



AGLatency Tool User Manual

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Version 1 Draft

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1 Summary

The purpose of this document is to detail the download, installation and use of the AG (Availability Group) Latency Tool. The AGLatency tool can be used to determine which step in a synchronous AlwaysOn Availability Group replication topology is generating the most latency.

2 Prerequisites

This section details the prerequisites for using the AGLatency Tool.

2.1 .Net version

The AGLatency tool requires .Net version 4.5.2 or higher.

3 Download and install

The purpose of this section is to detail the process for downloading and installing the AGLatency Tool.

3.1 Download

The AG Latency tool is available on GitHub at the link below.

<https://github.com/suyouquan/AGLatency/releases/download/v2.0/AGLatencyV2.0.zip>

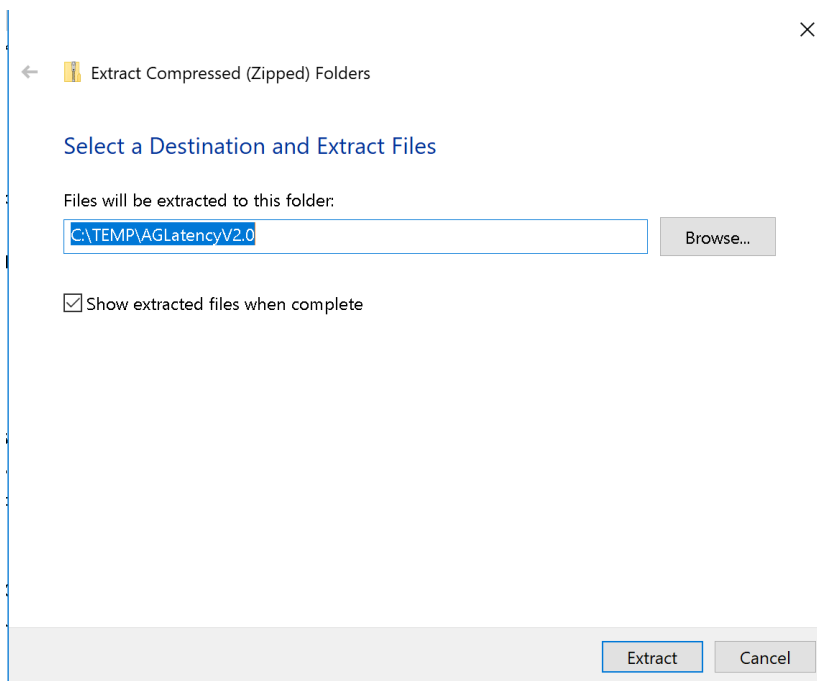
The main project page is located at the link below.

<https://github.com/suyouquan/AGLatency>

3.2 Install

1. Unzip the AGLatencyV2.0.zip file to a suitable location on the client machine.

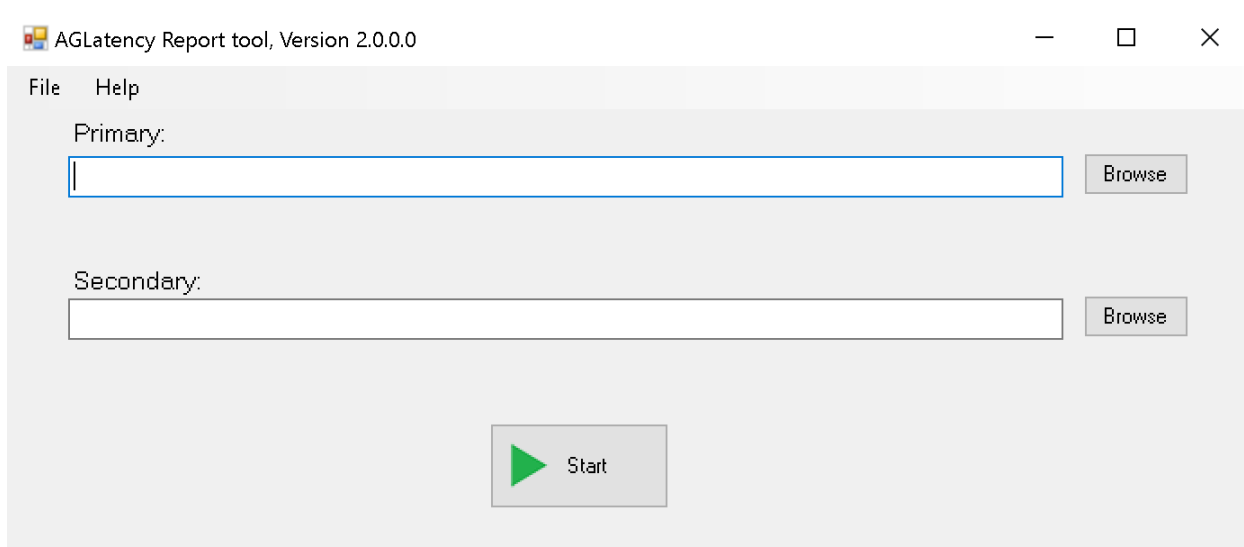
NOTE: Best practice is to extract and install the AGLatency Tool on a client workstation or non-production server.



2. Double-click the AGLatency.exe file. The AGLatency Tool main screen will appear.

This PC > Local Disk (C:) > TEMP > AGLatencyV2.0

Name	Date modified	Type	Size
html	10/14/2018 9:47 PM	File folder	
LOG	10/13/2018 9:48 PM	File folder	
Report	10/13/2018 9:49 PM	File folder	
SQLiteDB	10/13/2018 9:22 PM	File folder	
x64	10/14/2018 9:47 PM	File folder	
x86	10/14/2018 9:47 PM	File folder	
AGLatency.exe	10/13/2018 9:48 PM	Application	159 KB
AGLatency.exe.config	7/21/2018 10:01 AM	XML Configuration Fi	1 KB
AGLatency.pdb	10/13/2018 9:48 PM	Program Debug Data...	200 KB
AGLatency.vshost.exe	10/13/2018 9:21 PM	Application	23 KB

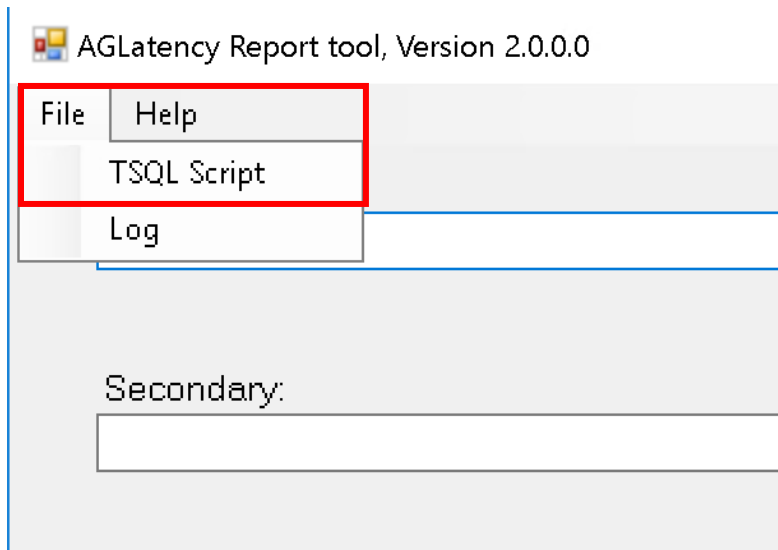


4 Generate AG topology XML files

This section details the process of generating XML query results containing the AlwaysOn Availability Group environment and topology information.

4.1 Execute environment and topology query

1. Choose "File" → "TSQL Script".



2. A text document will open. Choose the first query and execute on both the primary and secondary replicas.

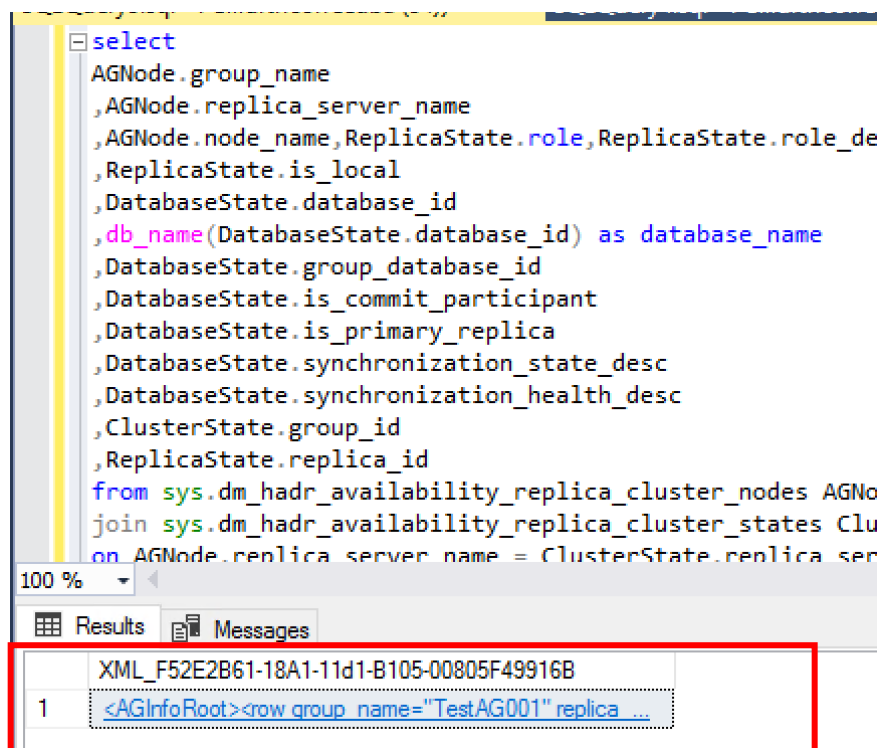

```

TSQL_XEventsql - Notepad
File Edit Format View Help

select
AGNode.group_name
,AGNode.replica_server_name
,AGNode.node_name,ReplicaState.role,ReplicaState.role_desc
,ReplicaState.is_local
,DatabaseState.database_id
,db_name(DatabaseState.database_id) as database_name
,DatabaseState.group_database_id
,DatabaseState.is_commit_participant
,DatabaseState.is_primary_replica
,DatabaseState.synchronization_state_desc
,DatabaseState.synchronization_health_desc
,ClusterState.group_id
,ReplicaState.replica_id
from sys.dm_hadr_availability_replica_cluster_nodes AGNode
join sys.dm_hadr_availability_replica_cluster_states ClusterState
on AGNode.replica_server_name = ClusterState.replica_server_name
join sys.dm_hadr_availability_replica_states ReplicaState
on ReplicaState.replica_id = ClusterState.replica_id
join sys.dm_hadr_database_replica_states DatabaseState
on ReplicaState.replica_id=DatabaseState.replica_id
for XML RAW, ROOT('AGInfoRoot')

```

3. Save the XML query results from the primary and secondary replicas to separate files.
Click the XML to open the results in a new SSMS tab.



```

select
AGNode.group_name
,AGNode.replica_server_name
,AGNode.node_name,ReplicaState.role,ReplicaState.role_desc
,ReplicaState.is_local
,DatabaseState.database_id
,db_name(DatabaseState.database_id) as database_name
,DatabaseState.group_database_id
,DatabaseState.is_commit_participant
,DatabaseState.is_primary_replica
,DatabaseState.synchronization_state_desc
,DatabaseState.synchronization_health_desc
,ClusterState.group_id
,ReplicaState.replica_id
from sys.dm_hadr_availability_replica_cluster_nodes AGNode
join sys.dm_hadr_availability_replica_cluster_states ClusterState
on AGNode.replica_server_name = ClusterState.replica_server_name

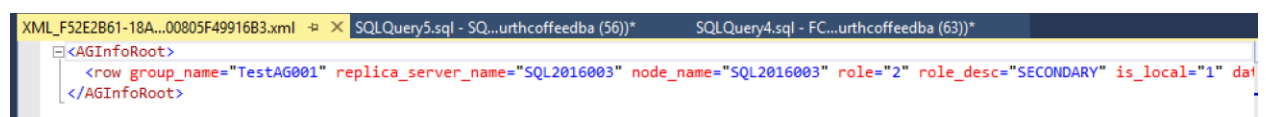
```

100 %

Results Messages

XML_F52E2B61-18A1-11d1-B105-00805F49916B

1 <AGInfoRoot><row group_name="TestAG001" replica ...



XML_F52E2B61-18A1-11d1-B105-00805F49916B3.xml SQLQuery5.sql - SQ...urthcoffeedba (56)) SQLQuery4.sql - FC...urthcoffeedba (63))

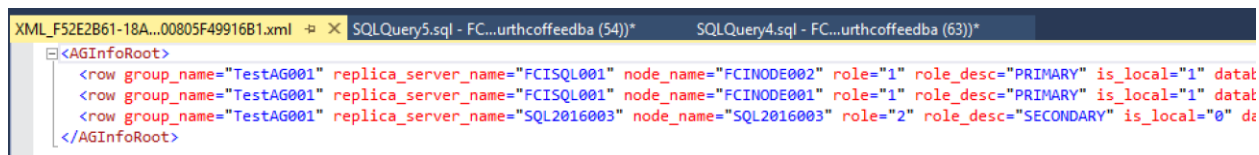
```

<AGInfoRoot>
<row group_name="TestAG001" replica_server_name="SQL2016003" node_name="SQL2016003" role="2" role_desc="SECONDARY" is_local="1" data
</AGInfoRoot>

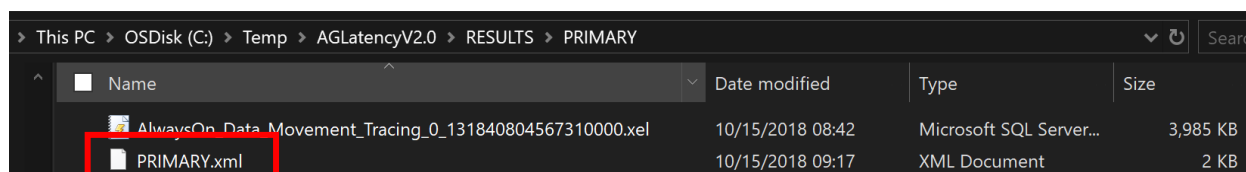
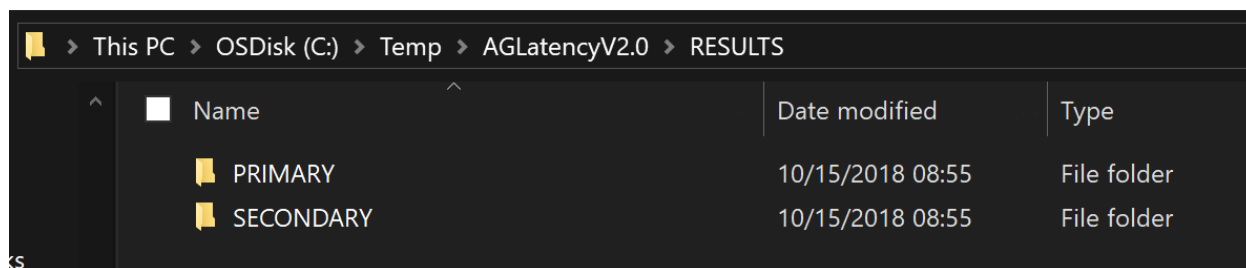
```

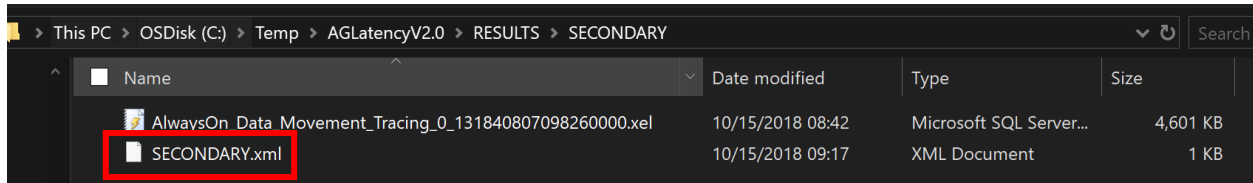
4. Save the XML contents of this tab to a file, keeping the results for the primary and secondary replicas in separate files. Separate directories for each replica are helpful in preventing confusion.

NOTE: The XML results files must be named PRIMARY.xml and SECONDARY.xml.



```
<AGInfoRoot>
  <row group_name="TestAG001" replica_server_name="FCISQL001" node_name="FCINODE002" role="1" role_desc="PRIMARY" is_local="1" data...
  <row group_name="TestAG001" replica_server_name="FCISQL001" node_name="FCINODE001" role="1" role_desc="PRIMARY" is_local="1" data...
  <row group_name="TestAG001" replica_server_name="SQL2016003" node_name="SQL2016003" role="2" role_desc="SECONDARY" is_local="0" data...
</AGInfoRoot>
```



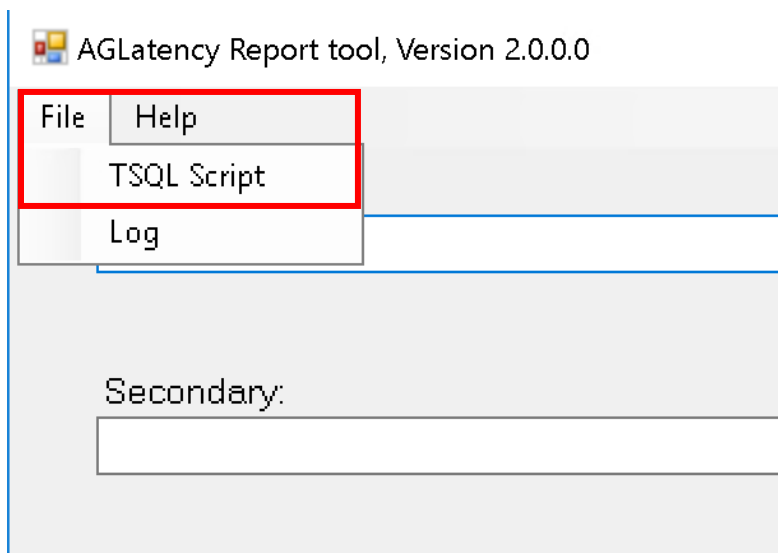


5 Create Extended Event trace

The purpose of this section is to describe the process for creating the Extended Events trace to collect the data the tool will use to perform its analysis.

5.1 Execute Extended Event trace script

1. From the main screen of the AGLatency Tool, select "File" → "TSQL Script". This will open a text document containing the extended event trace definition.



```

TSQL_XEventsql - Notepad
File Edit Format View Help
--Step 2: Run below script on both primary and secondary at the same time, for about 5-10 minutes, and then stop it.

--You can change "c:\temp" to other folder accordingly.

CREATE EVENT SESSION [AlwaysOn_Data_Movement_Tracing] ON SERVER
ADD EVENT sqlserver.hadr_apply_log_block,
ADD EVENT sqlserver.hadr_capture_filestream_wait,
ADD EVENT sqlserver.hadr_capture_log_block,
ADD EVENT sqlserver.hadr_capture_vlfheader,
ADD EVENT sqlserver.hadr_db_commit_mgr_harden,
ADD EVENT sqlserver.hadr_log_block_compression,
ADD EVENT sqlserver.hadr_log_block_decompression,
ADD EVENT sqlserver.hadr_log_block_group_commit,
ADD EVENT sqlserver.hadr_log_block_send_complete,
ADD EVENT sqlserver.hadr_lsn_send_complete,
ADD EVENT sqlserver.hadr_receive_harden_lsn_message,
ADD EVENT sqlserver.hadr_send_harden_lsn_message,
ADD EVENT sqlserver.hadr_transport_flow_control_action,
ADD EVENT sqlserver.hadr_transport_receive_log_block_message,
ADD EVENT sqlserver.log_block_pushed_to_logpool,
ADD EVENT sqlserver.log_flush_complete,
ADD EVENT sqlserver.recovery_unit_harden_log_timestamps
ADD TARGET package0.event_file(SET filename=N'c:\temp\AlwaysOn_Data_Movement_Tracing.xel',max_file_size=(500),max_rollover_files=(4))
WITH (MAX_MEMORY=4096 KB,EVENT_RETENTION_MODE=ALLOW_SINGLE_EVENT_LOSS,MAX_DISPATCH_LATENCY=30 SECONDS,MAX_EVENT_SIZE=0 KB,
MEMORY_PARTITION_MODE=None,TRACK_CAUSALITY=OFF,STARTUP_STATE=ON)
GO

```

2. Modify the extended event target settings to adjust the location to which the trace files are written, the maximum size per trace file and the maximum number of trace files.

For instance, in the example below, extended event trace files will be written to "C:\Temp\AlwaysOn_Data_Movement_Tracing.xel". Each file will have a maximum size of 500MB and four (4) trace files will be created.

```

ADD EVENT sqlserver.log_block_pushed_to_logpool,
ADD EVENT sqlserver.log_flush_complete,
ADD EVENT sqlserver.recovery_unit_harden_log_timestamps
ADD TARGET package0.event_file(SET filename=N'c:\temp\AlwaysOn_Data_Movement_Tracing.xel',max_file_size=(500),max_rollover_files=(4))
WITH (MAX_MEMORY=4096 KB,EVENT_RETENTION_MODE=ALLOW_SINGLE_EVENT_LOSS,MAX_DISPATCH_LATENCY=30 SECONDS,MAX_EVENT_SIZE=0 KB,

```

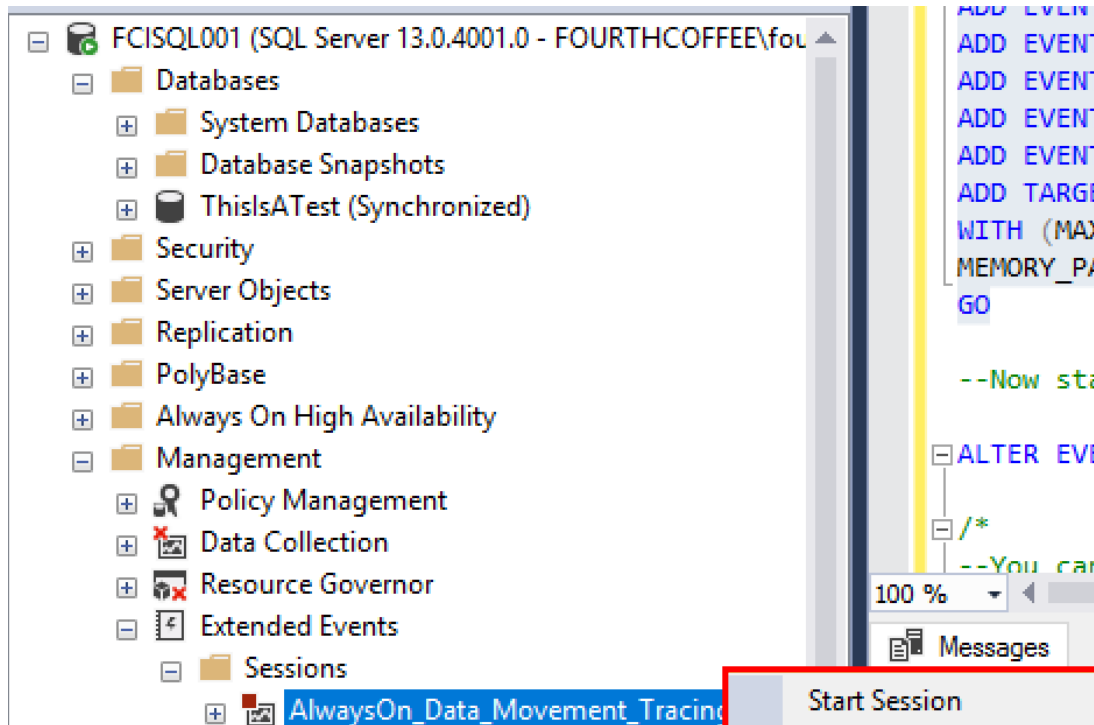
3. Start the extended event trace using the SSMS GUI or TSQL command.

TSQL:

```
ALTER EVENT SESSION [AlwaysOn_Data_Movement_Tracing] ON SERVER STATE=START;
```


SSMS:

Expand the "Management" folder → "Extended Events" node → "Sessions" folder. Right-click the "AlwaysOn_Data_Movement_Tracing" session and choose "Start Session"



4. Once running, the extended event trace files should be visible at the specified filesystem location. Allow the trace session to collect data for 5 – 10 minutes.

NOTE: On busy systems, these trace files have the potential to grow very rapidly and consume multi-GB of space!

This PC > Local Disk (C:) > TEMP				
<input type="checkbox"/> Name	Date modified	Type	Size	
 AlwaysOn_Data_Movement_Tracing_0_131840800724450000.xel	10/15/2018 5:27 A...	Microsoft SQL Ser...	28 KB	

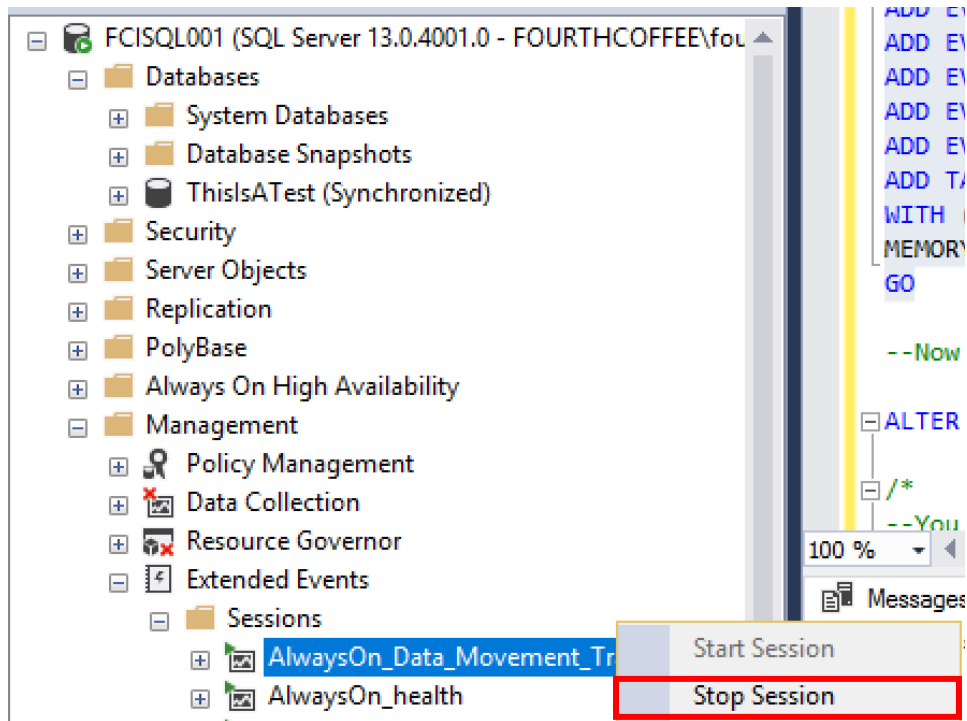
5. After approximately 10 minutes has elapsed, stop the extended event trace. This can be done through the SSMS GUI or via a TSQL command.

TSQL:

```
ALTER EVENT SESSION [AlwaysOn_Data_Movement_Tracing] ON SERVER STATE=STOP;
```

SSMS:

Expand the "Management" folder → "Extended Events" node → "Sessions" folder. Right-click the "AlwaysOn_Data_Movement_Tracing" session and choose "Stop Session"

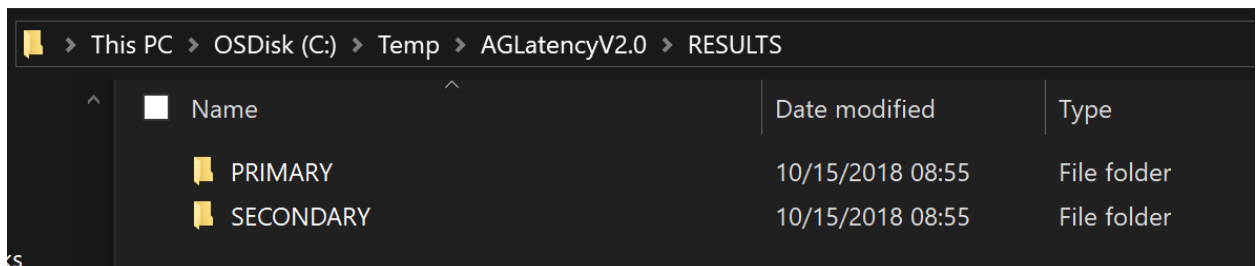


6 Load XEvent trace files

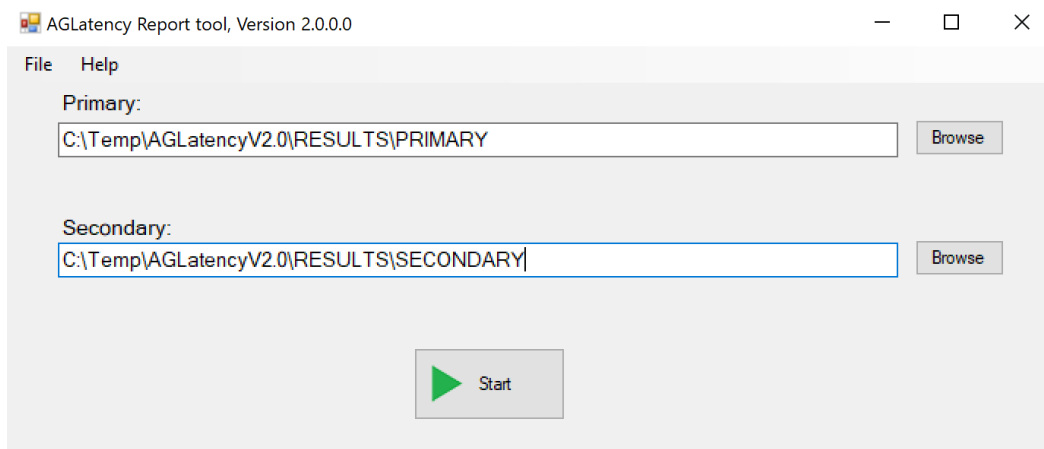
The purpose of this section is to detail the process of loading the extended event trace files into the AGLatency Tool for analysis.

6.1 Copy trace files to client machine

1. Copy the extended event trace files from both the primary and secondary replicas to a location on the client machine from which the AGLatency Tool was opened. Separate directories for each replica are helpful in preventing confusion.

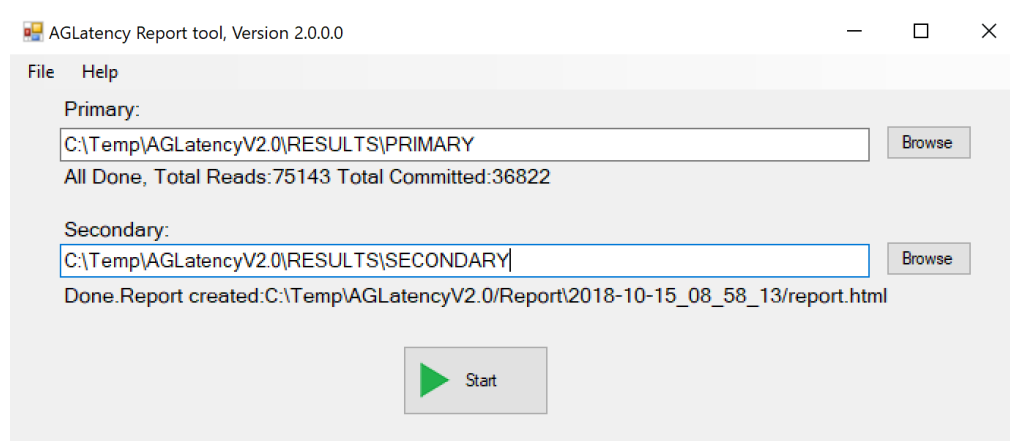
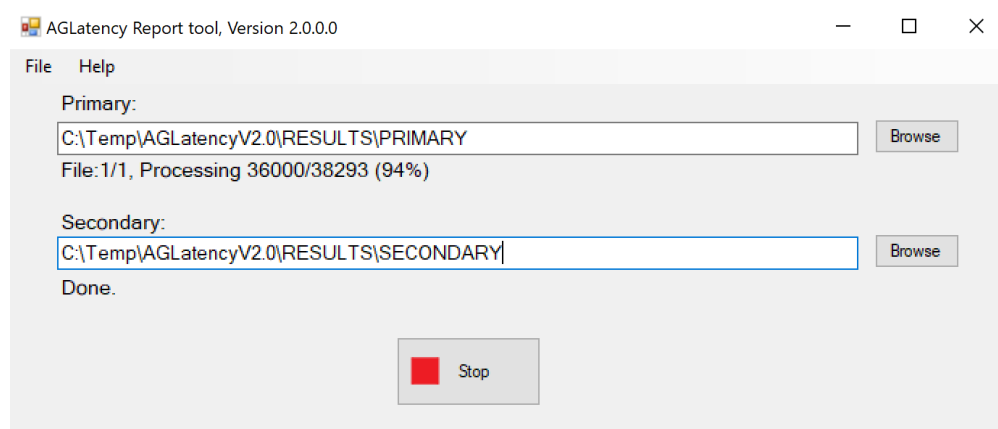
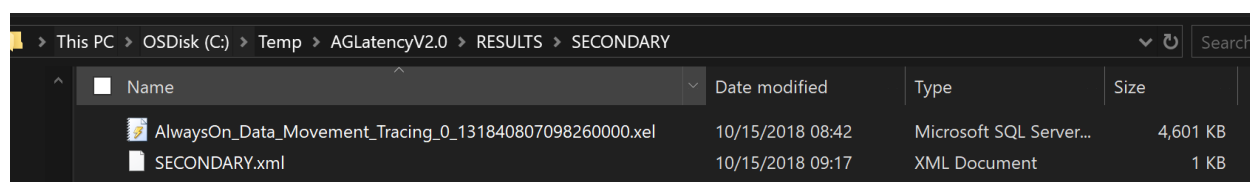
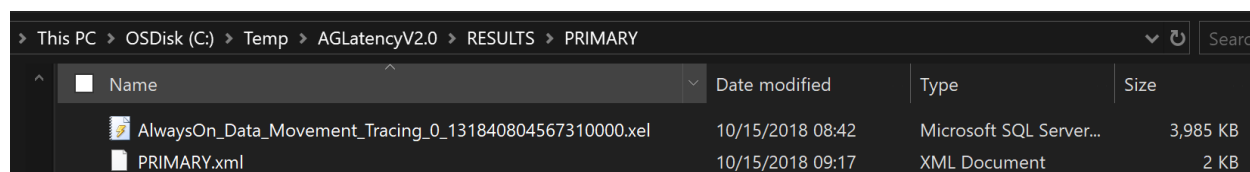


2. In the AGLatency Tool, browse to the location of the trace file for the primary replica. Repeat the same process for the secondary replica.

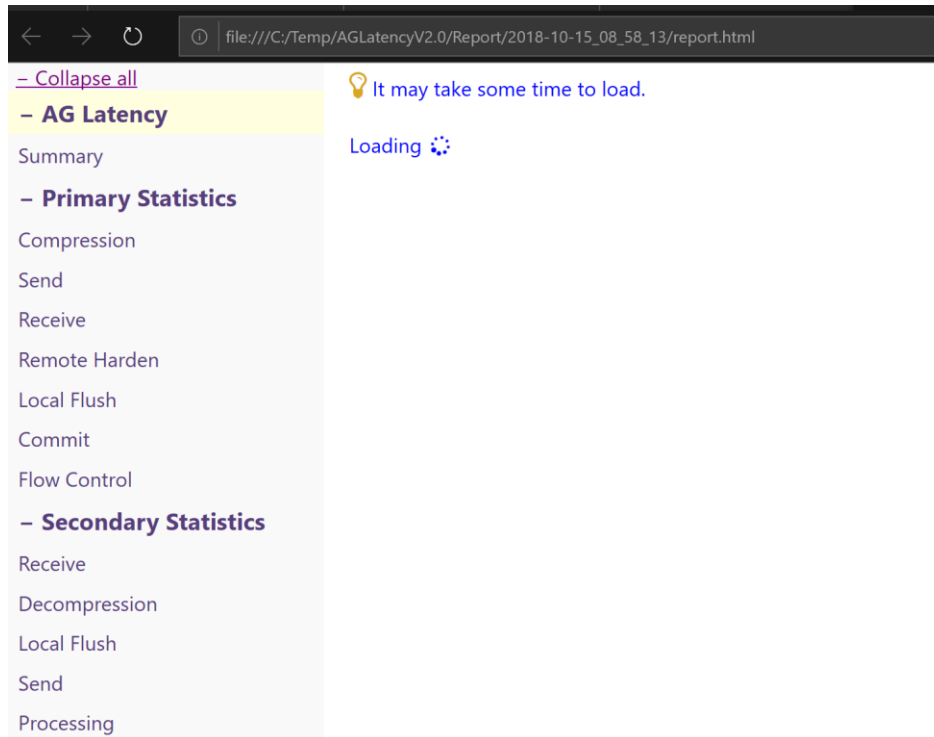


- Press the "Start" button to begin the trace file analysis. Processing time is dependent upon the quantity and size of the extended event trace files.

NOTE: Before pressing "Start", ensure both the environment and topology XML results AND the extended event trace files are present in the PRIMARY and SECONDARY locations specified below.



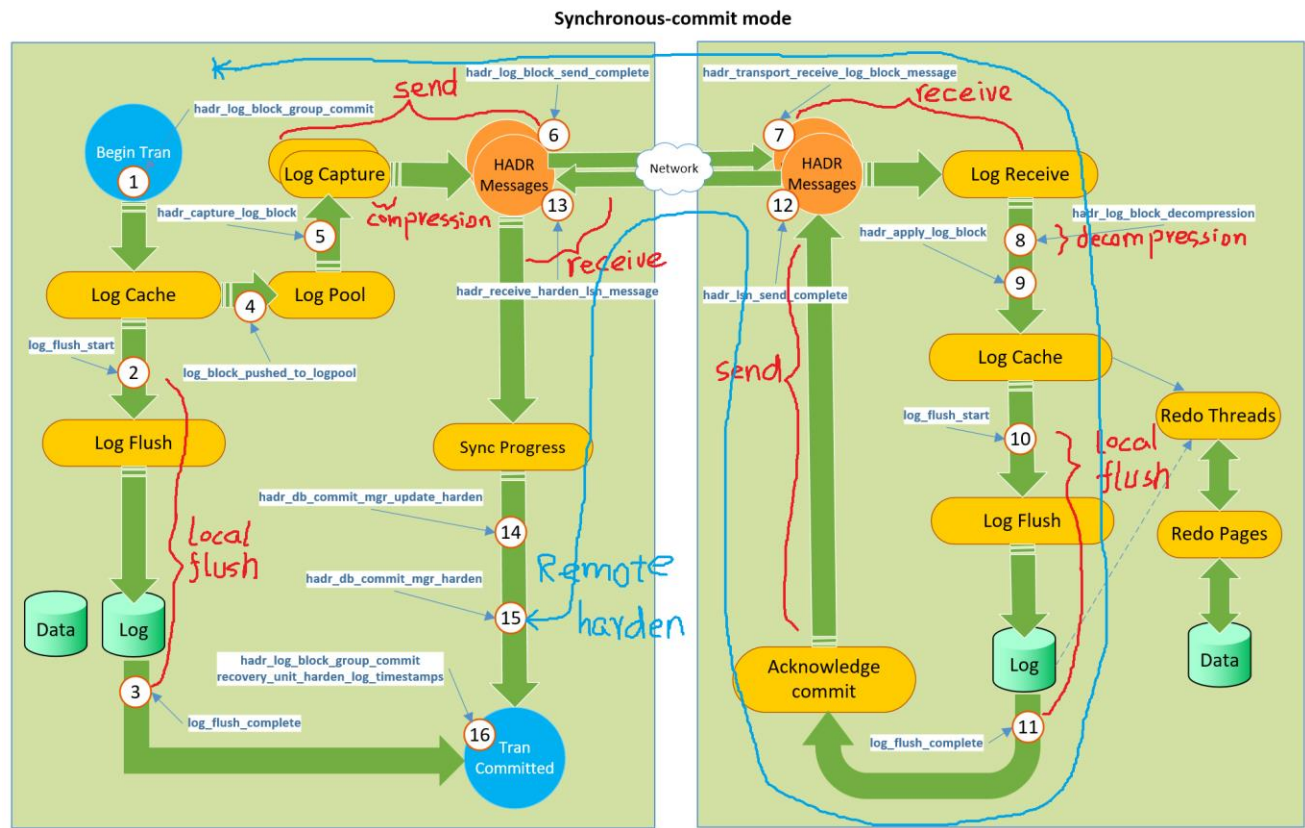
At the completion of the extended event trace file processing, an internet browser window will open indicating that the data is loading to main report.



This section describes various sections of the output report.

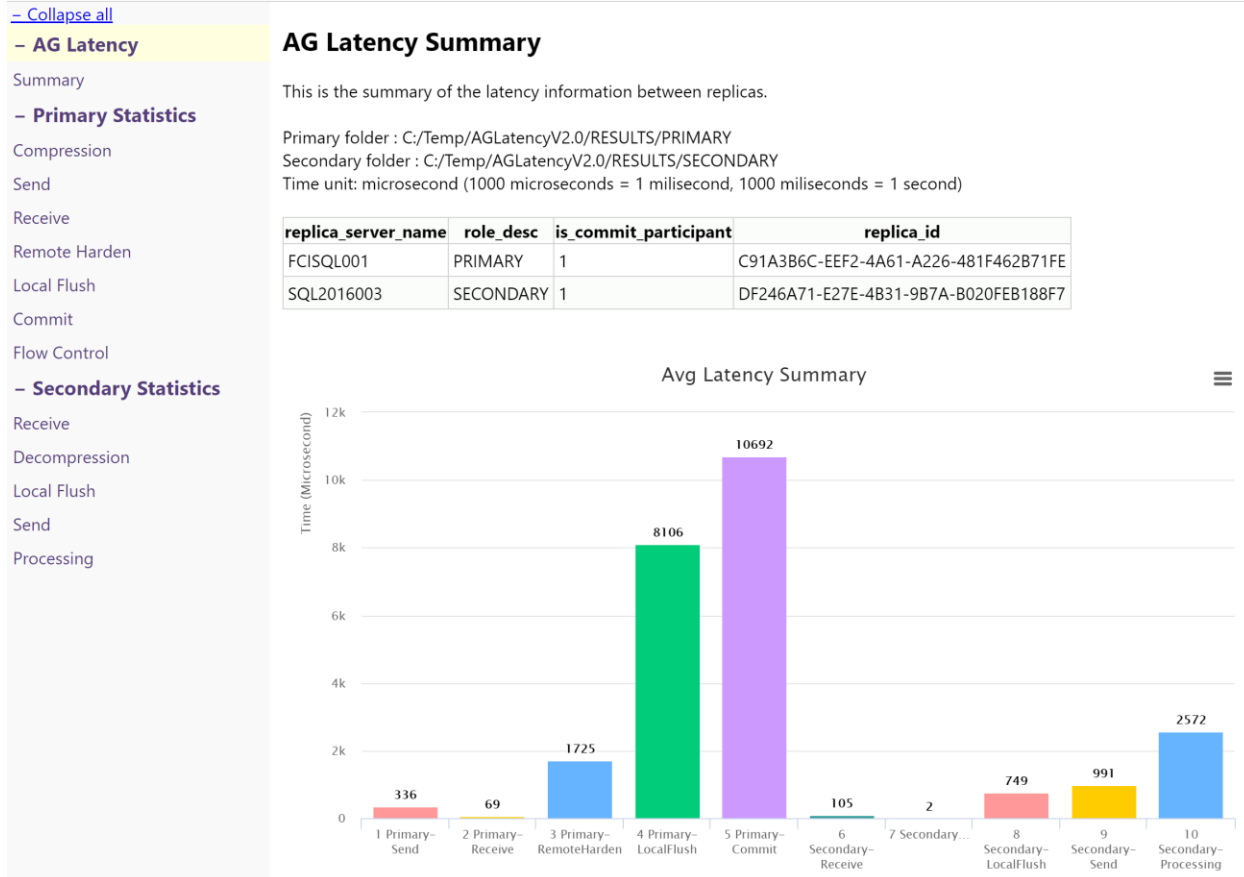
7.1 Reference chart

The diagram below depicts the end-to-end process for moving log blocks between the primary and secondary replicas in a synchronous commit availability group. The numbers on the diagram below correspond to the various data points throughout the report sections outlined below.



7.2 Main screen

The main report screen will appear in a browser window at the completion of the trace file analysis detailed in section #4.



[Collapse all](#)

AG Latency

Summary

Primary Statistics

Compression

Send

Receive

Remote Harden

Local Flush

Commit

Flow Control

Secondary Statistics

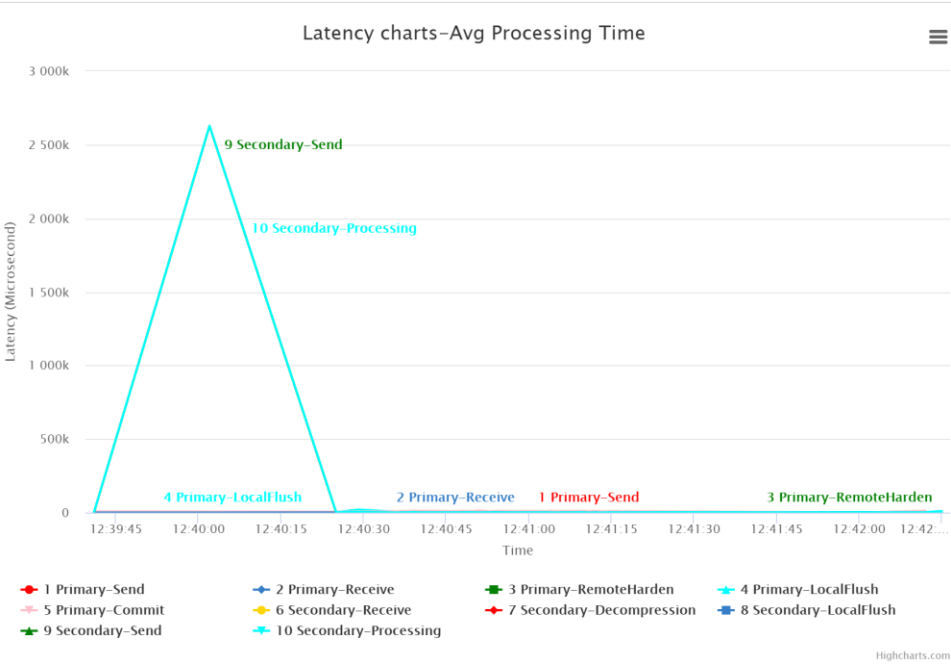
Receive

Decompression

Local Flush

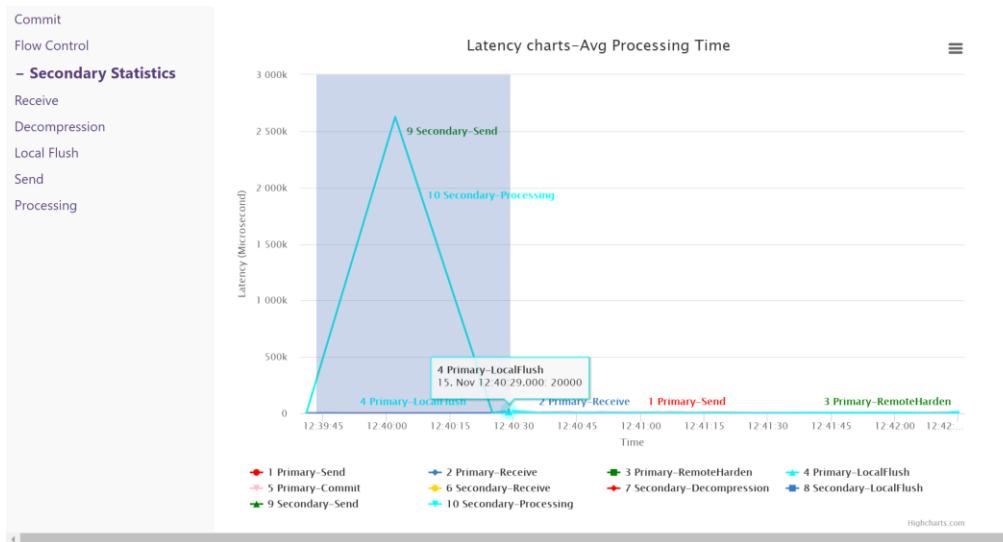
Send

Processing



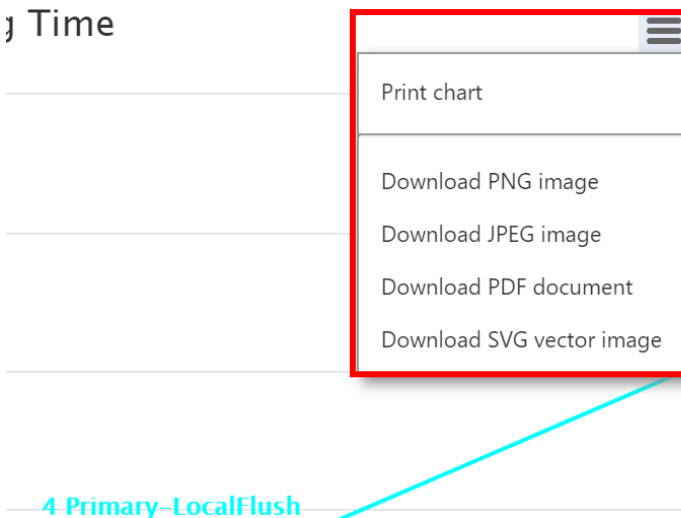
The charts and graphs are interactive and drilldown on a specific data point is possible by clicking and dragging on the desired data point.

The example below depicts closer inspection on the period between 1239 and 1240.



Charts can also be exported to several different image formats. Printing is also available.

j Time



7.3 Primary Statistics section

The Primary Statistics section of the report details statistics for the various stages of log block movement as it relates to the Primary replica.

– Primary Statistics

Compression

Send

Receive

Remote Harden

Local Flush

Commit

Flow Control

1. The Compression Statistics page will display time spent compressing log blocks on the primary replica.

NOTE: For SQL Server 2016 and above, if the Primary and Secondary replicas are a synchronous Availability Group, no compression statistics data will appear as log stream compression is not enabled by default.

AlwaysOn Availability Group log stream compression behavior can be controlled via trace flags [detailed in this article](#).

[– Collapse all](#)
[– AG Latency](#)
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[– Primary Statistics](#)
Compression
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Compression Statistics

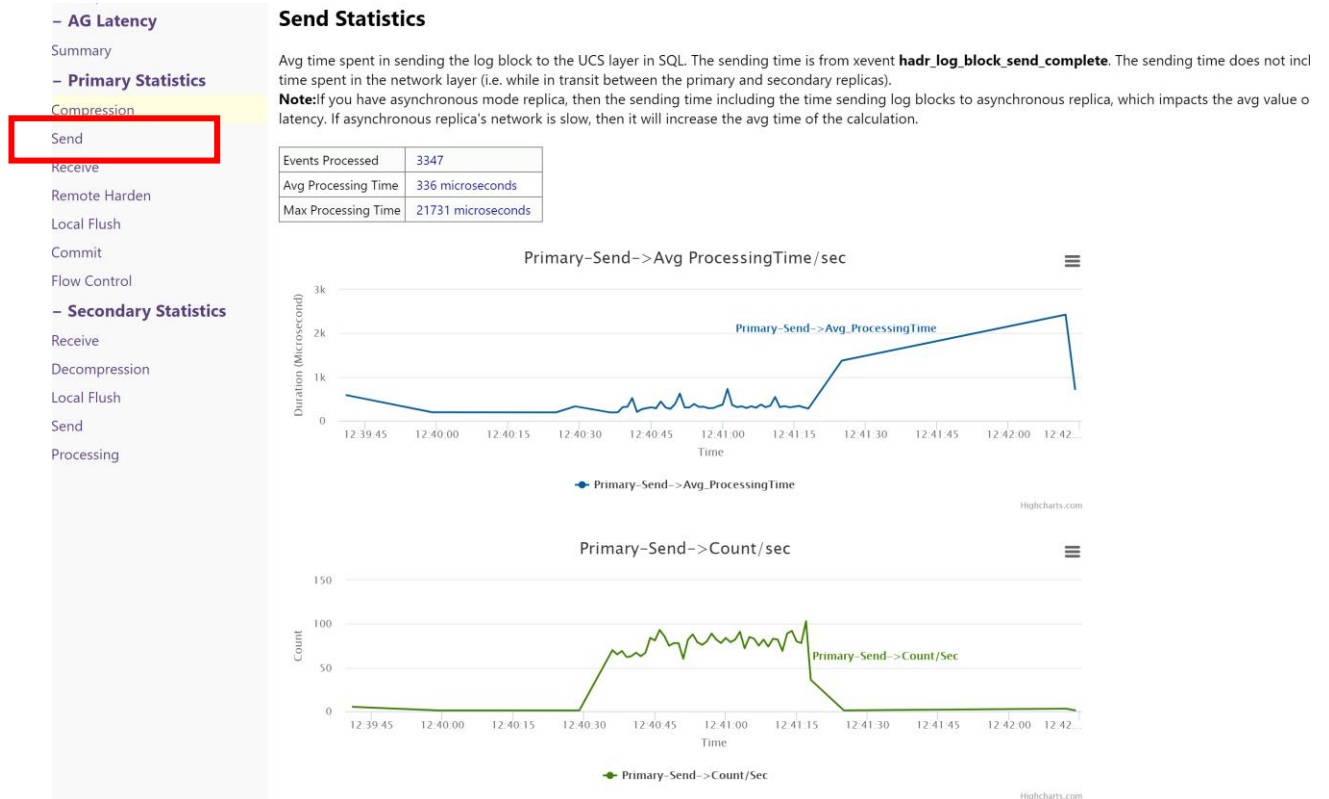
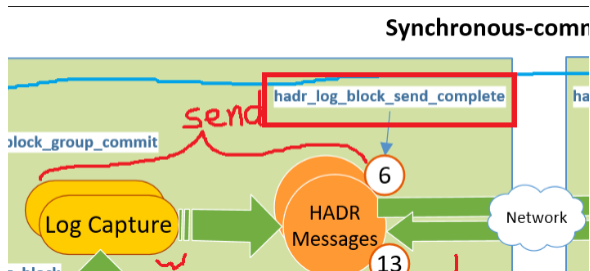
Processing time of xevent **hadr_log_block_compression**.

Copy
Excel
Show All entries [Expand All](#)
Search:

No data available in table

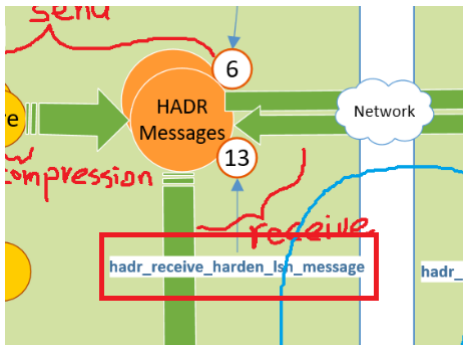
Showing 0 to 0 of 0 entries
Previous
1
Next

- The Send Statistics page represents the amount of time spent sending log blocks to the UCS (Usage Control Service) layer in SQL. This corresponds to #6 on the diagram above. In synchronous replication, this does not include the time log blocks are traversing the network to the secondary replica.



- The Receive Statistics screen displays time spent receiving the hardened LSN message from the secondary replica.

This doesn't include the time that message transverses on the network. It is the time delta that the primary receives the LSN ack message from UCS layer and then the message gets processed while "hadr_receive_harden_lsn_message" event is fired.



– AG Latency

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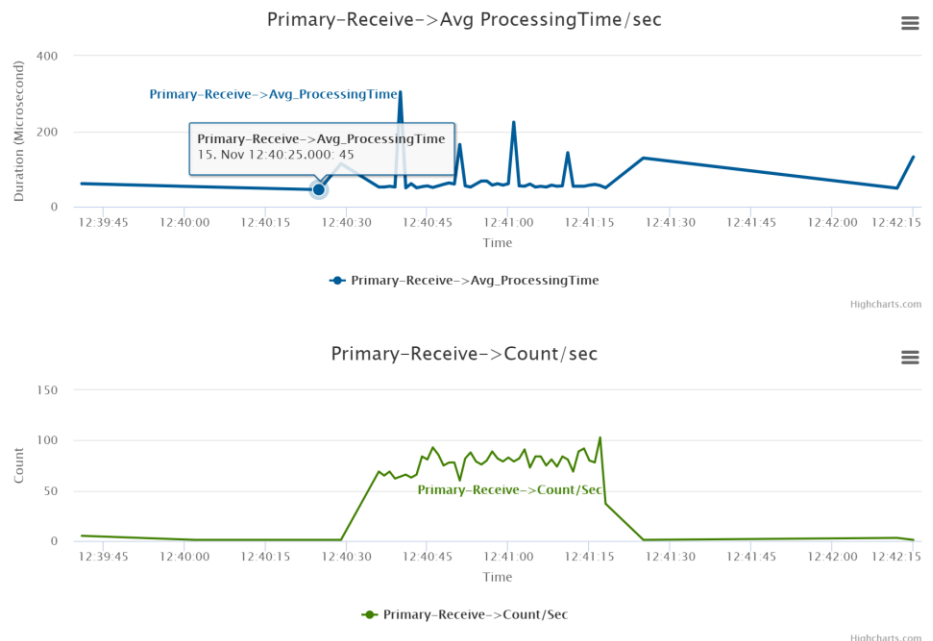
Send

Processing

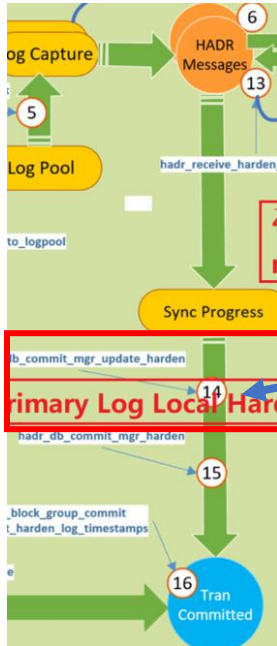
Receive Statistics

Processing time statistics of xevent **hadr_receive_harden_lsn_message** (mode=2).

Events Processed	3346
Avg Processing Time	69 microseconds
Max Processing Time	9194 microseconds



- The Remote Harden Statistics displays the time spent sending log blocks to the secondary replica and receiving the associated LSN harden message back from the secondary replica.

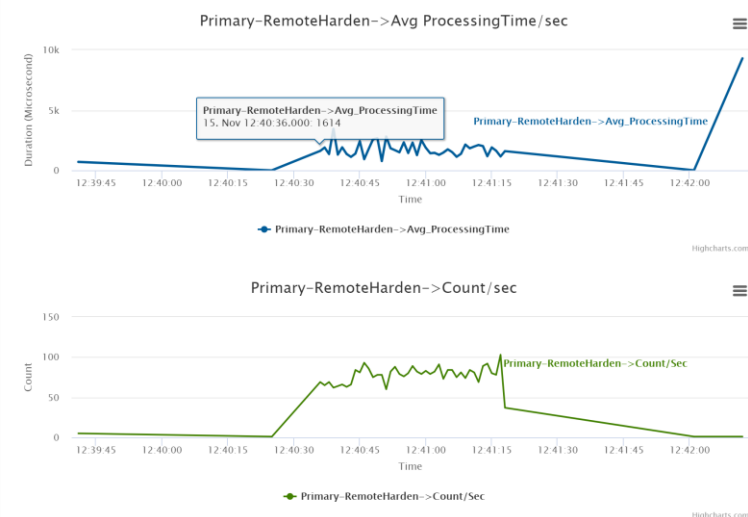


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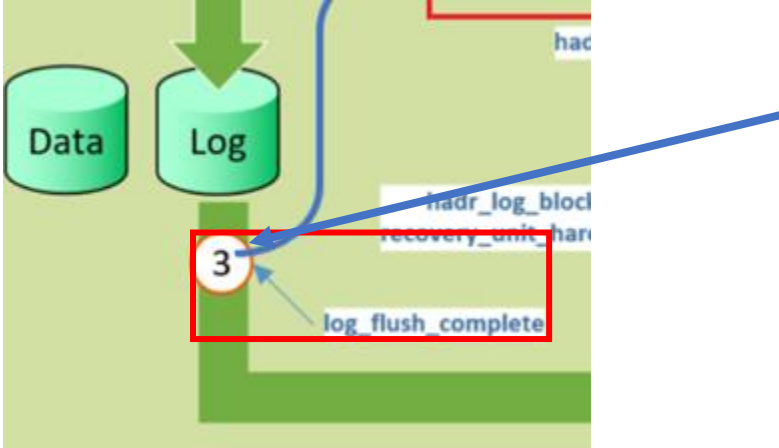
Remote Harden Statistics

Time elapsed between sending a log block to a secondary replica and getting the associated harden_lsn message back from the secondary replica.
remote Harden time = primary->send + network wire+ secondary->processing + network wire+ primary->receive + other.

Events Processed	3341
Avg Processing Time	1725 microseconds
Max Processing Time	43315 microseconds



- The Local Flush page displays time spent flushing log blocks to local media (disk).



– AG Latency

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Local Flush

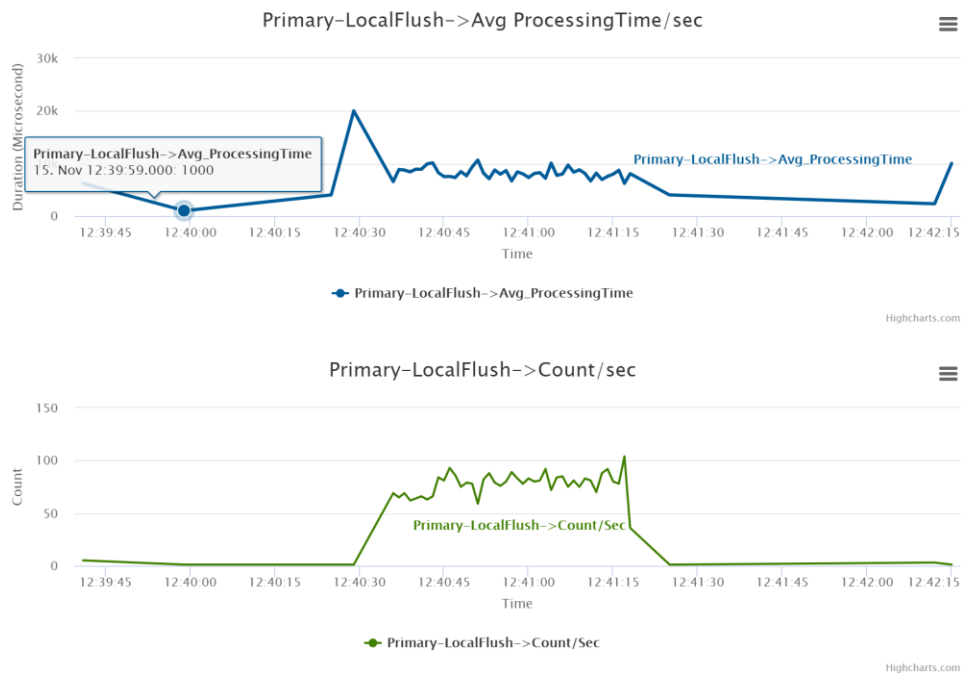
Send

Processing

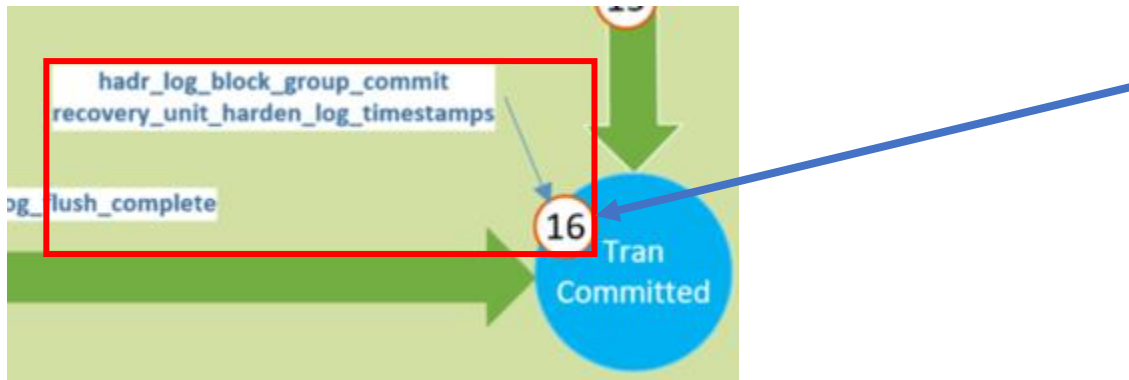
Local Flush Statistics

Processing time statistics of xevent **log_flush_complete**, the time to flush the log block to local stable media.

Events Processed	3347
Avg Processing Time	8106 microseconds
Max Processing Time	70000 microseconds



6. The Commit Statistics page displays the average time for transactions to commit on the Primary replica.



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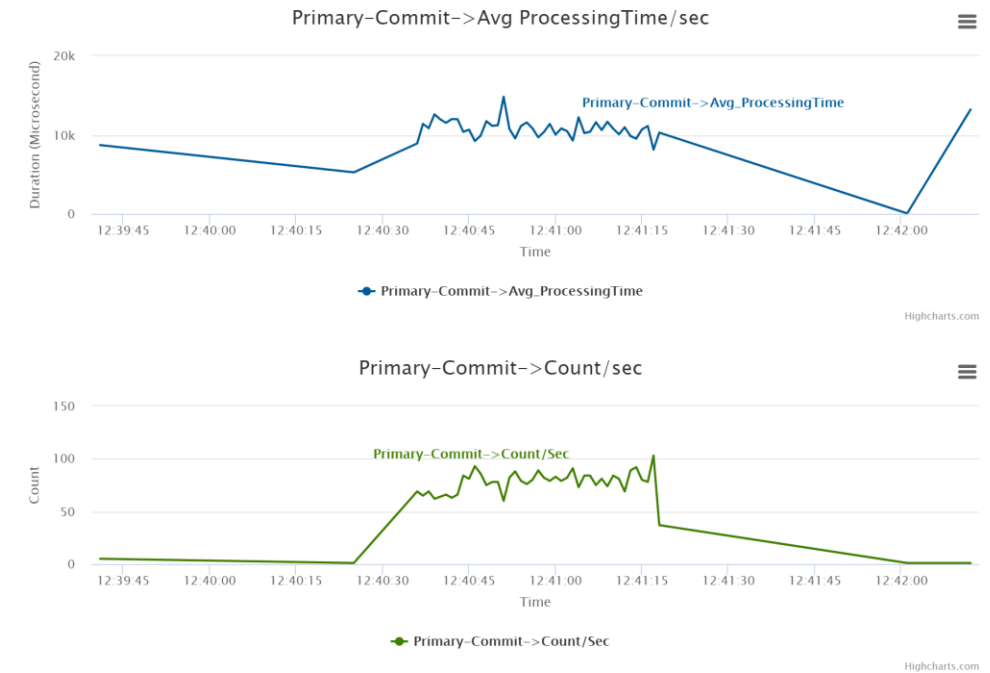
Send

Processing

Commit Statistics

Avg time to commit transactions on the Primary Replica. When a transaction commit completes, xevent **recovery_unit_harden_1** processing_time records how long the transaction takes to finish.
Primary->Commit time= max(primary->local flush, primary->remote harden).

Events Processed	3341
Avg Processing Time	10692 microseconds
Max Processing Time	73081 microseconds



- The Flow Control Statistics page displays time spent processing flow control actions. Flow control actions are set to either "0" or "1" (off and on) and indicates that there are messages waiting to be sent to secondary when the maximum number of queued messages has been reached.

This indicates that log scans are running faster than network sends. This indicates an issue only if network sends are slower than expected.

Database level flow control gate values (internally controlled) are:

- 1792 for x64 environments
- 256 for x86 environments

– AG Latency

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Flow Control Statistics

Processing time statistics of xevent **hadr_database_flow_control_action**.

Copy

Excel

Show 20 entries [Expand All](#)

Search:

No data available in table

Showing 0 to 0 of 0 entries Previous Next

No data

7.4 Secondary Statistics section

The Secondary Statistics section of the report details statistics for the various stages of log block movement as it relates to the Secondary replica.

– Secondary Statistics

Receive

Decompression

Local Flush

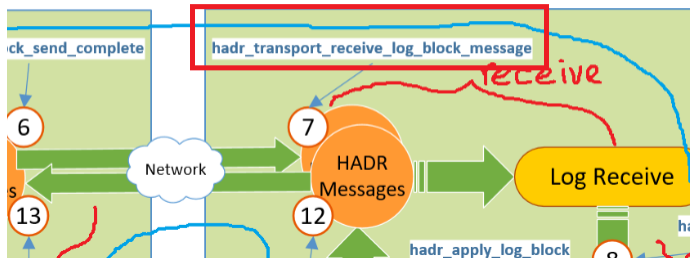
Send

Processing

1. The Receive Statistics page details time spent processing receipt of log blocks on the Secondary replica.

This doesn't include the time it spends on the network. The time duration begins when secondary UCS receives the message and ends when the xevent "hardr_transport_receive_log_block_message" is fired.

Synchronous-commit mode



– AG Latency

Summary

– Primary Statistics

Compression

Send

Receive

Remote Harden

Local Flush

Commit

Flow Control

– Secondary Statistics

Receive

Decompression

Local Flush

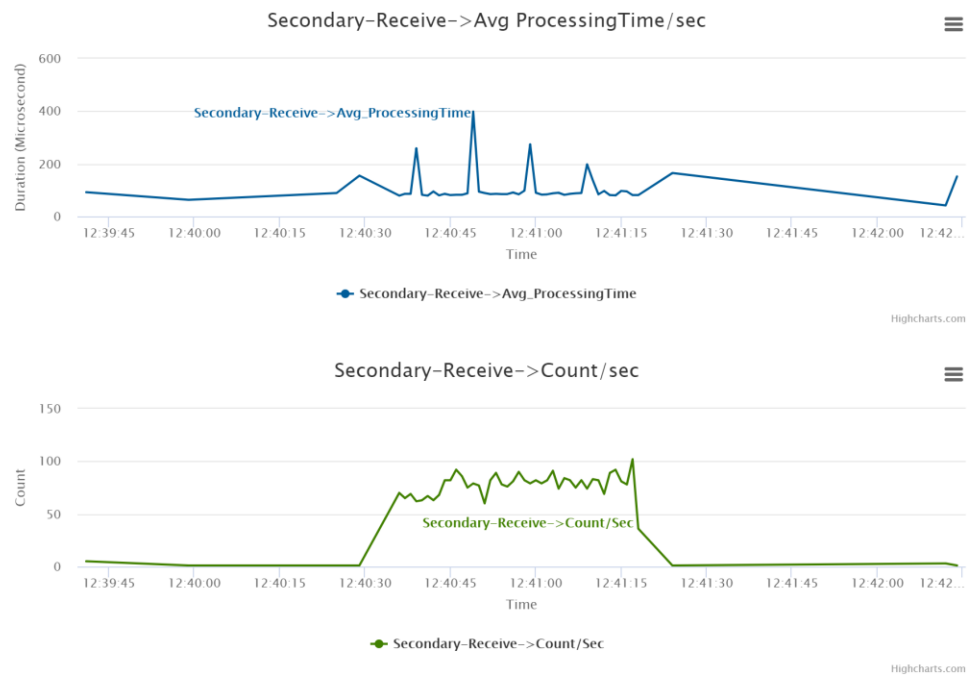
Send

Processing

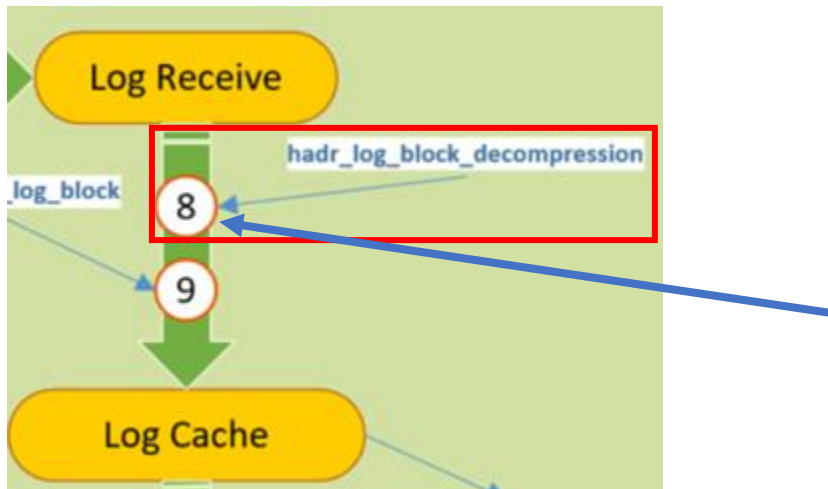
Receive Statistics

Processing time statistics of xevent **hdr_transport_receive_log_block_message** (mode=2).

Events Processed	3347
Avg Processing Time	105 microseconds
Max Processing Time	11062 microseconds



2. The Decompression Statistics page details time spent decompression log blocks on the Secondary replica.

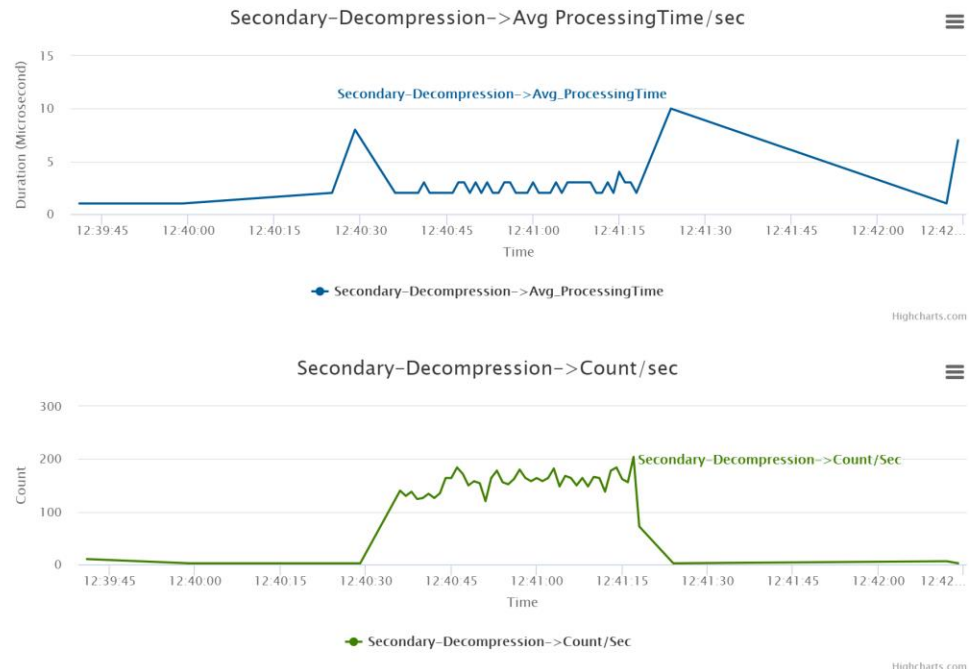


- AG Latency
- Summary
- Primary Statistics
- Compression
- Send
- Receive
- Remote Harden
- Local Flush
- Commit
- Flow Control
- Secondary Statistics
- Receive
- Decompression
- Local Flush
- Send
- Processing

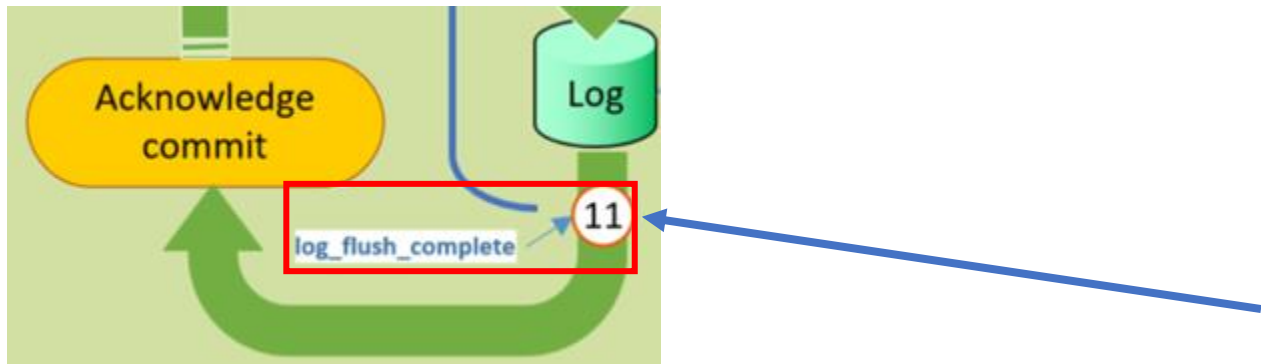
Decompression Statistics

Processing time of xevent **hadr_log_block_decompression**.

Events Processed	6693
Avg Processing Time	2 microseconds
Max Processing Time	104 microseconds



3. The Local Flush statistics page details the time spent flushing log blocks to local media (disk) on the Secondary replica.



– AG Latency

Summary

– Primary Statistics

Compression

Send

Receive

Remote Harden

Local Flush

Commit

Flow Control

– Secondary Statistics

Receive

Decompression

Local Flush

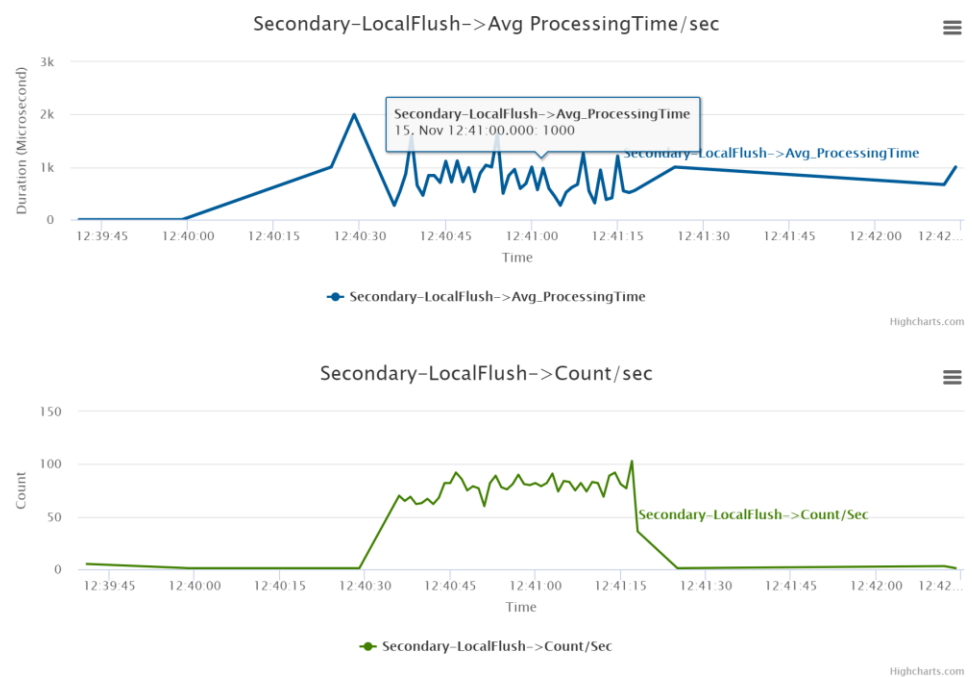
Send

Processing

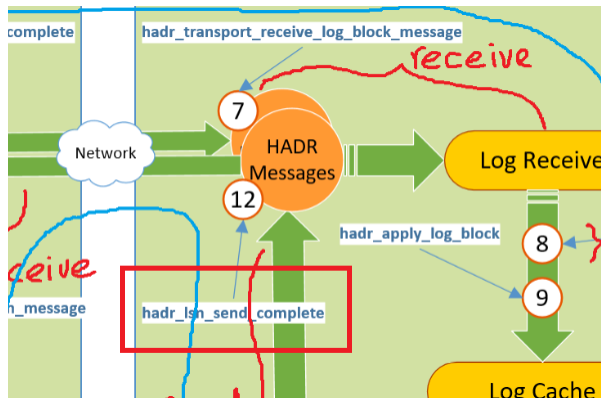
Local Flush Statistics

Processing time statistics of xevent **log_flush_complete**, the time to flush the log block to local stable media.

Events Processed	3347
Avg Processing Time	749 microseconds
Max Processing Time	35000 microseconds



4. The Send Statistics page displays time spent process LSN send complete messages.



– AG Latency

Summary

– Primary Statistics

Compression

Send

Receive

Remote Harden

Local Flush

Commit

Flow Control

– Secondary Statistics

Receive

Decompression

Local Flush

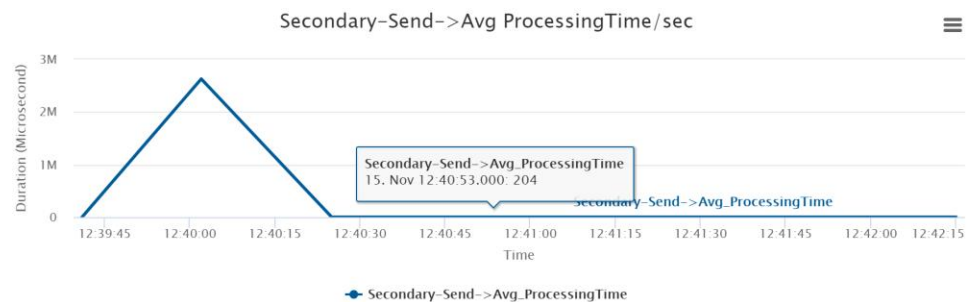
Send

Processing

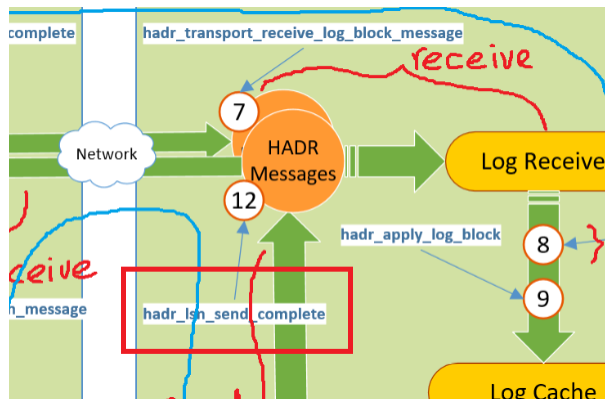
Send Statistics

Processing time statistics of xevent of **hadrlsn_send_complete**.

Events Processed	3346
Avg Processing Time	991 microseconds
Max Processing Time	2626805 microseconds



- The Processing Statistics page indicates the average total processing time of log blocks on the Secondary replica.

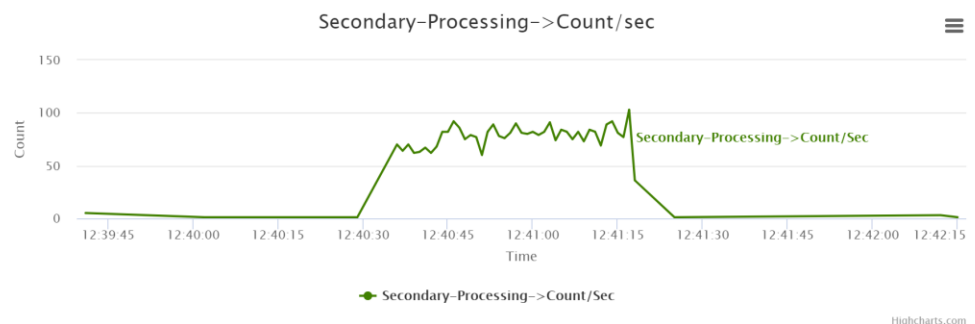
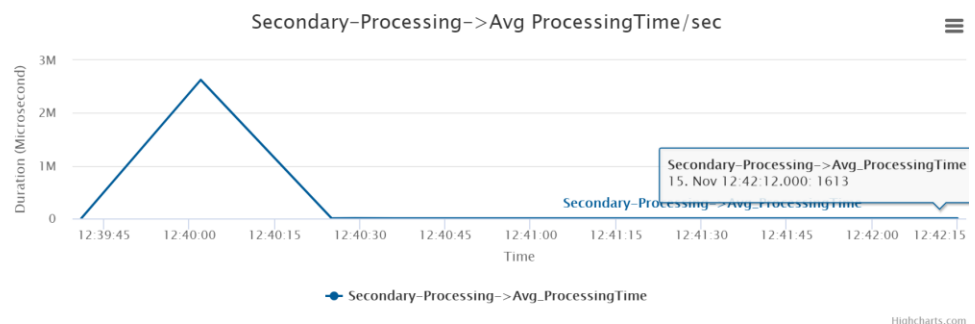


- AG Latency
 - Summary
 - Primary Statistics
 - Compression
 - Send
 - Receive
 - Remote Harden
 - Local Flush
 - Commit
 - Flow Control
 - Secondary Statistics
 - Receive
 - Decompression
 - Local Flush
 - Send
 - Processing

Processing Statistics

Avg total_processing_time of log blocks on secondary, recorded in xevent of **hadr_lsn_send_complete**.
Secondary->processing= Secondary:receive + decompression + local flush + send + other.

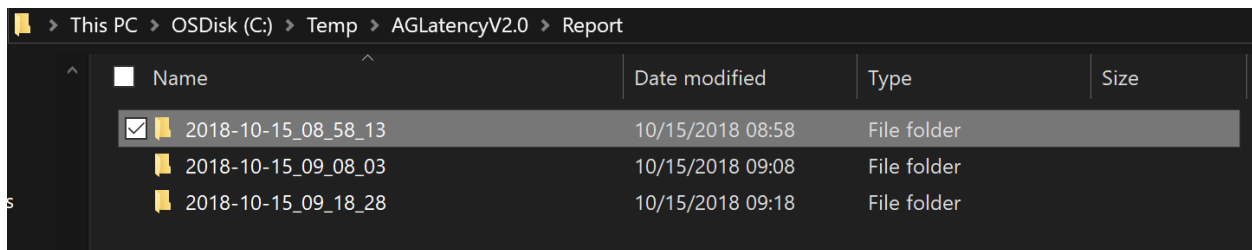
Events Processed	3346
Avg Processing Time	2572 microseconds
Max Processing Time	2627447 microseconds



8 Miscellaneous

8.1 Historical reports

Each time a new set of extended event session files is analyzed and corresponding reports generated, a new directory with the date and time as directory name will be created in the "...\\AGLatencyV2.0\\Report" directory.



Name	Date modified	Type	Size
<input checked="" type="checkbox"/> 2018-10-15_08_58_13	10/15/2018 08:58	File folder	
2018-10-15_09_08_03	10/15/2018 09:08	File folder	
2018-10-15_09_18_28	10/15/2018 09:18	File folder	

9 References

<https://blogs.msdn.microsoft.com/psssql/2018/04/05/troubleshooting-data-movement-latency-between-synchronous-commit-always-on-availability-groups/>

<https://github.com/suyouquan/AGLatency>