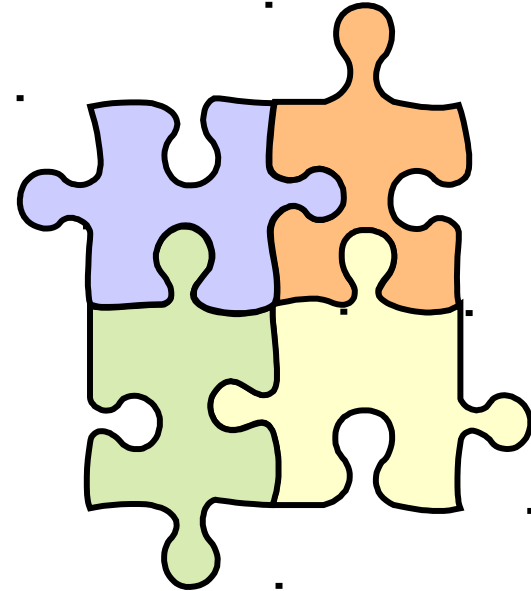
# RLS in More Detail





# VSAM RLS I/O Path – Sub Components

- VSAM Record Management (**VRM**)
  - Provides the VSAM interfaces: GET, PUT, POINT, ERASE, etc
  - Parameters passed to VRM are through the RPL control block
- Storage Management Locking Services (**SMLS**)
  - Interfaces with VRM and XCF locking services
  - Obtains, releases, and alters locks in the coupling facility lock structure(s)



# VSAM RLS I/O Path – Sub Components

- Sysplex Cache Manager (SCM)
  - Interfaces with Buffer Management Facility and XCF caching services
  - Obtains directory elements and read/write data elements in the coupling facility cache structures
- Buffer Management Facility (BMF)
  - Interfaces with VRM and SCM to locate/add buffers to the local pool
  - Supports buffering past close
    - Data sets reopened for RLS within 10 minutes can reuse valid buffers remaining in the pool
  - Manages the size of the local buffer pool via a Least Recently Used (LRU) manager

# VSAM RLS I/O Path

- **Performance Goal:** Spend the least amount of time in the I/O path!

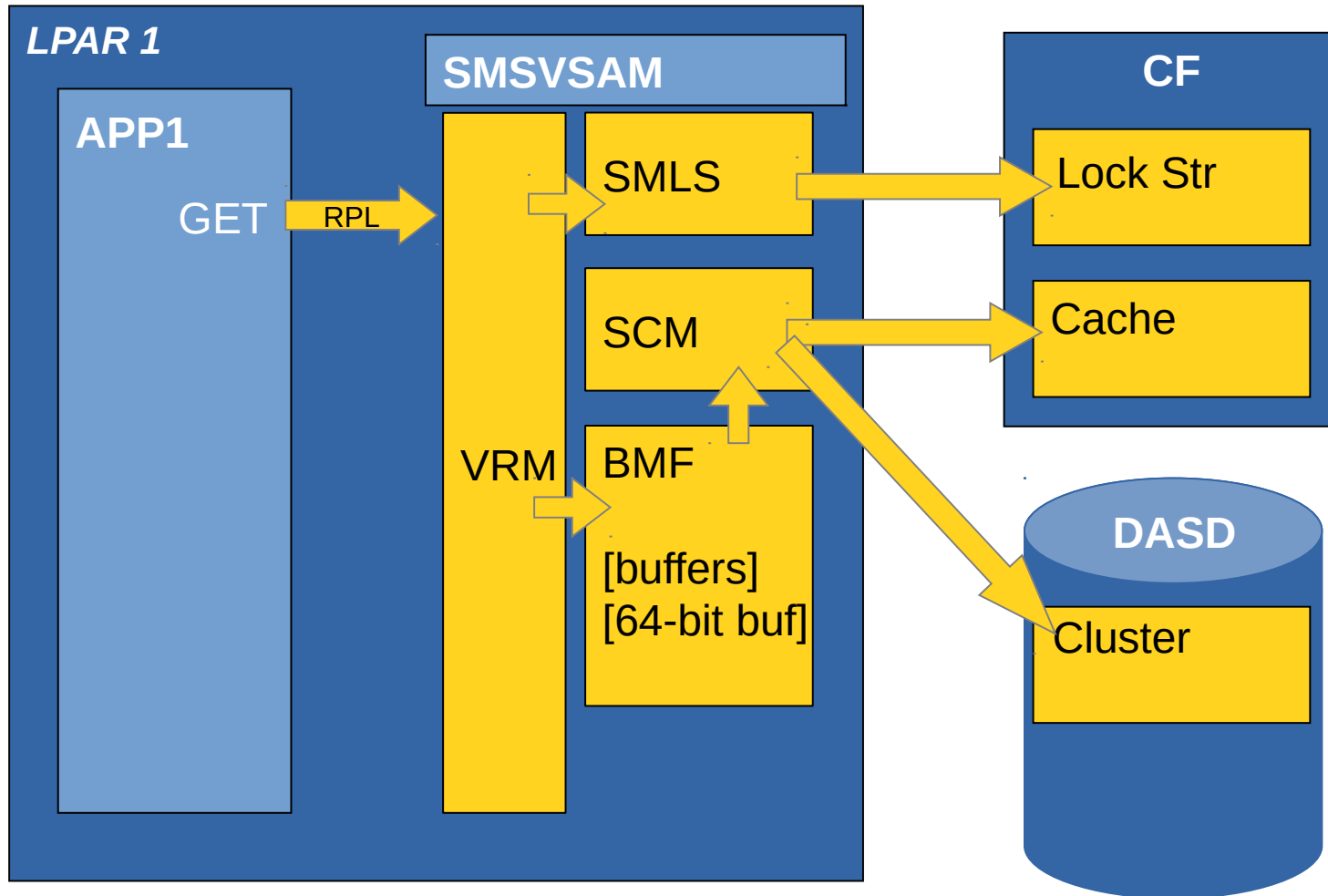
GET/PUT ↔ VRM ↔ SMLS ↔ XCF Locking services

↔ BMF ↔ SCM ↔ XCF Caching Services

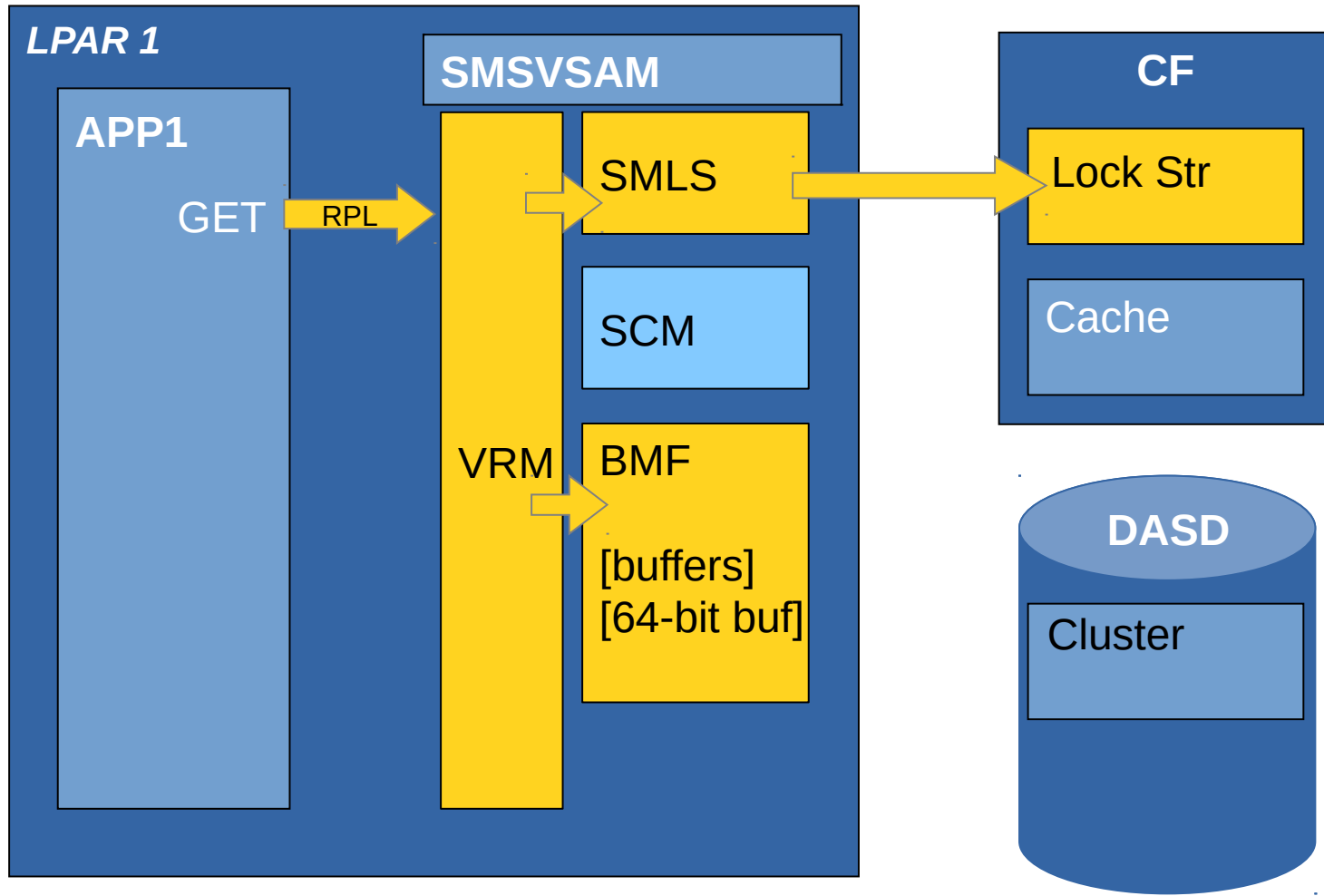
↔ Media Mgr Services (to DASD)



# GET request – not buffered



# GET request – buffered



# VSAM RLS I/O Path

- **Performance Goal:** Spend as little time as possible I/O path!

GET/PUT ↔ VRM ↔ SMLS ↔ XCF Locking services  
↔ BMF ↔ SCM ↔ XCF Caching Services  
↔ Media Mgr Services (DASD)



# Agenda

- Overview of RLS
- **Measurements Overview**
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- Request-level Parameters
- Diagnostics

# Measurements Overview

- SMF
  - Type 60-66 – Open / Close / Extend records
  - SMF 42:16-19 – RLS specific records
- RMF Monitor III
- Display Commands
  - RLS – CFLS, DIAG(C), QUIESCE
  - GRS
  - XCF
- Health Checker



# Performance Measurements – SMF 42

- SMF 42 Subtypes
  - **Subtype 15** - RLS statistics by storage class
  - **Subtype 16** - RLS statistics by data set\*
  - **Subtype 17** - RLS CF lock structure usage
  - **Subtype 18** - RLS CF caching statistics
  - **Subtype 19** - Buffer Manager LRU statistics
- Note: Only one system in the sysplex collects the SMF 42 records. The system collecting the records is displayed in the D SMS,SMSVSAM operator command.
- \* Must use V SMS,MONDS(spherenam),ON to collect subtype 16 statistics

# Performance Measurements – RMF

- RMF Monitor III
  - Statistics gathered from SMSVSAM
  - Mirrors and summarizes SMF42 data
  - Enabled via the VSAMRLS parm in ERBRMF04
  - RMF Option:
    - 3 – Monitor III
    - S – SYSPLEX
- See reference slides for notes on starting RMF

# Performance Measurements – RMF

## RMF Sysplex Report Selection Menu

Enter selection number or command for desired report.

### Sysplex Reports

1	SYSSUM	Sysplex performance summary	(SUM)
2	SYSRTD	Response time distribution	(RTD)
3	SYSWKM	Work Manager delays	(WKM)
4	SYSENQ	Sysplex-wide Enqueue delays	(ES)
5	CFOVER	Coupling Facility overview	(CO)
6	CFSYS	Coupling Facility systems	(CS)
7	CFACT	Coupling Facility activity	(CA)
8	CACHSUM	Cache summary	(CAS)
9	CACHDET	Cache detail	(CAD)
10	RLSSC	VSAM RLS activity by storage class	(RLS)
11	RLSDS	VSAM RLS activity by data set	(RLD)
12	RLSLRU	VSAM LRU overview	(RLL)

# RLSSC - Sysplex Totals View

RMF V2R1		VSAM RLS Activity - CAPTKEN1					Line 1 of 5			
Samples: 120	Systems: 1	Date: 03/08/14	Time: 17.28.00	Range: 120	Sec					
	< 2GB / > 2GB									
LRU Status	: Good / Good									
Contention %	: 0.0 / 0.0									
False Cont %	: 0.0 / 0.0									
Stor Class	Access	Resp Time	----- Read Rate	----- BMF%	----- CF%	----- DASD%	----- Valid%	----- BMF False	----- Inv%	Write Rate
RLS										
Below 2GB	DIR	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00
Above 2GB	DIR	0.001	2303	99.4	0.0	0.6	100	0.00		1158
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00

# Health Checker

- z/OS Tool introduced in V1R4,
- SMSVSAM checks added starting in V1R7
- Periodically runs “checks” against system to watch for errors and attempt to prevent problems
- Checks **IBMV SAMRLS**
  - VSAMRLS\_CFCACHE\_MINIMUM\_SIZE
  - VSAMRLS\_CFLS\_FALSE\_CONTENTION
  - VSAMRLS\_DIAG\_CONTENTION
  - VSAMRLS\_QUIESCE\_STATUS
  - VSAMRLS\_SHCDS\_CONSISTENCY
  - VSAMRLS\_SHCDS\_MINIMUM\_SIZE
  - VSAMRLS\_SINGLE\_POINT\_FAILURE
  - VSAMRLS\_TVS\_ENABLED

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- Overview of RLS
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# Lock Structures

- Locks
  - Records locks
  - Special locks
  - Global RLS parameters
- Lock Structures
  - Stores hash table of locks
  - Defined via CFRM Policy
  - Stored in Coupling Facility
  - Named IGWLOCK00



# Lock Structures – Potential Problems

- **Running out of Lock Space**
  - IGW326W \*\*\* Warning \*\*\* DFSMS SMSVSAM RECORD TABLE IN IGWLOCK00 100% FULL.
  - Can cause abends and failed requests
    - RPLFDBK 090800BD
- **False Contention**
  - Causes performance degradation
  - Two locks incorrectly stored in the same spot
  - Indicates that Lock Structure is too small
  - Target rate < 5%





# Lock Structures - Sizing

- Size requirement depends on how many locks are active
- **Lock\_Structure\_Size =**  
**10M \* Number\_Of\_Systems \* Lock\_Entry\_Size**
  - Lock\_Entry\_Size, depends on the MAXSYSTEM
    - MAXSYSTEM <= 7            Lock\_Entry\_Size = 2
    - MAXSYSTEM >= 8 & <24    Lock\_Entry\_Size = 4
    - MAXSYSTEM >=24 & <=32   Lock\_Entry\_Size = 8
- Example: MAXSYSTEM = 16, with 8 systems in sysplex:
- Lock\_Structure\_Size = 10M \* 4 \* 8 = 320M
  - Note: Minimum size of 13M is recommended
  - You can also use CFSIZER to help determine appropriate size:  
<http://www-947.ibm.com/systems/support/z/cfsizer/vsamrls/>

# Lock Structures – Potential Problems

- **False Contention**
  - Causes performance degradation
  - Two locks incorrectly stored in the same spot
  - Indicates that Lock Structure is too small
  - Target rate < 5%
- **To review false contention**
  - HealthCheck
  - D SMS,CFLS command
  - RMF CF activity report
  - SMF 42 subtype 17



# Health Check

HZS0002E CHECK(IBMVSAMRLS,VSAMRLS\_CFLS\_FALSE\_CONTENTION) :  
IGWRH0131E FALSE LOCK CONTENTION HAS BEEN DETECTED.  
THE CURRENT FALSE CONTENTION RATE IS 7.120%.

- VSAMRLS\_CFLS\_FALSE\_CONTENTION
  - Average of the last hour
  - Samples taken every second
  - Has configurable threshold

# D SMS,CFLS

IGW320I 11:37:11 Display SMS,CFLS(IGWLOCK00 )

PRIMARY STRUCTURE:IGWLOCK00 VERSION:CCC6425A4759D195 SIZE:4096K

RECORD TABLE ENTRIES:10358 USED:2

SECONDARY STRUCTURE:IGWLOCK00 VERSION:CCC6425AD06E219A SIZE:4096K

RECORD TABLE ENTRIES:10358 USED:2

LOCK STRUCTURE MODE: DUPLEXED STATUS: ENABLE

Total Available Locks

System	Interval	LockRate	ContRate	FContRate	WaitQLen
SYSTEM1	1 Minute	585.6	0.000	0.031	0.00
SYSTEM1	1 Hour	95.1	0.000	0.000	0.00
SYSTEM1	8 Hour	11.9	0.000	0.000	0.00
SYSTEM1	1 Day	8.9	0.000	0.000	0.00

\*\*\* No other systems provided data

\*\*\*\*\* LEGEND \*\*\*\*\*

LockRate = number of lock requests per second

CONTRATE = % of lock requests globally managed

FCONTRATE = % of lock requests falsely globally managed

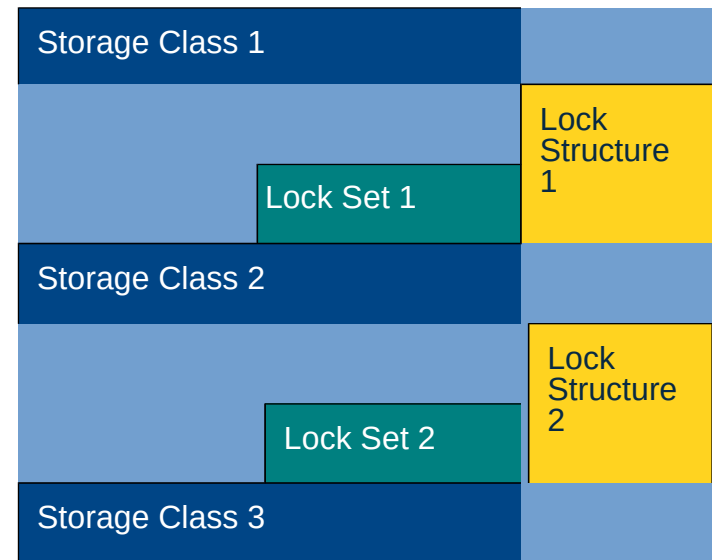
WaitQLen = Average number of requests waiting for locks

# False Contention - Measuring

- Other ways to measure:
  - RMF Mon III – Structure details on IGWLOCK00
    - S.7 - “Coupling Facility Activity”
  - RMF Mon III – RLSSC and RLSDS
    - < 2GB / > 2GB
    - LRU Status : Good / Good
    - Contention % : 0.0 / 0.0
    - False Cont % : 0.0 / 0.0
- SMF 42 subtypes 15,16,17
  - SMF42FOA – Number of Lock Requests
  - SMF42FOC – Number of Lock Req causing False Contention

# Multiple Lock Structures

- Allows separation of workloads
- SMS allows up to 256 different lock sets
- Can use any name:
  - IGWLOCKxx is easy
- Storage Class →  
SMS Lock Set →  
Lock Structure
- Does not include special locks  
(such as CI split lock)



# Locking Summary

- Lock size depends on active locks
- Recommended size is > 13mb,  
at least 20mb / system
- **Best Practice:**  
*Watch False Contention to see if you  
need to increase lock structure size*
- Multiple Lock Structures good for keeping workload  
lock activity separate



# Agenda

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- **Buffering**
- Caching
- Data set parameters
- Request-level Parameters
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# Buffer Management Overview

- Data buffered at the CI level
- All RLS data is buffered
- As buffers age, LRU routine removes them
- Two possible pools:
  - 31 Bit Buffer Pool
    - Size: 10M to 1728M
    - Defined using the `RLS_MAX_POOL_SIZE` parameter
    - Same on all systems
  - 64 Bit Buffer Pool
    - Size: 0 or > 500MB
    - Defined using `RLSAboveTheBarMaxPoolSize`
    - Can be specified per system

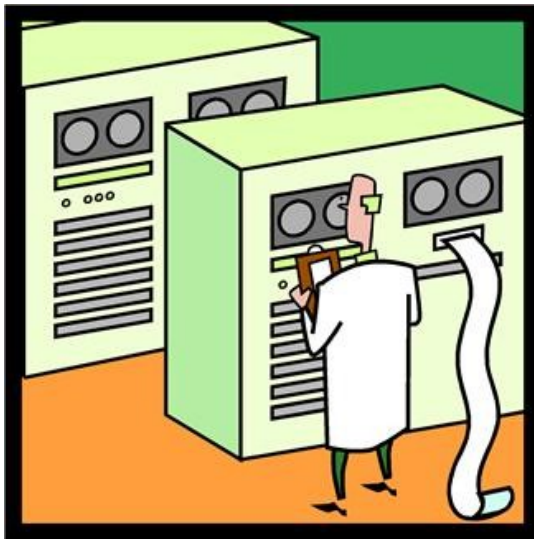
Below (2GB)  
Maximum 1728

LRU Modes:  
Accel: 120%  
Panic: 200%

Above (> 2GB)  
Limited by  
available storage

LRU Modes:  
Accel: 90%  
Panic: 100%

# Performance and Tuning – Buffer Pools



- Pool Size values are a *goal*, not a limit
- If more buffers are required, the pool will exceed the goal
- Total size of buffer pools should not exceed amount of real storage.
- A paged out buffer is immediately freed by the LRU.

# SMSVSAM LRU <= 1.12

- Runs every 15 seconds and throw out buffers

- **Normal Mode**

- 60 min or on disconnect

- **Maintenance Mode**

- 32-bit: 240-(maint cycles)
- 64-bit: 60min

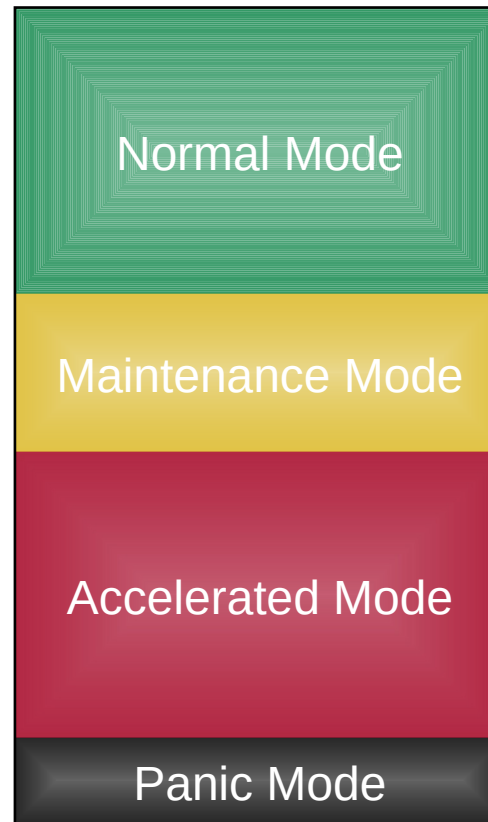
- **Accelerated Mode**

- 31-bit threshold:  
240 – (accel cycles \* 4)
- 64-bit threshold: 30min
- Buffer stealing starts

- **PANIC MODE**

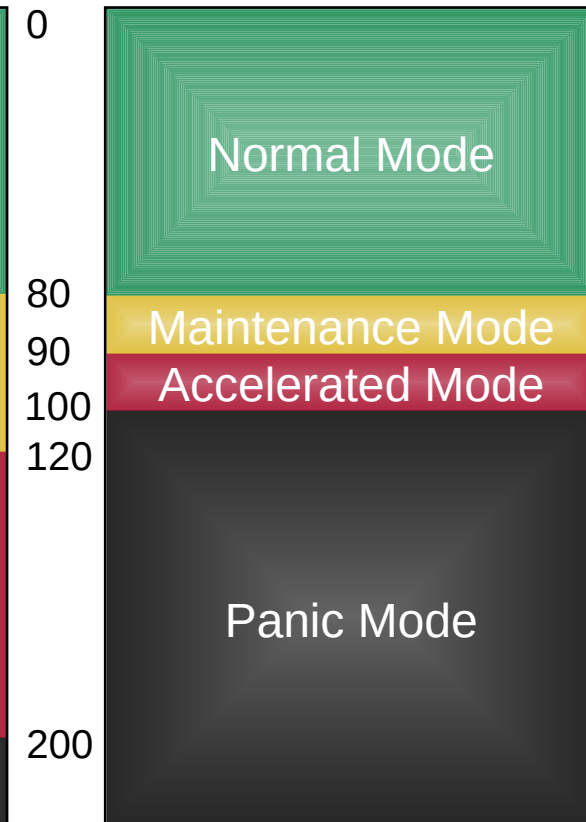
- Runs every 5 seconds
- 31-bit threshold:  
240 – (panic cycles \* 8)
- 64-bit threshold: 5 min
- Use stolen buffers

## 31-bit



*RLS\_MAX\_POOL\_SIZE*

## 64-bit

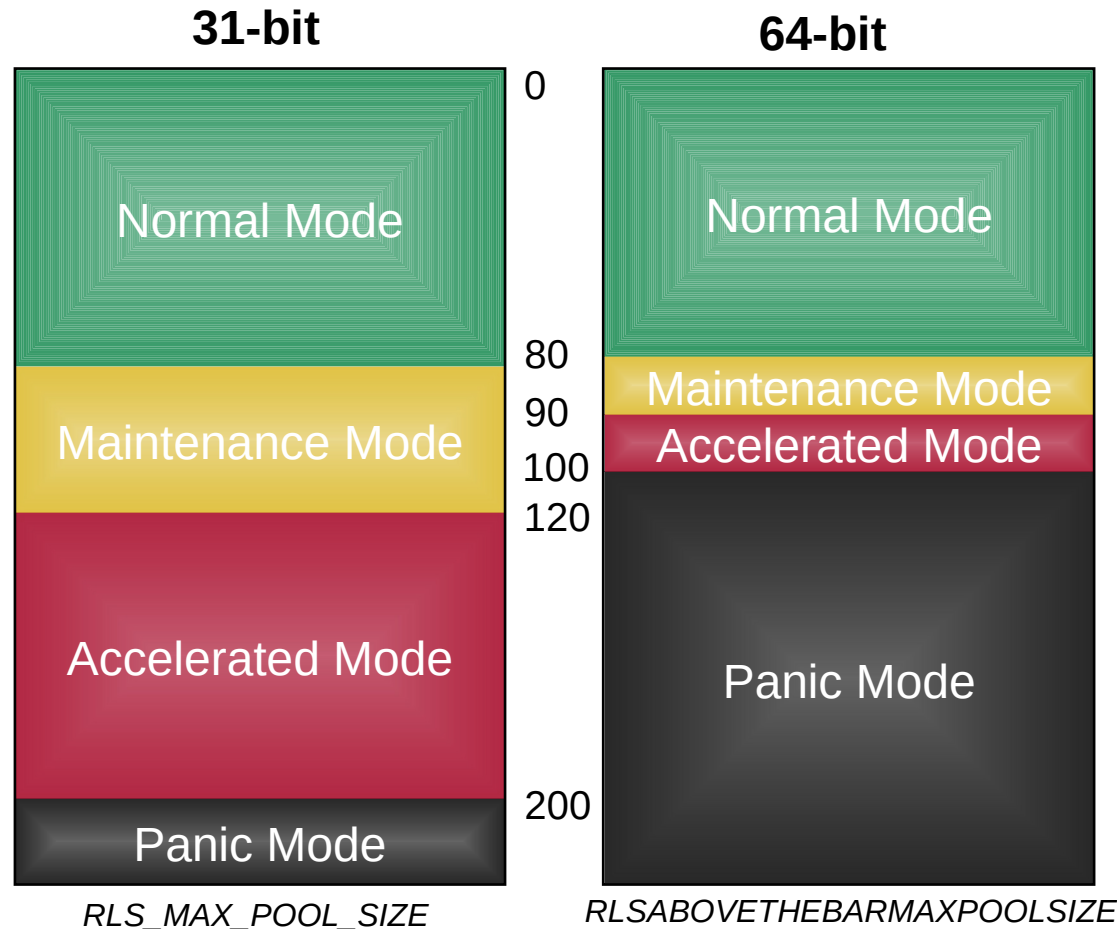


*RLSABOVETHEBARMAXPOOLSIZ*

# SMSVSAM LRU $\geq 1.13$

- Runs every 15 seconds and throw out buffers

- **Normal Mode**
  - Tossed only when data set disconnects
- **Maintenance Mode**
  - 32-bit: 60 min
  - 64-bit: 60 min
- **Accelerated Mode**
  - 31-bit threshold: 30 min
  - 64-bit threshold: 30 min
  - Buffer stealing starts
- **PANIC MODE**
  - Runs every 5 seconds
  - 31-bit threshold: 5 min
  - 64-bit threshold: 5 min
  - Use stolen buffers



# Considerations

- In normal mode, buffers will sit “indefinitely”
  - They will get purged when data set is disconnected (10 minutes after close)
  - There is a parm “Disconnect on Close” in Storage Class
- In Accelerated mode, they get purged at 60 minutes
- Result: Buffers will hit accelerated mode more often when you have a high throughput
- Caveat: below the bar also will enter maintenance at 90% of 1728MB, Accelerated at 99%, and Panic at 100%

# Buffer Sizing Considerations

- **Consider:**
  - How much of your data are you going to want in-buffer?
  - How long do you want it there / how often is it referenced?
  - How much data do you have flowing through SMSVSAM?
  - How fast does it flow?
- **Buffers will be thrown out when one of the following is true:**
  - Over 60 minutes old (in accelerated mode)
  - Invalidated from the cache
  - Disconnected (close)
  - Increased LRU mode causes them to be pitched sooner
- **No easy way to calculate a goal**
  - Manual states no smaller than 150% of combined non-RLS buffers
  - Needs to hold relevant data for a relevant time period
  - You want to avoid loading more than will fit in the buffer within 60 minutes



# Specifying Buffer Pool Size

- **SYS1.PARMLIB(IGDSMSxx)**
  - **RLS\_MAX\_POOL\_SIZE(nnnn)**
    - Maximum size of SMSVSAM local buffer pool
    - nnnn = 10 to 9999, with over 1500 treated as 1728
    - **Recommendation: RLS\_MAX\_POOL\_SIZE( <= 850 )**
  - **RLSAboveTheBarMaxPoolSize([sys1,val1;sys2,val2...] | [ALL,value])**
    - Amount of virtual storage allocated above 2G bar for RLS buffering
    - nnnn = 0, or 500M > size > 2,000,000M (2 TB)
    - **Recommendation: RLSAboveTheBarMaxPoolSize( <= 32768 )**

# Performance and Tuning – Data Class

- **RLS Above the 2-GB Bar (YES | NO )**
  - Specifies whether SMSVSAM can use 64-bit virtual buffering for the data set
  - Must specify a non-zero RLSAboveTheBarMaxPoolSize



# Monitoring Buffers

- SMF 42 subtype 15, 16, 19
- RMF Monitor III – RLSSC, RLSLRU
- Omegamon XE
- ***Watch for:***
  - Accelerated or panic mode
  - Buffer usage vs buffer goal
  - Reads satisfied by BMF %

# SMF42 Buffer-related Fields

- **Subtype 19 – LRU Summary**
  - Available at sysplex-level or system-level
  - Split into below-the-bar and above-the-bar sections
  - Buffer goal: SMF42JQI
  - Buffer used: SMF42JQM
  - Accelerated/panic mode rate:  
SMF42JPH / SMF42JPG
- **Subtype 15, 16 – Storage Class & Data Set**
  - Also split into plex / system
  - Also split into below / above the bar
  - Additionally split into SEQ / DIR
  - Hit rate = SMF42FII / SMF42FIG

# RMF MON III - RLSLRU

RMF V2R1 VSAM LRU Overview - CAPTKEN1

Line 1 of 3

Samples: 100      Systems: 1      Date: 03/08/14      Time: 15.23.20      Range: 100      Sec

MVS System	Avg CPU Time	- Buffer Goal	Size High	- Accel %	Reclaim %	----- BMF%	Read CF%	----- DASD%
SYSTEM1								
Below 2GB	<.001	100M	10M	0.0	0.0	0.0	0.0	0.0
Above 2GB	<.001	<b>1000M</b>	<b>328M</b>	0.0	0.0	99.4	0.0	0.6

# OMEGAMON XE for Storage

## RLS Workspaces - Buffer LRU System Detail Workspace

RLS Buffer LSU System Detail - US-L-TE01 - SYSADMIN \*ADMIN MODE\*

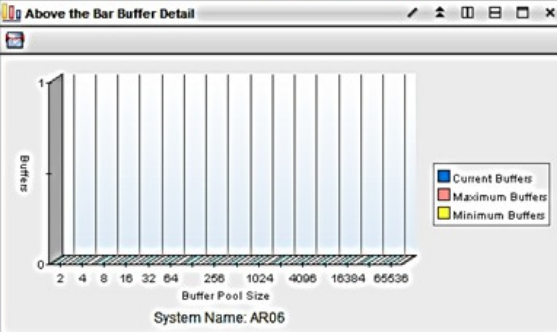
File Edit View Help

Navigator View: Physical

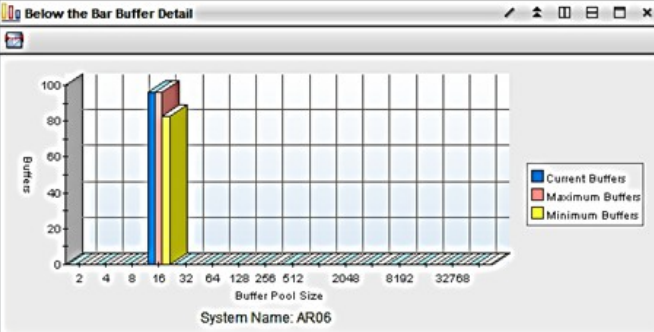
- Tape Group
- Virtual Tape Subsystems
- SMS Storage Groups Performance
- SMS Storage Groups Space
- User DASD Groups Performance
- User DASD Groups Space
- DFSMShsm Status
- Tape Management Status
- Record Level Sharing
- Dataset Attributes System Summary
- Dataset Group Summary
- SMS Configuration

Physical

Above the Bar Buffer Detail



Below the Bar Buffer Detail



Local Level Buffer Pool Summary

Location	BMF Panic Mode Pct	BMF Panic Mode	BMF Accelerated Mode Pct	BMF Accelerated Mode	XCF Castout Lock Cont Retry Pct	XCF Castout Lock Retries	Current BMF Read Hit Pct	Min BMF Read Hit Pct	Curr Recursive Local CI Ref Pct	Max Recursive Local CI Ref Pct	Current CF Cache Read Hit Pct	Minimum CF Cache Read Hit Pct	Average CF Cache Read Hit Pct	Current DASD Hit Pct	Avg Recursive Local CI Ref Pct	Average Local CI Refresh Pct
Below the bar	0.0	0	0.0	0	0.0	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above the bar	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sysplex: AR06

Local Level Above the Bar Buffer Pool Detail

Buffer Pool Size KB	Current Buffers	Maximum Buffers	Minimum Buffers	Current Extents	Maximum Extents	Minimum Extents
2	0	0	0	0	0	0
4	0	0	0	0	0	0
8	0	0	0	0	0	0
16	0	0	0	0	0	0
32	0	0	0	0	0	0
64	0	0	0	0	0	0
128	0	0	0	0	0	0
256	0	0	0	0	0	0
512	0	0	0	0	0	0
1024	0	0	0	0	0	0
2048	0	0	0	0	0	0
4096	0	0	0	0	0	0
8192	0	0	0	0	0	0

Sysplex: AR06

Local Level Below the Bar Buffer Pool Detail

Buffer Pool Size KB	Current Buffers	Maximum Buffers	Minimum Buffers	Current Extents	Maximum Extents	Minimum Extents
2	0	0	0	0	0	0
4	0	0	0	0	0	0
8	0	0	0	0	0	0
16	96	96	83	1	1	1
32	0	0	0	0	0	0
64	0	0	0	0	0	0
128	0	0	0	0	0	0
256	0	0	0	0	0	0
512	0	0	0	0	0	0
1024	0	0	0	0	0	0
2048	0	0	0	0	0	0
4096	0	0	0	0	0	0
8192	0	0	0	0	0	0

Sysplex: AR06

Buffer Pool Statistics for a single z/OS image

# Buffering Summary

- Use adequate buffers to hold your data as long as it is needed
- Above-the-bar is available for large pools
- **Best Practice: Monitor buffers:**
  - Ensure LRU is OK
  - Watch for % BMF
  - Watch used vs goal
- *Make changes as needed*

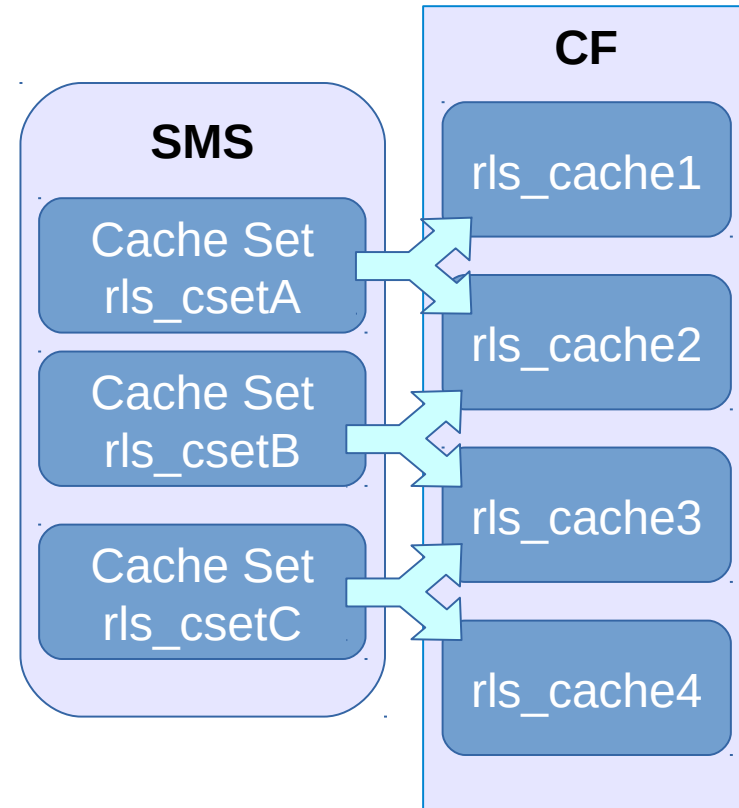


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- **Caching**
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# Cache Structures

- Caches are:
  - Structures in the Coupling Facility
  - SMSVSAM uses them to store CIs for other systems to read
- Cache Sets are:
  - SMS constructs inside base configuration
  - Allows for partitioning of workloads and data sets
  - One cache set points to multiple caches
  - One cache set assigned to each storage class
- Proper cache structure sizing is required to ensure maximum buffer effectiveness!
- Caching at the CI level



# Cache Settings

- RLS\_MaxCFFeatureLevel( A | Z )
  - Set in IGDSMSxx
  - A – caches up to 32k CIs
  - Z – caches the first 4k of any size CI
- RLS CF Cache Value
  - In the Data Class
  - Only valid if using mode A
  - Possible Values:
    - ALL – cache everything
    - NONE – cache only the index
    - UPDATESONLY – only WRITES are cached
    - DIRONLY – Cache nothing, but use the cache as a way to track interest in CIs



# Cache Sizing

- Total cache size should be the size of all your shared data
- For best results, use Total Cache = Total Buffers
  - Sum of 31 bit and 64 bit buffer goals
    - 31 bit buffer goal =
      - $RLS\_Max\_Pool\_Size * Number\ of\ Systems$
    - 64 bit buffer goal =
      - $(RLSAboveTheBarMaxPoolSize(system1) + RLSAboveTheBarMaxPoolSize(system2) + \dots + RLSAboveTheBarMaxPoolSize(systemN))$
  - Assumptions:
    - $RLS\_MaxCFFeaturelevel(A)$ : caching all data
    - No sharing of data across the sysplex

# Caching

- Example of official recommendation:
  - RLS\_Max\_Pool\_Size(850)
  - Number of Systems = 2
  - RLSAboveTheBarMaxPoolSize(System1,2048)
  - RLSAboveTheBarMaxPoolSize(System2,4096)
  - **Cache Size = (850\*2) + 2048 + 4096 = 7844M**

# Caching

- Example of practical recommendation:
  - RLS\_Max\_Pool\_Size(850)
  - Number of Systems = 2
  - Shared Data: 500MB
  - Unique Data: 250MB / system
  - **Cache Size = 500 + (250 \* 2 ) = 1000M**

# Caching

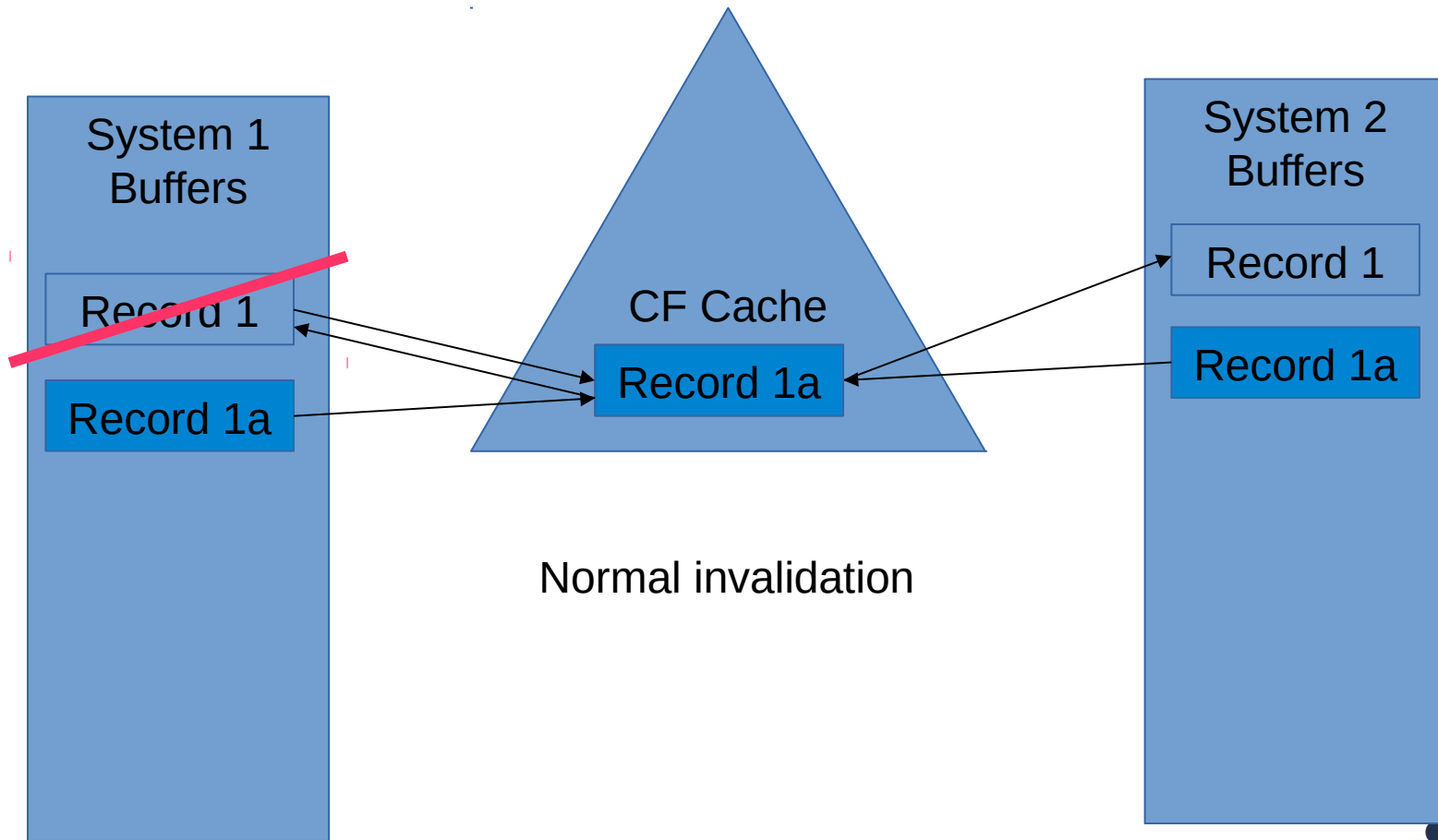
- Recommendations
  - Allocate different cache structures for different applications.
    - Ex: different cache for HSM, catalog, CICS
  - Allocate different structures to match structure usages.
    - Ex: Different cache for 8k, 4k, 32k
- If using more than one cache structure:
  - Divide total space between caches
  - Base sizes on data set usage distribution

# Cache Structures – False Invalids

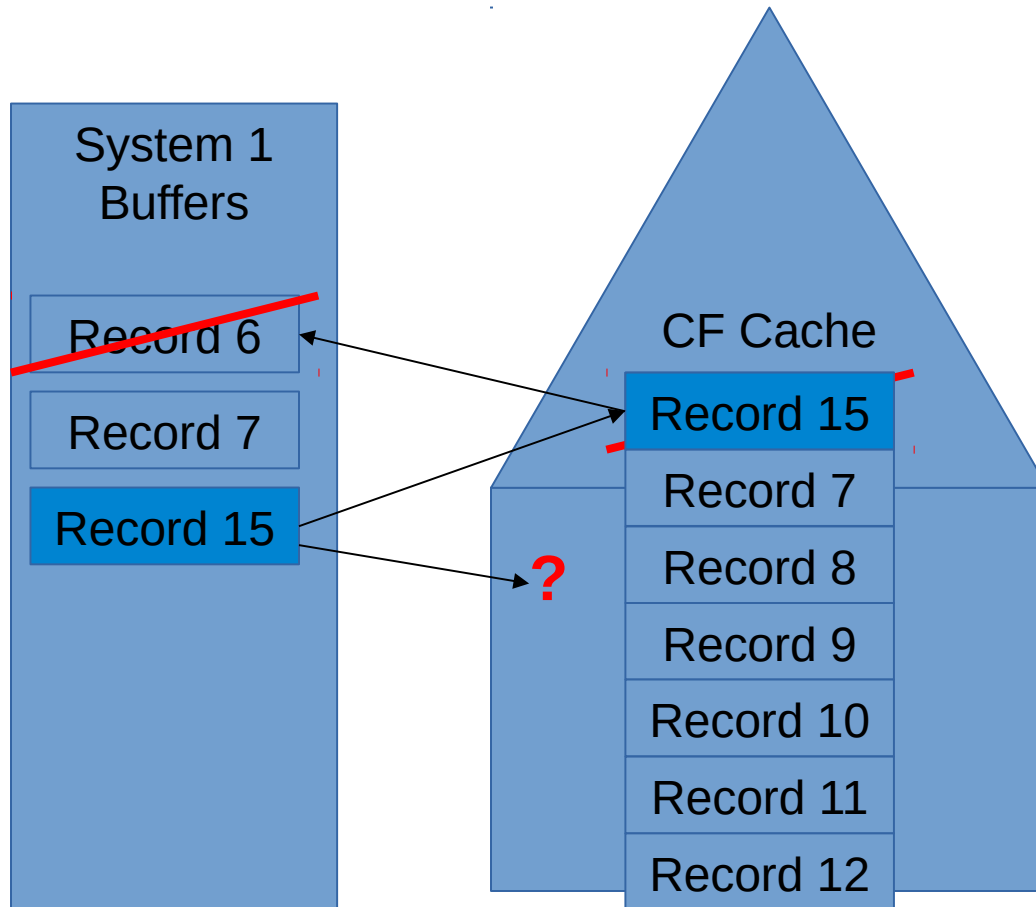
- False Invalids:
  - Take place when a cache structure(s) too small for current buffer allocations
  - Cache structures invalidate entries to make room for new requests
  - Causes additional requests to DASD!
  - Tracked in
    - RMF panels RLSSC, and RLSDS
    - SMF 42 subtypes 15-16



# Normal Invalidation Example



# False Invalidation Example



False invalidation is when a buffer gets marked invalid in order to make room for a new buffer.

# RMF MON III – RLSSC & RLSDS

RMF V2R1 VSAM RLS Activity - CAPTKEN1 Line 1 of 5

Samples: 100 Systems: 1 Date: 03/08/14 Time: 15.23.20 Range: 100 Se

< 2GB / > 2GB

LRU Status : Good / Good

Contention % : 0.0 / 0.0

False Cont % : 0.0 / 0.0

Stor Class	Access	Resp Time	----- Read Rate	----- Read BMF%	----- Read CF%	----- Read DASD%	----- BMF Valid%	----- BMF False Inv%	Write Rate
RLS									
Below 2GB	DIR	0.000	0.00	0.0	0.0	0.0	0.0	0.00	0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00	0.00
Above 2GB	DIR	0.001	2254	99.4	0.0	0.6	100	0.10	1137
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00	0.00



# Cache Health Check

- **VSAMRLS\_CFCACHE\_MINIMUM\_SIZE**

- Verifies that caches are at least 10% of optimal size
- Calculated by adding up buffer pools
- Can cause confusion if caches are not connected

- Messages:

- `IGWRH0121I` The VSAM RLS CF cache size does not meet IBM's recommended minimum CF cache size for the current sysplex buffer pool configuration.
- `IGWRH0122I` The IBM recommended minimum cache size for your current sysplex buffer pool configuration is CacheMinSize MB.

According to the current configuration of the VSAM RLS buffer pool in the sysplex, the VSAM RLS CF cache optimal size should be CacheOptSize MB. CF cache size should be at least CacheMinPercent% of the CF cache optimal size. Thus, the CF cache size for the sysplex should be at least CacheMinSize MB.

# Buffer / Cache Dance

- A balance between buffer and cache allocations must be made for optimum performance
- Buffer space = large and cache space = small
  - Bottleneck in cache will occur between buffers and DASD
  - Cache will invalidate buffer entries to make room for new requests: thrashing
  - False Invalids occur when the cache structure needs more space than it has to satisfy CI requests.
- Buffer space = small and cache space = large
  - Potentially wasted coupling facility space is expensive
  - Cache will try to keep as much data in it as possible
  - Buffer LRU will be the constraining factor



# RLSSC - Sysplex Totals View

RMF V2R1 VSAM RLS Activity - CAPTKEN1									
Line 1 of 5									
Samples: 120		Systems: 1		Date: 03/08/14		Time: 17.28.00		Range: 120 Sec	
< 2GB / > 2GB LRU Status : Good / Good Contention % : 0.0 / 0.0 False Cont % : 0.0 / 0.0									
Stor Class	Access	Resp Time	----- Read Rate	----- Read BMF%	----- Read CF%	----- Read DASD%	----- BMF Valid%	----- BMF False Inv%	Write Rate
RLS									
Below 2GB	DIR	0.000	0.00	0.0	0.0	0.0	0.0	0.00	0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00	0.00
Above 2GB	DIR	0.001	2303	99.4	0.0	0.6	100	0.00	1158
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00	0.00

# Caching Summary

- Caches should hold as much of your buffers as you can manage
- Use multiple caches to spread your workload
- Use RLS CF Cache Value wisely
- **Best Practice:** *Monitor BMF False Contention as a health indicator for cache size*



# Agenda

- Overview of RLS
- Measurements Overview
- Locking and Structures
- Buffering
- Caching
- **Data set-level parameters**
- Request-level Parameters
- Diagnostics

# Data Set Parameters

- CISIZE

- Currently, both RLS and base VSAM will serialize the *entire* data set when
  - CI / CA split is in progress
  - CI / CA reclaim is in progress
  - Accessing spanned records
- **Best Practice:** *When reasonable, increase CI size for data sets with higher insert activity.*
  - Larger is better in terms of CPU
  - Larger also means larger buffers: performance vs. storage tradeoff
  - Larger CIs will contain more records which may lead to contention on DASD flush



# Data Class Parameters

- CA Reclaim (YES | NO)
  - Specifies whether DASD space for empty CAs in KSDS data sets will be reused
  - Must be enabled in IGDSMSxx or with SETSMS command
  - Recommended to avoid data set fragmentation and to reduce reorg frequency



# Data Class Parameters

- BWO (NO | TYPECICS | TYPEIMS)
  - BWO: Backup While Open
  - NO: BWO not used for CICS or IMS VSAM data sets
  - TYPECICS: BWO used for CICS VSAM file control data sets
    - Requires multiple SVC 26 calls to catalog
    - Component 1 lock held across VRM requests
  - TYPEIMS: BWO used for IMS VSAM data sets with IMS 6.1+
  - **Recommendation:** To maximize concurrent VRM performance, only use BWO when absolutely necessary.



# Agenda

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- **Request-level Parameters**
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# Request Level – ACB / GENCB / RPL

- RLSREAD / OPTCD (NRI | CR | CRE)
  - NRI – No Read Integrity
    - No Read Integrity
    - Can occasionally result in “dirty” read
  - CR – Consistent Read
    - Will get / release record lock
  - CRE – Consistent Read Extended
    - Will get record lock
    - Locks released at commit

# Request Level Considerations

- Be careful when using CRE
- Long-running transactions can hold locks, causing delays
- **Best Practice:** use GET NUP when browsing, and then use GET UPD before update. If consistency is required, use CR



# Agenda

- Overview of RLS
- Measurements Overview
- Locking and Structures
- Buffering
- Caching
- Data set-level parameters
- Request-level Parameters
- **Diagnostics**

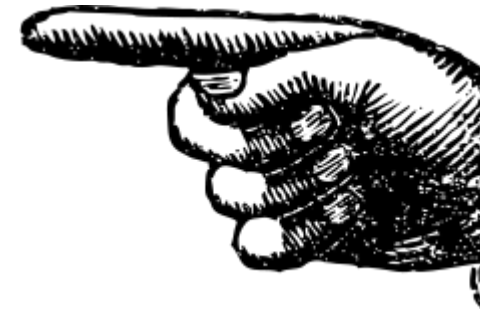
# SMSVSAM Diagnostics

- Display commands:
  - D SMS,SMSVSAM,ALL
  - D SMS,TRANVSAM,ALL (if TVS is in use)
  - D SMS,SMSVSAM,DIAG(C) (system scope)
  - D SMS,SMSVSAM,QUIESCE (system scope)
  - D GRS,C (system scope)
  - D XCF,STR,STRNM=[IGWLOCK00 | lock\_structure]
  - D XCF,STR,STRNM=[cachestructurename]

# Gather Diagnostic Dumps

- Plex-wide dumps
  - Need SMSVSAM address and data spaces
  - Dump plex-wide if you can
- **Best Practice:** *Create an IEADMCxx member for dumping SMSVSAM and perhaps CATALOG*
  - Example of a plex-wide parmlib definition:

```
COMM=(SMSVSAM hang)
JOBNAME=( *MASTER* , SMSVSAM ),
DSPNAME=( ' SMSVSAM ' . * ),
SDATA=(ALLNUC, COUPLE, CSA, GRSQ, LPA, LSQA,
PSA, RGN, SUM, SQA, SWA, TRT, XESDATA),
REMOTE=(SYSLIST=( * ( ' SMSVSAM ' ) ), DSPNAME, SDATA)
```



# Maintenance – PSP Bucket

- The RLS PSP bucket is on the web at:
  - <https://ibm.biz/BdFr4K>
- Search for SMSVSAM
- Maintenance organized by release
  - Upgrade ZOSV2R1, Subset DFSMS

# Agenda

- Overview of RLS
- Measurements Overview
- Locking and Structures
- Buffering
- Caching
- Data set-level parameters
- Request-level Parameters
- Diagnostics



# References

- *VSAM Demystified*
  - SG24-6105-01
- *DFSMSdfp Storage Administration*
  - SC26-7402
- *DFSMS: Using Data Sets*
  - SC26-7410
- *z/OS MVS System Management Facilities*
  - SA22-7630

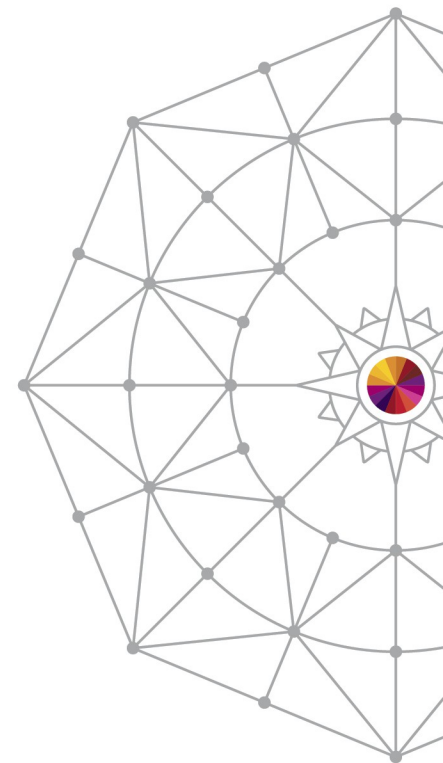
## *DFSMS Basics: VSAM*

# VSAM RLS Best Practices

*How to leverage VSAM RLS best practices and performance tweaks*

*Neal Bohling, [bohling@us.ibm.com](mailto:bohling@us.ibm.com)*

*Session : 16125*



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# Configuring RMF Monitor III

- SYS1.PARMLIB( ERBRMF04 ) keywords
  - CFDETAIL – detailed CF information
  - VSAMRLS – enables RLS data gathering
  - VSAMRLS(ADD( DSMASK) )
    - enables data-set level statistics
  
- To start
  - S RMF
  - F RMF,S III
  - Issue TSO RMF