# The Problems with RLS:
# A User Experience Implementing VSAM RLS and CICS

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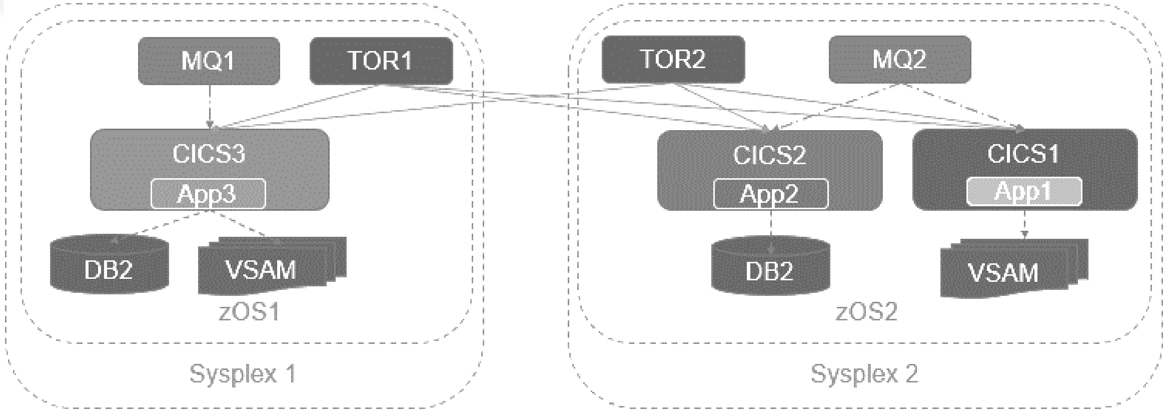
# INTRODUCTION: THE CHALLENGE

(What were we trying to do?)

# Implementing CICSPlex

- At SHARE Fort Worth 2020, we talked about a project where our client was moving three applications to CICSPlex.
- Each to have multiple CICS regions on different z/OS systems sharing incoming workloads.



# Implementing CICSPlex

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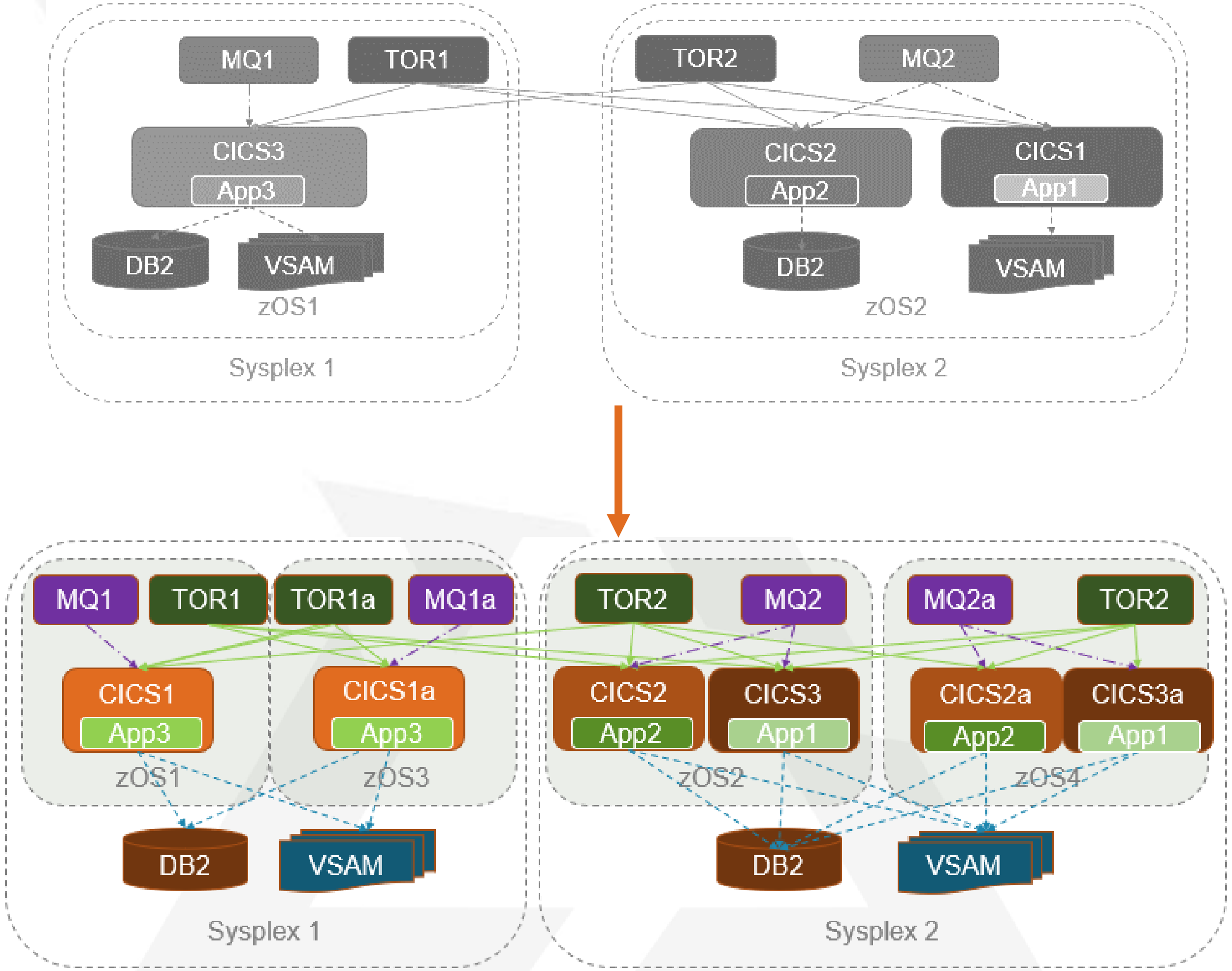
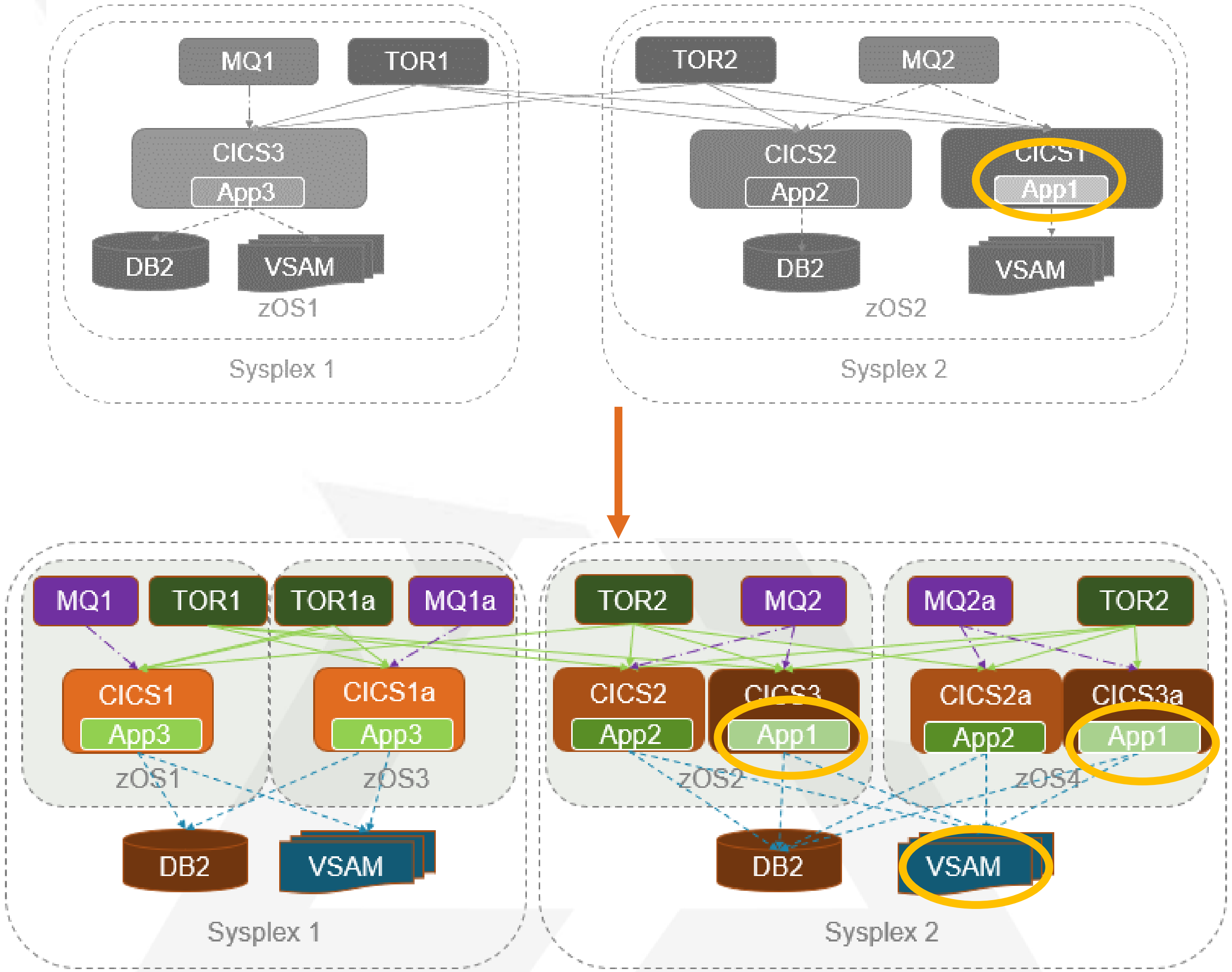
- Each to have multiple CICS regions on different z/OS systems sharing incoming workloads.



# Implementing CICSPlex

- One of these applications was a heavy VSAM user – needed to implement VSAM RLS
- That's what we will be covering today



# Application-Oriented Session

- This presentation is CICS application oriented.
- Will talk about decisions made, problems faced, and performance
- Will also include some CICS system issues

✓ VSAM Definitions

✓ CICS Application Problems

✓ CICS File Definitions

✓ Performance Issues

# Application-Oriented Session

- This presentation is CICS application oriented.
- Will talk about decisions made, problems faced, and performance
- Will also include some CICS system issues
- Not covering RLS infrastructure issues
  (nothing about SMSVSAM, coupling facility structures, SMF recording, IGDSMSxx parmlib etc.)

✓ VSAM Definitions

✓ CICS Application Problems

✓ CICS File Definitions

✓ Performance Issues

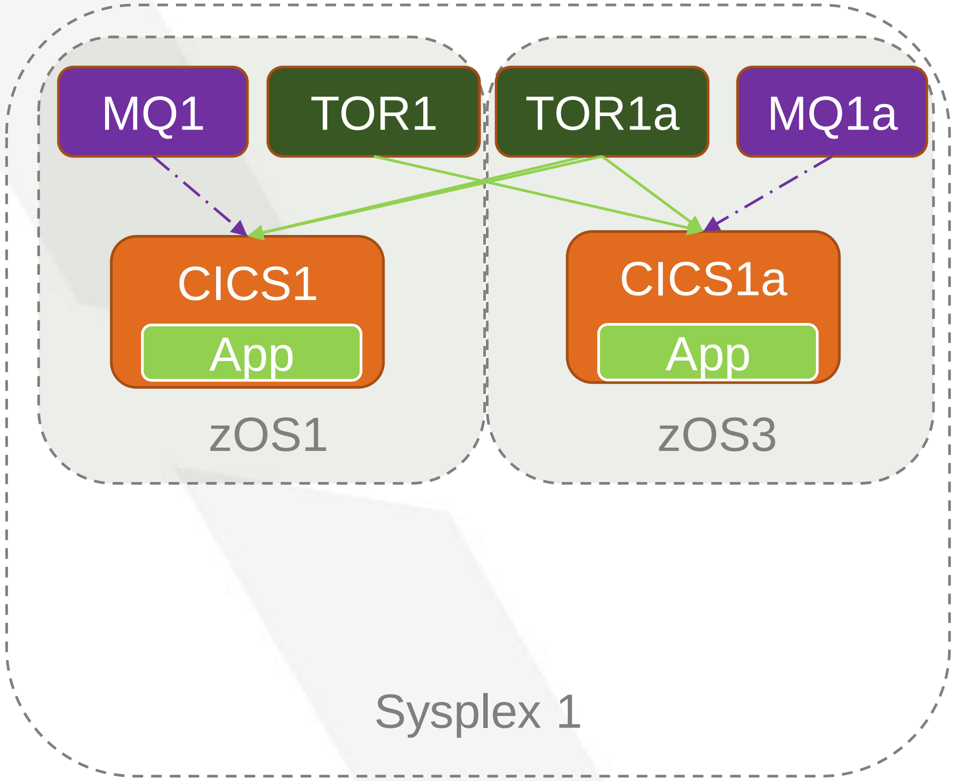
✗ ~~Coupling Facility Issues~~

✗ ~~Parmlib (IGDSMSxx)~~

✗ ~~Other z/OS System Issues~~

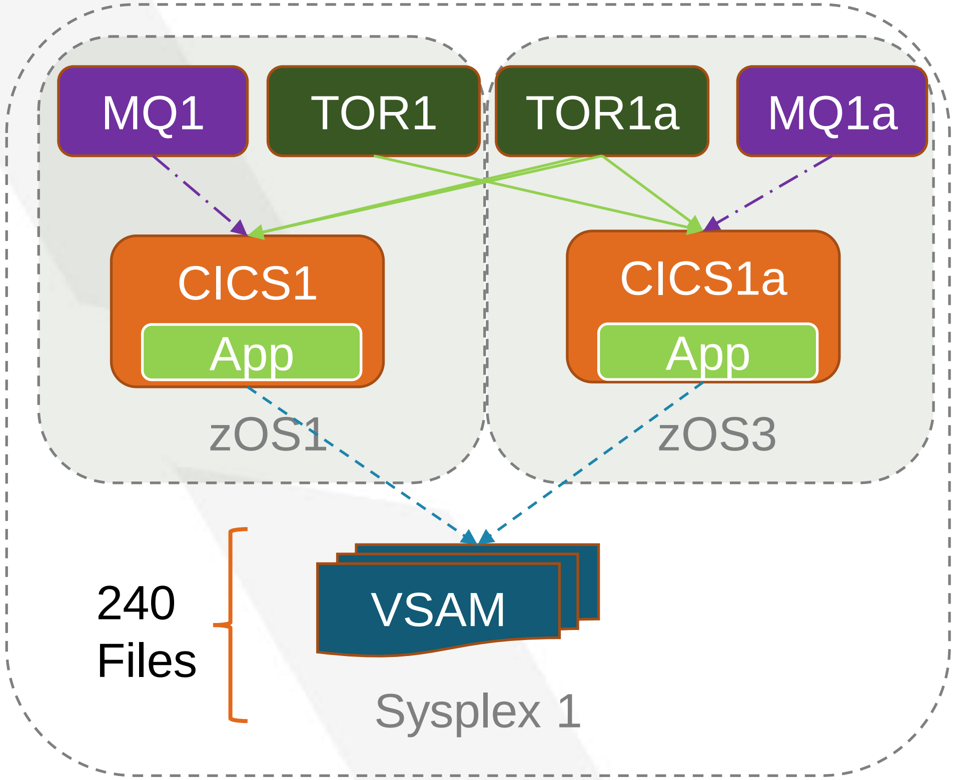
# Our Application

- COBOL, some Assembler
- Around 3000 CICS and batch programs
- Partially threadsafe
- Most traffic MQ, some 3270 and web services
- CICS TS 5.3, z/OS 2.3



# Our Application's Files

- 240 VSAM Files
- Most KSDS, some RRDS, ESDS
- Handful of IAM
- One CICS Managed Data Table



# PART 1: INITIAL ISSUES AND DECISIONS

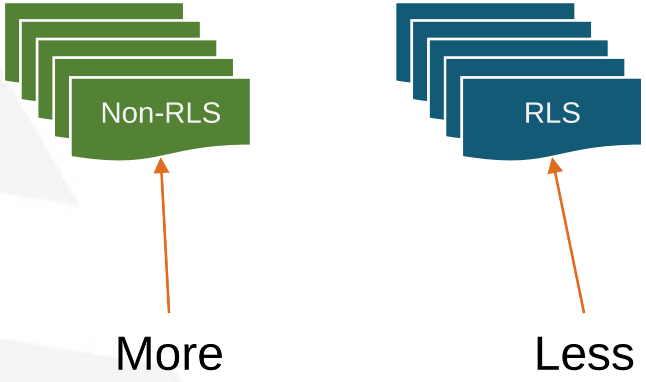
(Not all of them – just some of the more interesting)

# Decision 1: Only Some VSAM to RLS

Only files that must be RLS to be converted to RLS.

- Concerned about performance: less RLS = less performance risk.
- Wanted to minimize VSAM RLS overhead (smaller coupling facility structures, less buffers etc.)
- Less change = less chance of errors

- But how?



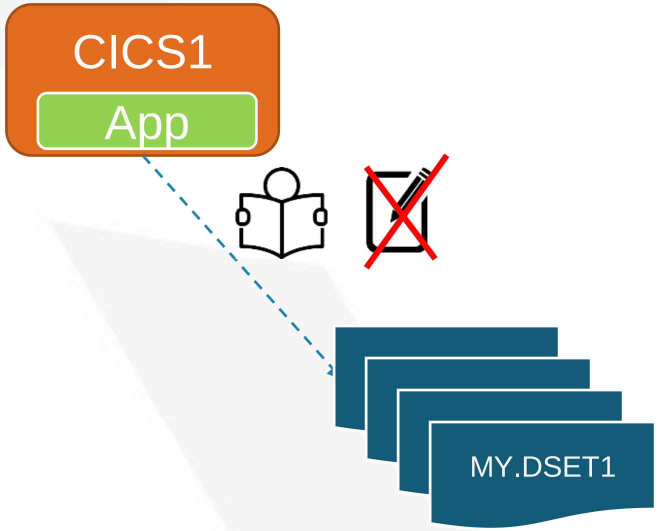
Less RLS

# Decision 1: Read-Only Datasets

- CICS statistics (SMF type 110 subtype 2) showed that some VSAM files were not updated in CICS

**SAS/MXG Code:**

```
Data T1;
Set PDB.CICFCR;
   WHERE A17BDSNM=:'HLQ' AND JOB='CICS1';
```

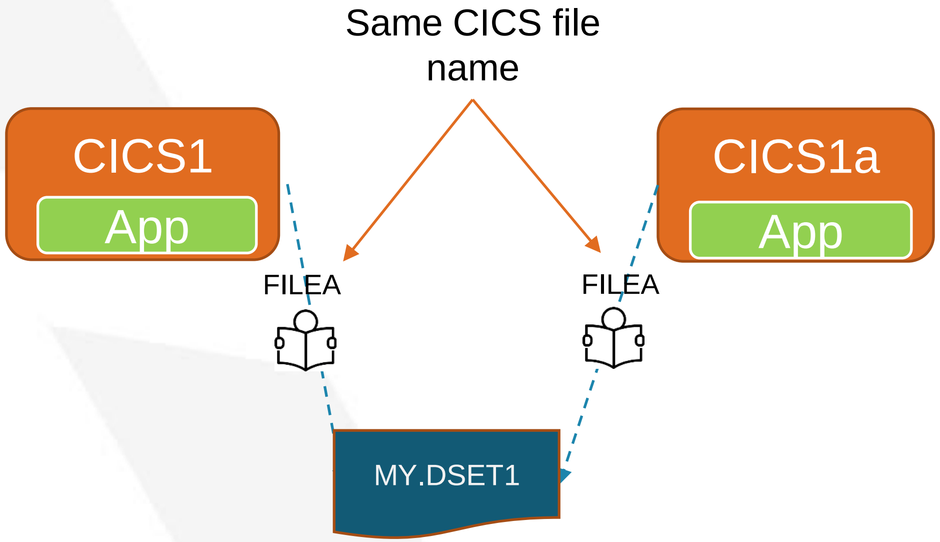


Less RLS

1. Read-only datasets

# Decision 1: Read-Only Datasets

- CICS statistics (SMF type 110 subtype 2) showed that some VSAM files were not updated in CICS
- Set these files to read-only in FCT, and left non-RLS
- Multiple CICS regions could now open each dataset (read-only)



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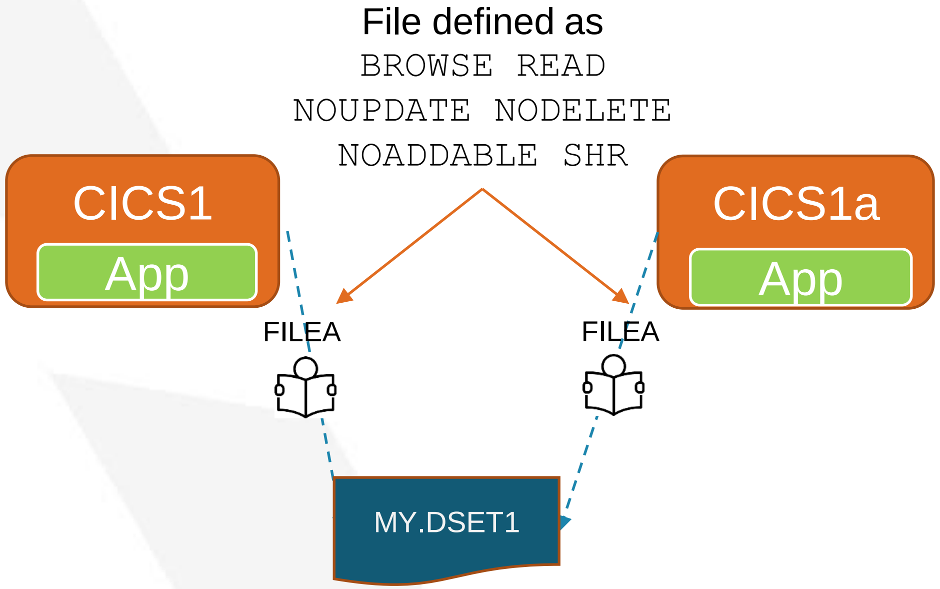

**Less RLS**

1. Read-only datasets

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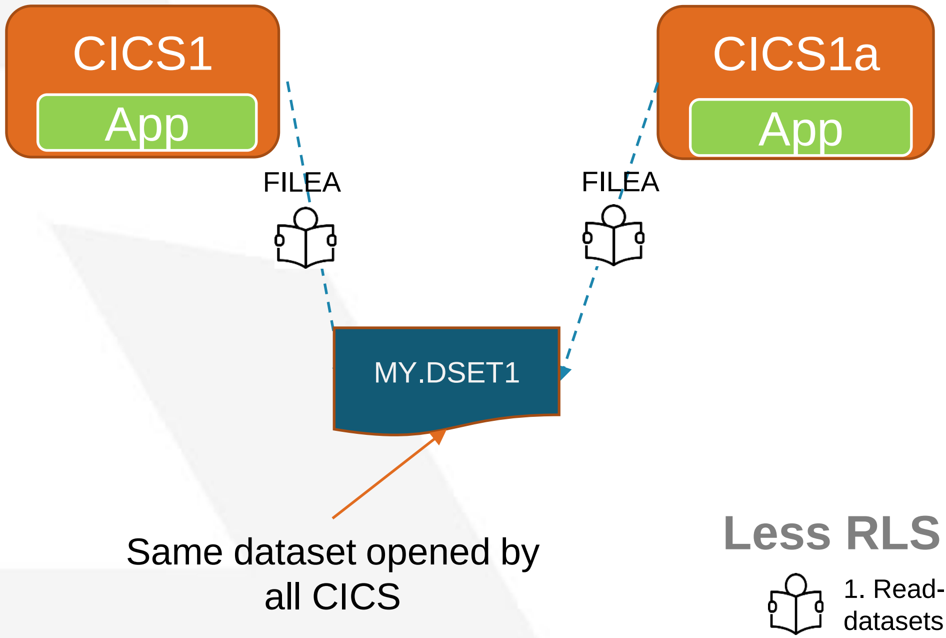


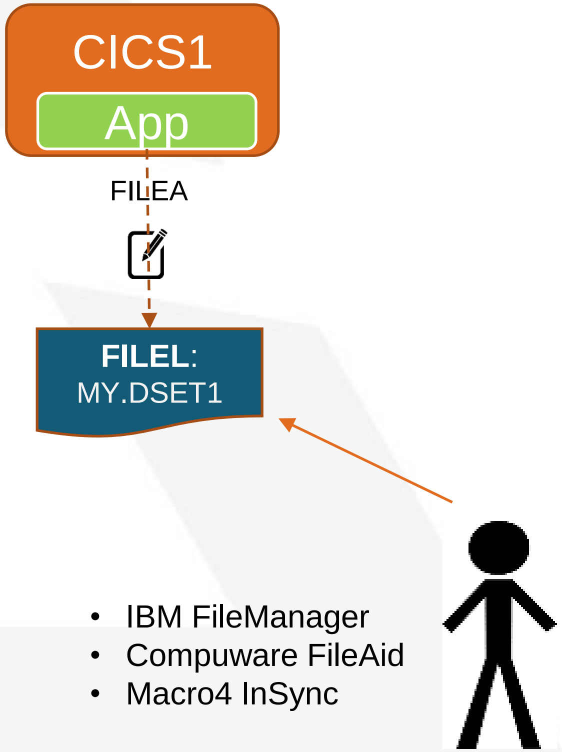
Same dataset opened by all CICS

**Less RLS**

1. Read-only datasets

# Decision 1: Logs

- Some VSAM files were log files:
  - CICS programs insert records
  - Users browse files using ISPF VSAM browse utility.



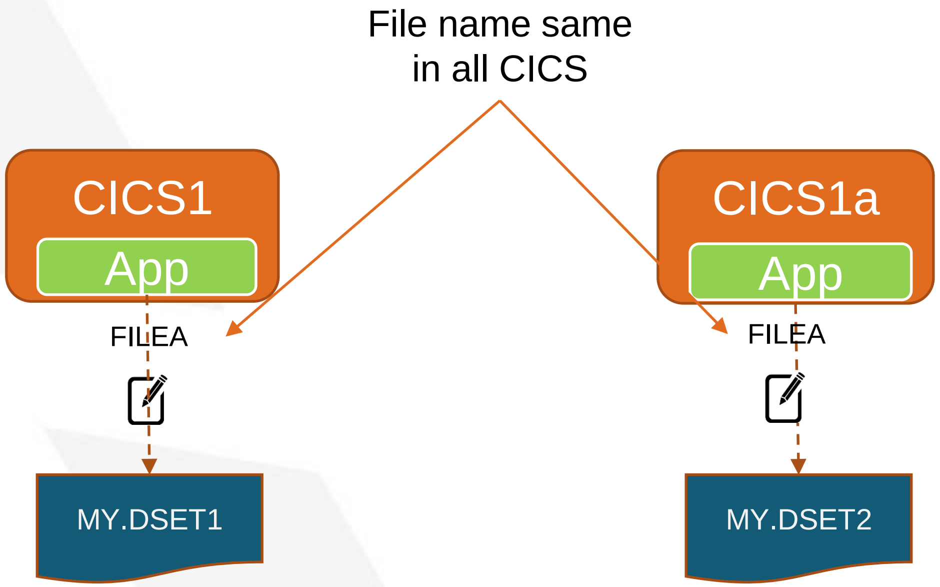
- IBM FileManager
- Compuware FileAid
- Macro4 InSync

Less RLS

1. Read-only datasets
2. Logs

# Decision 1: Logs

- Different VSAM dataset name for each CICS region.
- Same CICS File name for each CICS region



Less RLS

1. Read-only datasets
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# Decision 1: Logs

- Different VSAM dataset name for each CICS region.
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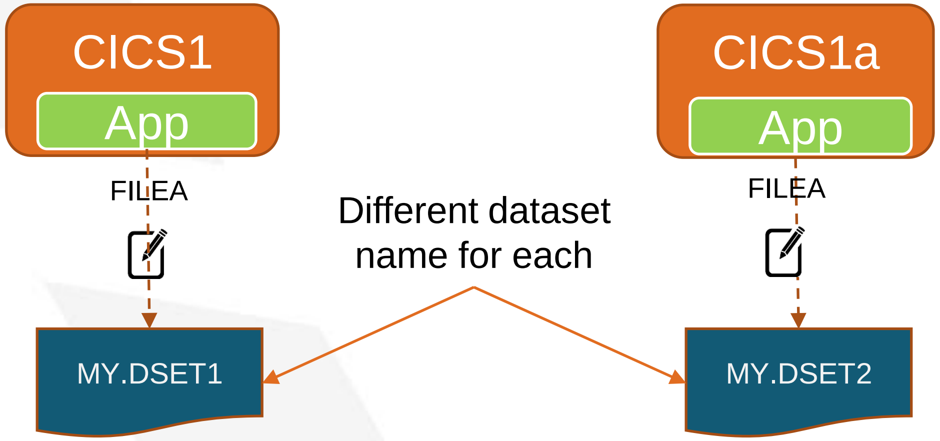
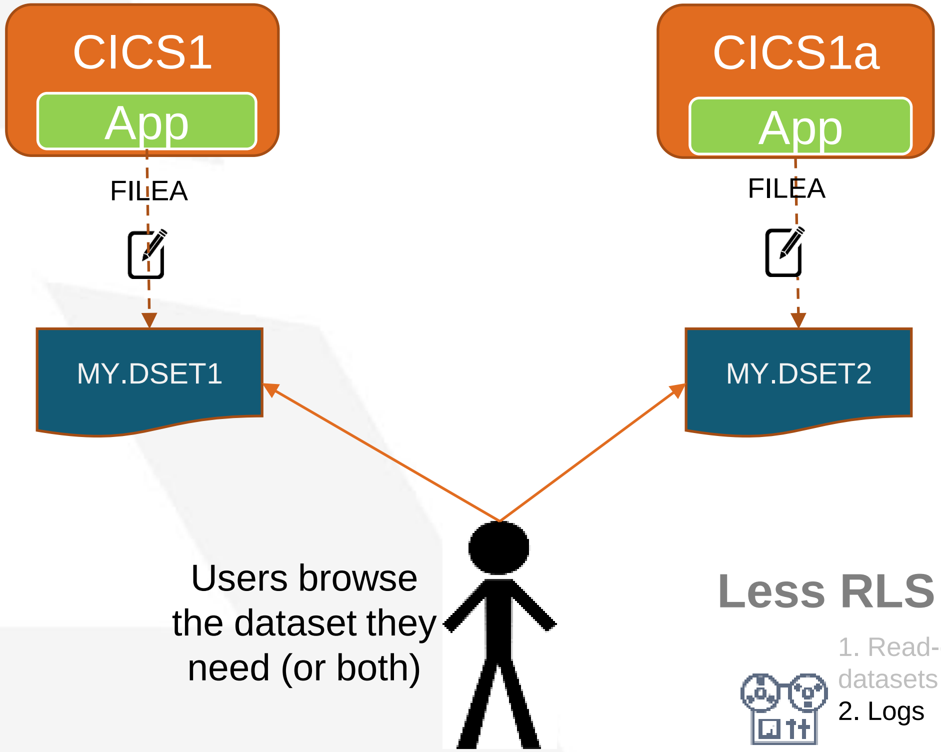


**Less RLS**

1. Read-only datasets
2. Logs

# Decision 1: Logs

- Different VSAM dataset name for each CICS region.
- Same CICS File name for each CICS region



Less RLS

1. Read-only datasets
2. Logs

# Decision 1: Unused

- Used CICS statistics (SMF 110 subtype 2) to identify datasets that had no use for an eight week period.
- Confirmed with application teams that these were no longer required.
- These were decommissioned (easier than converting to RLS).

**SAS/MXG Code:**

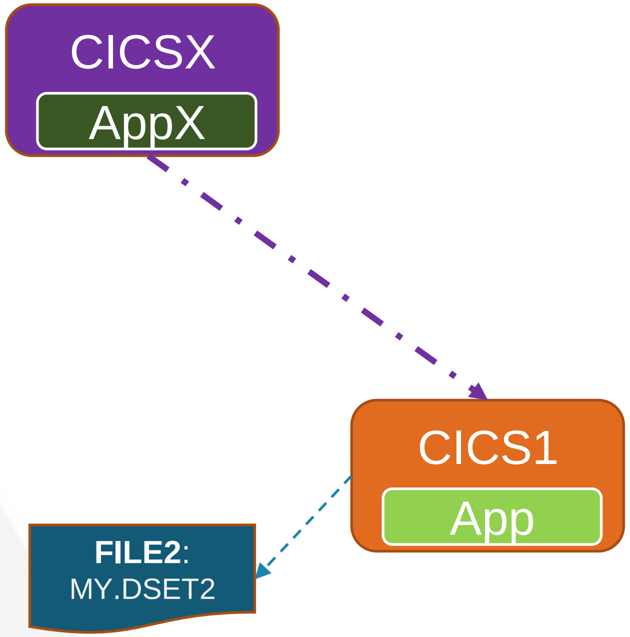
```
Data T1;
Set PDB.CICFCR;
   WHERE A17BDSNM=:'HLQ' AND JOB='CICS1';
```

Less RLS

1. Read-only datasets
2. Logs
3. Unused

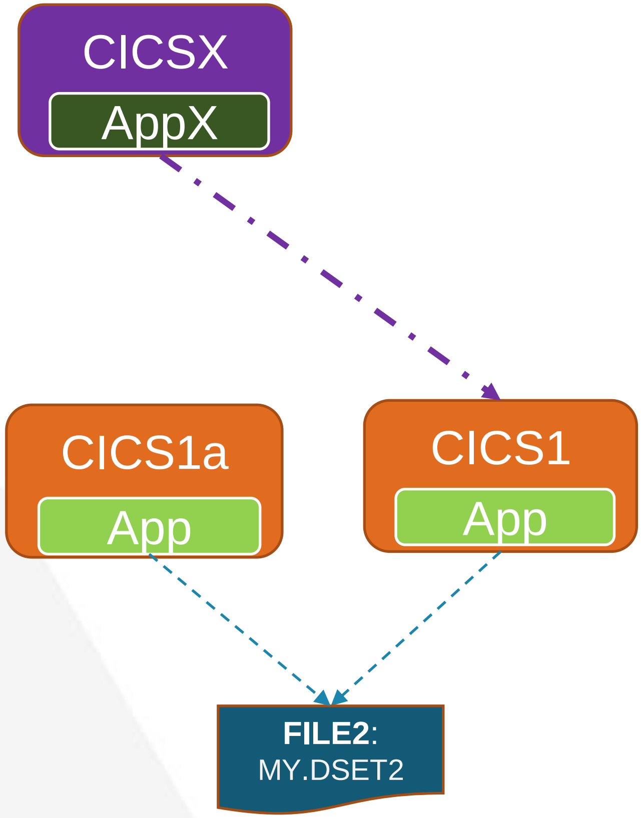
# Decision 2: External Application Access

- CICS applications from external CICS regions access some VSAM datasets using CICS function shipping.



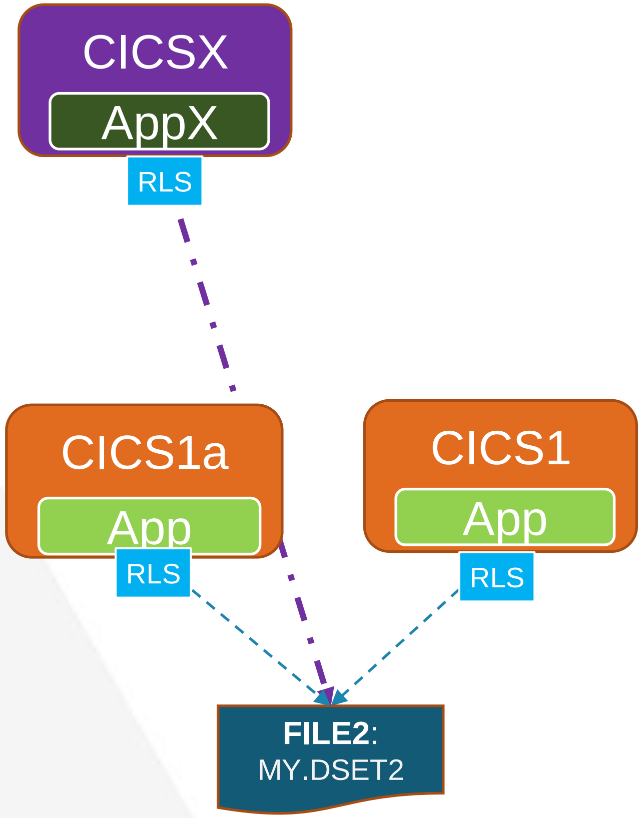
# Decision 2: External Application Access

- CICS applications from external CICS regions access some VSAM datasets.
- Choices:
  - Leave as is (external application gets no resilience benefit from CICSPlex)



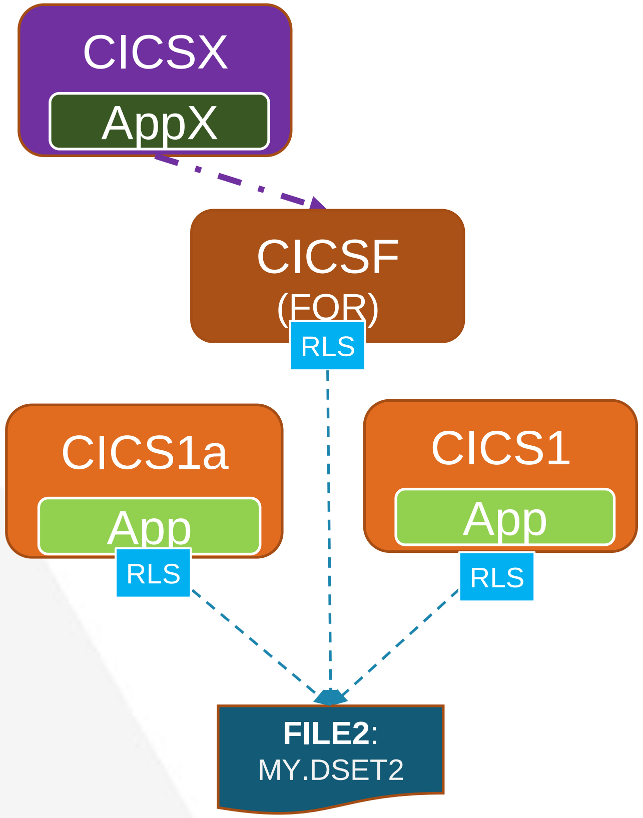
# Decision 2: External Application Access

- CICS applications from external CICS regions access some VSAM datasets.
- Choices:
  - Leave as is
  - All external CICS to use RLS (won't work for applications in another parallel Sysplex)



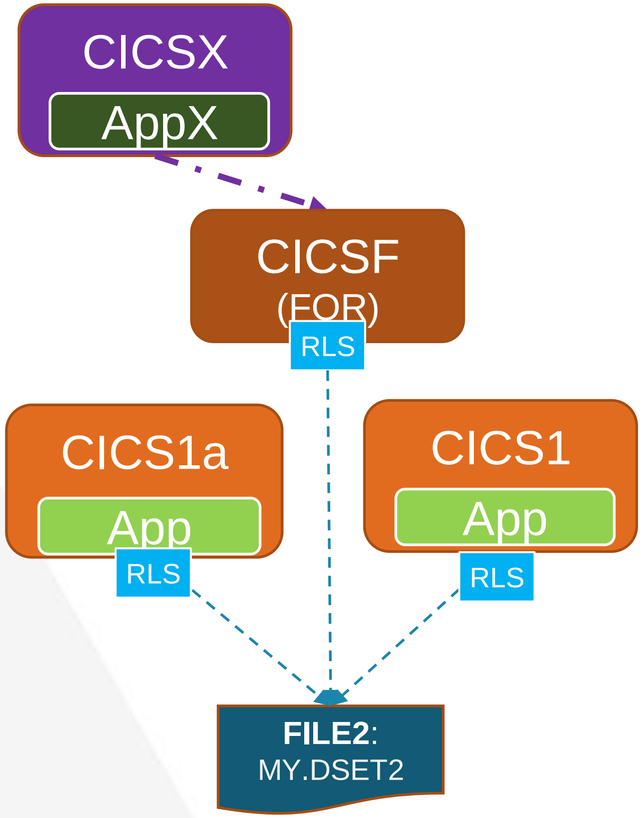
# Decision 2: External Application Access

- CICS applications from external CICS regions access some VSAM datasets.
- Choices:
  - Leave as is
  - All external applications to use RLS
  - Use an FOR



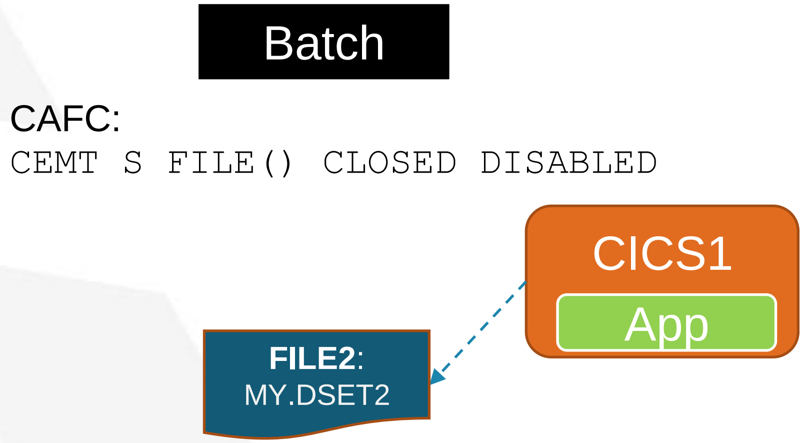
# Decision 2: Use a File Owning Region

- Decided to use an FOR
- Advantages:
  - No need to worry about external applications if closing RLS file for batch
  - Works for applications in different sysplexes
  - Some resilience benefit: less chance of FOR failing, FOR restarts faster.
- Disadvantages:
  - Not as resilient as using RLS



# Decision 3: Batch Access

- Batch accessed VSAM datasets.
- Previously, files were closed from batch jobs (using SDS CAFC)



CAFC:

```
CEMT S FILE() CLOSED DISABLED
```

# Decision 3: Batch Access

- Batch accessed VSAM datasets.
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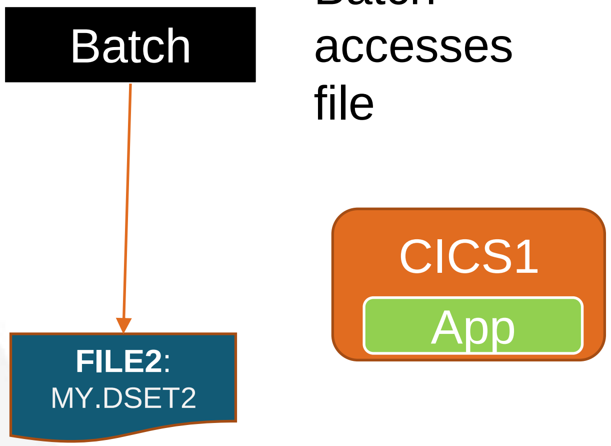

Batch accesses file

# Decision 3: Batch Access

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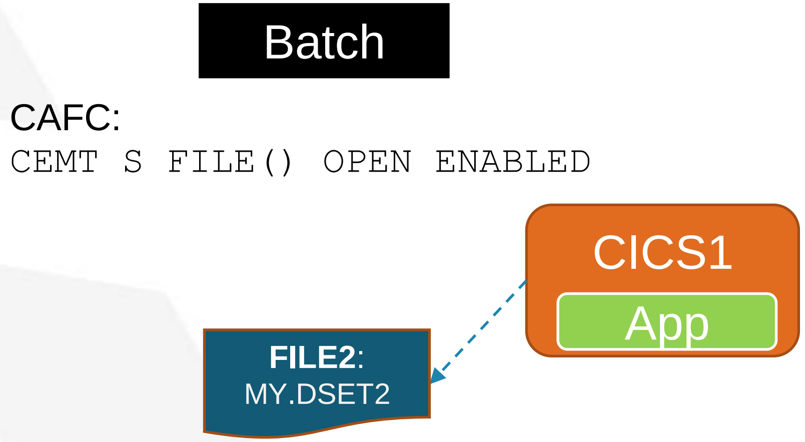

CAFC:

```
CEMT S FILE() OPEN ENABLED
```

# Decision 3: Batch Access

- Batch accessed VSAM datasets.
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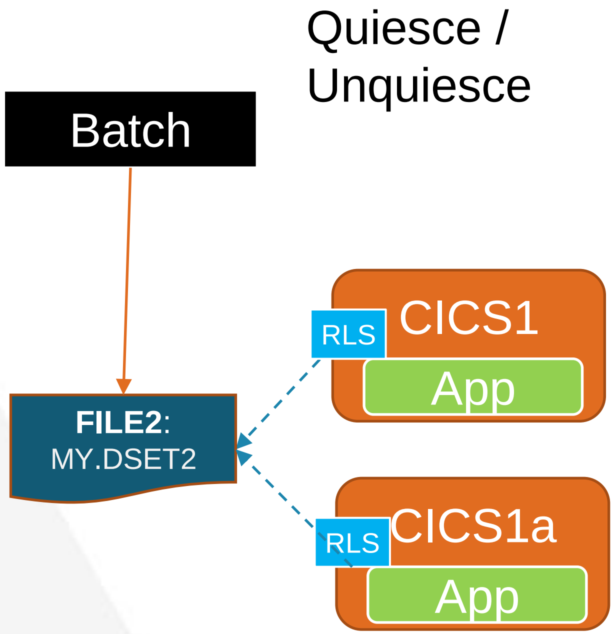
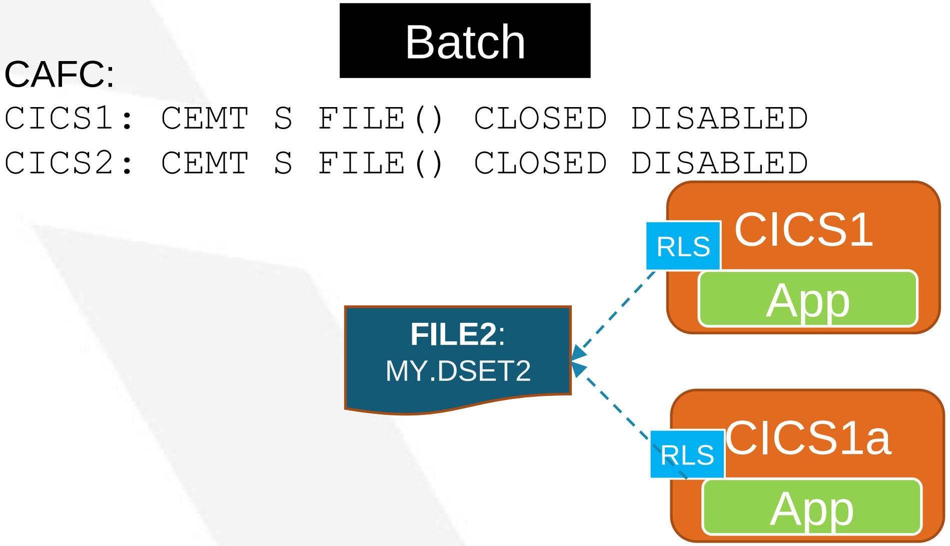
- RLS Options:
  - Perform RLS Quiesce before processing. RLS Unquiesce after processing.



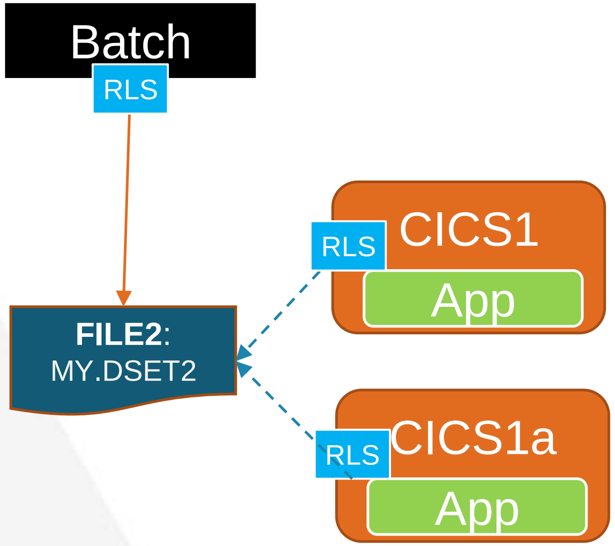
# Decision 3: Batch Access

- Batch accessed VSAM datasets.
- Previously, files were closed from batch job using CAFC
- RLS Options:
  - Perform RLS Quiesce, batch access, RLS Unquiesce
  - Close CICS files to all regions before processing, open them after


Batch
CAFC:
CICS1: CEMT S FILE() CLOSED DISABLED
CICS2: CEMT S FILE() CLOSED DISABLED
FILE2: MY.DSET2
RLS
CICS1
App
RLS
CICS1a
App

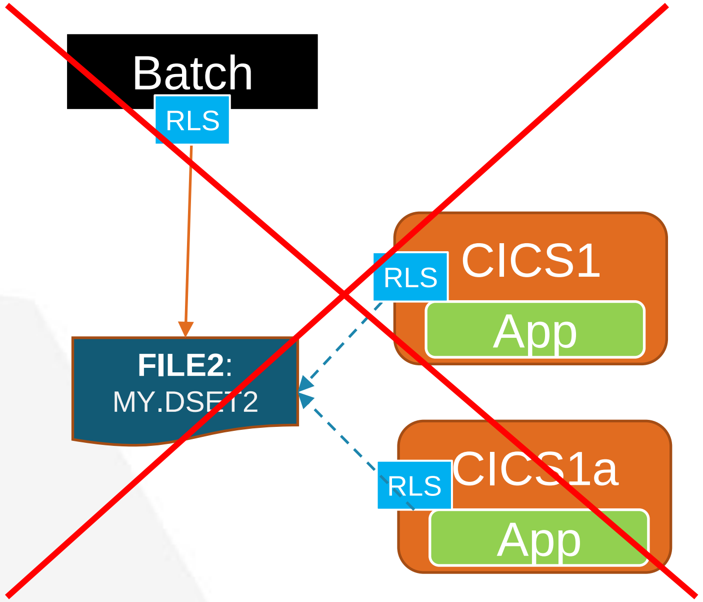
# Decision 3: Batch Access

- Batch accessed VSAM datasets.
- Previously, files were closed from batch job using CAFC
- RLS Options:
  - Perform RLS Quiesce, batch access, RLS Unquiesce
  - Close CICS files to all regions before processing, open them after
  - Access files in RLS mode from batch



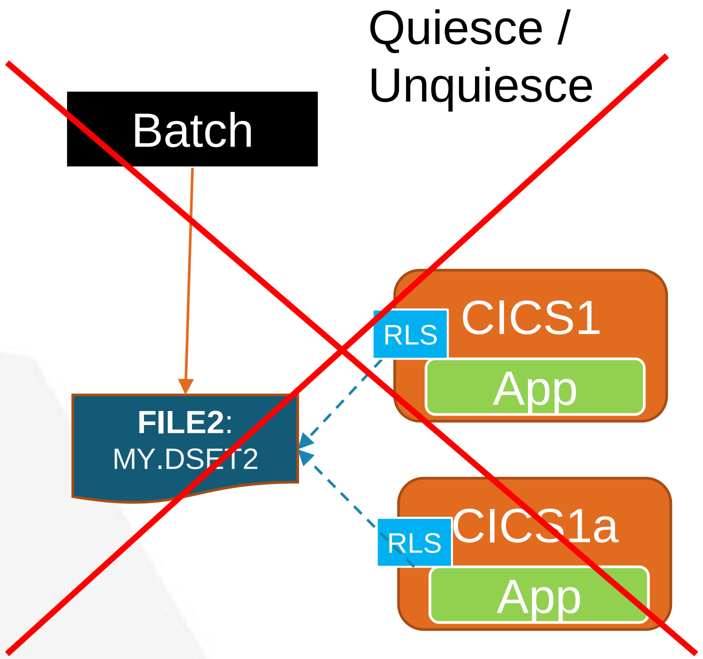
# Decision 3: Batch Access Issues

- Decided not to use RLS for batch read access:
  - Too much work – lots of batch
  - More risk – all batch must go RLS at the same time as CICS.
  - Cannot update from batch without DFSMStvs
  - Can be revisited later.



# Decision 3: Batch Access Issues

- Concerned about RLS Quiesce:
  - Quiesce must wait for all address spaces with dataset open to respond
  - Unquiesce must wait for all address spaces registered with RLS in Sysplex to respond
  - Unquiesce does not re-open CICS files, just enables them (had processing that enquired if file is open or not)



# Decision 3: Batch Access Decision

- Every batch job closes file in all CICS regions, performs processing, and then re-opens them.
- CPSM Batch interface to open/close files
- One CPSM scope to include all CICS regions opening file as RLS (including FOR)

**JCL**

```
//TSO    EXEC  PGM=IKJEFT01
//STEPLIB  DD  DISP=SHR,DSN=CICS.SEYUAUTH
//         DD  DISP=SHR,DSN=CICS.SEYULOAD
//*
//SYSTSPRT DD  SYSOUT=*
//SYSPROC  DD  DISP=SHR,DSN=REXX.SOURCE.DSET
//SYSTSIN  DD  *
  %CPSMFILE PLEX SCOPE FILE C
```

**REXX CPSMFILE** (only small part)

```
            ….
W_PARM = 'BUSY(WAIT)'
W_PARMLEN = LENGTH(W_PARM)
W_CRITERIA = 'FILE = '||filename||'.'
W_CRITERIALEN = LENGTH(W_CRITERIA)
XX = EYUAPI('PERFORM OBJECT('OBJECT('W_RESOUCE')' ,
            'ACTION(CLOSE)' ,
            'CRITERIA(W_CRITERIA)' ,
            'LENGTH('W_CRITERIALEN')' ,
            'PARM(W_CRITERIA)' ,
            'PARMLENGTH('W_CRITERIALEN')' ,
            'RESULT(W_RESULT)' ,
            'THREAD(W_THREAD)' ,
            'RESPONSE(W-RESPONSE)' ,
            'REASON(W_REASON)’
```

# Decision 4: Implement in Four Steps

RLS was new to client, so they were hesitant to move to RLS.

Decided to implement RLS in four steps for each file:

Before converting, SIT parms:

- `RLS=YES` – enable RLS
- `NONRLSRECOV=VSAMCAT` – recovery options from catalog if specified
- `FTIMEOUT=30` – RLS file timeout of 30 seconds

# Decision 4: Implement in Four Steps

RLS was new to client, so they were hesitant to move to RLS.

Decided to implement RLS in three steps for each file:

- Step 1: Change file DEFINE CLUSTER definitions: make RLS Ready

```
DEFINE CLUSTER( -
   NAME(VSAM.DSET) -
   LOG(ALL) –
   LOGSTREAMID(FWD_LS_MVS1)
   STORAGECLASS(SC_RLS) –
   DATACLASS(SC_RLS) )
```

# Decision 4: Implement in Four Steps

RLS was new to client, so they were hesitant to move to RLS.

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- Step 1: Change file DEFINE CLUSTER definitions: make RLS Ready
- Step 2: CICS FCT change in current CICS region

**CICS1:**

```
DEFINE FILE(FILE1)
    DSNAME(MY.DSET1)
    RLSACCESS(YES)
    READINTEG(UNCOMMITTED)
```

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Decided to implement RLS in three steps for each file:

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- Step3: Batch changes to open/close files using CPSM.

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//STEPLIB   DD  DISP=SHR,DSN=CICS.SEYUAUTH
//          DD  DISP=SHR,DSN=CICS.SEYULOAD
//*
//SYSTSPRT DD   SYSOUT=*
//SYSPROC   DD  DISP=SHR,DSN=REXX.SOURCE.DSET
//SYSTSIN   DD  *
  %CPSMFILE PLEX SCOPE FILE C
```

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RLS was new to client, so they were hesitant to move to RLS.

Decided to implement RLS in three steps for each file:

- Step 1: Change file DEFINE CLUSTER definitions: make RLS Ready
- Step 2: CICS FCT change in current CICS region
- Step3: Batch changes to open/close files using CPSM.
- Step 4: Define files to other CICS regions

**CICS1a:**

```
DEFINE FILE(FILE1)
   DSNAME(MY.DSET1)
   RLSACCESS(YES)
   READINTEG(UNCOMMITTED)
```

**FOR:**

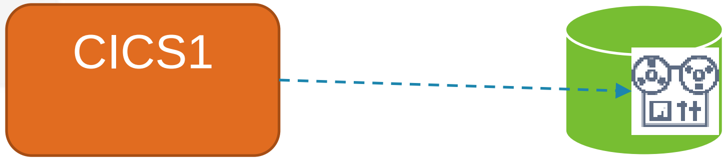
```
DEFINE FILE(FILE1)
   DSNAME(MY.DSET1)
   RLSACCESS(YES)
   READINTEG(UNCOMMITED)
```

# PART 2: EXPECTED ISSUES FOUND

(The ones we knew about before they happened)

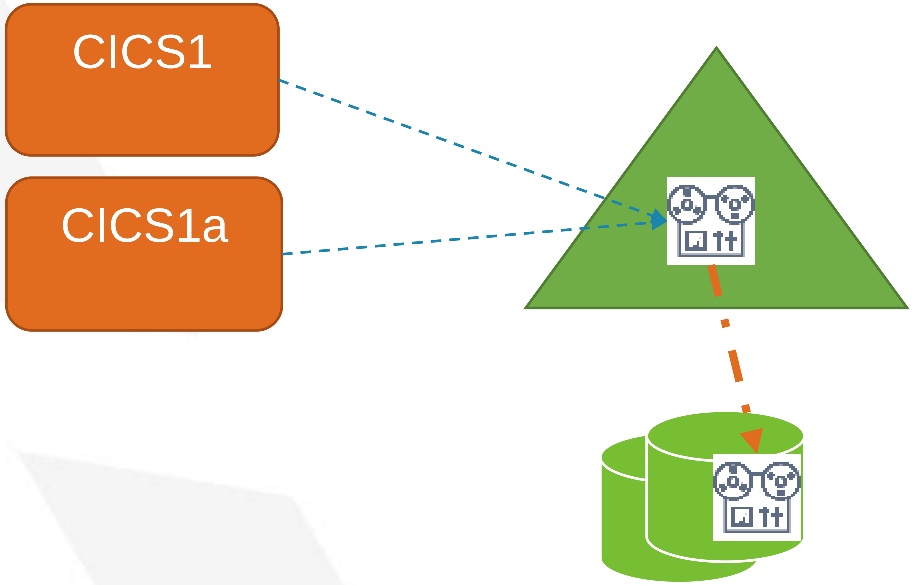
# Issue 1: Forward Recovery

- Used BMC Recovery Utility for VSAM for backup/recovery. This uses a CICS journal for forward recovery.
- Forward recovery journal was a DASD-only logstream.
- With multiple CICS regions updating file, need to accumulate journal records for recovery.



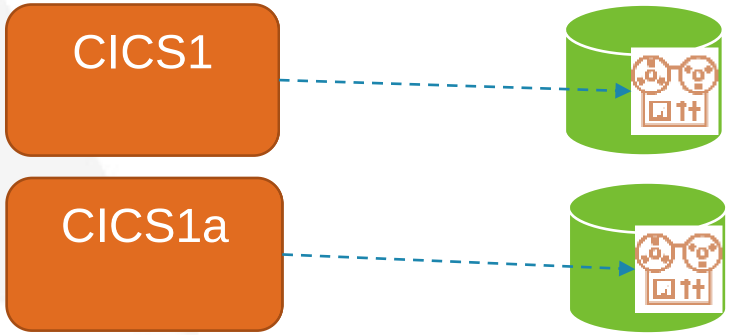
# Issue 1: Forward Recovery

- Solution: coupling facility logstream shared by all CICS regions.
- Separate logstream for each application
- Logstream duplexed for offsite recovery
  (DASD is replicated to DR site, coupling facility is not)



# Issue 1: Forward Recovery

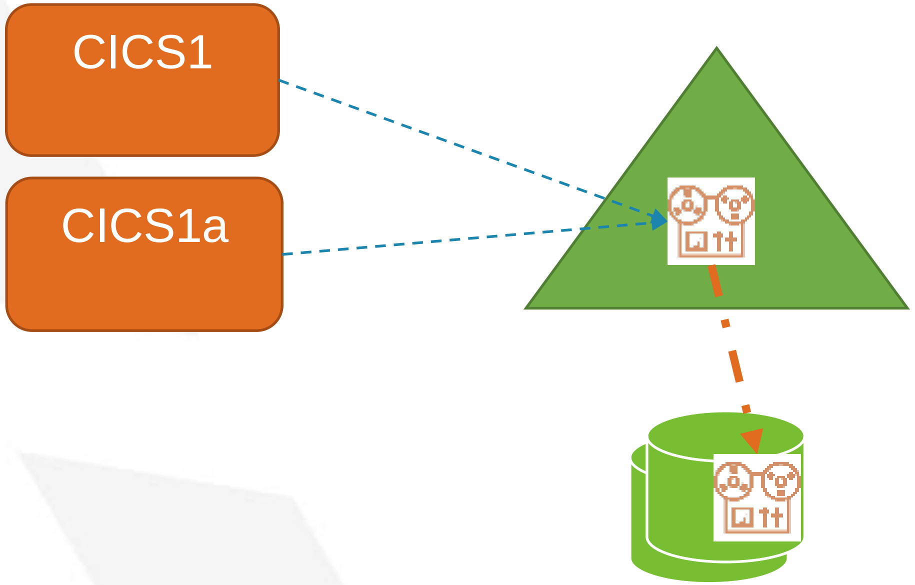
- BMC RUV uses the ‘Log of Logs’ (DFHLGLOG) for recovery.
- Initially, every CICS region had its own DASD-only logstream for the log of logs.
- BMC RUV needs one Log of Logs.



# Issue 1: Forward Recovery

- BMC RUV uses the ‘Log of Logs’ (DFHLGLOG) for recovery.
- Initially, every CICS region had its own DASD-only logstream for the log of logs.
- BMC RUV needs one Log of Logs.

- Solution: all CICS regions in Parallel Sysplex to share a common Coupling Facility logstream for Log of Logs
- Duplexed to DASD for offsite recovery



# Issue 2: Recovery Options

- Recovery options were specified in the CICS FCT definition

```
DEFINE FILE(FILE1)
   DSNAME(MY.DSET1)
   RECOVERY(ALL)
   FWDRECOVLOG(1))
```

# Issue 2: Recovery Options

- Recovery options were specified in the CICS FCT file
- With RLS, this needs to be defined to the VSAM dataset (DEFINE CLUSTER, or ALTER CLUSTER).
- Was not specified on data class: applications needed to specify.

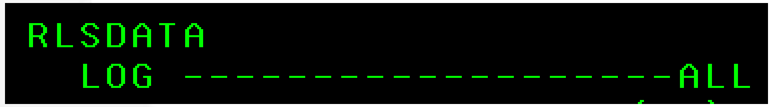
```
DEFINE CLUSTER( -
    NAME(VSAM.DSET) -
    LOG(ALL) -
    LOGSTREAMID(FWD_LS_PLX1)-
    STORAGECLASS(SC_RLS) -
    DATACLASS(SC_RLS) )
```

**IBM CICS Documentation:**

The recovery options on the CICS® file resource definitions (RECOVERY, FWDRECOVLOG, and BACKUPTYPE) are ignored if the file definition specifies RLS access..

# Issue 2: Recovery Options

- There is no default LOG setting. Must be specified.
- If specified, LISTCAT shows setting - nice

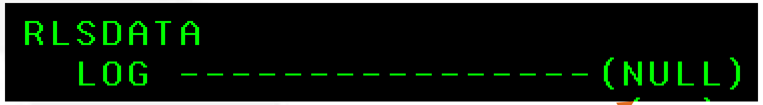


```
RLSDATA
  LOG -------------------ALL
```

# Issue 2: Recovery Options

- There is no default LOG setting. Must be specified.
- If specified, LISTCAT shows setting - nice
- Applications sometimes were confused by `(NULL)` shown if LOG not specified, and that this isn't the same as `NONE` (and won't work with RLS).

**IBM Documentation:**
If you do not specify LOG, RLS cannot access the data set.



```
RLSDATA
  LOG -----------------(NULL)
```

Not set: can't be done for RLS

# Issue 3: Shareoptions

- Some VSAM datasets were defined with SHAREOPTIONS(3,x). So batch jobs could update while VSAM open to CICS.
- If files opened by CICS in RLS mode, this won’t work – batch jobs won’t be able to update file.
- Must use DFSMStvs to update a dataset in batch that is opened in RLS mode elsewhere

CICS tells us about SHAREOPTIONS(3,x) or (4,x):

```
DFHFC0970 CICS1
Recoverable non-RLS file FILE1 opened with VSAM SHROPT 3 or 4.
CICS cannot ensure integrity.
```

# Issue 3: Shareoptions

- Solution: investigate reason for SHAREOPTIONS(3,x), change to (2,x).
- In our case, none of the datasets needed to have SHAREOPTIONS(3,x)

If only reading a dataset from batch, could use RLS.

# Issue 4: CICS Managed Data Tables

- Used CICS Managed Data Tables (CMDT) for performance.
- Not possible with VSAM RLS.
- Could not use User Managed Data Tables (UDT) – files sometimes updated in CICS

# Issue 4: CICS Managed Data Tables

- Used CICS Managed Data Tables (CMDT) for performance.
- Not possible with VSAM RLS.
- Could not use User Managed Data Tables (UDT) – files sometimes updated in CICS
- Solution: VSAM used as 'normal' files.

Average Response Time:

- CMDT: 0.002 milliseconds
- VSAM RLS: 0.011 milliseconds

# Issue 5: ESDS

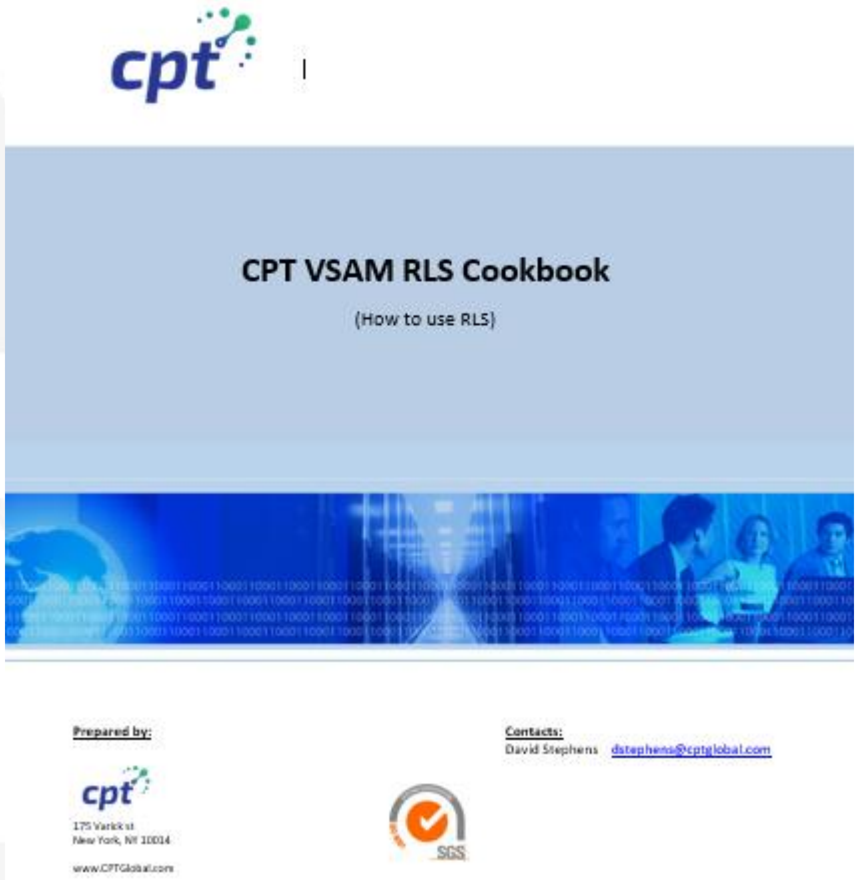
- Some files were ESDS
- Can define ESDS as RLS, but not a good idea.
- Solution: either
  - Convert to KSDS/RRDS
  - One ESDS per CICS (no RLS)

**IBM CICS Documentation:**

Using RLS with entry-sequenced data sets (ESDS) can have a negative effect on the availability of the data set when you are adding records using multiple tasks from multiple regions. This is because adding a record requires an exclusive add-to-end lock in order to perform the write. **If a CICS region fails while writing to an ESDS, the data set might be locked until the CICS region is restarted.**

# Issue 5a: ESDS After Project

- After project, an RLS ESDS dataset ‘crept in’ to production.
- Application education was an issue. Lots of new technology for applications to learn (RLS, CICSPlex, shared MQ queues and more)
- Created a ‘cookbook’ explaining RLS.



CPT VSAM RLS Cookbook

(How to use RLS)

**Prepared by:**

175 Varick st
New York, NY 10014

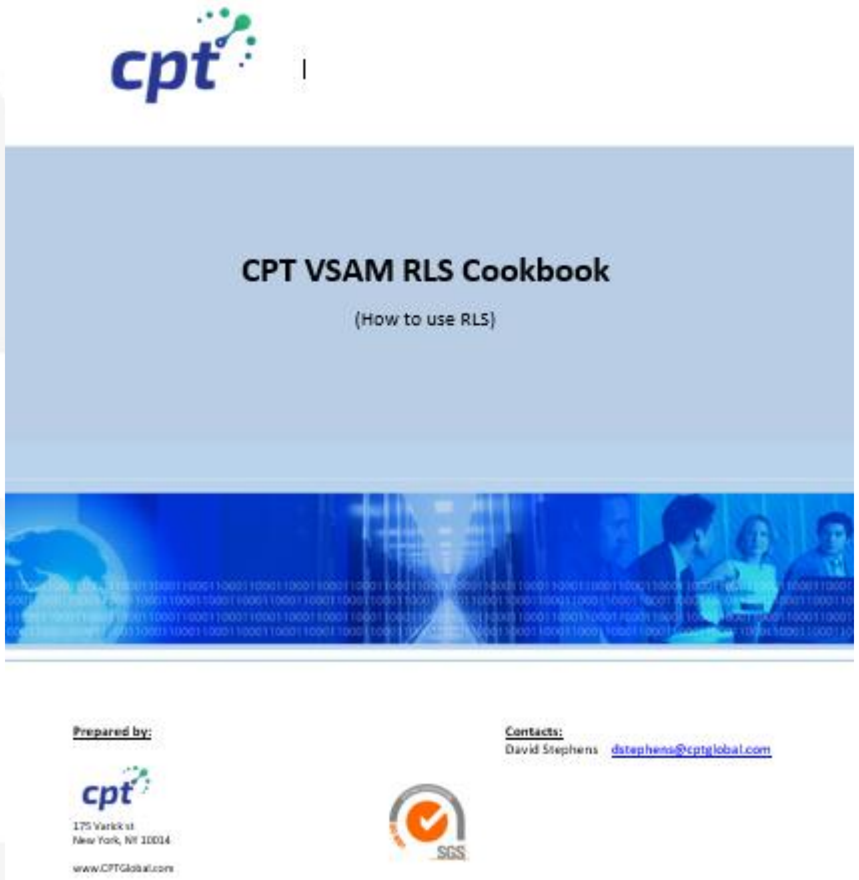
www.CPTGlobal.com

**Contacts:**
David Stephens dstephens@cptglobal.com

# Issue 5a: ESDS After Project

- After project, an RLS ESDS dataset ‘crept in’ to production.
- Application education was an issue. Lots of new technology for applications to learn (RLS, CICSPlex, shared MQ queues and more)
- Created a ‘cookbook’ explaining RLS..

- Even after the project, possible for applications to make ‘mistakes.’
- Solution: application was reminded about problems with ESDS and RLS.



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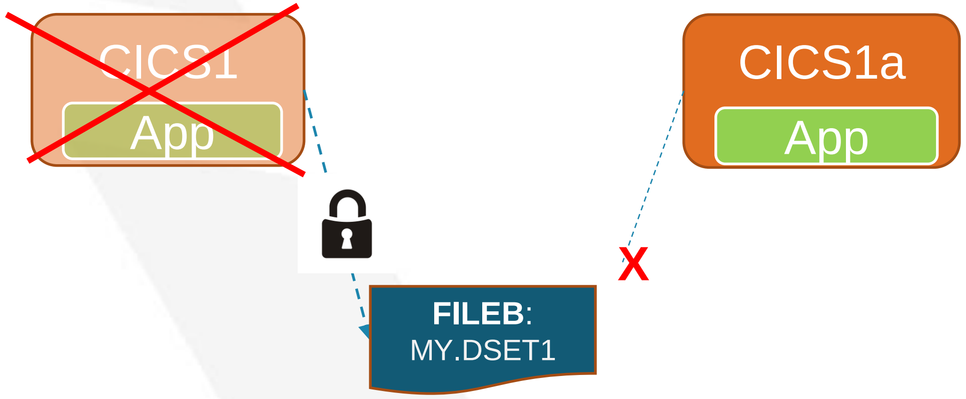
# Issue 6: Retained Locks

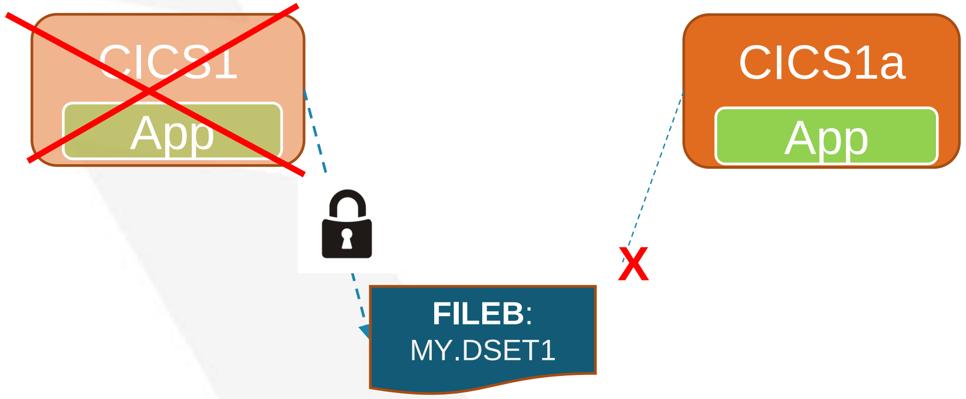
- We are implementing CICSPlex for additional resilience.
- But what happens if a CICS region falls hard – and there is a retained RLS lock?



# Issue 6: Retained Locks

- We are implementing CICSPlex for additional resilience.
- But what happens if a CICS region falls hard – retained RLS lock?

- Unable to reproduce in testing (yes, we crashed a few CICS regions in test).
- Solution: change operations procedures to restart a failing CICS region ASAP on any available z/OS system in Sysplex.



# PART 2: UNEXPECTED ISSUES FOUND

(The ones that we didn’t know about until they happened)

# Issue 7: Rules Enforced with RLS

- Some programs coded:

```
EXEC CICS READ FILE() UPDATE RIDFLD()
EXEC CICS DELETE FILE() RIDFLD()
```

- Although not permitted, works with non-RLS VSAM. Fails with RLS.

```
EXEC CICS READ FILE()
UPDATE RIDFLD()

EXEC CICS DELETE
FILE() RIDFLD()
```

✓ Non-RLS: OK

⚠ RLS: Fails

**IBM Documentation: DELETE Command**:

You can also use this command to delete a single record that has previously been retrieved for update (by a READ UPDATE command). **In this case, you must not specify the RIDFLD option.**

# Issue 7: Rules Enforced with RLS

- Some programs coded:

```
EXEC CICS READ FILE() UPDATE RIDFLD()
EXEC CICS DELETE FILE() RIDFLD()
```

- Although not permitted, works with non-RLS VSAM. Fails with RLS.
- Solution: One of
  - Remove RIDFLD parameter of DELETE
  - Issue EXEC CICS UNLOCK FILE() command before DELETE
  - Remove READ command before DELETE
- Scanned application code to find all occurrences, and resolved.

```
EXEC CICS READ FILE()
UPDATE RIDFLD()

EXEC CICS DELETE
FILE() ~~RIDFLD()~~
```

# Issue 8: AFCK Abends

- Application used BMC Recovery Utility for VSAM + IBM FlashCopy to backup a VSAM dataset open to CICS.
- Non-RLS: OK
- RLS: AFCK (write attempt to file locked by DFSMSdss) abends

**CICS Messages for RLS:**

```
19:41.12 DFHFC6039 CICS has been invoked by VSAM
RLS to process a backup of dataset APP.DSET1
```

*(applications get AFCK abends)*

```
19:41.28 DFHFC6039 CICS has been notified of the
completion of CICS processing for a quiesce or
backup of data set APP.DSET1
```

# Issue 8: AFCK Abends

Why?

1. BMC RUV is calling DFSMSdss to perform IBM FlashCopy

# Issue 8: AFCK Abends

Why?

1. BMC RUV is calling DFSMSdss to perform IBM FlashCopy
2. DFSMSdss performs RLS QUIESCE when performing backup of RLS dataset.

**IBM CICS Documentation:**

**Non-BWO data set backup start**

A quiesce interface function initiated by DFSMSdss in readiness for non-BWO backup processing for a data set that is open in RLS mode. This function prevents CICS file control issuing RLS update requests against a sphere so that the VSAM sphere can be backed up.

# Issue 8: AFCK Abends - Solution

- Modified programs to handle AFCK abends
- If get AFCK, retry after 1 second up to 20 times.
- If still get AFCK, abend transaction.

# Issue 8a: AFCK Abends - Gotcha

- Many programs waiting / getting AFCK abends for one minute

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- Many programs waiting / getting AFCK abends for one minute

Why?

- A CICS transaction performed:
  - EXEC CICS WRITE FILE
  - *(no EXEC CICS SYNCPOINT)*
  - MQ Getwait
  - Exit
- Transaction held RLS lock during MQ Getwait (for up to 1 minute)

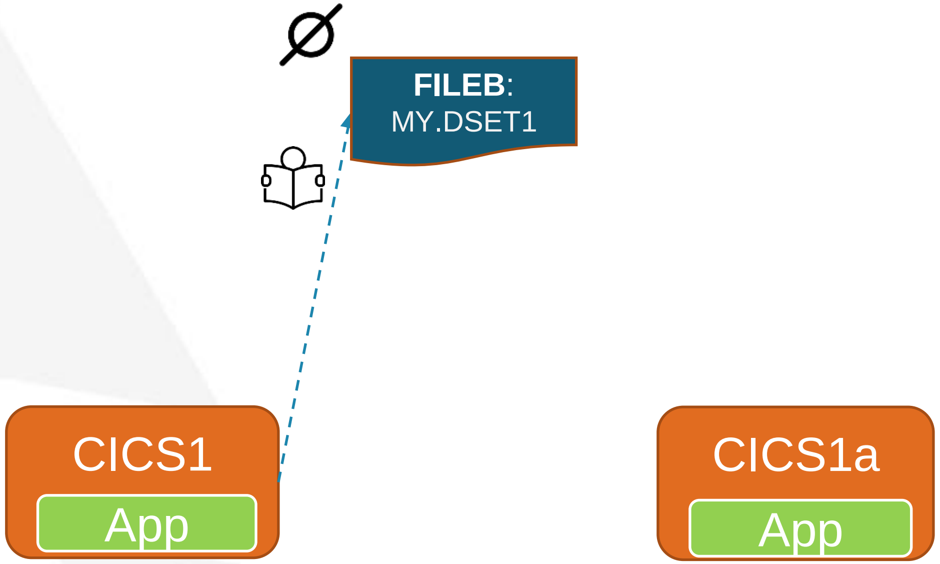
1. Program1: EXEC CICS WRITE FILE()
2. Program1: MQ GETWAIT
3. DFSMSdss: RLS QUIESCE. Waits for all incomplete units of work to end.
4. All other CICS programs attempting to update file wait for DSS QUIESCE (wait for 1 minute).
5. Program1: ends (implied syncpoint commits RLS change)
6. DFSMSdss: QUIESCE successful, performs processing.
7. DFSMSdss: UNQUIESCE.
8. Updates can now continue

# Issue 8a: AFCK Abends – Gotcha Solution

- Application code modified to perform EXEC CICS SYNCPOINT before MQ Getwait.
- Applications advised to ALWAYS perform syncpoint before long running command (e.g. MQ Getwait)

# Issue 9: Empty VSAM

- Some files were not converted to RLS, but defined as read-only to multiple CICS regions.
- Found that if these files were newly created without any records, the following problem occurred:
    1. CICS1 opens file.



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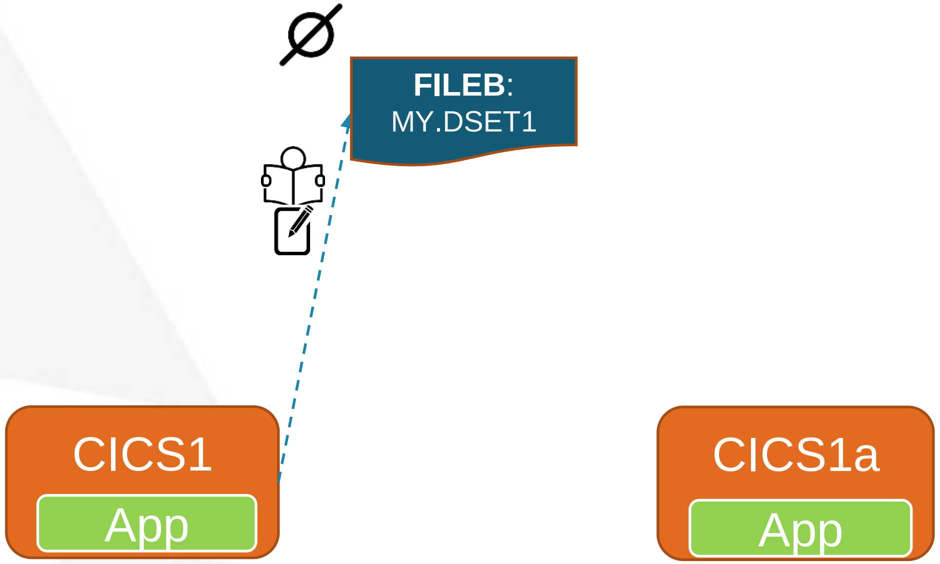
  1. CICS1 opens file. As it is empty and unused, it opens it for UPDATE



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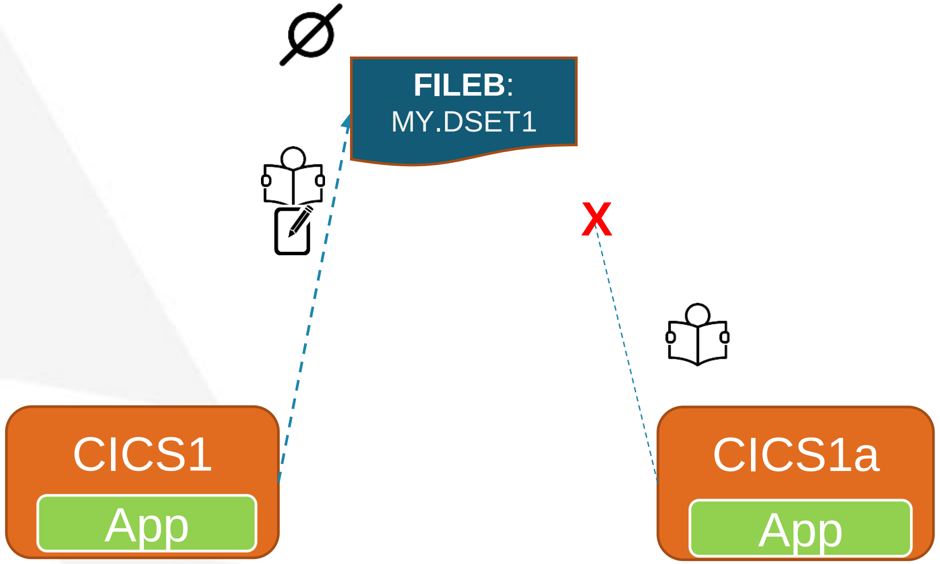

# Issue 9: Empty VSAM

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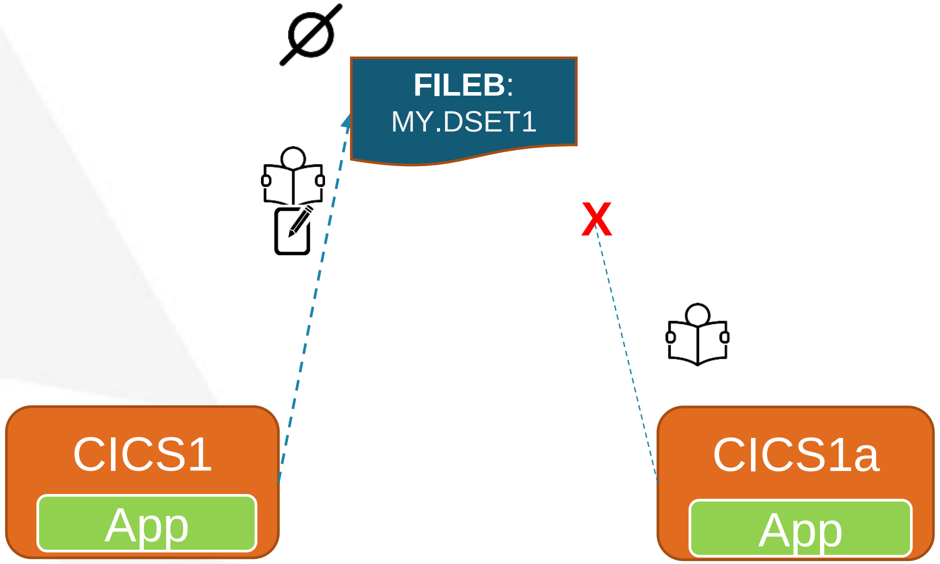
- Found that if these files were newly created without any records, the following problem occurred:
  1. CICS1 opens file. As it is empty and unused, it opens it for UPDATE
  2. CICS1a attempts to open the file READ ONLY, and fails.
- Solution: prime VSAM files with a record (insert/delete) after DEFINE.

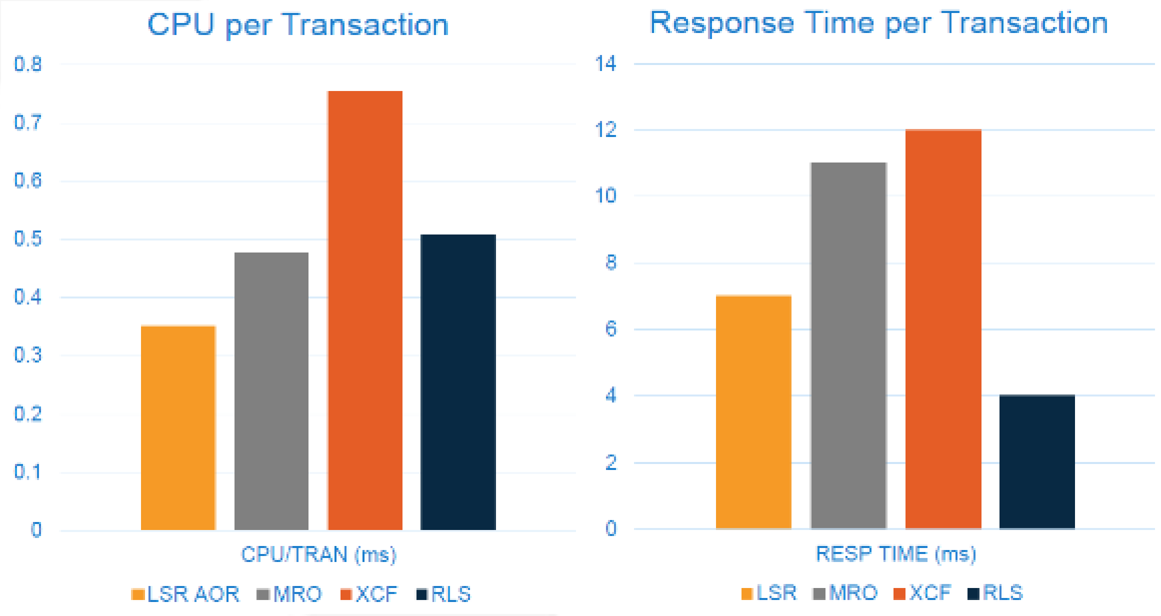


# PART 3: PERFORMANCE

(Was RLS faster, or slower?)

# What We Expected

- Not many benchmarks available
- Clark/Bohling at Share 2015 indicated a possible performance benefit.
- Our LSR wasn't perfect, so were hoping for better buffering with RLS.
- Bottom line: were expecting a small performance benefit



*(Source: Getting the Most out of your VSAM Data Sets in CICS Using RLS, Share 2015, Clark/Bohling)*

# SMF Type 42

- Let’s start with SMF type 42 (subtype 6) dataset records
- Record for every VSAM dataset, and every job accessing that dataset
- Great performance statistics
- Can compare RLS vs non-RLS performance (can’t using RLS-only sources like type 42 subtype 16, RMF Mon III)

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- Record for every VSAM dataset, and every job accessing that dataset
- Great performance statistics
- Can compare RLS vs non-RLS performance (can’t using RLS-only sources like type 42 subtype 16, RMF Mon III)

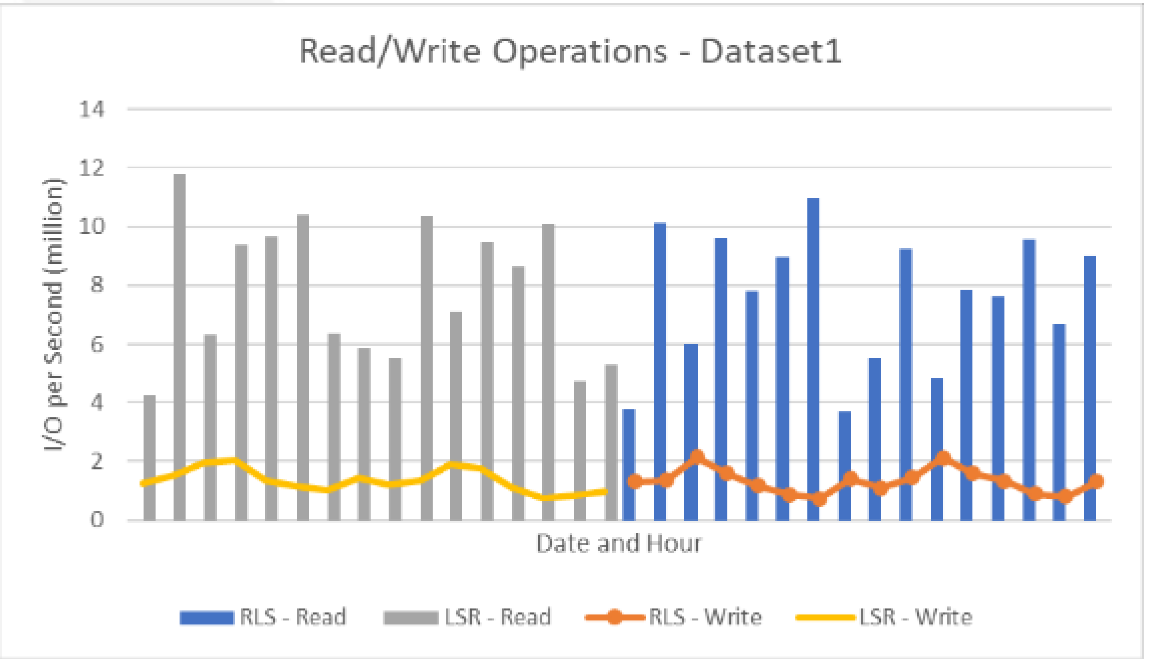
- Limit jobs to CICS region(s) and SMSVSAM
- Records from every z/OS system where CICS access VSAM

**SAS/MXG Code:**

```
Data T1;
Set PDB.TYPE42DS;
   WHERE JOB='CICS1' OR JOB='SMSVSAM';
```

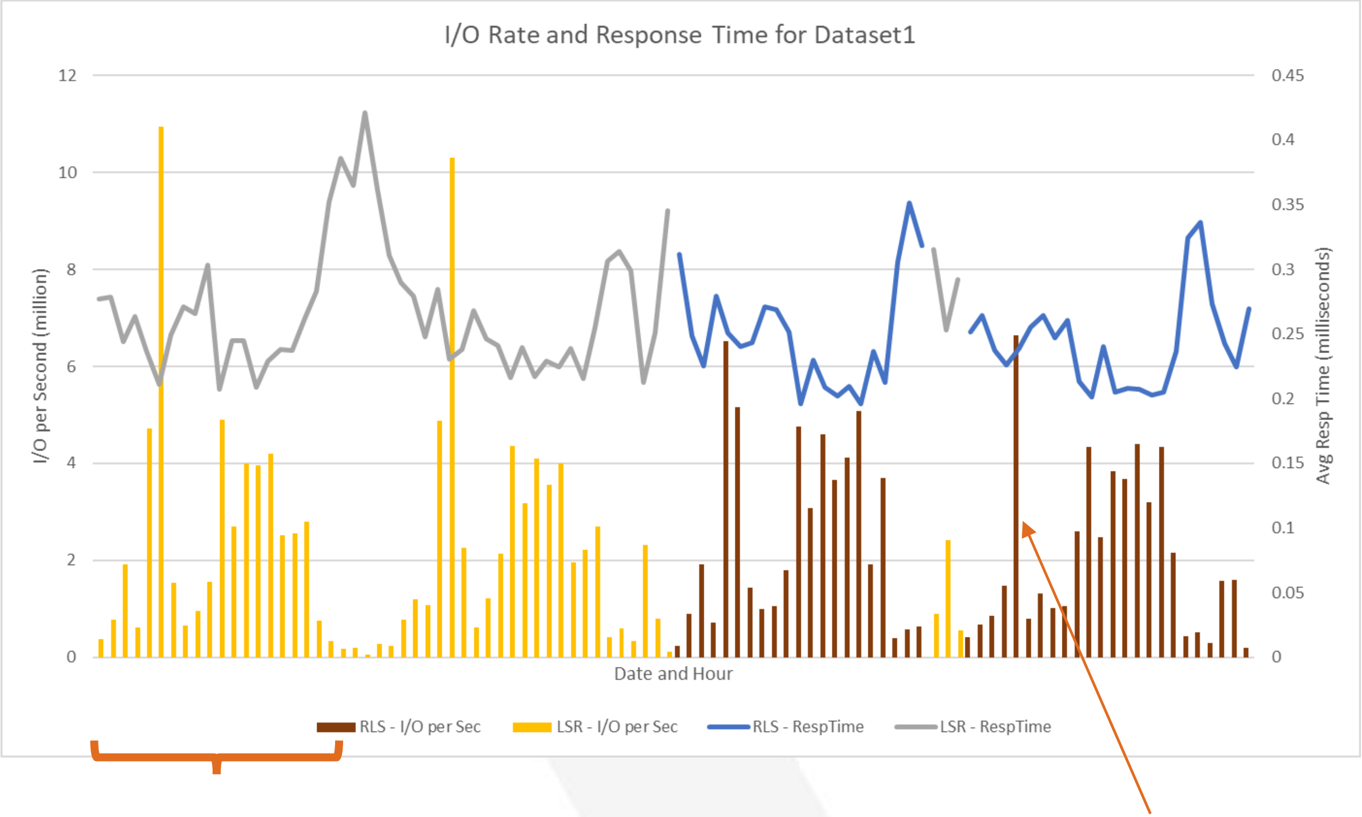
# SMF Type 42: Dataset1

- Let's look at one dataset – our 'worst' (biggest, very high I/O)
- VSAM KSDS, 2 AIX (stats average all components
- Mostly reads, around 20% update
- Big (40G)



# SMF Type 42: Dataset1

- Data for two days before (non-RLS), two days after
- Data for all VSAM components (data, index, two AIX)
- Not a lot of change



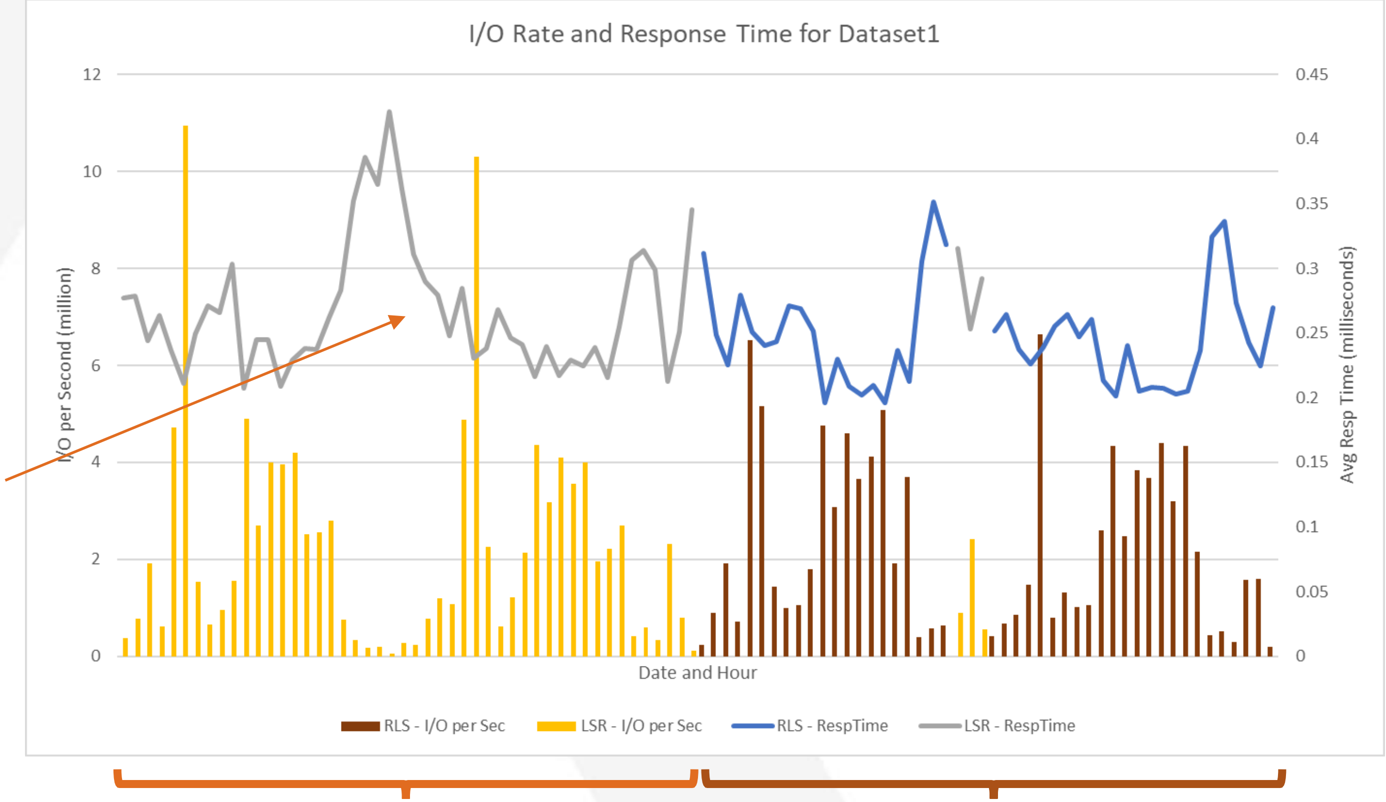
One day.

Average response time for one hour

# SMF Type 42: Dataset1

- Slightly better performance: around 8% improvement – nice

Load about the same before and after



Before (non-RLS)

After (RLS)

# SMF Type 42: Other Datasets

- But results were different for other datasets.
- Results mixed: 30% better, 70% worse
- Most increases were < 0.5 milliseconds
- Few really big jumps

| File | Average Response | | | Request count | |
|---|---|---|---|---|---|
| | Before | After | Difference | Before | After |
| DSET1 | 0.23 | 0.21 | -9% | 51,890,280 | 57,872,084 |
| DSET10 | 4.01 | 4.76 | 19% | 3,112,221 | 2,915,786 |
| DSET11 | 0.08 | 0.08 | 0% | 17,671,121 | 17,000,262 |
| DSET12 | 1.45 | 1.86 | 28% | 617,853 | 598,480 |
| DSET13 | 1.33 | 1.66 | 25% | 479,390 | 471,975 |
| DSET14 | 2.75 | 3.27 | 19% | 4,224,829 | 3,740,010 |
| DSET15 | 3.37 | 4.54 | 35% | 261,000 | 272,000 |
| DSET16 | 1.45 | 1.20 | -17% | 220,283 | 273,118 |
| DSET17 | 4.42 | 5.80 | 31% | 2,144,403 | 1,936,541 |
| DSET18 | 1.45 | 1.37 | -6% | 2,344,575 | 2,720,605 |
| DSET19 | 3.85 | 4.90 | 27% | 227,835 | 227,517 |
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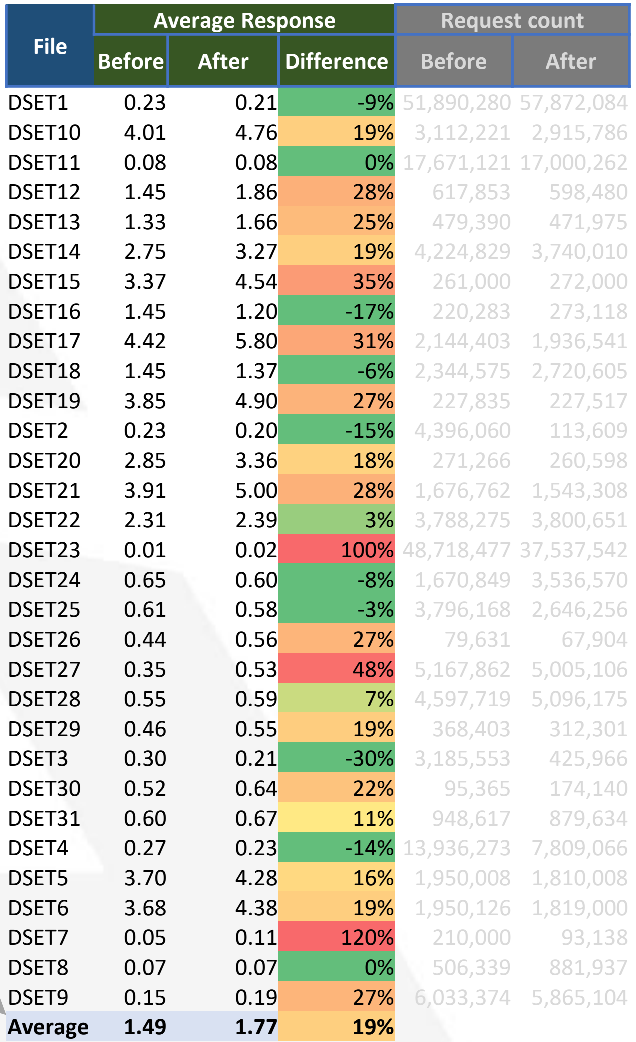
| DSET8 | 0.07 | 0.07 | 0% | 506,339 | 881,937 |
| DSET9 | 0.15 | 0.19 | 27% | 6,033,374 | 5,865,104 |
| **Average** | **1.49** | **1.77** | **19%** | | |

Average response time between 0900 and 1659 for 5 days before and after conversion to RLS

# SMF Type 42: Other Datasets

- But results were different for other datasets.
- Results mixed: 30% better, 70% worse
- Most increases were < 0.5 milliseconds
- Few really big jumps
- Overall average: 19% increase in service time (of 0.28 milliseconds).



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| **Average** | **1.49** | **1.77** | **19%** | | |

# SMF Type 42: Many Small Changes

- But an average increase of 19% may not be that bad
- For some cases, the response time was small. So 19% may not be a big deal

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| DSET8 | 0.07 | 0.07 | 0% | 506,339 | 881,937 |
| DSET9 | 0.15 | 0.19 | 27% | 6,033,374 | 5,865,104 |
| **Average** | **1.49** | **1.77** | **19%** | | |

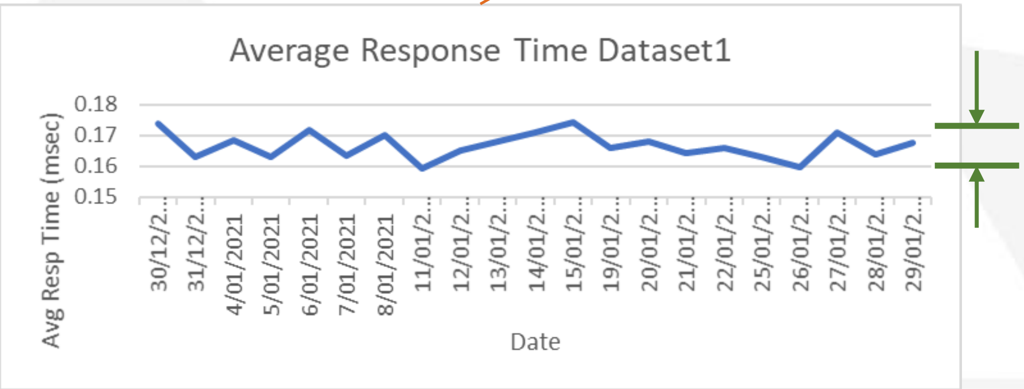
100% increase = 0.01 milliseconds

120% increase = 0.06 milliseconds

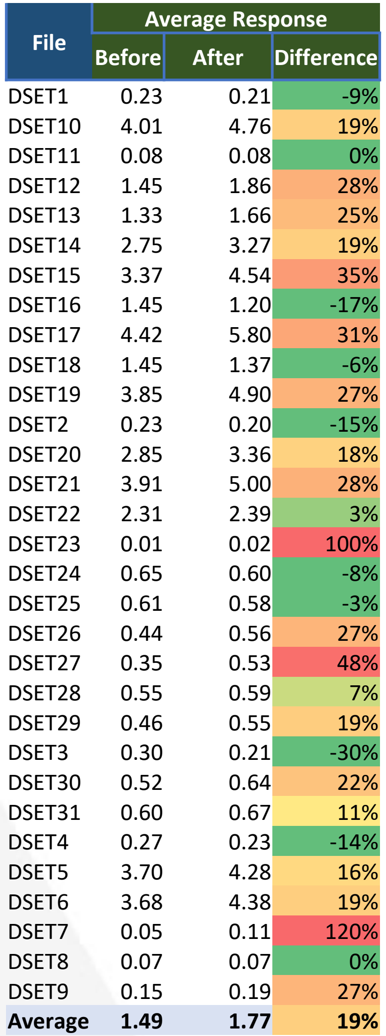
27% increase = 0.04 milliseconds

# SMF Type 42: Variable Response Time

- For most datasets, the day-to-day average response varied by up to 20%
- So this 19% increase (or some of it) may be normal variation.



0.013 msec
=8%



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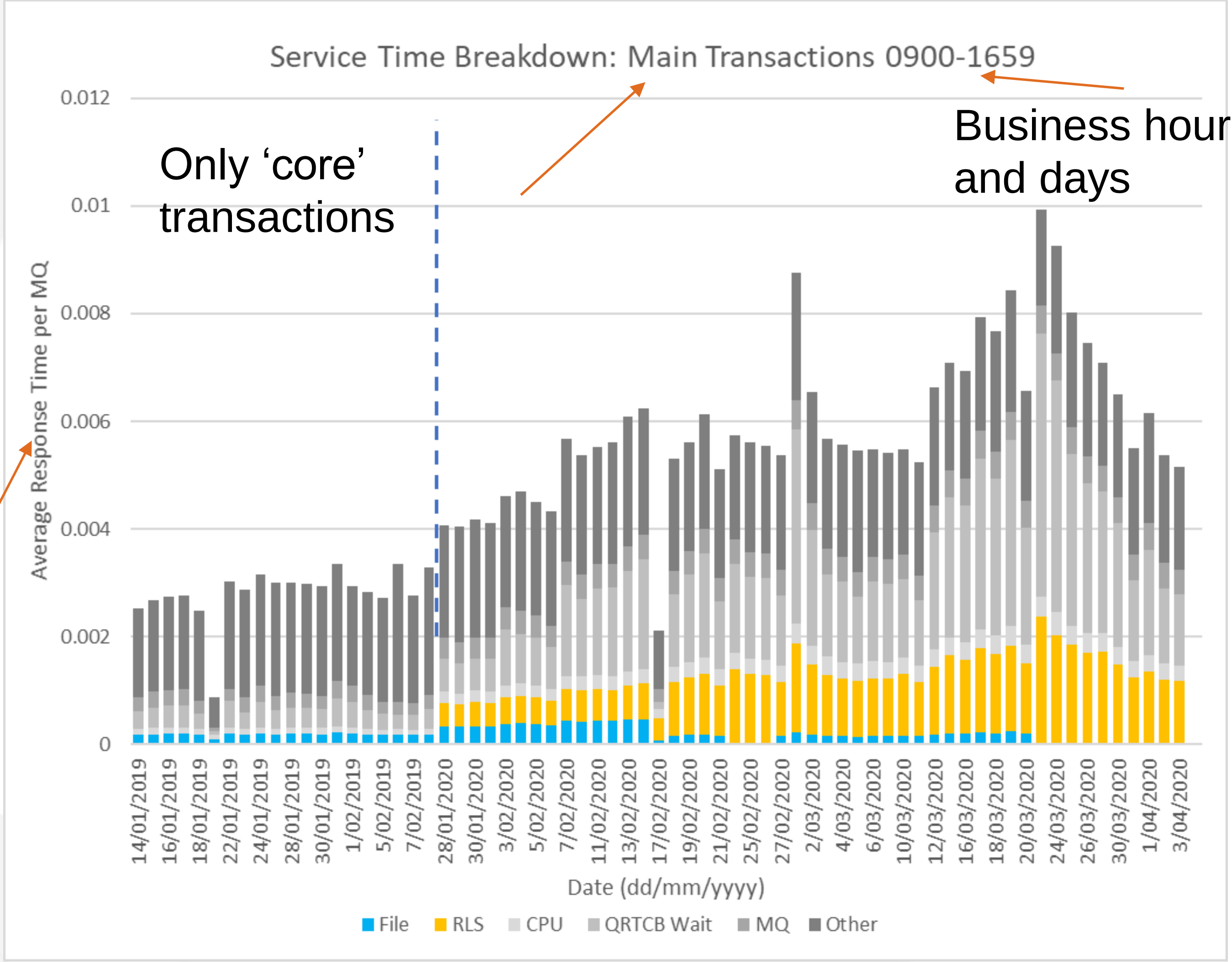
| DSET20 | 2.85 | 3.36 | 18% |
| DSET21 | 3.91 | 5.00 | 28% |
| DSET22 | 2.31 | 2.39 | 3% |
| DSET23 | 0.01 | 0.02 | 100% |
| DSET24 | 0.65 | 0.60 | -8% |
| DSET25 | 0.61 | 0.58 | -3% |
| DSET26 | 0.44 | 0.56 | 27% |
| DSET27 | 0.35 | 0.53 | 48% |
| DSET28 | 0.55 | 0.59 | 7% |
| DSET29 | 0.46 | 0.55 | 19% |
| DSET3 | 0.30 | 0.21 | -30% |
| DSET30 | 0.52 | 0.64 | 22% |
| DSET31 | 0.60 | 0.67 | 11% |
| DSET4 | 0.27 | 0.23 | -14% |
| DSET5 | 3.70 | 4.28 | 16% |
| DSET6 | 3.68 | 4.38 | 19% |
| DSET7 | 0.05 | 0.11 | 120% |
| DSET8 | 0.07 | 0.07 | 0% |
| DSET9 | 0.15 | 0.19 | 27% |
| **Average** | **1.49** | **1.77** | **19%** |

- Bottom line: probably an increase in response time 👎

# Effect on CICS Transactions

- Did this affect our CICS transactions?
- Used CICS SMF110 end of transaction statistics to break down CICS response time by category.



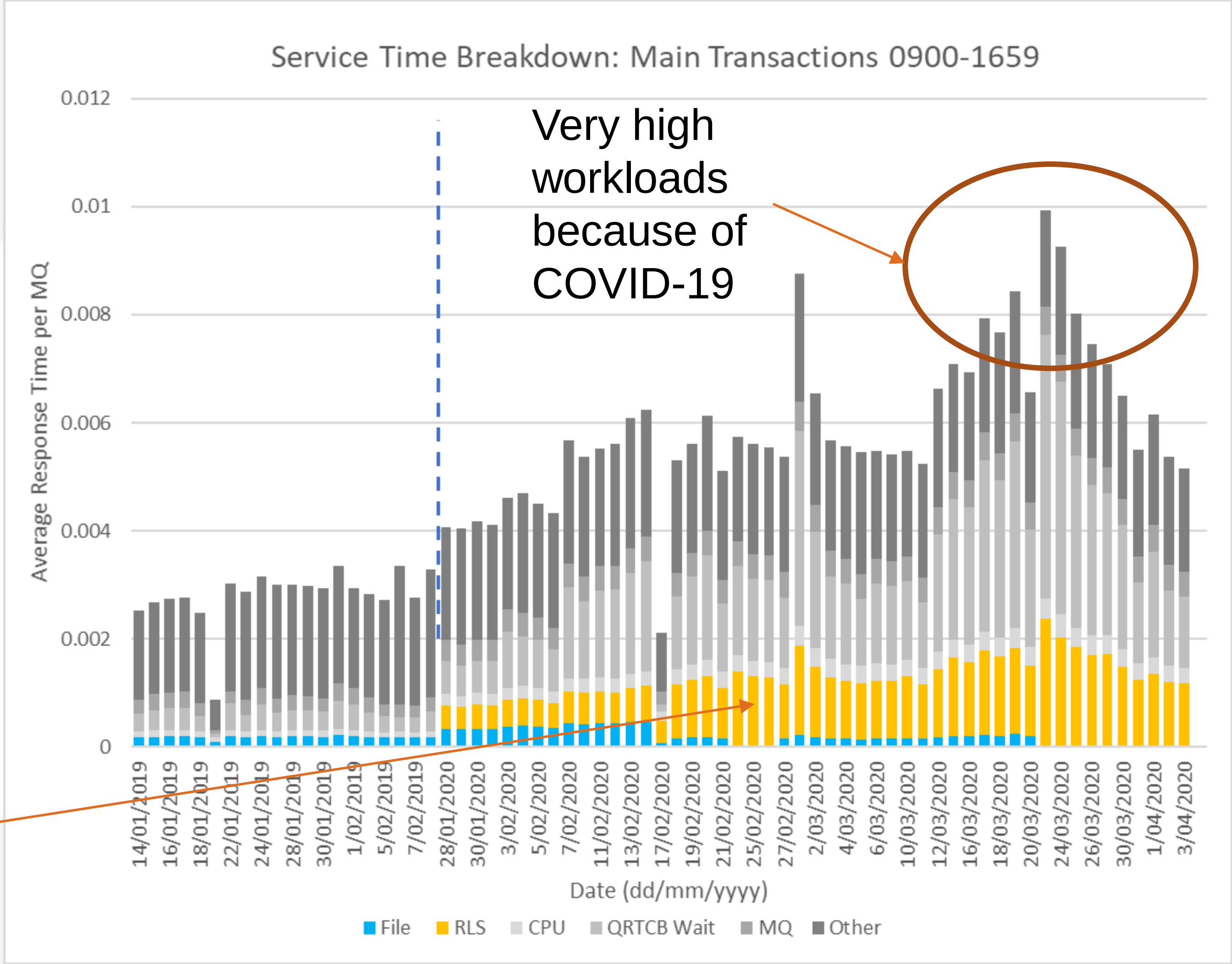
Only ‘core’ transactions

Business hours and days

Normalized by MQ operation

# Effect on CICS Transactions

- Did this affect our CICS transactions?
- Used CICS SMF110 end of transaction statistics to break down CICS response time by category.
- File/RLS service times have increased

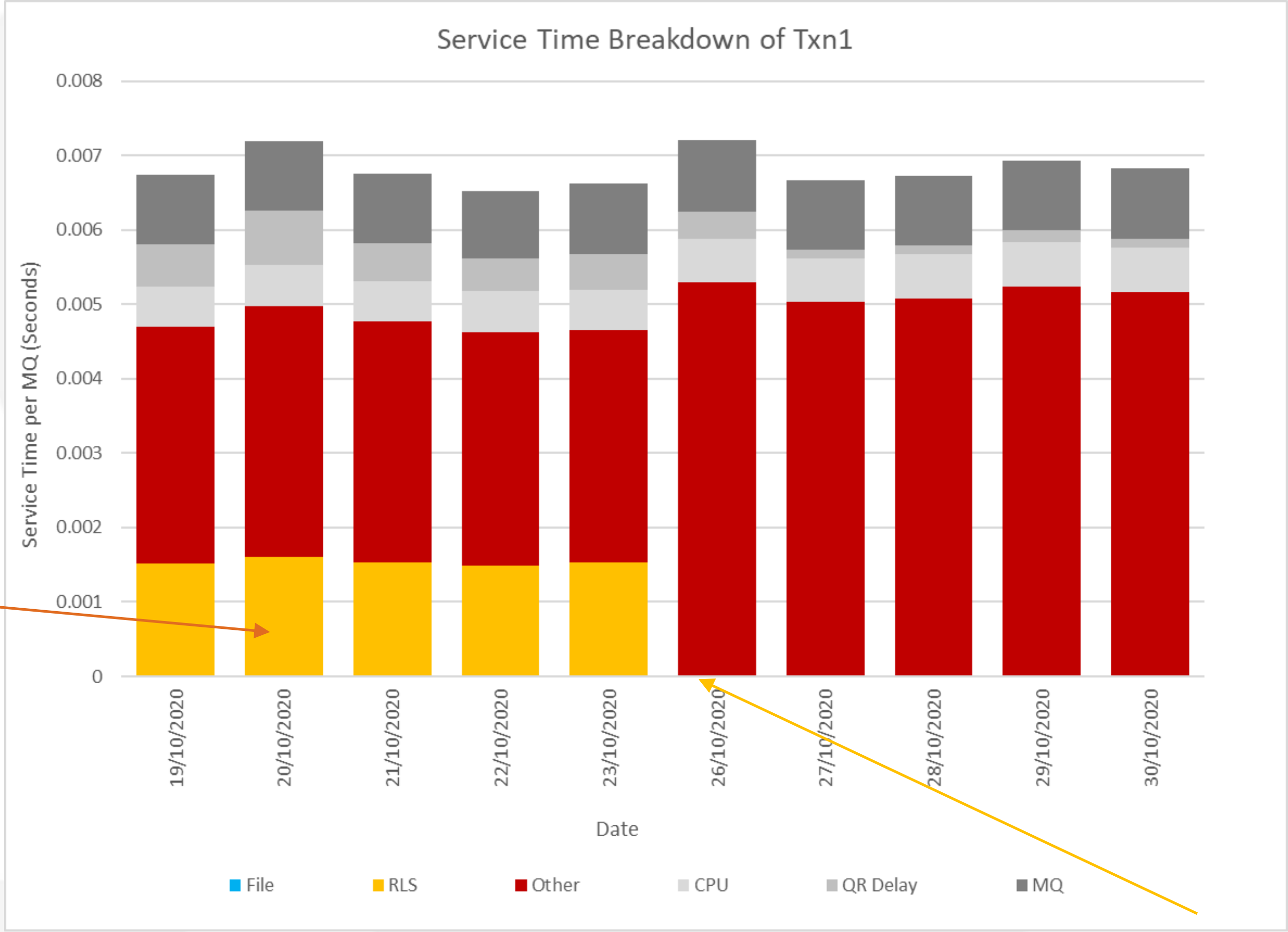


Very high workloads because of COVID-19

Looks bad!

# Maybe Even Worse

- We 'lose' the VSAM and RLS visibility from the SMF110 records when transactions are threadsafe

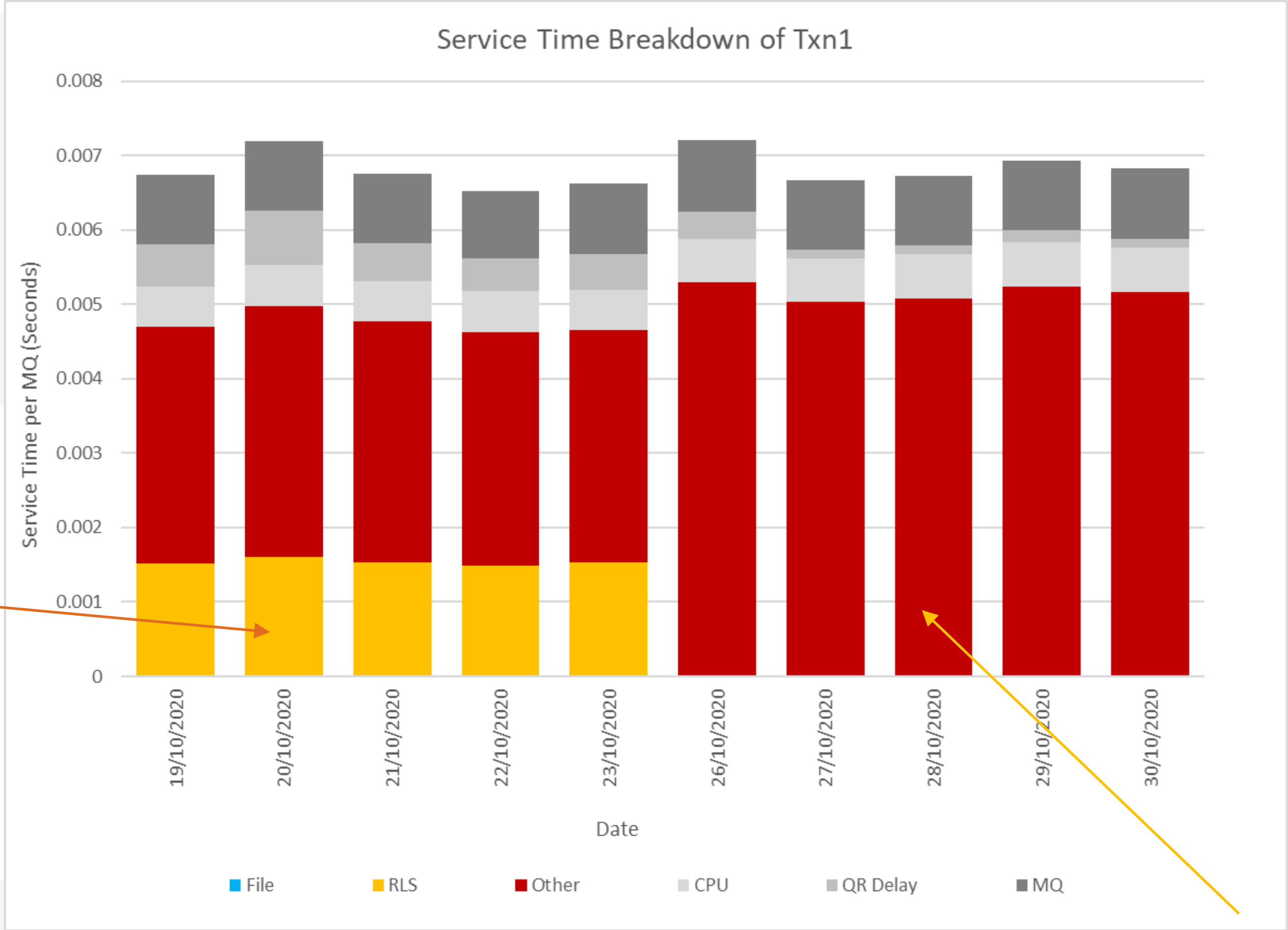


Now you see RLS

Transaction threadsafe from here

# Maybe Even Worse

- We 'lose' the VSAM and RLS visibility from the SMF110 records when transactions are threadsafe

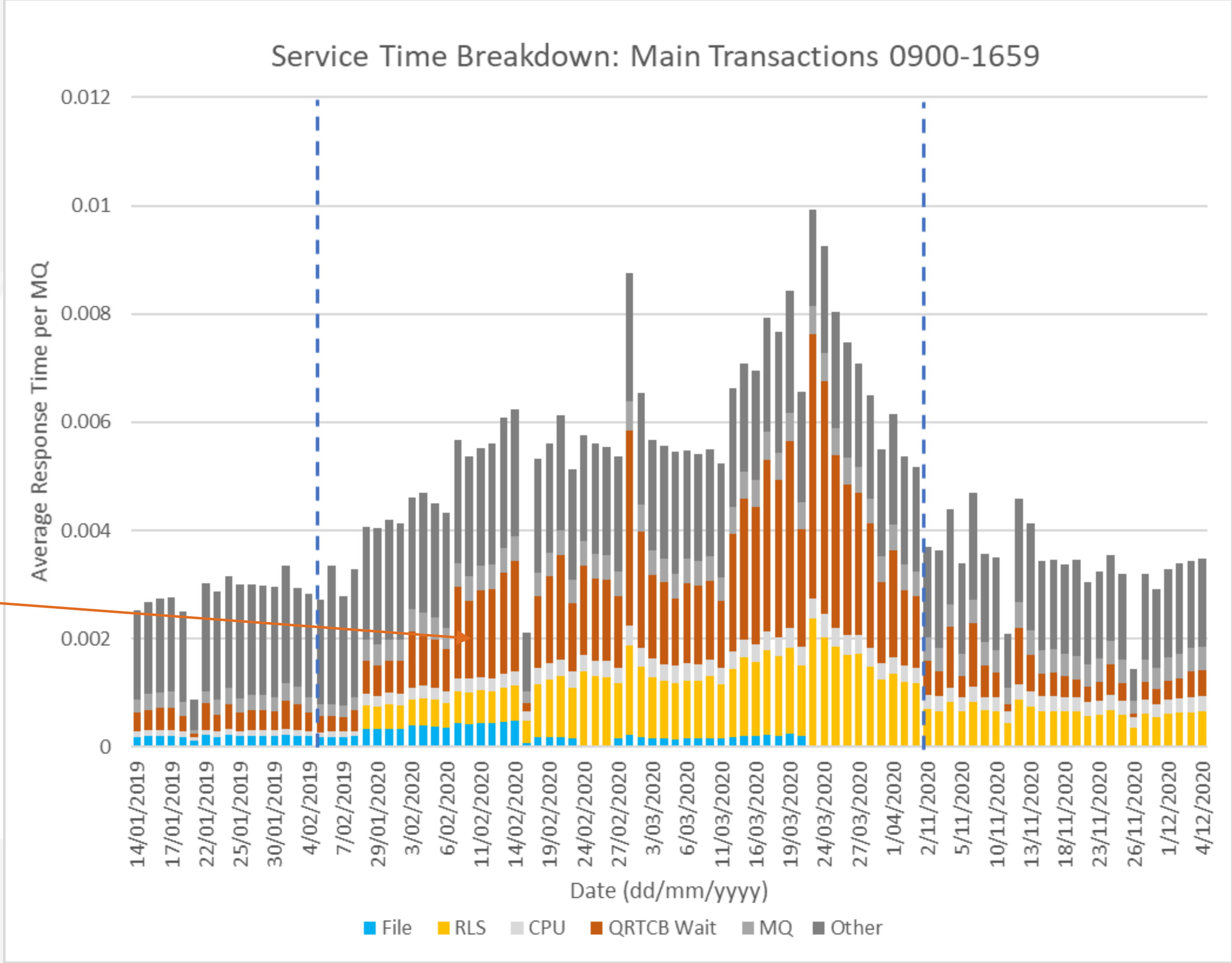


Now you see RLS

Now you don’t (is in ‘Other’ category)

# Effect on CICS Transactions

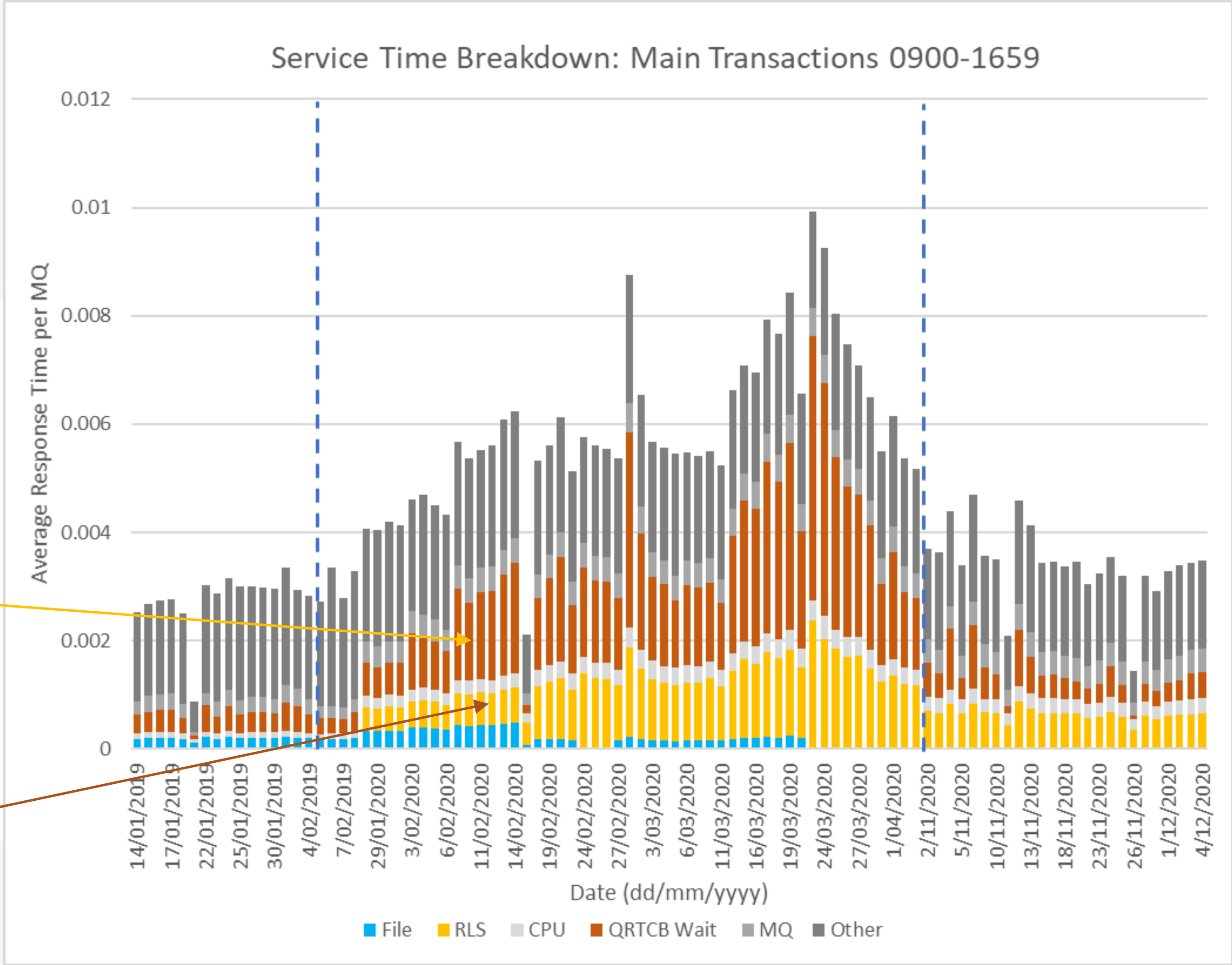
- But not necessarily that bad.
- By reducing QRTCB delays, RLS times also reduced.



High QRTCB Delays

# Effect on CICS Transactions

- But not necessarily that bad.
- By reducing QRTCB delays, RLS times also reduced.

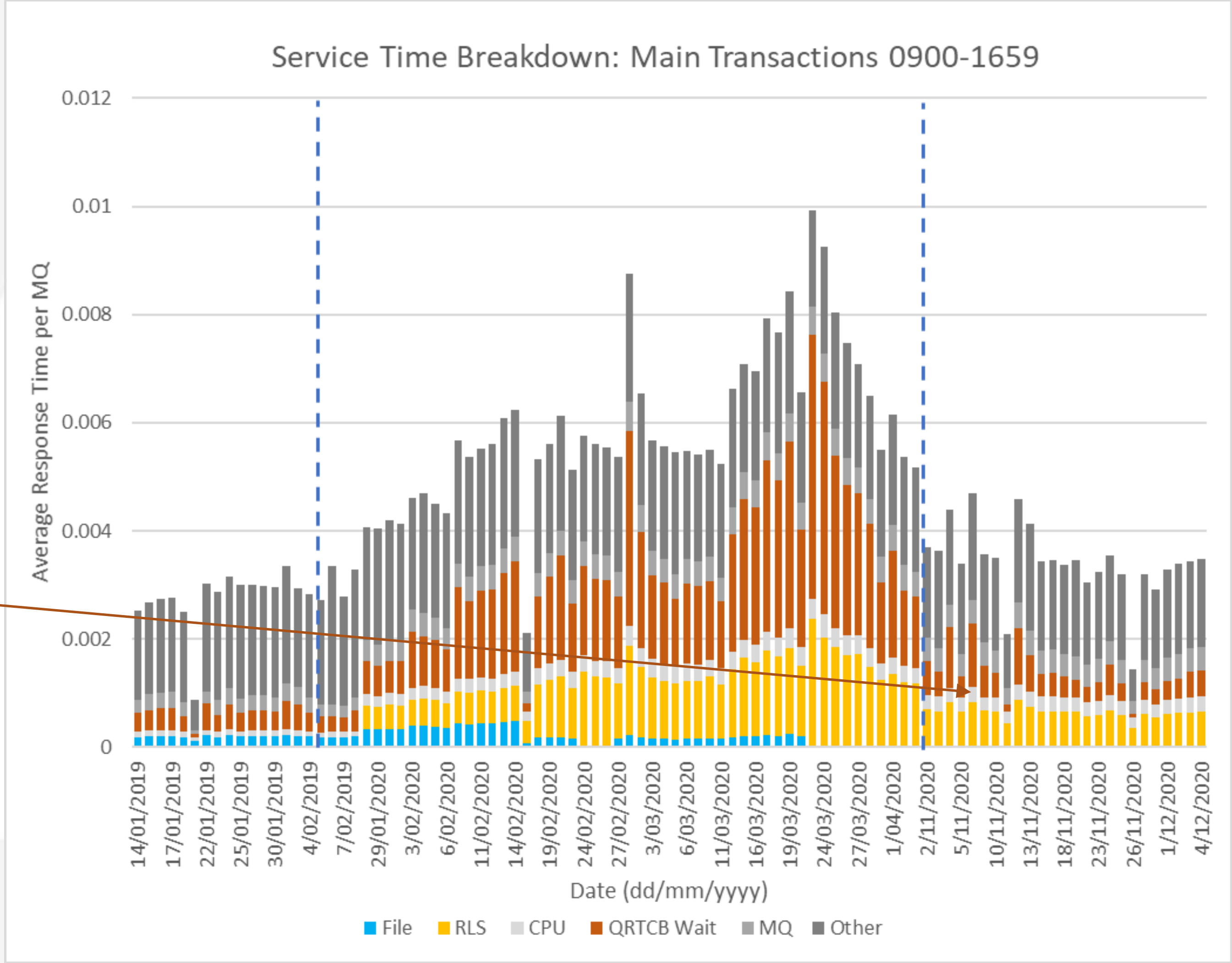


High QRTCB Delays

Cause higher RLS times

# Effect on CICS Transactions

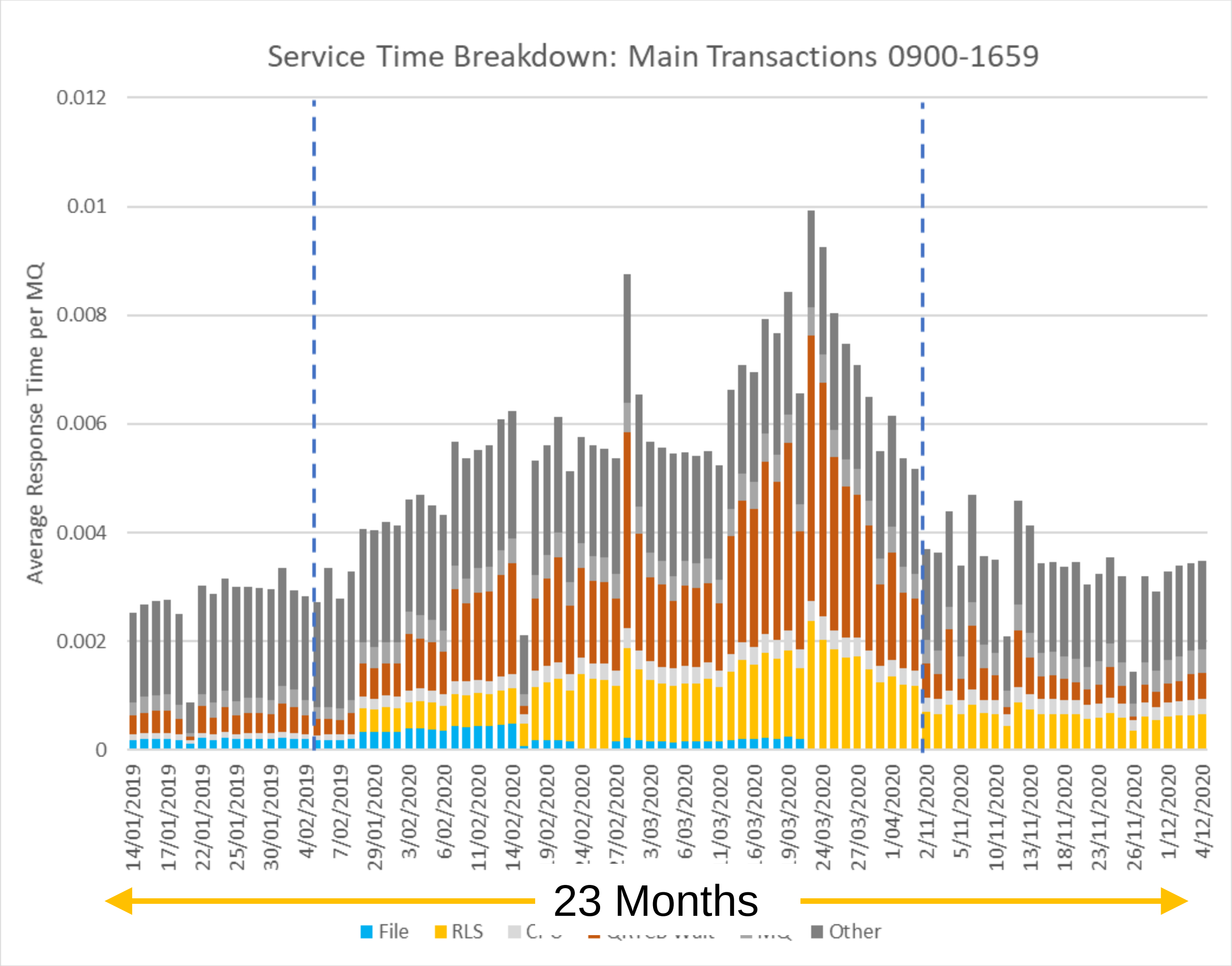
- But not necessarily that bad.
- By reducing QRTCB delays, RLS times also reduced.



RLS reduces when QRTCB delays reduce

# Effect on CICS Transactions

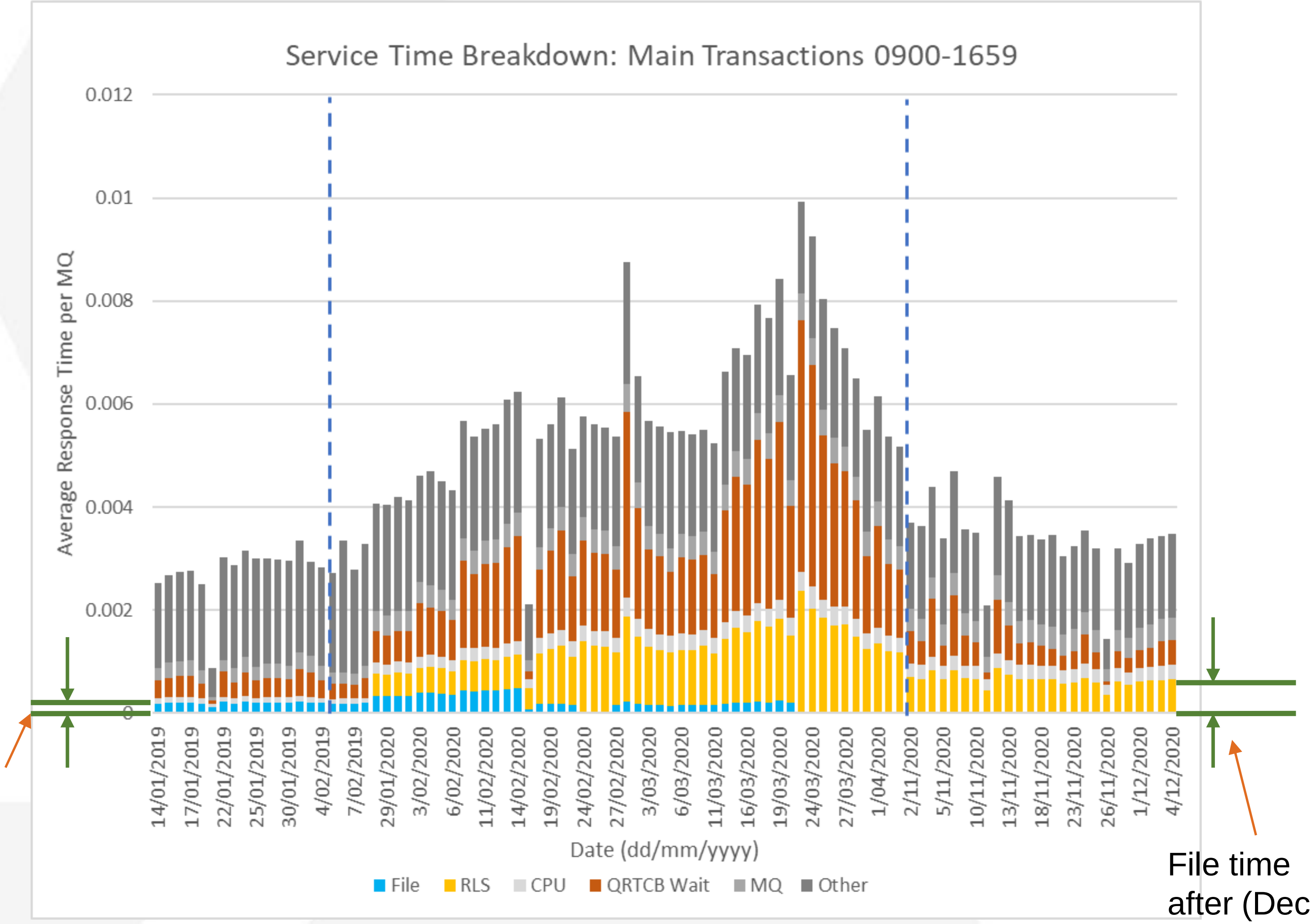
- Did take a performance hit from:
  - Conversion from IAM
  - Conversion from CICS Managed Data Table
- Long time between beginning and end: did have application changes, increase in load.
- These may explain some response time increases



23 Months

# Effect on CICS Transactions

- Bottom line: some response time increase from RLS.

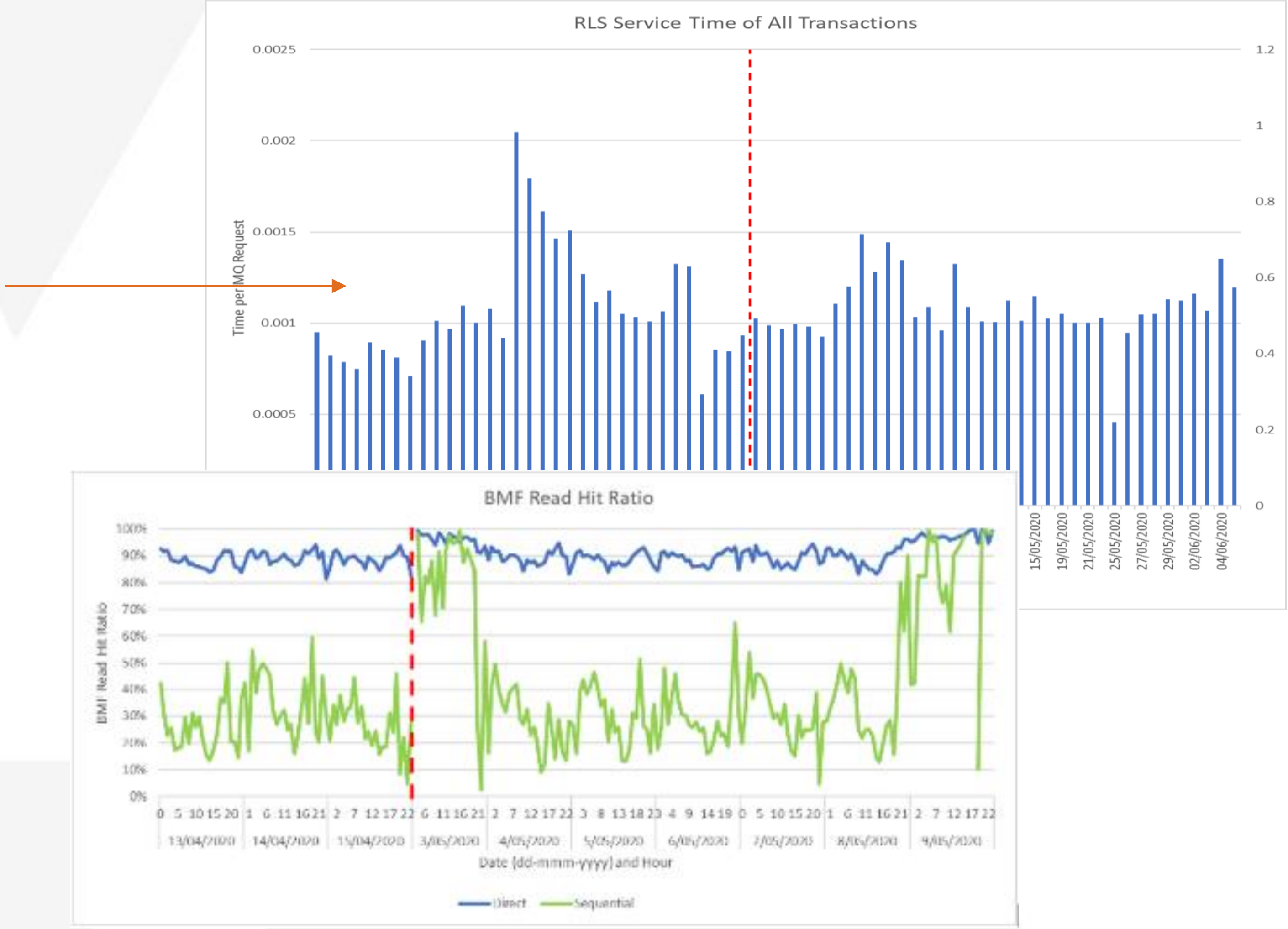


File time before (Jan 2019)

File time after (Dec 2020)

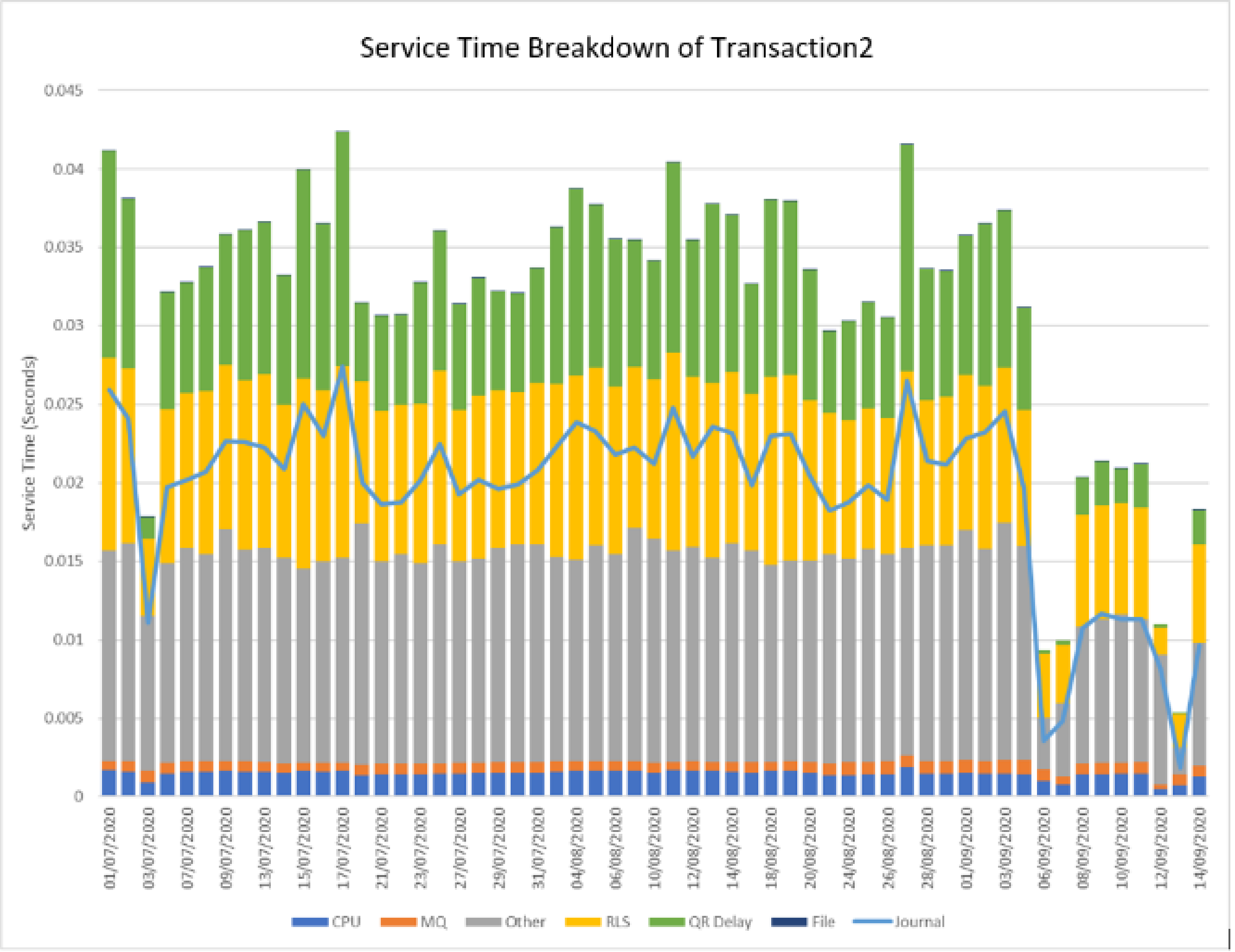
# RLS Infrastructure

- Analyzed RLS infrastructure: buffer sizes, hit ratios etc.
- Did increase the buffer sizes – this had little impact on performance
- Conclusion: little we can do to RLS infrastructure to improve performance



# Performance: Solution

- Improved performance in other areas to handle increase file/RLS times
- Reduced QRTCB / Journal (split into multiple CICS regions – the purpose of our CICSPlex project)
- Other tuning efforts



# SUMMARY

# A Big Project

### ‘Interesting’ Decisions:

- Minimize files to use RLS
- External Applications: use FOR
- Batch Access: Use CPSM/Batch to open/close files
- Implement in Four Steps

### Expected Issues:

- Forward Recovery
- Recovery Options
- Shareoptions (3,x)
- CICS Managed Data Tables
- ESDS
- Retained Locks
- Staff education

### Surprises:

- Rules Enforced with RLS
- AFCK Abends
- Empty Datasets

# RLS Today

**After two years:**

- RLS working well
- Performance good

# ABOUT LONGPELA AND CPT GLOBAL

# Who is David Stephens?

- z/OS systems programmer since 1989
- IBM software developer/L3 change team 2001-2010
- z/OS mainframe systems consultant since 2010

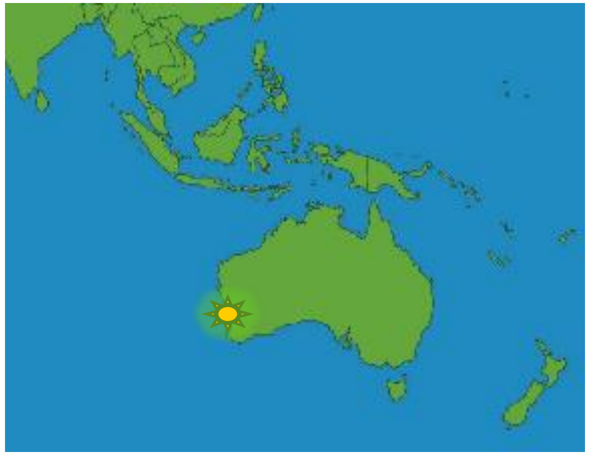
- CPT technical lead on CICSPlex project since 2018

- Loves cricket, travel, red wine
- Lives in Perth, Western Australia
- Works worldwide

Contact at dzs@longpelaexpertise.com.au

# About Longpela Expertise

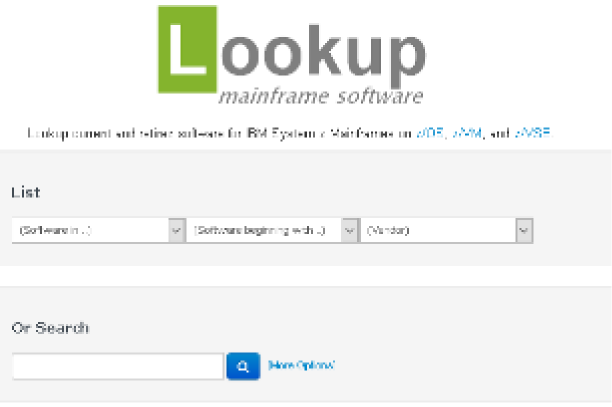
- Small z/OS consulting firm started in 1996
- Based in Perth, Western Australia. Work worldwide
- Systems consultants: z/OS, CICS, IMS and more



What On Earth is a Mainframe?

An Introduction to IBM zSeries Mainframes and z/OS Operating System for Total Beginners

David Stephens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Lookup current and retired software for IBM System z Mainframes on z/OS, z/VM, and z/VSE.

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Behind [www.lookupmainframesoftware.com](http://www.lookupmainframesoftware.com) and the book "*What On Earth is a Mainframe*"

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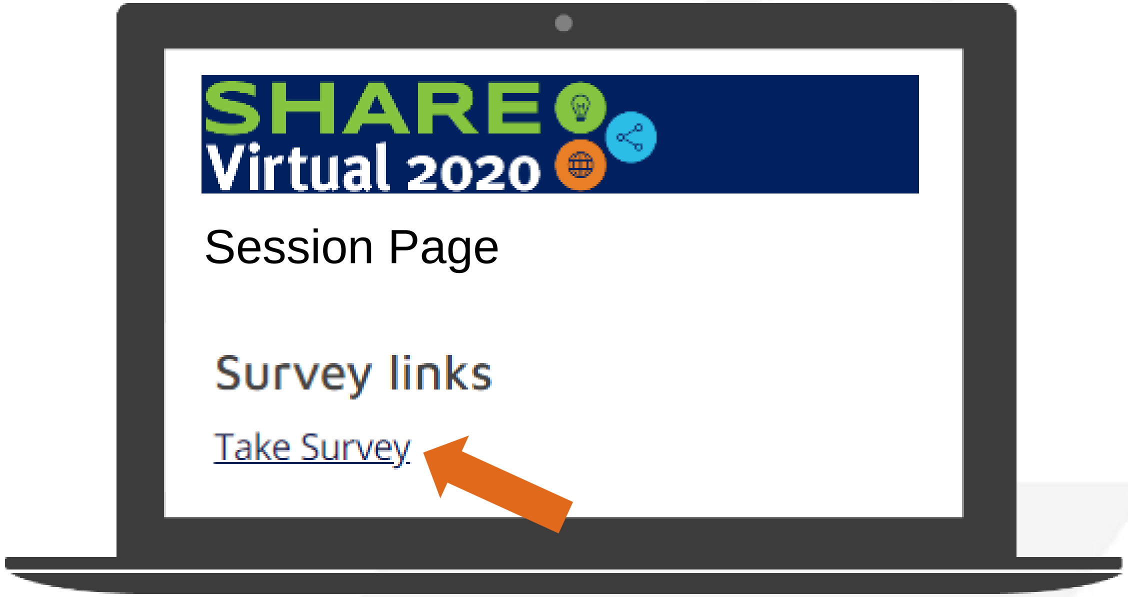

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