

IDUG

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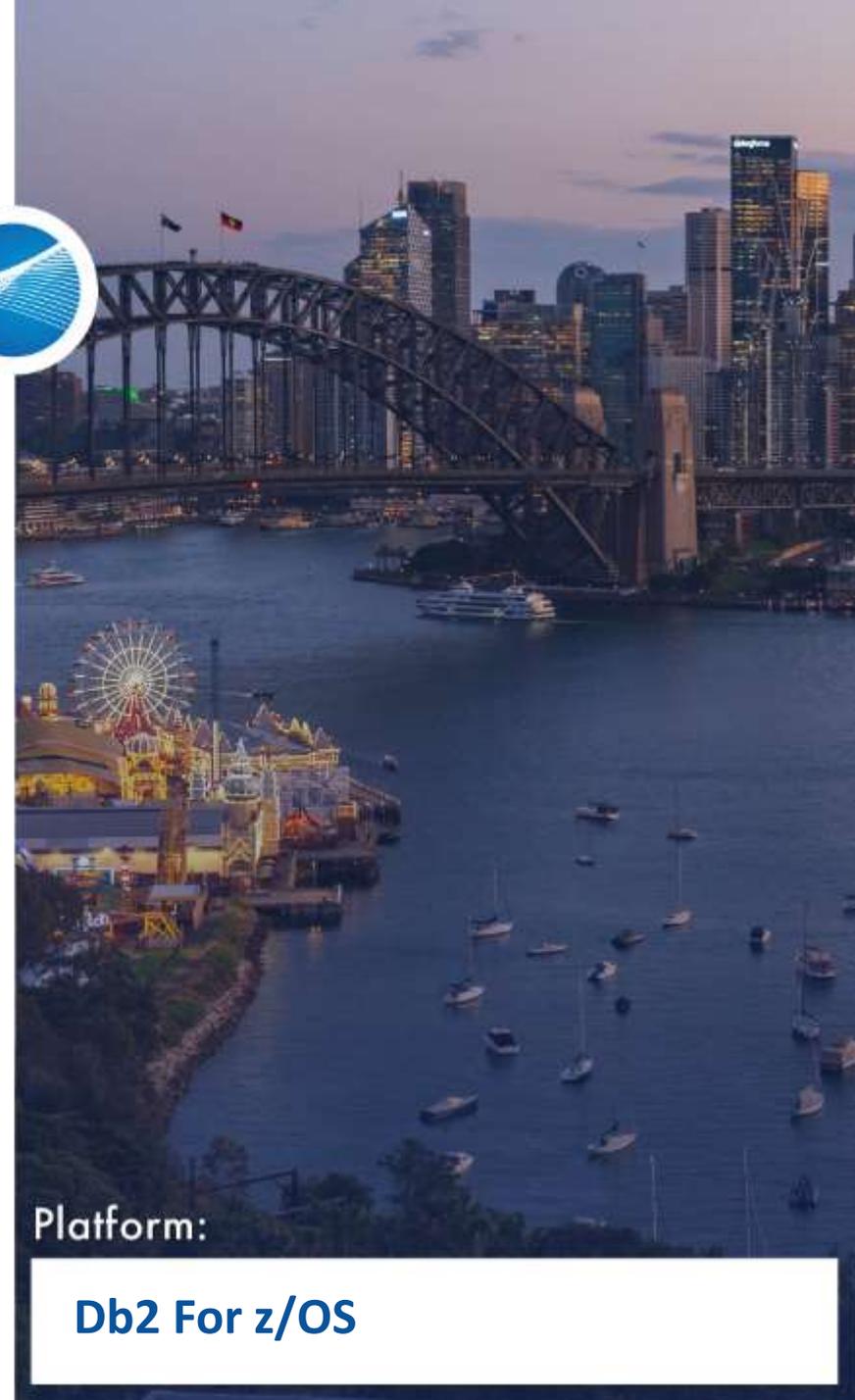
Sydney | March 16 - 18

AU Db2 TECH CONFERENCE

Mastering Integrated Synchronization

Cüneyt Göksu, IBM

Session Code: C11



Platform:

Db2 For z/OS

Agenda

Architecture of Integrated Synchronization

Encryption setup

HA Setup & Managing multiple accelerators

Monitoring and Usability

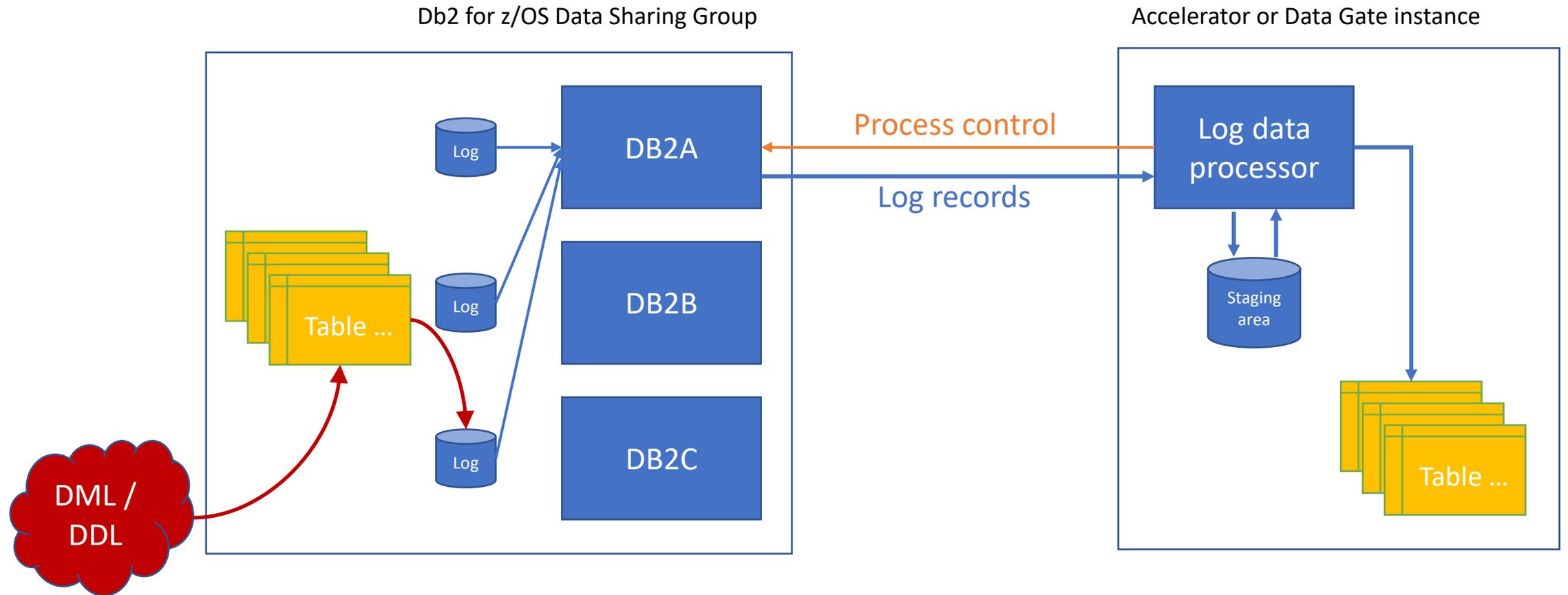
Architecture of Integrated Synchronization

- Integrated Synchronization is an incremental update protocol from Db2 for z/OS to IBM Db2 Analytics Accelerator or IBM Db2 for z/OS Data Gate
 - zIIP enabled
 - Complete application transparency
 - Enterprise-grade HTAP enabler
- Allows better handling of non-logged changes to Db2 tables
 - Ability to replicate selected non-logged utility actions, such as load with dummy partition or reorg discard full partition
- Simplified installation, packaging, administration, upgrade

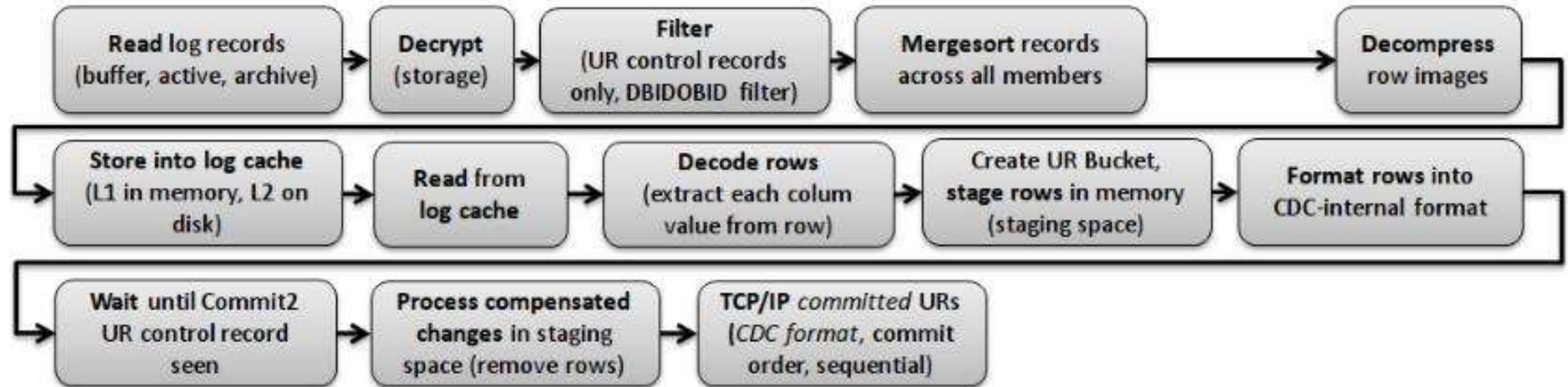
Architecture of Integrated Synchronization

- Log reader component **built into Db2 for z/OS**
 - No additional software license/installation or maintenance required
- Data transfer only via **encrypted connections**
- All buffering of long running transactions and decoding/apply logic done on the **target to reduce workload on z/OS**
- Protocol controlled by target

Integrated Synchronization components

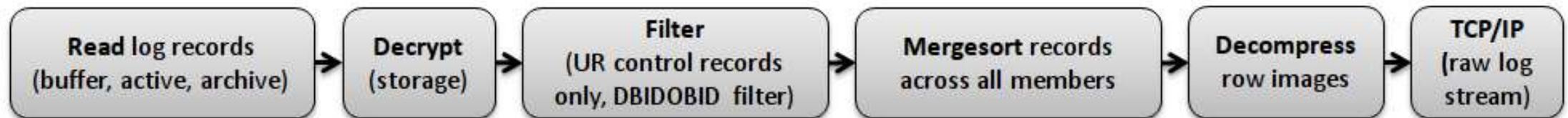


Simplified capture processing on z/OS



old

new

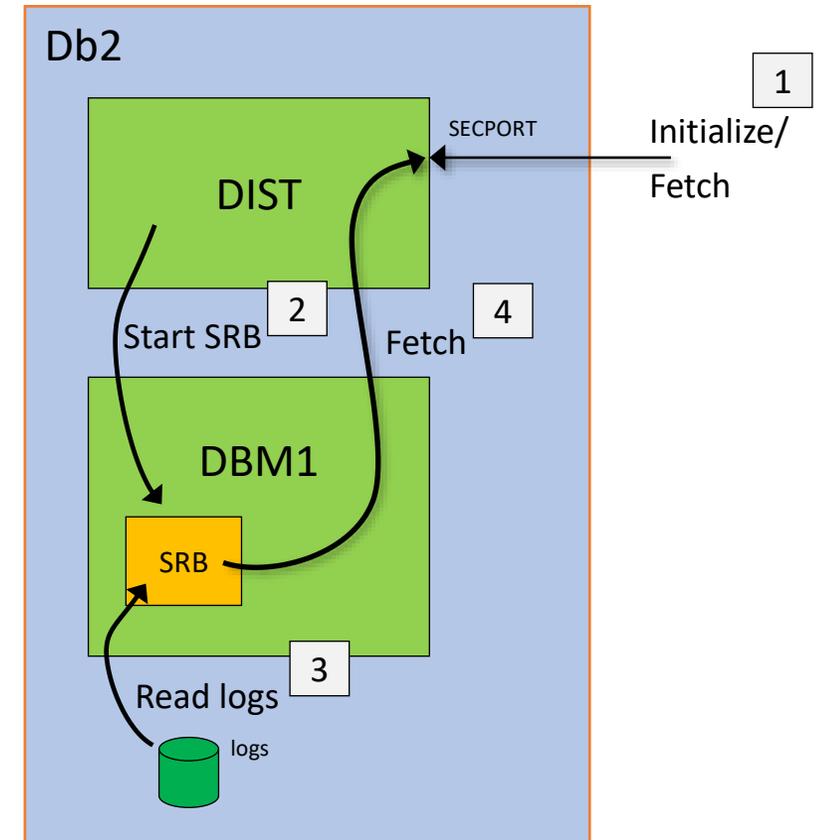


Starting a new log reader task

- Communication through SSL encrypted connection with DDF
- Log data processor connects to DB2 for z/OS DDF and requests a new log reader task to be started
- Log reader task is started as an SRB which reads filtered log records into a memory buffer
- Log data processor will fetch log records from memory buffer
- One SRB per connected accelerator or data gate :

-DISPLAY STATS(LOGREADERTASKS)

SESSIONID	STATUS	CURR. POSITION	NUM RECS	AGE
164FA983947B0801	SUSP EOS	00000000000018898F744	4	167s



Optimized apply processing on target side

- Dynamic switch between „bulk“ and „trickle“ apply mode
 - Bulk apply for mass updates in one table
 - Trickle apply for small updates in many tables
- Presumed commit (early apply)
 - feed (but not commit!) large changes as they arrive, not only after they are committed on source
 - When rollback on source, rollback on target
- Better handling of non-logged changes to Db2 tables
 - Able to replicate selected non-logged utility actions, such as LOAD with dummy input or REORG DISCARD of full partition

Defining informational constraints for replicated tables

- Replication requires a **unique constraint**
- If you want to replicate tables that currently don't have a primary key or unique index defined, then the following alternatives exist:
 - Add a primary key or unique index to your Db2 for z/OS table
 - Add column(s) that are guaranteed to be unique as „informational unique key“ during ACCEL_ADD_TABLES
 - Add a (generated) identity column and specify it as informational key column during ACCEL_ADD_TABLES
- „Informational“ unique constraints
 - Columns that have unique values, but uniqueness is not enforced by the database but externally, e.g. applications generating guaranteed unique values (example: Java's UUID class)
 - New XML element for ACCEL_ADD_COLUMNS input XML:

```
<informationalUniqueKey>  
  <column name=„GUUID_COL" />  
</informationalUniqueKey>
```

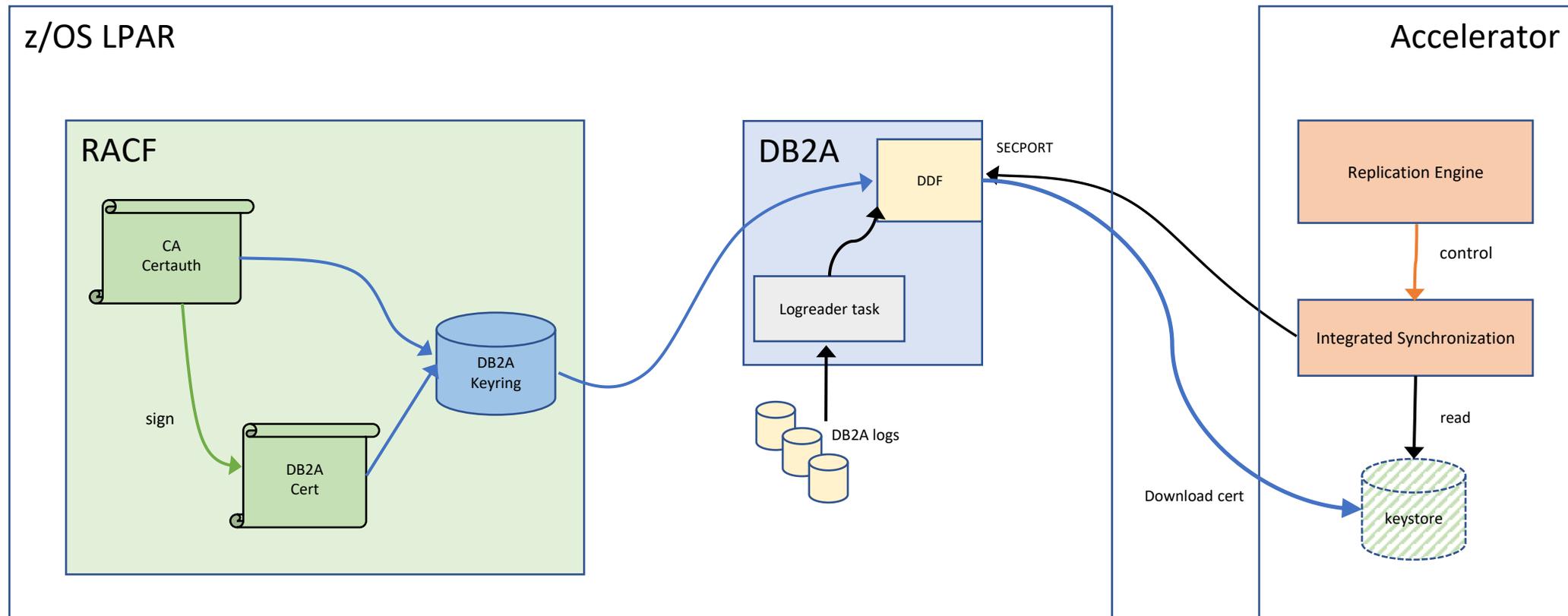
Integrated Synchronization – Installation Highlights

- DDF needs to listen on private network used to communicate with accelerator or data gate
- Define SSL setup for DDF if it doesn't exist yet:
 - Define SECPORT, **highly recommended to use dedicated SECPORT through location alias**
 - Create server certificate
 - Configure AT-TLS access to server certificate for Db2 subsystem
 - Export public key for signer (CA) certificate
- Identify or create user ID to be used for Integrated Synchronization access into Db2
 - Allow read access to RACF DSNR profiles ssid.DIST and ssid.ACCEL for this user ID
 - Grant MONITOR2 privilege to this user ID
- Enable incremental updates on IDAA using Integrated Synchronization method via console
- Docu: <https://www.ibm.com/docs/en/daafz/7.5?topic=updates-integrated-synchronization>

Certificates needed for encryption

Requires at least two certificates:

- CA certificate (certificate authority) – source of trust that guarantees originality of any certificate signed by it, usually long running validity
- Server certificate – to encrypt the data transfer, identifies service provider (Db2) and provides keys for encryption, usually shorter expiration dates



Encryption setup – Certificates and RACF

Network setup requirements

- Encrypted connection to DDF SECPORT
 - AT-TLS setup required
- Integrated Synchronization connections use a session concept
 - Need to remain connected to the same Db2 for z/OS member
 - Fail over possible in data sharing, but should be minimized as it comes with a processing overhead
 - In data sharing, it mandates special setup for access through group IP with concurrent distributed SQL workload which should be evenly distributed

Certificate Authority (CA) certificates

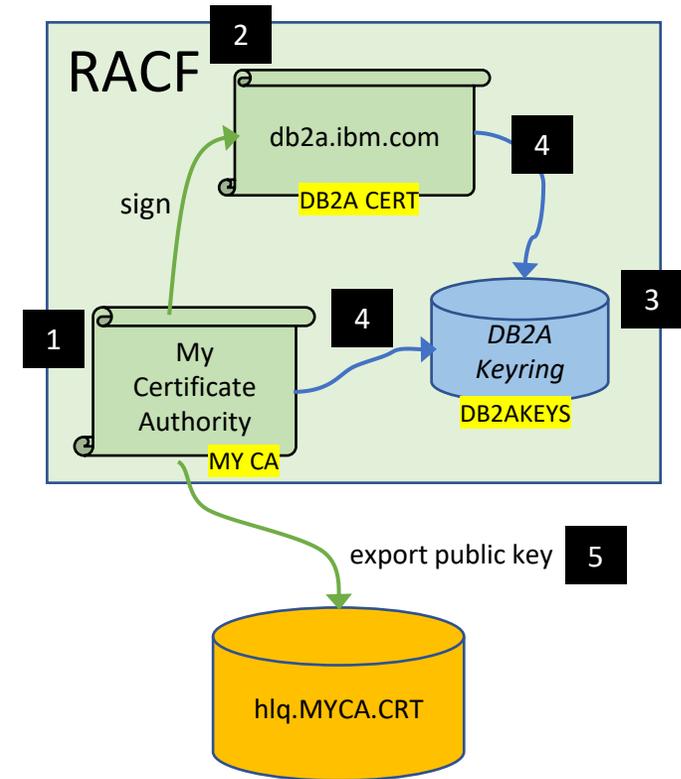
- RACF maintains CA certificates in the CERTAUTH category
- Can either be:
 - Self signed CA
 - Company specific CA infrastructure
 - External CA (e.g. Verisign)
- CAs can have multiple hierarchical levels to delegate signing of locally created certificates

Keyrings in RACF

- AT-TLS retrieves server certificate and CA certificate from a KEYRING assigned to an encrypted connection
- Keyring must either be owned by userid running DDF address space or access to it needs to be permitted
- Certificates are connected to a keyring
 - Any certificate can be connected to multiple keyrings
- Server certificate needs to be connected as DEFAULT certificate

Create certificates with RACF

- 1 RACDCERT CERTAUTH GENCERT -
SUBJECTSDN(OU('My Certificate Authority')) -
NOTAFTER(DATE(2030-12-31)) -
WITHLABEL('MY CA') KEYUSAGE(CERTSIGN)
- 2 RACDCERT ID(DB2USER) GENCERT -
SUBJECTSDN(CN('db2a.ibm.com')) -
NOTAFTER(DATE(2030-12-31)) -
WITHLABEL('DB2A CERT') -
SIGNWITH(CERTAUTH LABEL('MY CA'))
- 3 RACDCERT ID(DB2USER) ADDRING(DB2AKEYS)
- 4 RACDCERT ID(DB2USER) CONNECT(CERTAUTH LABEL('MY CA') RING(DB2AKEYS))
RACDCERT ID(DB2USER) CONNECT(ID(DB2USER) LABEL('DB2A CERT') RING(DB2AKEYS) DEFAULT)
- 5 RACDCERT CERTAUTH EXPORT(LABEL('MY CA')) DSN('hlq.MYCA.CRT') FORMAT(CERTDER)



Encryption setup – AT-TLS

AT-TLS setup overview for Integrated Synchronization

- Setup AT/TLS to encrypt the DDF connections using the created certificates
 - Check/add availability of TTLS parameter to TCPCONFIG statement in TCP/IP configuration file
 - TCP/IP started task refers to TCP/IP configuration file
 - TTLS parameter enables AT/TLS
 - Specify rules in the AT/TLS configuration file for SSL access to DDF
 - PAGENT started task refers to AT/TLS configuration file
 - Inbound **TTLSRule** specifies DDF address space name, secure port
 - **TTLSEnvironmentAction** specifies the keyring to read the certificate from and the role (role Server required for Integrated Synchronization)
 - **TTLSCipherParms** refers to the ciphers that can be used for encryption
 - Activate the definitions by refreshing the PAGENT address space (/F PAGENT,REFRESH)
 - Verify successful SSL configuration

Basic AT-TLS rule layout 1/3

```
TTLRule DB2ARule
{
  LocalPortRange      12000
  JobName              DB2ADIST
  Direction            Inbound
  TTLGroupActionRef   DB2AGroup
  TTLEnvironmentActionRef DB2ASslEnv
}
```

This rule refers to a standalone Db2 subsystem with the name DB2A. The DDF listens to incoming connections on secure port 12000. The name of the Db2 subsystem is reflected in the address space name of the DDF, which is DB2ADIST.

Basic AT-TLS rule layout 2/3

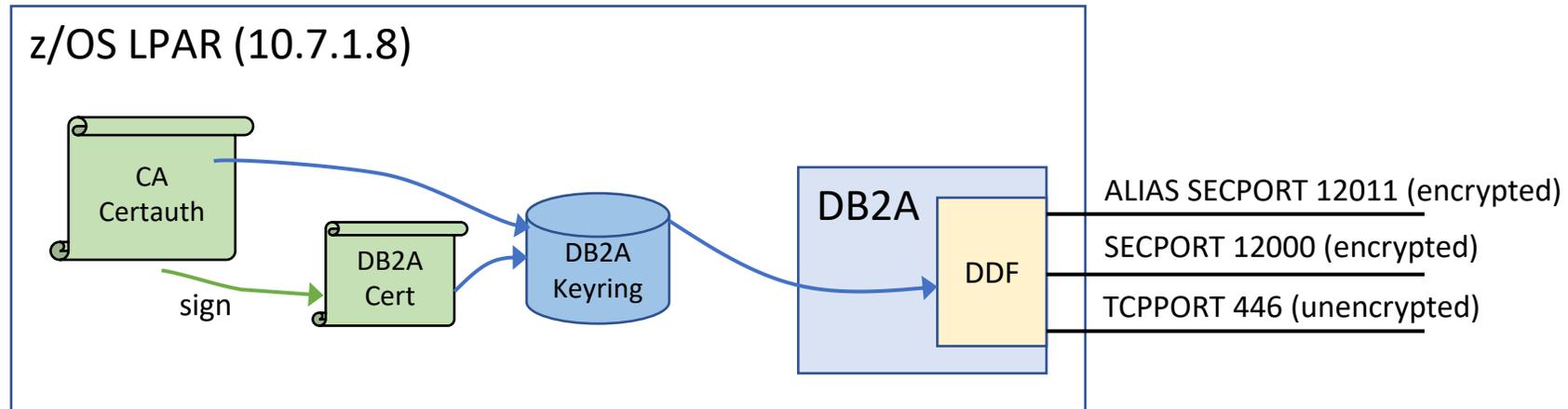
```
TTLSEnabled DB2AGroup
{
  TTLSEnabled      On
  Trace            3
}
```

This definition block enables TTLS and sets a specific trace option.

Using **location aliases** for Integrated Synchronization

- Allows a **different** SECPORT for Integrated Synchronization
- Specific SECPORT can be activated and de-activated with Db2 `command` without affecting another distributed workload
- Different network rules possible for regular DDF SECPORT and Integrated Synchronization SECPORT
- Need to be added on each Db2 member in data sharing that should be used for Integrated Synchronization
- **Highly recommended for standalone Db2 systems**
- Required for high availability setup in data sharing group

Additional SECPORT with Location Alias



Creating a location alias for Integrated Synchronization

-DB2A MODIFY DDF ALIAS(DB2AMBR1) ADD

- DSNL300I -DB2A DSNLTMDF MODIFY DDF REPORT FOLLOWS:
- **DSNL302I ALIAS DB2AMBR1 IS SET TO ADD**
- DSNL301I DSNLTMDF MODIFY DDF REPORT COMPLETE

-DB2A MODIFY DDF ALIAS(DB2AMBR1) SECPORT(12011)

- DSNL300I -DB2A DSNLTMDF MODIFY DDF REPORT FOLLOWS:
- **DSNL302I ALIAS DB2AMBR1 IS SET TO SECPORT 12011**
- DSNL301I DSNLTMDF MODIFY DDF REPORT COMPLETE

-DB2A MODIFY DDF ALIAS(DB2AMBR1) START

- DSNL300I -DB2A DSNLTMDF MODIFY DDF REPORT FOLLOWS:
- **DSNL302I ALIAS DB2AMBR1 IS SET TO START**
- DSNL301I DSNLTMDF MODIFY DDF REPORT COMPLETE
- DSNL314I -DB2A DSNLILNR THE ALIAS DB2AMBR1 IS STARTED

-DB2A MODIFY DDF ALIAS(DB2AMBR1) STOP

- DSNL300I -DB2A DSNLTMDF MODIFY DDF REPORT FOLLOWS:
- **DSNL302I ALIAS DB2AMBR1 IS SET TO STOP**
- DSNL301I DSNLTMDF MODIFY DDF REPORT COMPLETE
- DSNL314I -DB2A DSNLILNR THE ALIAS DB2AMBR1 IS STOPPED

-DB2A DIS DDF

- DSNL080I -DB2A DSNLTDDF DISPLAY DDF REPORT FOLLOWS:
- DSNL081I STATUS=STARTD
- DSNL082I LOCATION LUNAME GENERICCLU
- DSNL083I STLEC1 USIBMSY.SYEC1DB2 -NONE
- DSNL084I TCPPORT=446 SECPORT=12000 RESPOR=5001 IPNAME=-NONE
- ...
- DSNL087I ALIAS PORT SECPORT STATUS
- **DSNL088I DB2AMBR1 0 12011 STARTD**
- ...
- DSNL099I DSNLTDDF DISPLAY DDF REPORT COMPLETE

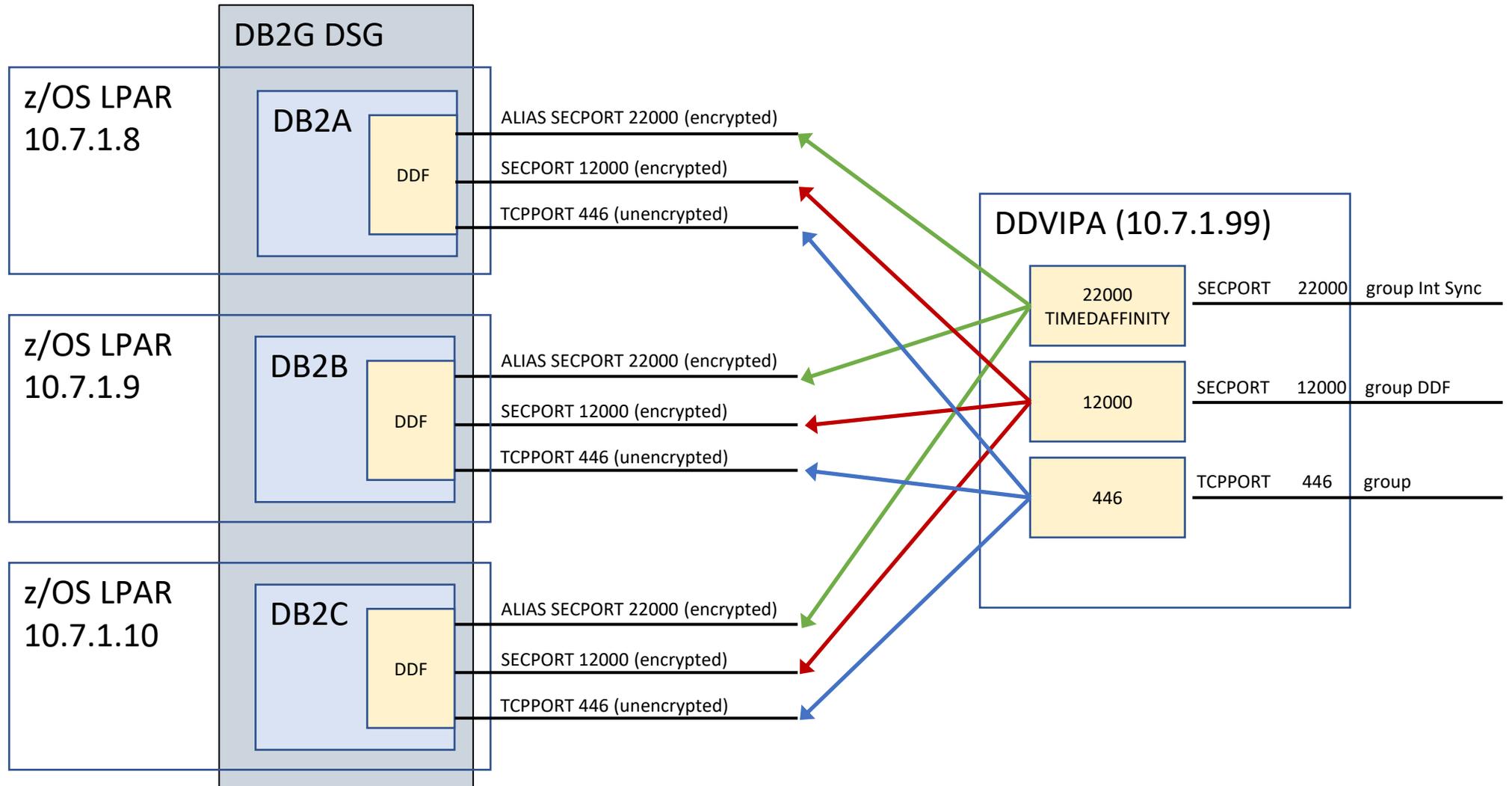
-DB2A DIS DDF

- DSNL080I -DB2A DSNLTDDF DISPLAY DDF REPORT FOLLOWS:
- ...
- DSNL087I ALIAS PORT SECPORT STATUS
- **DSNL088I DB2AMBR1 0 12011 STOPD**
- ...
- DSNL099I DSNLTDDF DISPLAY DDF REPORT COMPLETE



High Availability Setup

High Availability Setup in Data Sharing



High Availability Setup in Data Sharing

- DDVIPA setup for Integrated Synchronization does not influence existing setup if using a new SECPORT (through alias)
- [VIPADYNAMIC - VIPADISTRIBUTE statement - IBM Documentation](#)

```
VIPADISTRIBUTE DEFINE TIMEDAFFINITY 60 <ddvipa-ip-address>  
  PORT <db2-integrated-synchronization-secport>  
  DESTIP <db2-member-ip-address-1>  
        <db2-member-ip-address-2>  
  ...  
        <db2-member-ip-address-n>
```

Data Sharing Setup Considerations

- Each LPAR (IP address) can have only one Db2 member listen on the SECPORT for Integrated Synchronization requests
- ALIASes can be defined individually on each member
- Stop location aliases for Integrated Synchronization on other Db2 members on the same LPAR
- In case of failure of one member, start location alias of a different member on the same LPAR
- Not all members need to have the SECPORT open, even for HA

Setting up distributing dynamic VIPA

- VIPADISTRIBUTE statement can have a port number specified
- TIMEAFFINITY 60 will distribute new connections from the same originator to the same target when opened within 60s from the previous request
 - Integrated Synchronization will always have a request within 60s
 - Log reader task in Db2 for z/OS has a timeout of 60s to terminate itself

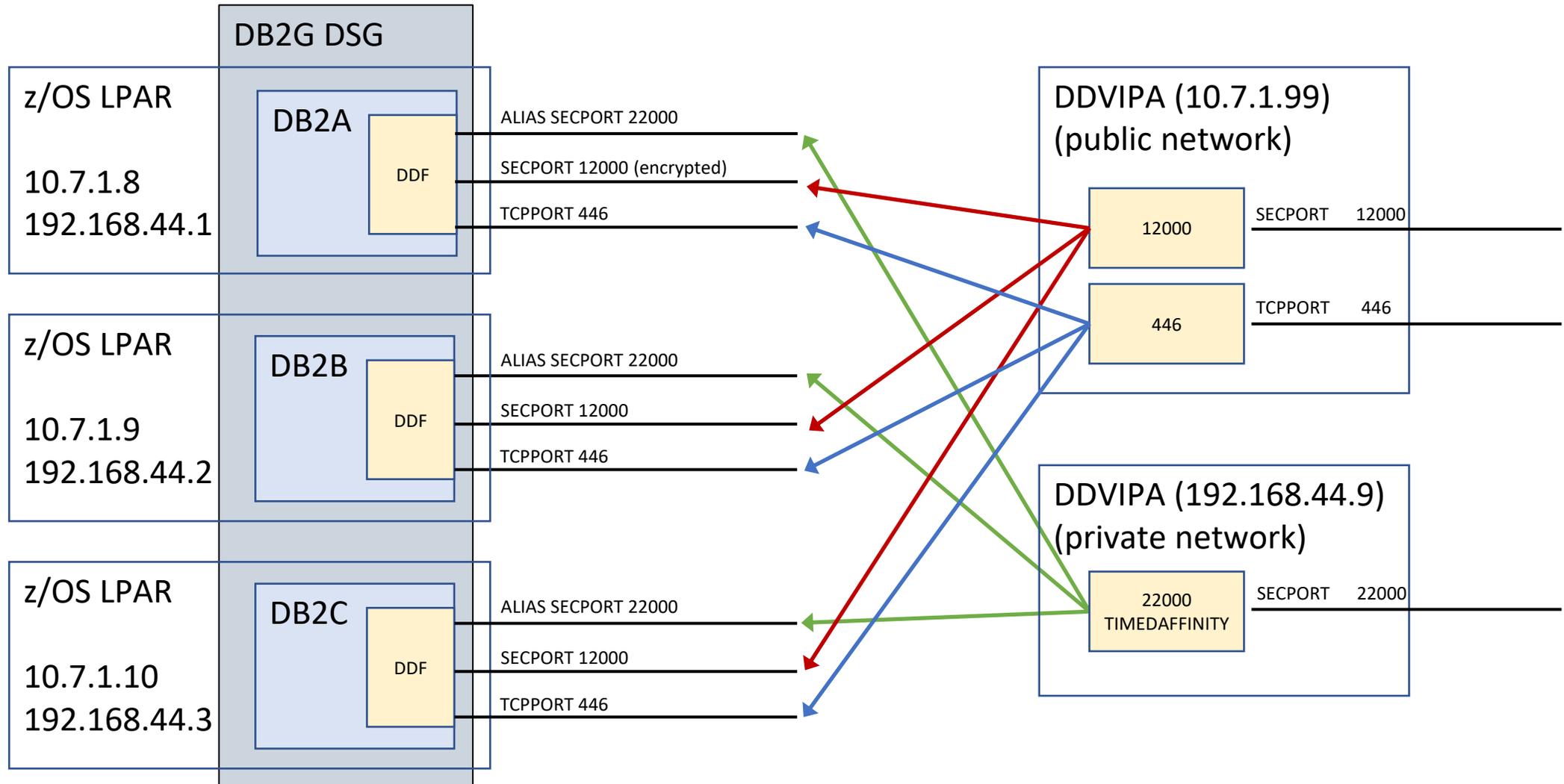
Sample DDVIPA definitions

```
VIPADefine MOVE IMMEDIATE 255.255.255.255 10.7.1.99 ; GROUP DB2G
```

```
VIPADISTRIBUTE DEFINE 10.7.1.99 PORT 446 12000 DESTIP ALL ; SQL
```

```
VIPADISTRIBUTE DEFINE DISTMETHOD ROUNDROBIN TIMEDAFFINITY 60  
10.7.1.99 PORT 22000 DESTIP ALL ; INSYNC
```

Network topology with private network



DDVIPA definitions for private/public network

; public network group DB2G

VIPADefine MOVE IMMEDIATE 255.255.255.255 10.7.1.99

VIPADistribute DEFINE 10.7.1.99 PORT 446 12000 DESTIP ALL ; SQL

; private network group DB2G, only Integrated Synchronization

VIPADefine MOVE IMMEDIATE 255.255.255.255 192.168.44.9

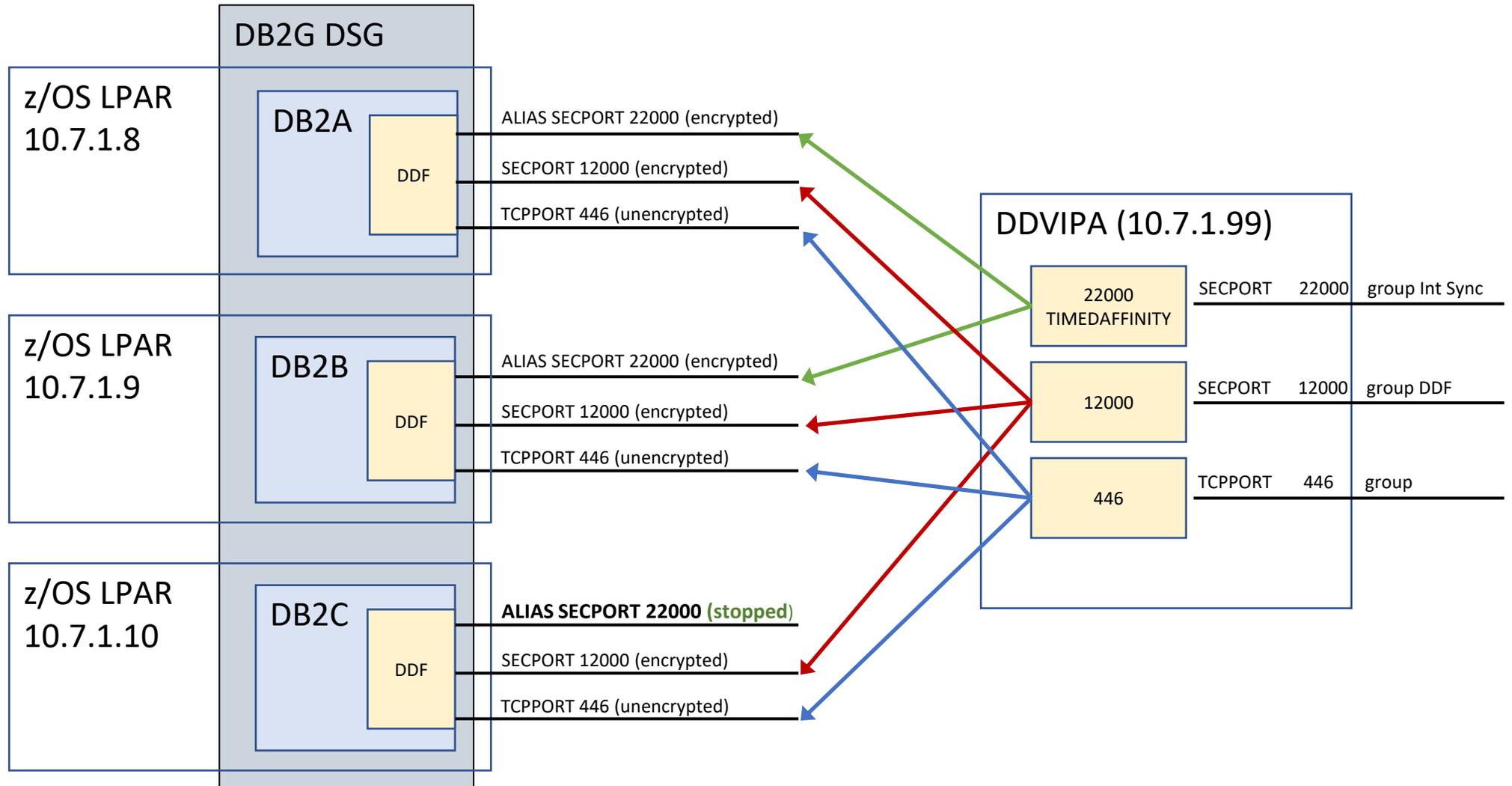
VIPADistribute DEFINE DISTMETHOD ROUNDROBIN TIMEDAFFINITY 60

192.168.44.9 PORT 22000 DESTIP ALL ; INSYNC

Load balancing in large data sharing groups

- To restrict load of reading log files for Integrated Synchronization the specific alias can only be started on a subset of members
 - Still able to fail over in case of problems
 - Load impact restricted to dedicated members only
- Target members can always be adapted by starting or stopping the alias on each member

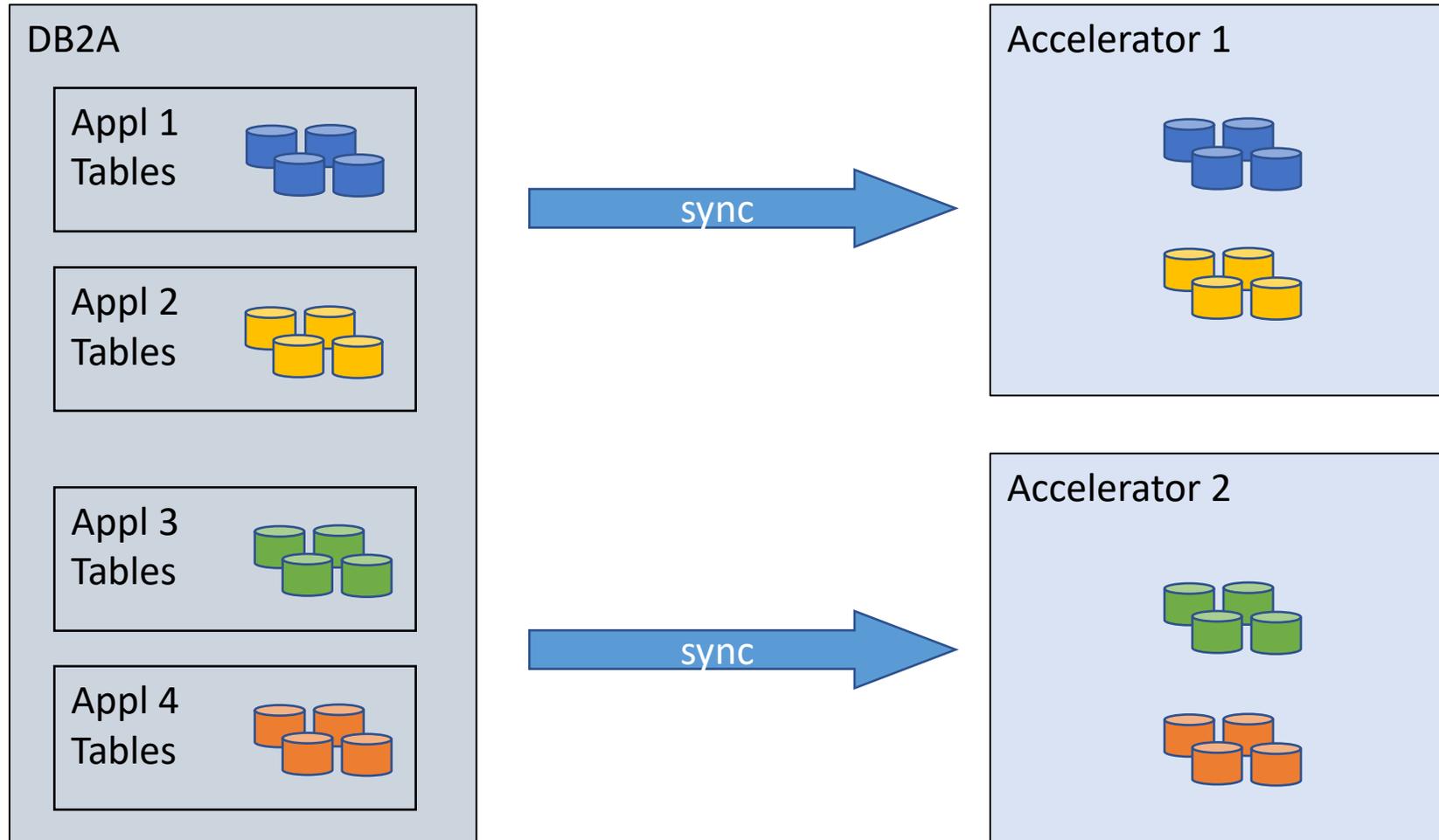
Load control by dedicated start of alias



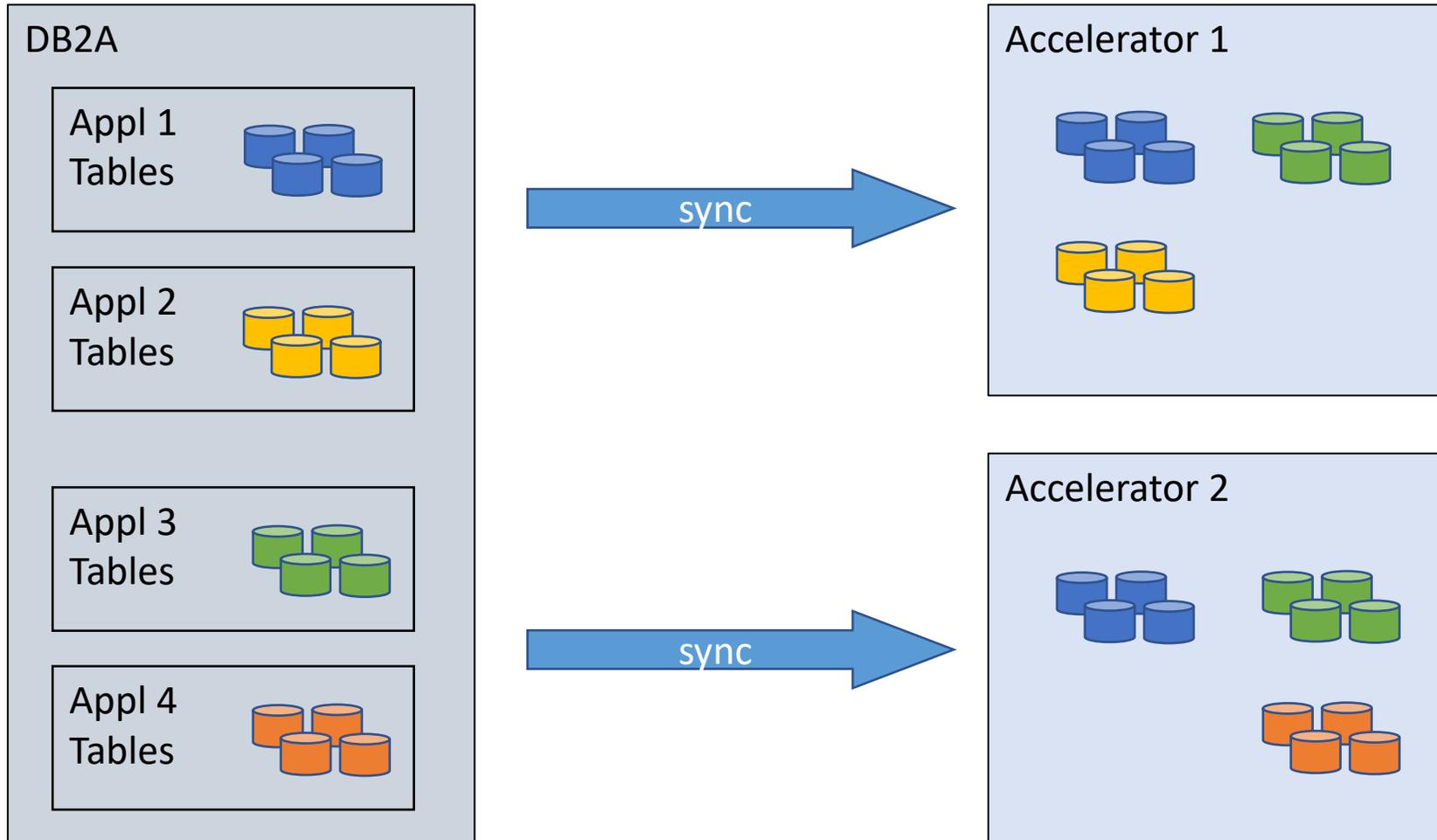
Managing multiple accelerators and data gates

- A single accelerator or Data Gate can only be paired once with the same data sharing group for incremental updates (not with each member)
- Multiple accelerators or Data Gates can be paired for incremental updates with the same Db2 subsystem or data sharing group
 - Either for different workloads replicating different sets of tables
 - Or for HA
- Using the previously mentioned methods, replication workload can be directed to different members using different aliases for each accelerator, if desired

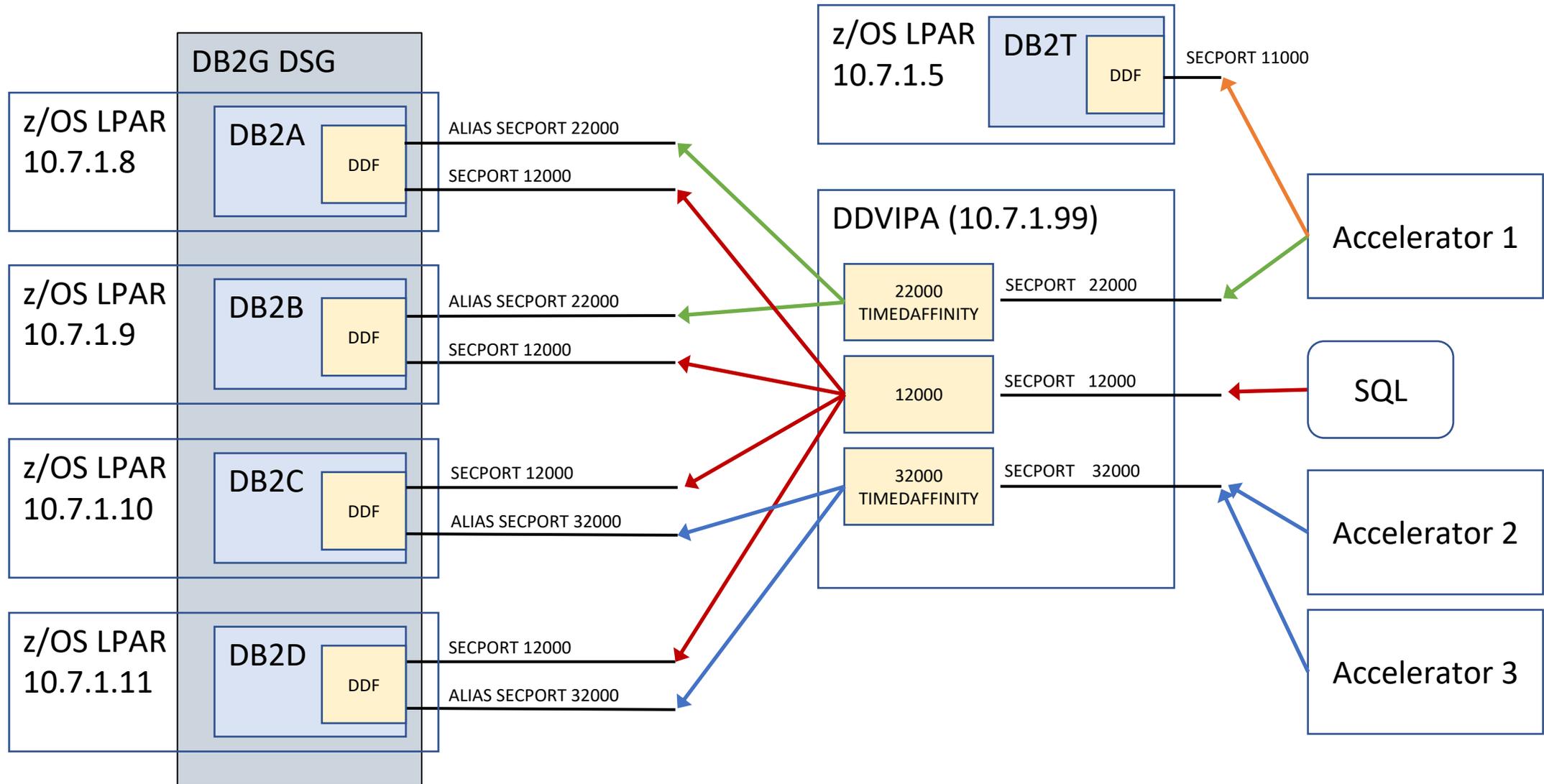
Distributing workload to multiple accelerators



Using multiple accelerators for high availability for some applications



Multiple accelerators with load balancing



Integrated Synchronization Monitoring – External Messages

When replication is started for a Db2 subsystem, Db2 starts an SRB in the DBM1 address space to collect log records for the replication enabled tables. The SRB remains active until replication is stopped or a timeout occurs

```
DSNI090I  -DB31 DSNILGRT -STARTING ASYNCHRONOUS LOG 837
READER TASK FOR
SESSION ID   B6F7C6AAD80B9401
LOCATION      IDAAV7
CORR-ID      014.LGRTSK01
STARTING AT  000000000000D0C30A62
WITH         1 QUALIFIERS
```

DSNX881I -DB31 20 W 207282 (2024-02-27 16:05:58 UTC) IDAAV7(10.1.1.99) Id: 1 Subscription:
ACCEL_DWA_DB3G_2023-11-17T16:25 **Message: Replication started**

[DSNI090I](#): It means an asynchronous task (SRB) for reading Db2 logs has started.

```
DSNI092I  -DB31 DSNILGRT -NORMAL TERMINATION OF 784
ASYNCHRONOUS LOG READER TASK FOR
SESSION ID   A6AC0D4DDF645201
LOCATION      IDAAV7
CORR-ID      014.LGRTSK01
ENDING AT    000000000000D0C10B62
AFTER READING 20721 LOG RECORDS
```

DSNX881I -DB31 20 W 207280 (2024-02-27 16:01:03 UTC) IDAAV7(10.1.1.99) Id: 1 Subscription:
ACCEL_DWA_DB3G_2023-11-17T16:25 **Message: Replication stopped**

[DSNI092I](#): This message notifies you that an asynchronous task (SRB) for reading Db2 logs has ended. If it is ended NORMAL or TIMEOUT CAUSED, no action is required. For the termination mode ERROR CAUSED, attempt to restart synchronization from the accelerator. If you are unable to successfully restart synchronization, contact IBM Software Support.

Integrated Synchronization Monitoring

```
08:35:43.56 STC07989 DSNI091I -DC11 DSNILGRT -ERROR IN ASYNCHRONOUS LOG 309
309 READER TASK FOR
309 SESSION ID 523DACEB8EBA0801
309 RETURN CODE 8
309 REASON 00C9000A
```

[DSNI091I](#): The replication is unable to receive data changes. Resynchronization of data might be required. Attempt to restart data replication.

The status of current log reader tasks can be obtained using the DISPLAY STATS command:

```
-DISPLAY STATS(LOGREADERTASKS) ;or short
-DISPLAY STATS(LRT)
```

[DSNT788I](#): This message is issued in response to the DISPLAY STATS(LOGREADERTASKS) command.

```
DSNT788I -DB2A
SESSIONID STATUS CURR. POSITION NUM RECS AGE
-----
164FA983947B0801 SUSP EOS 0000000000018898F744 4 167s
***** DISPLAY OF STATS TERMINATED *****
DSN9022I -DB2A DSNTDSTS 'DISPLAY STATS' NORMAL COMPLETION
```

The following STATUS values may be shown for log reader tasks:

- RUNNING: currently processing log records
- READING: reading log records from log
- SUSP READ: task suspended due to full buffer, waiting for accelerator to fetch more records
- SUSP EOS: task suspended at end of log, task will be woken up in short intervals to check for more log records
- CANCEL: task in termination processing

- Improved output of the [-DISPLAY STATS](#) (LOGREADERTASKS) command and improved log reader related messages (e.g. DSNT788I, DSNI090I, DSNI091I, DSNI092I) help to identify the **location** and **correlation ID** of the Accelerator that started the log reader task.
 - Example of -DISPLAY STATS (LOGREADERTASKS) output:

```

DSNT788I  -SSID
SESSIONID  STATUS      CURR. POSITION      NUM RECS  AGE
CORR-ID    LOCATION
-----
EE00982796560801  READING  0000000000018898F400  32071     89s
014.LGRTSK01  SVLSSC0A
EE00DAC3E7842E02  SUSP EOS  00000000000188CA2280  30         6s
014.LGRTSK02  DG653758
***** DISPLAY OF STATS ENDED *****
DSN9022I  -SSID DSNTDSTS 'DISPLAY STATS' NORMAL COMPLETION

```

CORR-ID

The correlation ID that identifies the log reading system task. It starts with 014.LGRTSK and is appended with a 2-digit number to make it unique.

LOCATION

The name of the Accelerator that initiated the asynchronous log reader task.

- New **SCOPE(GROUP)** option to the -DISPLAY STATS (LOGREADERTASKS) command to display information about log reader tasks running on all active members of a data sharing group.
- Both enhancements are delivered by Db2 for z/OS APAR PH40261; Accelerator V7.5.7 is not required.
 - See also: <https://www.ibm.com/docs/en/db2-for-zos/12?topic=12-recent-enhancements-db2>

Integrated Synchronization

New health and status information display in Configuration Console

- Retrieve **health and status information** using the Configuration Console
 - Status information such as latency, # of records applied or # of open transactions
 - List of open transactions including user ID and involved tables

```
main -> manageIU
-----
You have the following options:

(0) - Go back one level
(1) - Enable incremental updates
(2) - Disable incremental updates
(3) - Restart incremental update processes
(4) - Include or exclude tables not enabled for incremental updates
(5) - Allow or disallow queries to run if WAITFORDATA time
(6) - Change Db2 for z/OS credentials for Integrated Synchronization
(7) - Change IP and secure DDF port of Db2 for z/OS for Integrated Synchronization
(8) - (Menu) Manage Certificates for Replication
(9) - Integrated Synchronization status

(Default 0) >
```

```
(9) - Integrated Synchronization status
(Default 0) > 9

Select the Db2 subsystem to monitor:
Using the only applicable database system DWBDC11

Status information retrieved at Fri Feb 4 16:49:28 2022

1. Display status overview
2. Display list of open transactions
3. Refresh status information

Select ('' or '0' to exit): █
```

Integrated Synchronization

New health and status information display in Configuration Console

- **Option 1:** Display status overview

```
Status information retrieved at Fri Feb  4 16:50:14 2022

Latency: 300s
Latest commit RBA / LRSN: 00000000361AC99FE340
Parsed source operations: 1400 insert, 600 update, 2000 delete
Applied target operations: 2000 insert, 2600 delete
Tenured heap usage: 90%
Number of open transactions: 35

Type 'r' to refresh status information or press <return> to go back: █
```

Integrated Synchronization

New health and status information display in Configuration Console

- **Option 2:** Display list of open transactions
 - View tables

```
Status information retrieved at Fri Feb 4 20:51:18 2022
```

```
Number of open transactions: 35
```

```
Earliest open RBA / LRSN: 00000000361AC99FE340
```

```
Open transactions (showing 1-10 of 35):
```

#	URID	Begin RBA / LRSN	Begin Timestamp	User ID
1	000030A3B22E	00000000361AC99FE340	2021-11-4 16:10:16	SOMEUSER2
2	0000301AB40E	00000000B401A999FA30	2021-11-4 16:10:21	SOMEUSER2
3	000036A3C99F	000000009F1AC99FB40E	2021-11-4 16:10:22	SOMEUSER2
4	000030A3B21A	00000000361ACB00A340	2021-11-4 16:10:22	SOMEUSER2
5	00001AA3AC2E	00000000B2001A00E340	2021-11-4 16:11:26	SOMEUSER5
6	000030ACB22E	00000000300AC99FE340	2021-11-4 16:11:26	SOMEUSER6
7	0000301AB4AC	00000000B401A009FA30	2021-11-4 16:22:16	SOMEUSER7
8	000036ACC99F	00000000900AC99FB40E	2021-11-4 16:22:26	SOMEUSER8
9	000030A3AC1A	000000003600CB21A340	2021-11-4 16:26:16	SOMEUSER2
10	0000C9A3B22E	00000000B21A1A00E340	2021-11-4 16:34:11	SOMEUSER2

```
Select the transaction # to view its tables: 8
```

```
Tables for transaction with URID 000030A3B22E:  
SCHEMA8.TABLETABLE8 ( dbid 705, obid 1 )
```

```
Press <return> to go back to the list of transactions.
```

```
Type 'n' to view the next 10 transactions,  
't' to view transaction tables,  
or press <return> to go back to status information for DWBDC11: █
```

Integrated Synchronization - Monitoring Latency – Options

Structure of DSNX881I Messages in Db2 Analytics Accelerator Version 7

<https://www.ibm.com/support/pages/node/5694807>

<https://www.ibm.com/support/pages/node/6468003>

```
DSNX881I -DB2M 3000 W 32935 (2021-08-07 22:12:01 UTC) DB2MIDAA(10.195.120.200) THE CURRENT REPLICATION LATENCY OF  
5068S ON DB2 LOCATION HOMEDB2M (SUBSCRIPTION DWA_HOMEDB2M_2021-06-15T11:40) HAS EXCEEDED THE THRESHOLD OF 3600S
```

- Default value for replication latency is set as 3600 seconds for DSNX881I 3000 alert
- It is an IDAA server setting via REPLICATION_LATENCY_WARNING_THRESHOLD
- The value must be in the range of 0 and 7 days. A value smaller than 120s deactivates the threshold check completely.
- Please open a case and ask for a change of the threshold. IDAA L2 will make it via webex.

- In SMF, Statistics report
- Q8STCRL : REPLICATION LATENCY : The current replication latency for this DB2 system. Latency is defined as the time difference between the timestamp, when the last log record was applied to the target, compared to the current time.

As a result of running the SYSPROC.ACCEL_CONTROL_ACCELERATOR stored procedure in connection with the <getAcceleratorInfo> parameter.

Integrated Synchronization – Indoubt Thread Monitoring – Work in Progress for V8

Problem Statement: After IPL of a Db2 for z/OS system, There are indoubt transactions (transactions that wrote commit1 record but did not write commit2 records).

Customers have the possibility to abort / commit those transactions manually after Db2 has been restarted. In such scenarios the Db2 system starts a new transaction to handle the completion of the transaction and thus must figure out the original previous crashed URID from URLRXXUI.

Capability

Integrated Synchronization will introduce a new DSNX message to alert if there is a transaction that Insync did not receive the commit record for an in-scope transaction when a configurable wait time is elapsed.

If transaction for which the commit record was not received in the specified time, does not have any replicable changes neither has any schema changes nor a utility, then integrated synchronization will stop tracking this transaction anymore.

Usability: Customers will be alerted if there exists any in-scope indoubt transactions in periodic intervals. Any out-of-scope indoubt transaction will not be kept open in the system for long causing the integrated synchronization to jump back to very old log positions after a restart.

Integrated Synchronization Db2 for z/OS utility and Schema Change support summary

General Suggestions

- Use always LOG YES running utilities.
- Use SHRLEVEL CHANGE and LOG YES while running the LOAD utility
- Consider always UTS (Universal Table Space) for source tablespace type
- AREO and Integrated Synchronization (for details [click](#))
 - If Replication is ON and Table is set to AREO, Replication continues
 - If Replication is OFF and Table is set to AREO, Reorg first and then Turn replication ON
- If data is deleted from a synchronized Db2 for z/OS table or table partition completely by running **REORG DISCARD** or **LOAD REPLACE DD DUMMY**, the effect on the related accelerator-shadow table varies with respect to the type of the Db2 for z/OS table.
 - **Mirroring** : Only PBR or classic partitioned table spaces is allowed. The deleted rows are also deleted from the related accelerator-shadow table and replication remains enabled, no reload is required
 - **Table suspension** : If a REORG DISCARD or LOAD REPLACE DUMMY is run on a PBG, the table is suspended from Integrated Synchronization, query acceleration is disabled, and the table goes into *error* state.

General Suggestions

- Partial discards are not supported with REORG DISCARD
 - Partially emptied partitions will be set table into “Replication Error”
 - “Replication Error” will require re-load of the table or partition
 - Query acceleration will be disabled
- Basic REORG of non-partitioned tablespaces supported . Check APAR [PH48537](#)
- If a replicated table is set into error state, it will also have acceleration disabled to avoid queries on stale data

Vendor Utility Support

- Integrated Synchronization depends on utility diagnostic log records to detect events that can not be replicated
- Db2 for z/OS enabled vendor support to write diagnostic log records through PH11871 (UI65271)
- Vendor status (untested) for basic support (no REORG DISCARD):
 - BQU2907 for the NGT LOAD and REORG utilities
 - BQU2910 for Load Plus
 - BQU2911 for Reorg Plus
 - BQU2873 for AMI Recover
- For other vendors, please contact with your vendor rep.

Integrated Synchronization – Unsupported Utility

<https://www.ibm.com/support/pages/node/6468003>

Message ID: 2025 Severity: WARNING

Message text:

/W2025/ Setting table <table> to ERROR state because an unsupported utility operation <utility operation> was detected; resynchronization is required.

Explanation:

The affected table must be reloaded.

Message ID: 2026 Severity: WARNING

Message text:

/W2026/ Setting table <table> to ERROR state because an utility operation <utility operation> was detected on <partitioning type> tablespace; resynchronization is required.

Explanation:

The affected table must be reloaded.

Action:

Reload the table.

Message ID: 2027 Severity: WARNING

Message text:

/W2027/ Setting table <table> to ERROR due to utility handling error

Explanation:

The affected table must be reloaded.

Action:

Reload the table.

Utility or DDL at the source	Supported (Replication Continious)	Not-Supported (Table goes into error state)
REORG DISCARD	PBR : empty partition(s) For details click	PBG and Non-UTS
Simple REORG (without DISCARD statement)	UTS & non-UTS For details click	
REORG REBALANCE	X - toleration support on replicated PBR table, replication now continues instead of suspending the table from replication. (requires 7.5.12)	
RUNSTATS, REBUILD INDEX	X	
LOAD REPLACE SHRLEVEL REFERENCE NONE		X
LOAD RESUME YES SHRLEVEL CHANGE	X	
LOAD RESUME YES SHRLEVEL NONE		X
RECOVER TABLESPACE		X
ALTER ROTATE	X For details click	
ALTER LIMITKEY		X
TRUNCATE	X	
RENAME TABLE		X

Schema change (Add/Alter column) support

- Add/Alter column operations on Db2 for z/OS tables that are enabled for replication, are automatically synchronized to the Accelerator
 - Not required any more to remove, re-add and re-load a table to the accelerator to make the schema change available
- Support schema changes:
 - ALTER TABLE tablename ADD COLUMN colname [type] NULL
 - ALTER TABLE tablename ADD COLUMN colname [type] WITH DEFAULT [constant]
 - ALTER TABLE tablename ALTER COLUMN colname SET DATA TYPE [extend length of current type]
 - VARCHAR and VARGRAPHIC types only
 - ALTER TABLE tablename ALTER COLUMN colname SET WITH DEFAULT [constant];
- If the schema change affects columns of type TIMESTAMP, then Db2 for z/OS APAR **PH31772** is required
- [Schema changes - IBM Documentation](#)

Schema change (Add/Alter column) support for **non-replicated** tables

- Add/Alter column operations on Db2 for z/OS tables that are **not** enabled for replication, are now automatically synchronized to the Accelerator if Integrated Synchronization is enabled for the Db2 system
 - It is not required any more to remove, re-add and re-load a table to the accelerator to make the schema change available
- For replication enabled tables this support is already available since V7.5.6
- Supported schema changes:
 - ALTER TABLE tablename ADD COLUMN colname [type] NULL
 - ALTER TABLE tablename ADD COLUMN colname [type] WITH DEFAULT [constant]
 - ALTER TABLE tablename ALTER COLUMN colname SET DATA TYPE [extend length of current type]
 - VARCHAR and VARGRAPHIC types only
 - ALTER TABLE tablename ALTER COLUMN colname SET WITH DEFAULT [constant];

Schema change (Add/Alter column) support for **non-replicated** tables (*contd.*)

- Requirements:

- Integrated Synchronization must have been enabled for the Db2 system
- Db2 for z/OS APAR PH35389 - PTF UI76324 must be installed (<https://www.ibm.com/support/pages/apar/PH35389>)
- The Db2 for z/OS user specified during enablement of Integrated Synchronization needs the following additional privileges:
 - SELECT privilege on SYSIBM.SYSTABLES, SYSIBM.SYSCOLUMNS
 - SELECT, UPDATE privilege on SYSIBM.SYSACCELERATEDTABLES

DROP Table support

- After DROP TABLE command, which is replicated by Integrated Synchronization, the corresponding accelerator-shadow table is removed from all accelerators on which it is defined.
- The dropping of a Db2 for z/OS table triggers a run of the SYSPROC.ACCEL_REMOVE_TABLE stored procedure, which removes the accelerator-shadow table from the connected accelerators.
- When the stored procedure is executed depends on the replication status:
 - If the latency is low, the stored procedure is run almost immediately after the dropping of the Db2 for z/OS table.
 - If the latency is high, the stored procedure run is delayed until the log record with the DROP TABLE statement has been read by the log reader for Integrated Synchronization
 - If replication has been stopped, the stored procedure run is delayed until the replication process resumes.
- DSNX881I message in the z/OS SYSLOG is issued
- <https://www.ibm.com/docs/en/daafz/7.5?topic=operations-drop-table-behavior>

ALTER ROTATE PARTITION support

- ALTER ROTATE PARTITION operations are fully supported. That is, the IBM Integrated Synchronization function automatically picks up and propagates changes that were caused by such operations.
- It is no longer necessary to reload affected accelerator-shadow tables when a source table partition has been emptied and then filled with new (different) data. The support works even if you choose to empty source table partitions by LOAD REPLACE DUMMY operations.
- Note: Restrictions for tables partitioned by growth (PBG) remain in place.

Integrated Synchronization Monitoring - CPU

Integrated Synchronization Log Reader Task metrics for **CP/zIIP consumption** are added via PH29650/UI73402

In DSNDQ8ST / **Accelerator specific CPU and zIIP times for log reader tasks**

Q8STLRCP: CPU time used by asynchronous log reader task on behalf of this accelerator

Q8STLRZI: zIIP time used by asynchronous log reader task on behalf of this accelerator

Q8STLRZE: zIIP eligible time used by asynchronous log reader task on behalf of this accelerator

In DSNDQIST / **Overall CPU and zIIP times for log reader tasks since Db2 was started**

QISTLRCP: CPU time spent in all log reader tasks since Db2 start

QISTLRZI: zIIP time spent in all log reader tasks since Db2 start

QISTLRZE: zIIP eligible time executed on CP in all log reader tasks since Db2 start

More Reference for the meaning of the fields above

<https://www.ibm.com/docs/en/om-db2-pe/5.5.0?topic=i0ds-ifcid-002-accelerator-data-subsystemgroup-perspective-v4-later>

<https://www.ibm.com/docs/en/om-db2-pe/5.5.0?topic=managers-accelerator-statistics-detail>

Check the maintenance

<https://www.ibm.com/support/pages/apar/PH32510>

<https://www.ibm.com/support/pages/apar/PH29650>

CPU TIME FOR LOG READER TASK.....: 1:52.040922
ZIIP TIME FOR LOG READER TASK.....: 2:18:42.856322
ZIIP ELIGIBLE TIME FOR LOG READ TASK.: 1:52.040922

Q8STLRCP - **CPU time** used by the asynchronous log reader task of the Integrated Synchronization function on behalf of this accelerator

Q8STLRZI - **zIIP time** used by the asynchronous log reader task of the Integrated Synchronization function on behalf of this accelerator

Q8STLRZE - **zIIP-eligible time** used by the asynchronous log reader task of the Integrated Synchronization function on behalf of this accelerator

The total amount of CPU used by the Insync log reader is (CPU TIME FOR LOG READER TASK(cpu time on GCP) + ZIIP TIME FOR LOG READER TASK (cpu time on zIIP)) .

ZIIP ELIGIBLE TIME FOR LOG READ TASK is what could have run on zIIP but ran on GCP (because the zIIP was full or not available for some reason).

TechNotes

[Db2 Analytics Accelerator on Z: Monitoring - IFL, Memory and Storage](#)

[Db2 Analytics Accelerator -Incremental Update Monitoring](#)

