

Tuning Transactional Replication

Level: Intermediate

Paul Ou Yang

paulouyang.blogspot.com



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What would you do?

The screenshot shows the Replication Monitor interface. The left pane displays a tree view of publishers under 'My Publishers', including 'BOWSQLTEST2016A\BOMSSTEST20...'. The right pane shows the 'Tracer Tokens' tab, which includes an 'Insert Tracer' button and a table of subscriptions. The table has columns for Subscription, Publisher to Distributor, Distributor to Subscriber, and Total Latency. All entries in the table show 'Pending...' for the latter three columns.

Replication Monitor

File Action Go Help

Replication Monitor

My Publishers

BOWSQLTEST2016A\BOMSSTEST20...

- [tpcc_pub_paul_1]: all_tables
- [tpcc_pub_paul_1]: customer
- [tpcc_pub_paul_1]: district
- [tpcc_pub_paul_1]: new_order
- [tpcc_pub_paul_1]: order_line
- [tpcc_pub_paul_1]: orders
- [tpcc_pub_paul_1]: stock
- [tpcc_pub_paul_1]: warehouse
- [tpcc_pub_paul_2]: all_exec
- [tpcc_pub_paul_3]: all_tables
- [tpcc_pub_paul_4]: all_tables
- [tpcc_pub_paul_5]: all_tables
- [tpcc_pub_paul_6]: all_tables
- [tpcc_pub_paul_7]: all_tables
- [tpcc_pub_paul_8]: all_tables

Last refresh: 9/9/2017 9:13:04 PM

All Subscriptions Tracer Tokens Agents Warnings

Tracer Tokens measure latency from Publisher to Distributor, Distributor to Subscriber, and the total latency. Click [here](#) for more information.

Insert Tracer Time inserted: 9/9/2017 9:12:57 PM

	Subscription	Publisher to Distributor	Distributor to Subscriber	Total Latency
	[BOWSQLTEST20...	Pending...	Pending...	Pending...
	[BOWSQLTEST20...	Pending...	Pending...	Pending...
	[BOWSQLTEST20...	Pending...	Pending...	Pending...

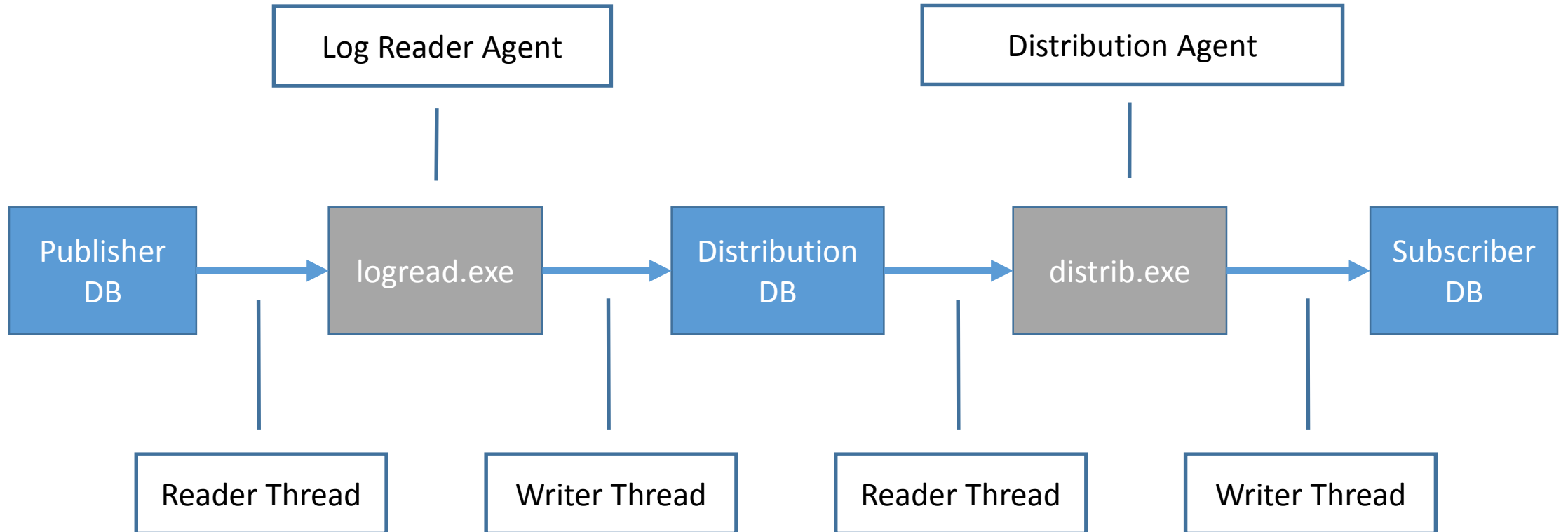
Agenda

- The Moving Parts
- The Bottlenecks
- The Tuning Knobs
- Take Away

Agenda

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Moving Parts



Task Manager

File Options View

Processes Performance Users Details Services

Name	0% CPU	26% Memory
SQL Server Replication Distribution Agent	0%	4.9 MB
SQL Server Replication Distribution Agent	0%	5.7 MB
SQL Server Replication Distribution Agent	0%	5.1 MB
SQL Server Replication Distribution Agent	0%	8.1 MB
SQL Server Replication Distribution Agent	0%	8.5 MB
SQL Server Replication Distribution Agent	0%	7.2 MB
SQL Server Replication Distribution Agent	0%	8.2 MB
SQL Server Replication Distribution Agent	0%	7.6 MB
SQL Server Replication Logreader Agent	0%	7.6 MB
SQL Server Replication Logreader Agent	0%	8.5 MB
SQL Server Replication Logreader Agent	0%	7.3 MB
SQL Server Replication Logreader Agent	0%	7.8 MB
SQL Server Replication Logreader Agent	0%	7.6 MB
SQL Server Replication Logreader Agent	0%	7.6 MB
SQL Server Replication Logreader Agent	0%	8.2 MB

^ Fewer details

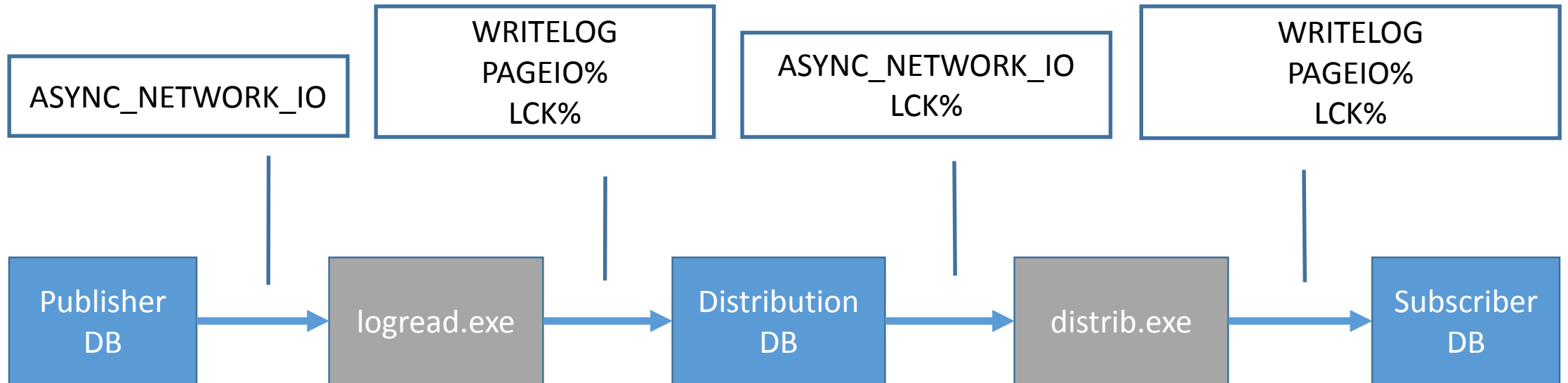
End task

Agent job executables

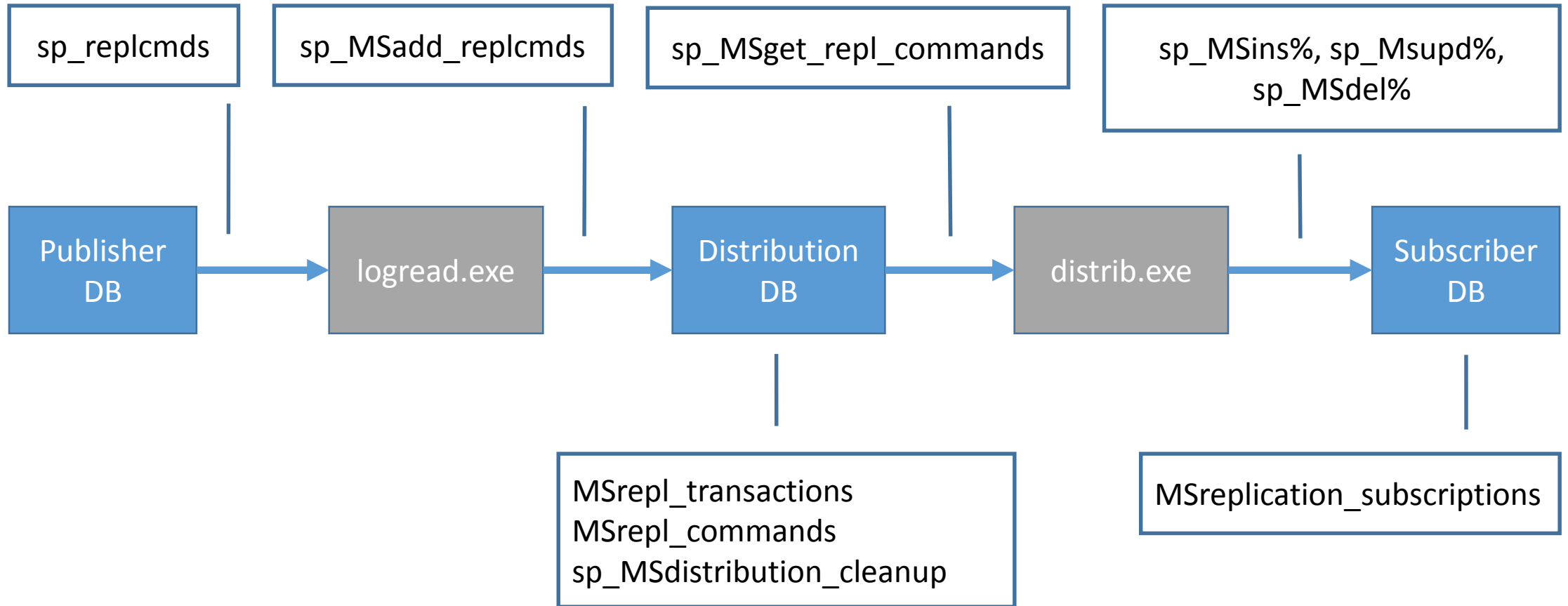
Agenda

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- **The Bottlenecks**
- The Tuning Knobs
- Take Away

Bottlenecks



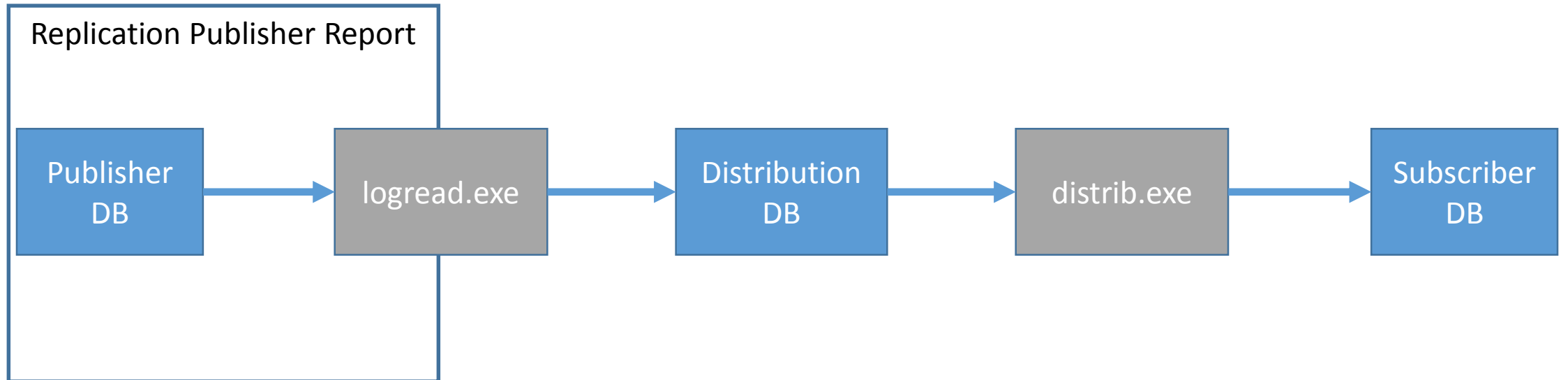
Commands



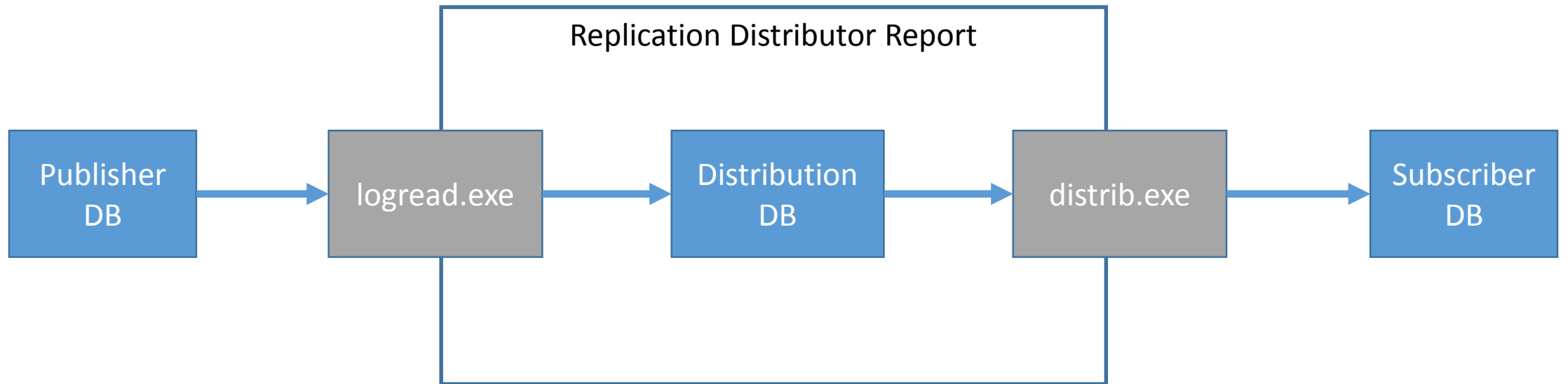
SSMS Reports

- Download link
- <https://github.com/paulouyang2/SSMSReplicationReports>

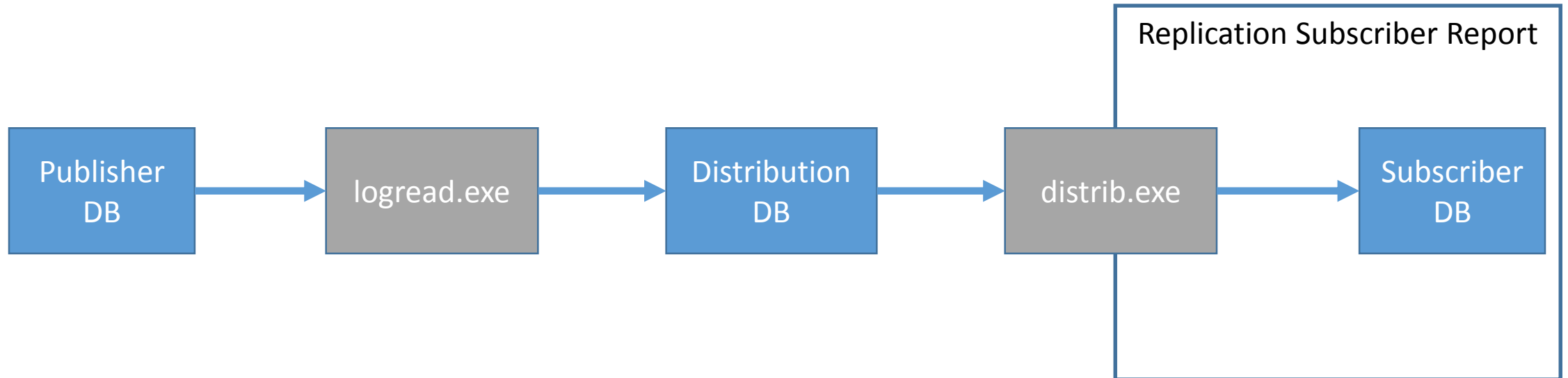
SSMS Reports



SSMS Reports



SSMS Reports



Demo

Agenda

- The Moving Parts
- The Bottlenecks
- **The Tuning Knobs**
- Take Away

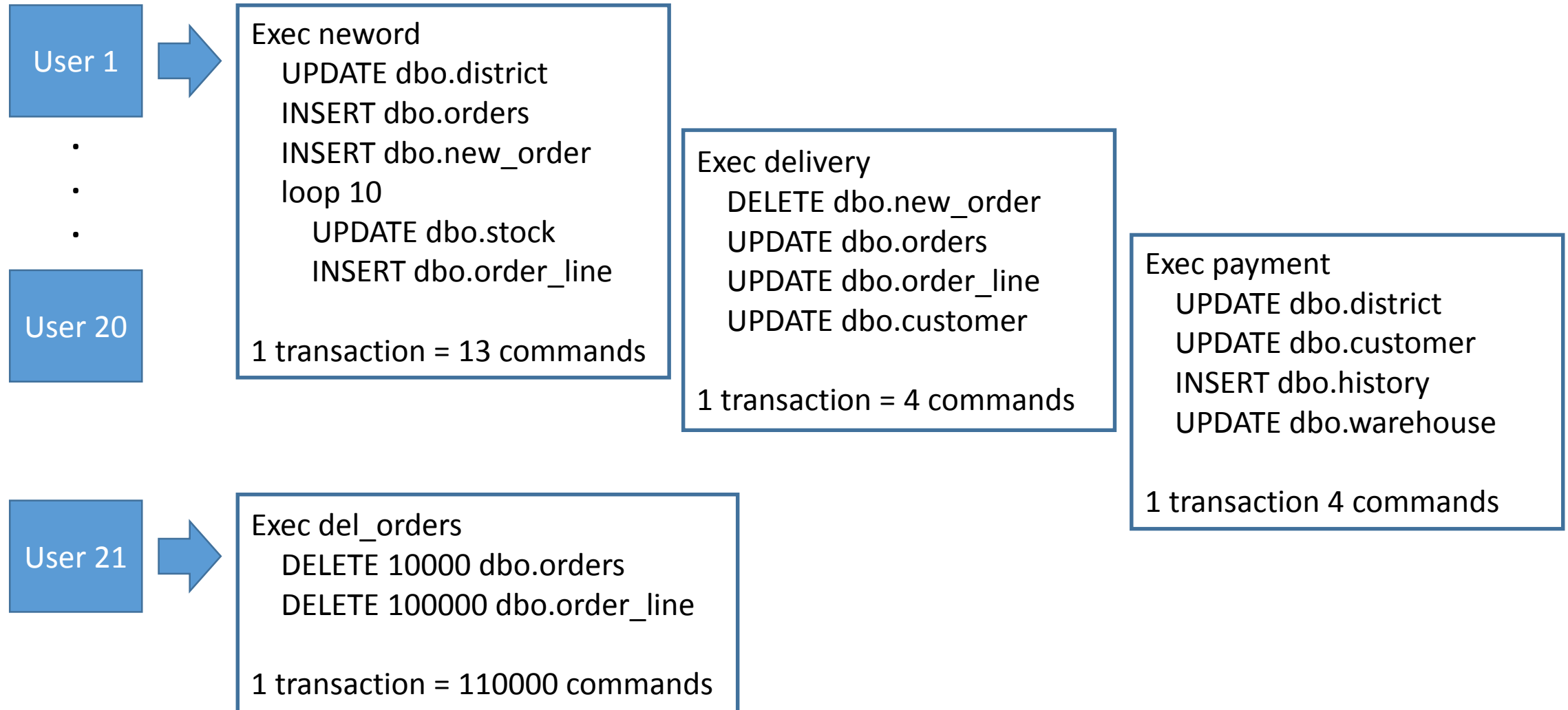
Tuning Knobs Latency Benchmark

- Test Workload
- Distribution Agent
 - Isolation level: Read Committed vs Snapshot
 - Properties: Commit Batch Size vs Stored Procedure Execution vs Subscription Streams
 - Topology: One vs Multiple Publications vs Multiple Publication DBs
 - Subscription Type: Push vs Pull
- Log reader Agent
 - Topology: One vs Multiple Publication DBs

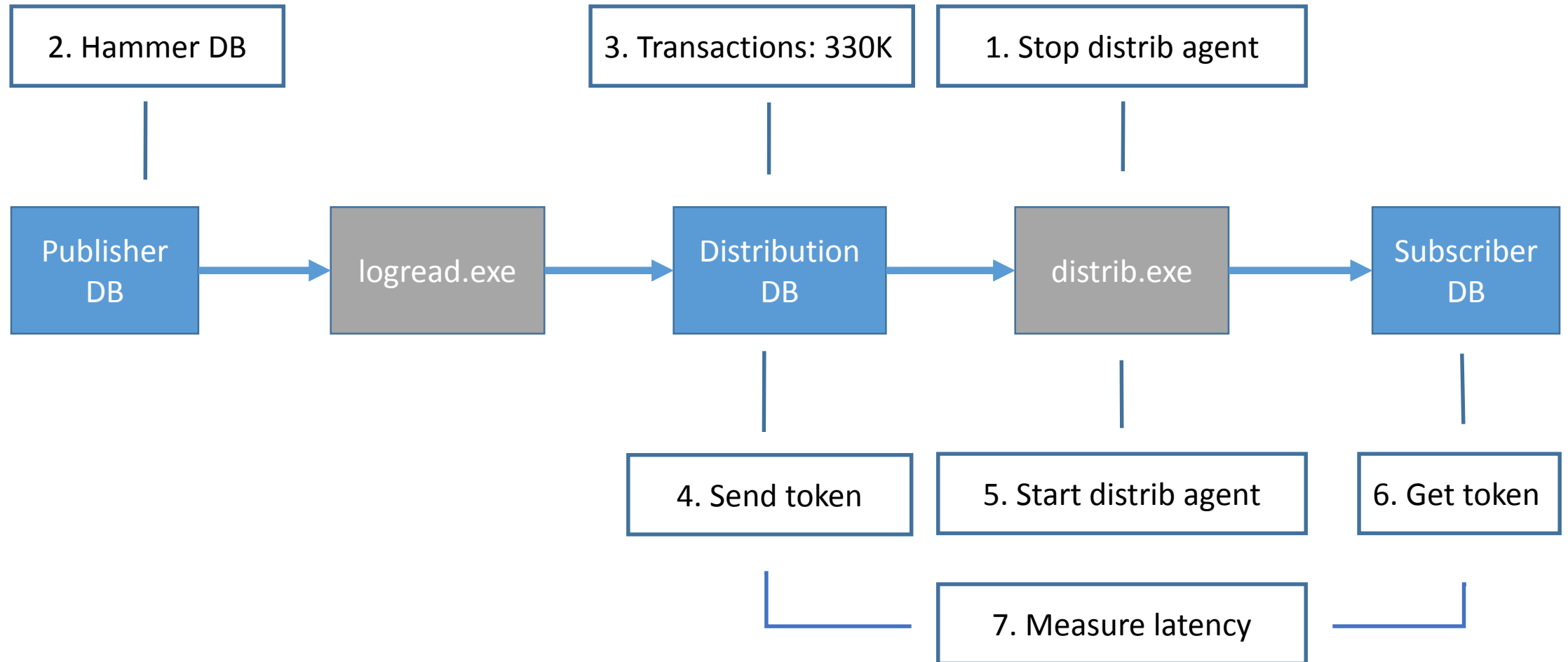
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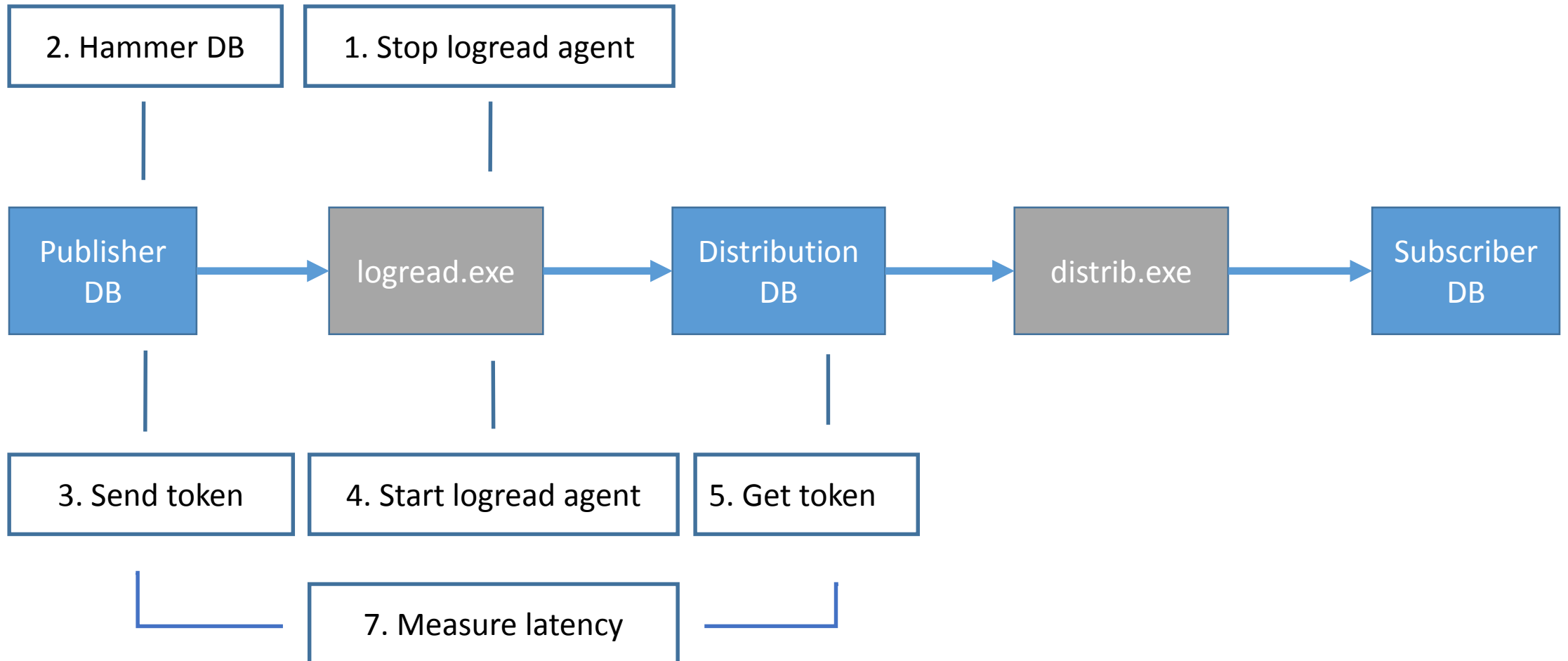
Hammer DB TPC-C Test Workload



Distribution Agent Workload Flow



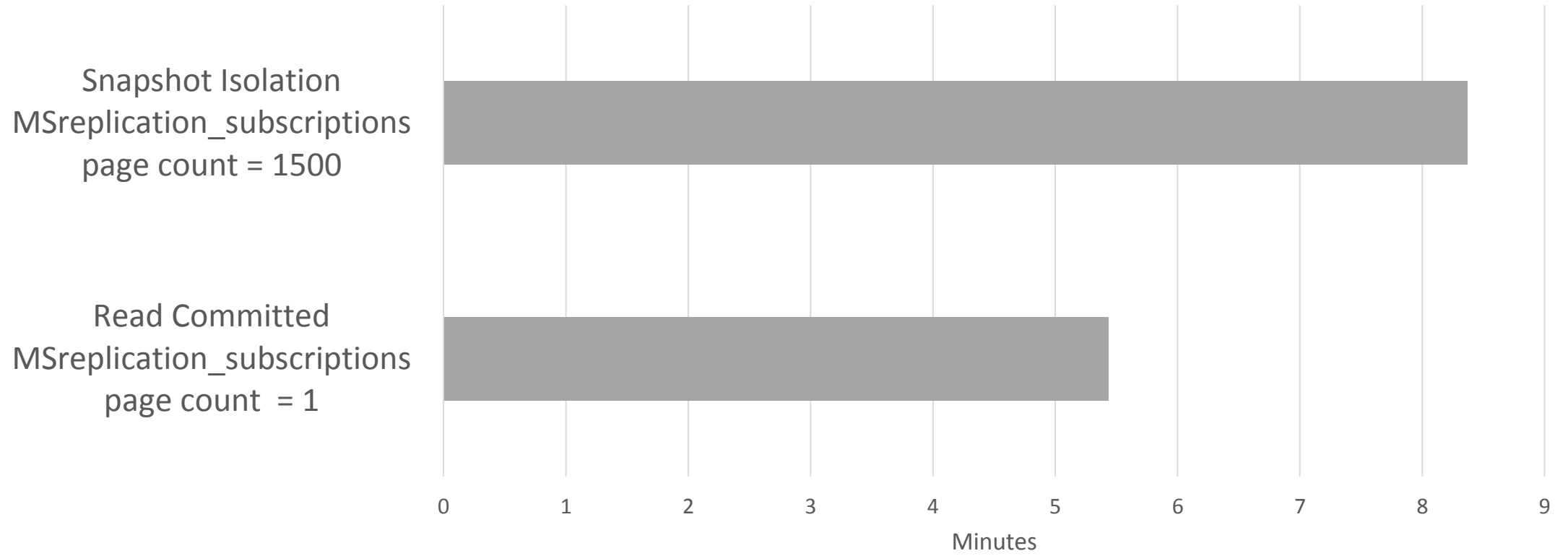
Log Reader Agent Workload Flow



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Isolation Level Latency Benchmark

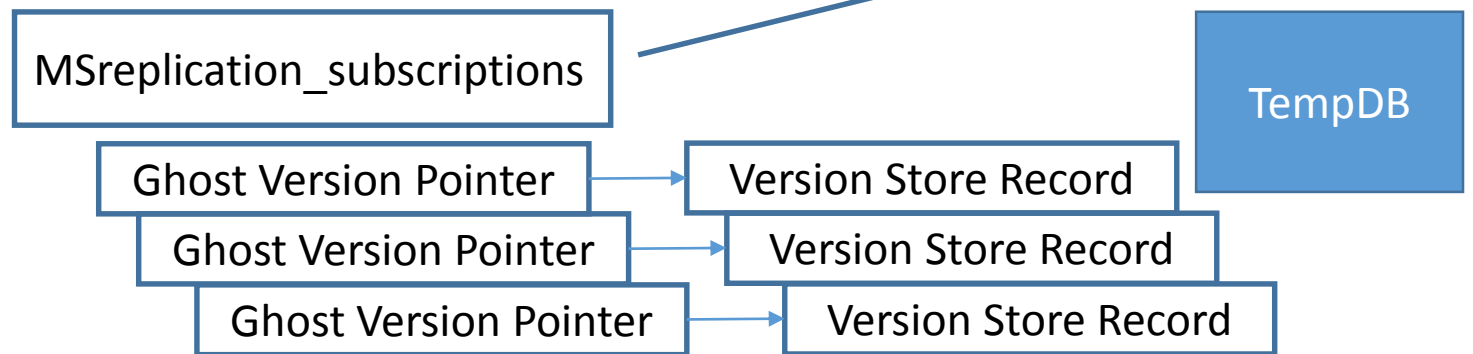


Snapshot Isolation Side Effect

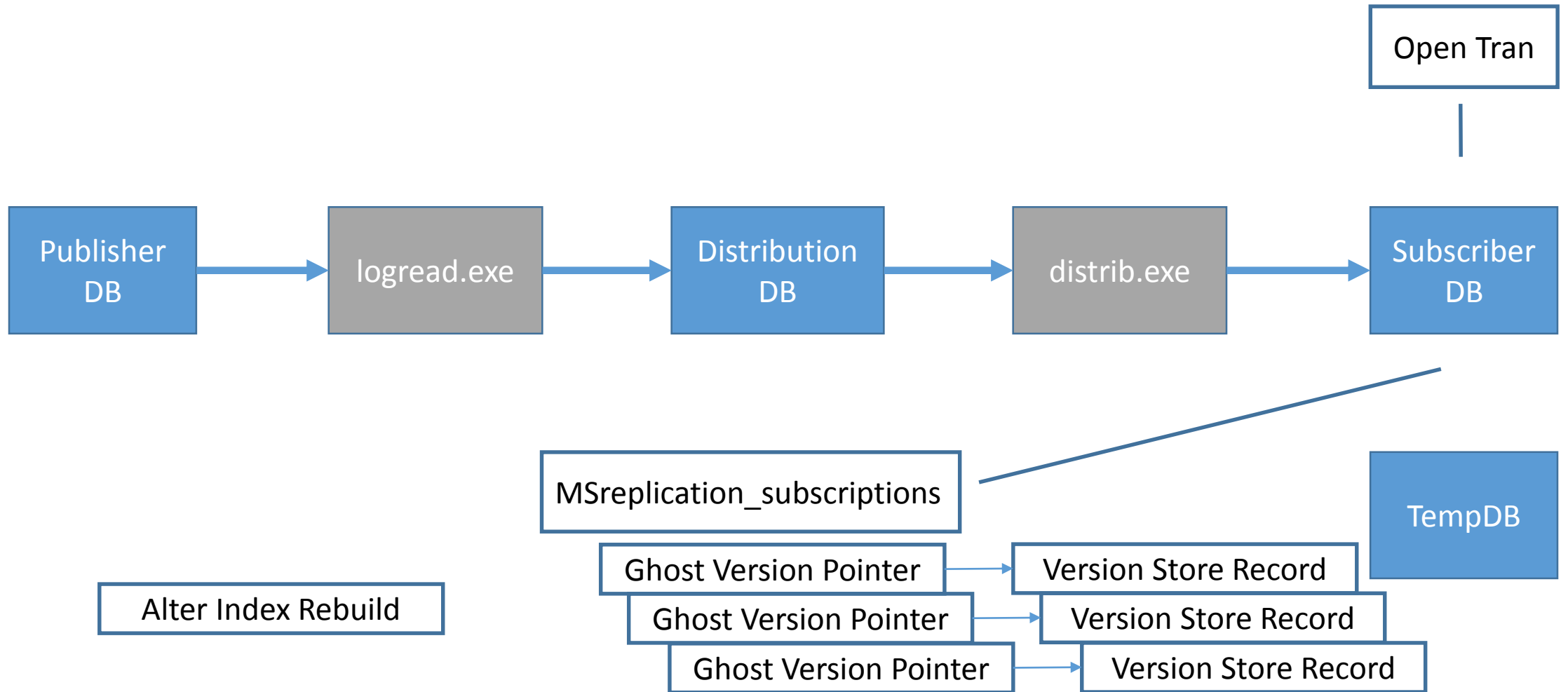
Replication Subscriber - Threads

subscription: [tpcc_pub_paul_1][all_tables]
page count: 1811
version ghost record count: 19913

Open Tran



Force Ghost Cleanup Workaround

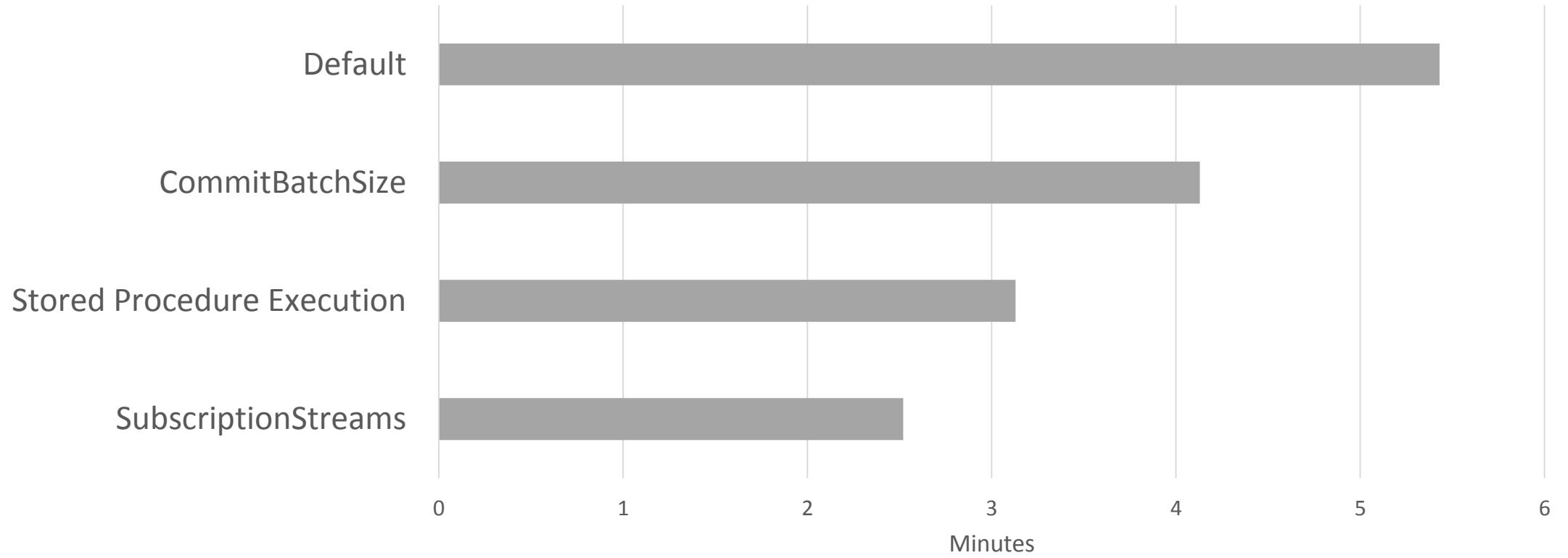


Demo

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Distribution Agent Properties Latency Benchmark



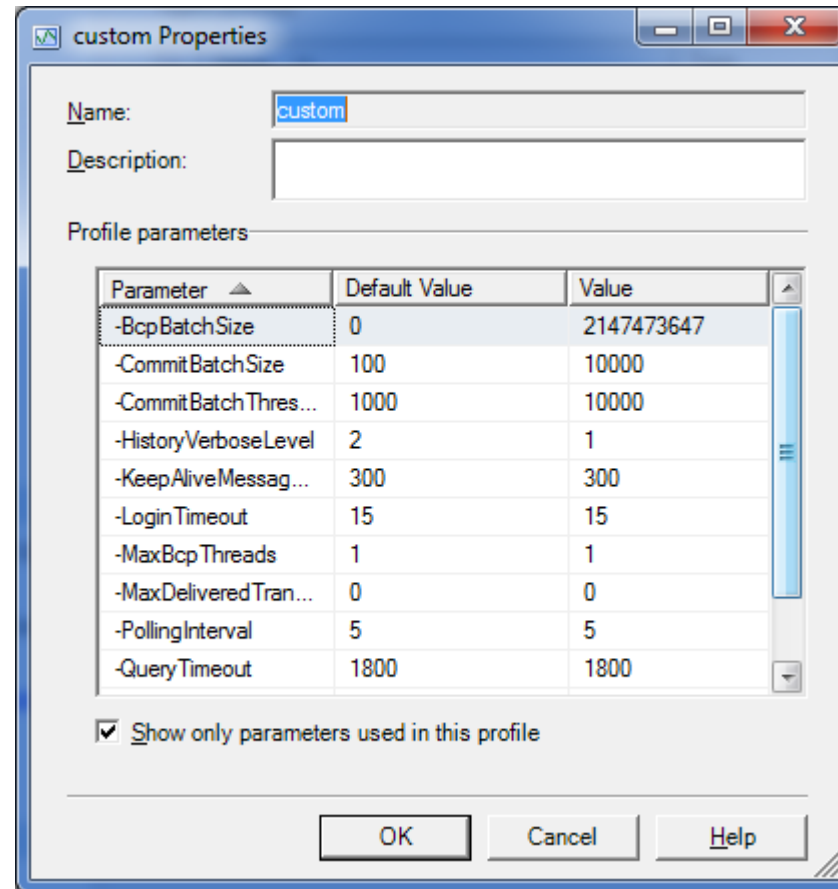
Default



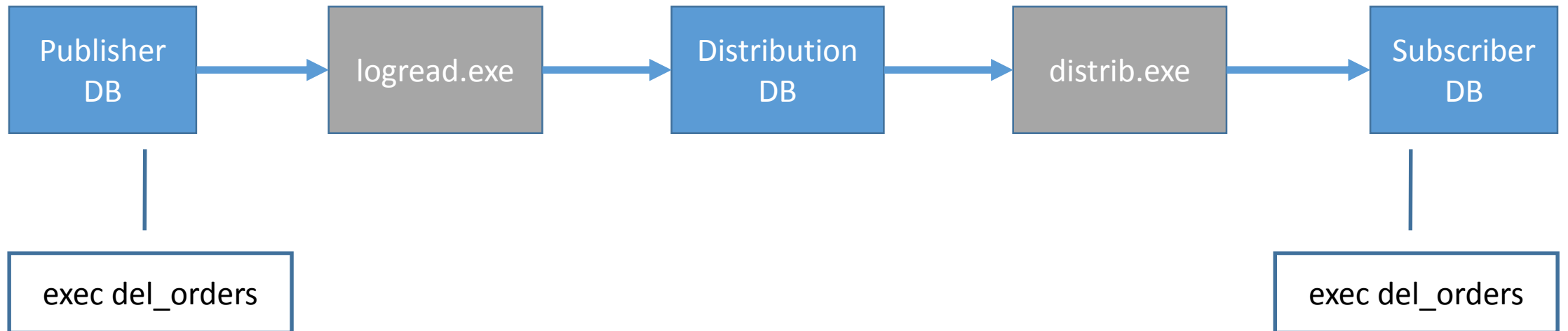
Commit Batch Size



Commit Batch Size Configuration

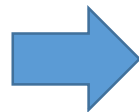


Stored Procedure Execution



Default is to Replicate Row by Row

```
create proc del_orders
as
delete dbo.order_line
from dbo.order_line ol
join #orders t
on t.o_id = ol.ol_o_id
and t.o_d_id = ol.ol_d_id
and t.o_w_id = ol.ol_w_id
```



37
38 sp_browsereplcmds

100 %

Results Messages

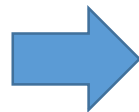
	xact_seqno	command	command_id
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (21961,4,2,7)}	112272
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (21959,8,2,4)}	112274
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (24593,9,4,7)}	112276
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (14368,5,22,9)}	112278
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (30081,3,19,9)}	112280
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (14041,9,20,4)}	112282
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (20757,4,21,2)}	112284
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (25027,7,8,7)}	112286
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (12699,7,15,2)}	112288
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (22053,2,2,14)}	112290
1...	0x00000162001030C00003	{CALL [sp_MSdel_dboorder_line] (25466,9,28,4)}	112292

1 transaction

100K commands

Replicate Stored Procedure Exec

```
create proc del_orders  
as  
  
delete dbo.order_line  
from dbo.order_line ol  
join #orders t  
on t.o_id = ol.ol_o_id  
and t.o_d_id = ol.ol_d_id  
and t.o_w_id = ol.ol_w_id
```



	xact_seqno	command	command_id
1	0x0000000D8000B75E80003	{call "dbo"."del_orders" (1)}	1

1 transaction

1 command

Stored Procedure Configuration

The image shows two windows from SQL Server Enterprise Manager. The background window is titled "Publication Properties - all_exec" and shows a tree view of objects to be published. The foreground window is titled "Article Properties - del_orders" and shows the configuration for a specific article.

Publication Properties - all_exec

Select a page: General, Articles, Filter Rows, Snapshot, FTP Snapshot, Subscription Options, Publication Access List, Agent Security

Objects to publish:

- Tables
 - customer (dbo)
 - district (dbo)
 - item (dbo)
 - new_order (dbo)
 - order_line (dbo)
 - orders (dbo)
 - stock (dbo)
 - warehouse (dbo)
- Stored Procedures
 - del_orders (dbo)

Article Properties: Article Properties

Article Properties - del_orders

Article name: del_orders

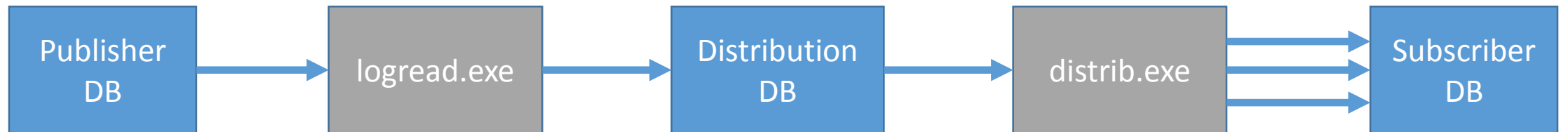
Properties:

Copy Objects and Settings to Subscriber	
Copy extended properties	False
Copy permissions	False

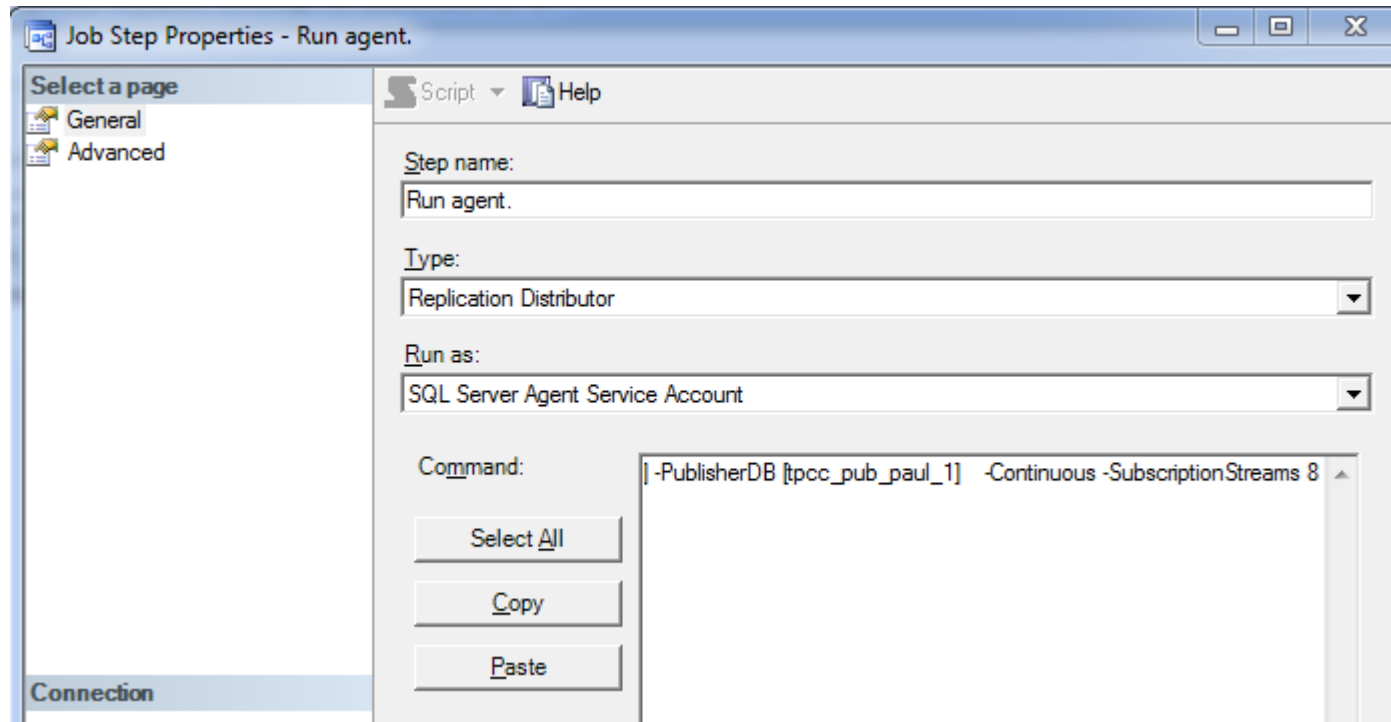
Destination Object	
Destination object name	del_orders
Destination object owner	dbo
Action if name is in use	Drop existing object and create a new o
Replicate	Execution of the stored procedure
Create schemas at Subscriber	True

Identification	
Description	
Source object name	del_orders
Source object owner	dbo

Subscription Streams



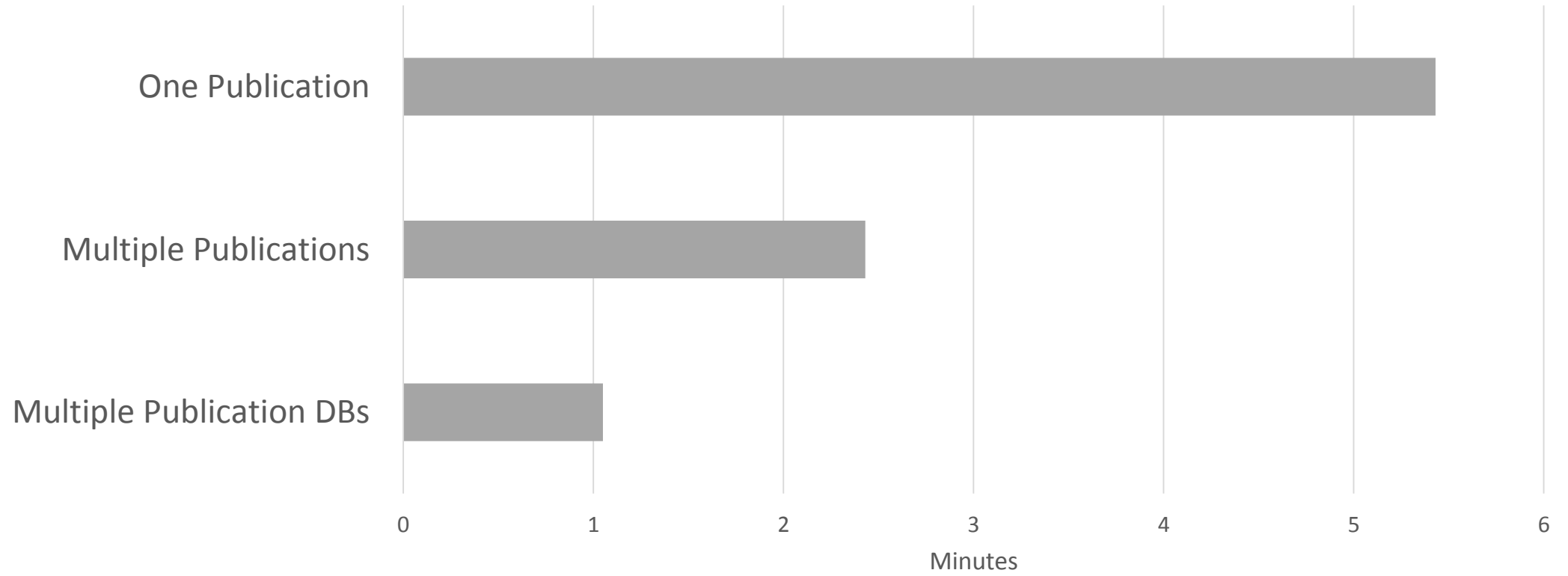
Subscription Streams Configuration



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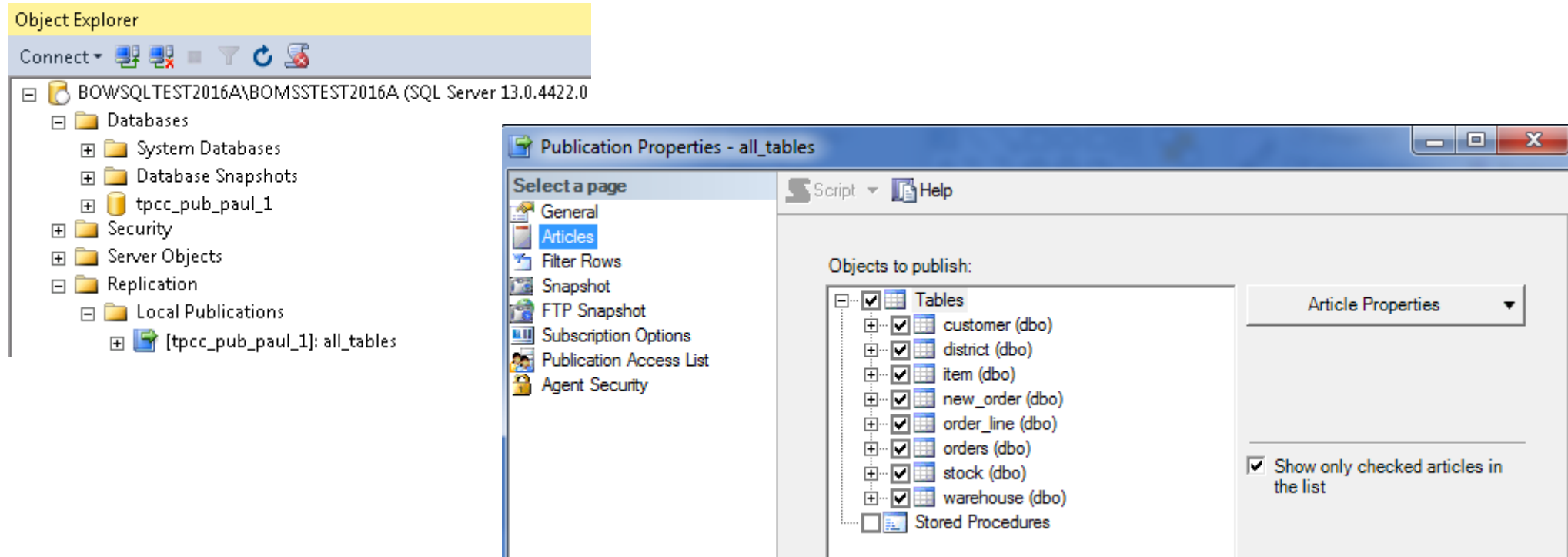
Distribution Agent Topology Latency Benchmark



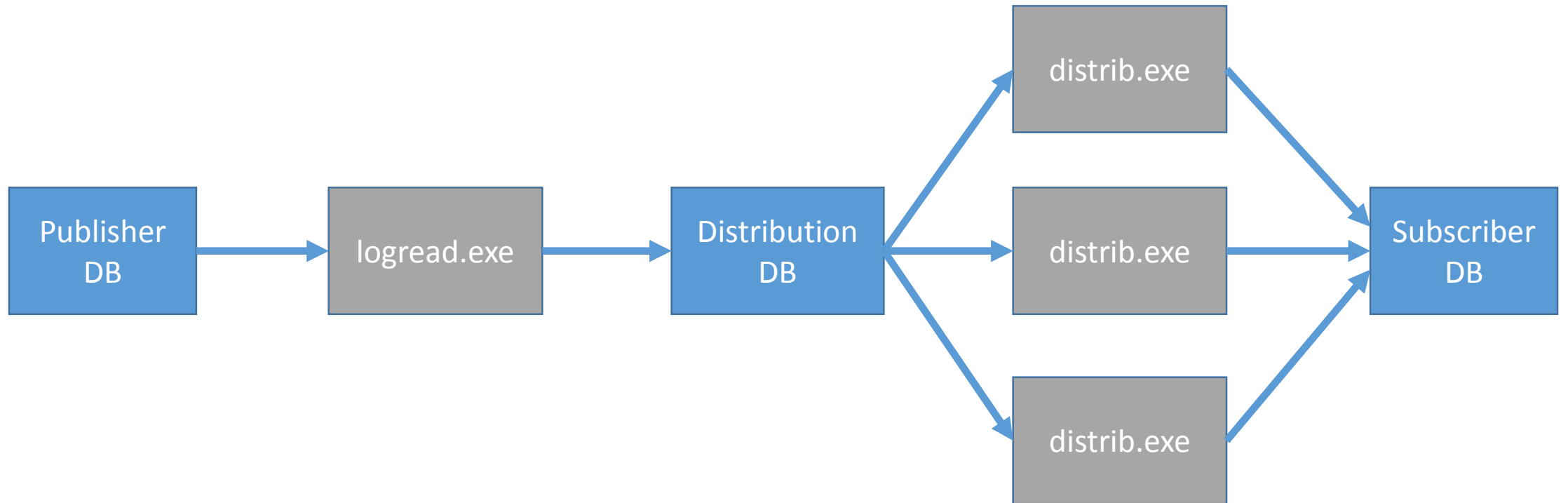
One Publication



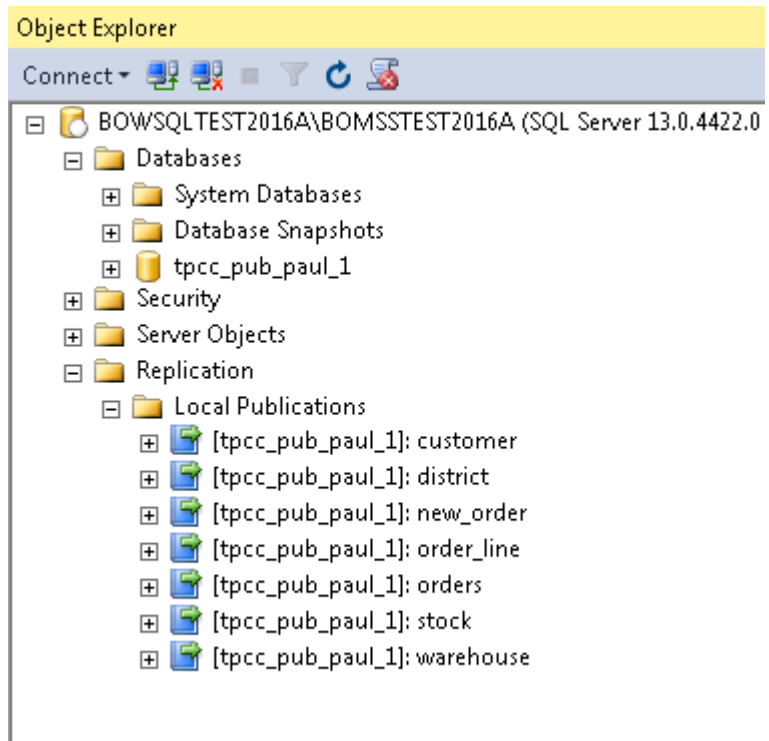
One Publication Configuration



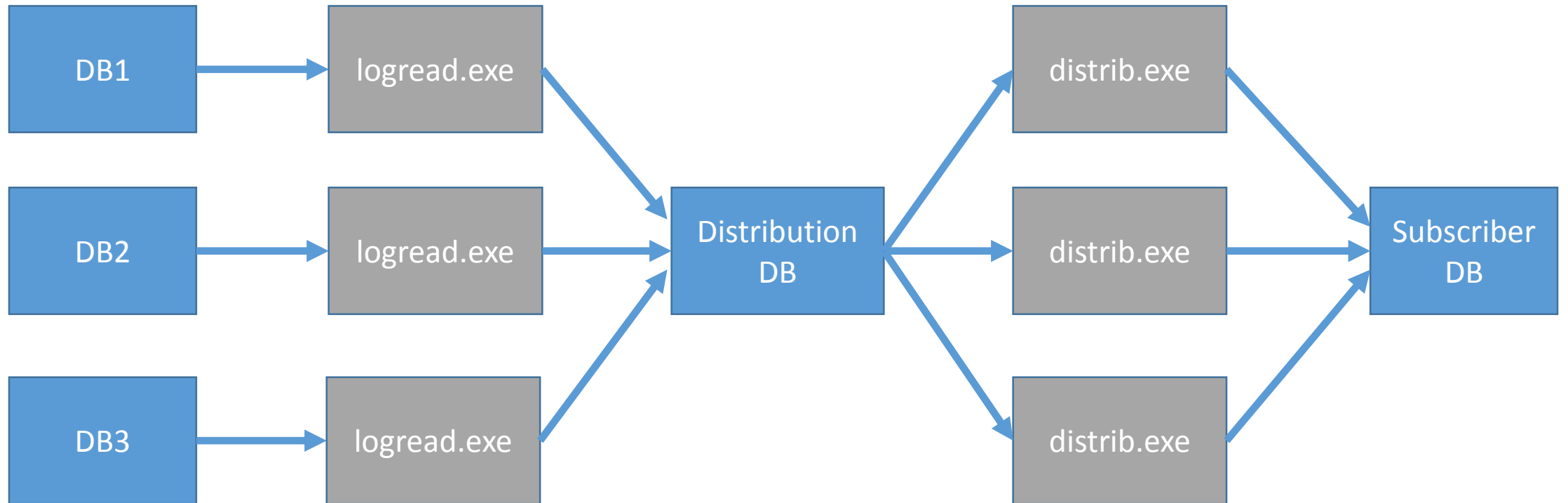
Multiple Publications



Multiple Publications Configuration



Multiple Publication DBs



Multiple Publication DBs Configuration

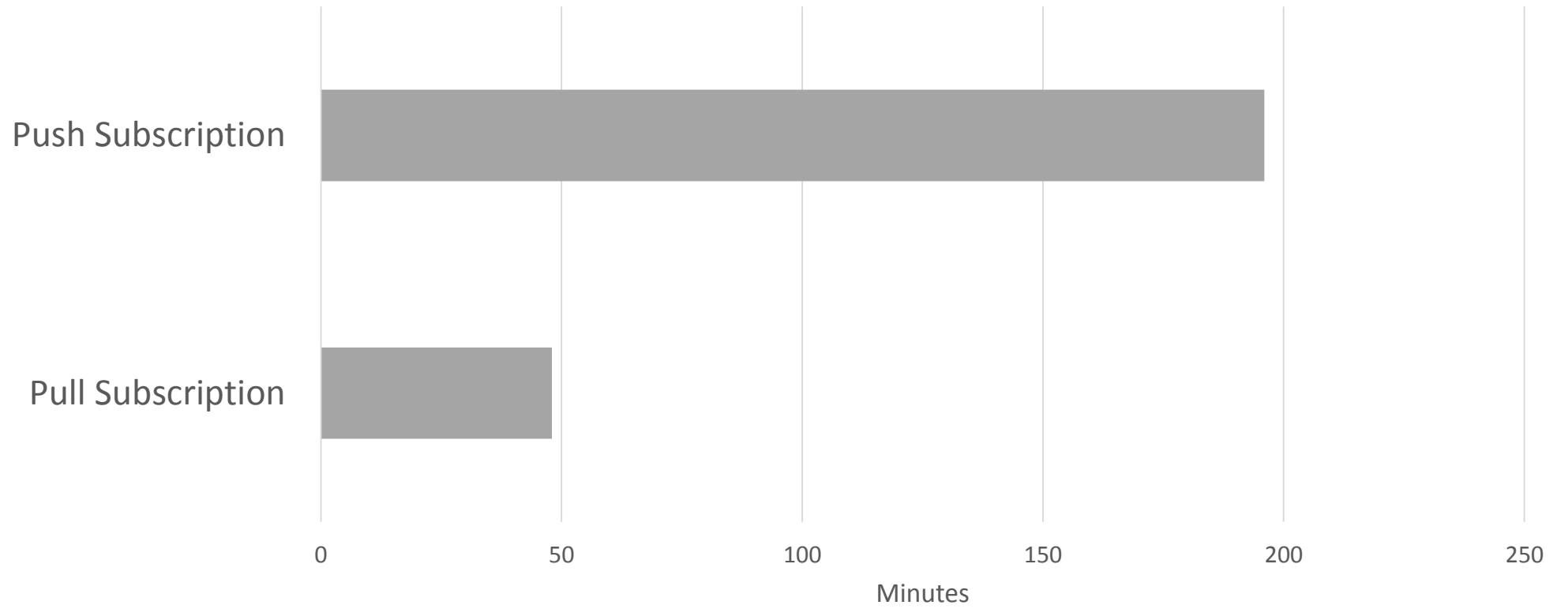
The screenshot displays the SQL Server Enterprise Manager interface. The Object Explorer on the left shows a server named 'BOWSQLTEST2016A\BOMSSTEST2016A (SQL Server 13.0.4422.0 -)'. Under the 'Replication' folder, there are eight local publications, each named '[tpcc_pub_paul_4]: all_tables' through '[tpcc_pub_paul_8]: all_tables'. The 'Publication Properties - all_tables' dialog is open, showing the 'Articles' page. The 'Objects to publish' list includes 'Tables' and 'Stored Procedures'. Under 'Tables', the following tables are selected for publication: customer (dbo), district (dbo), item (dbo), new_order (dbo), order_line (dbo), orders (dbo), stock (dbo), and warehouse (dbo). The 'Article Properties - customer' dialog is also open, showing the configuration for the 'customer' article. The 'Article name' is 'customer'. The 'Properties' section includes the following settings:

Property	Value
Copy filtered nonclustered col	False
Destination Object	
Destination object name	customer_4
Destination object owner	dbo
Action if name is in use	Truncate all data in the existing object
Convert data types	False
Convert TIMESTAMP to BINA	False
Create schemas at Subscriber	True
Convert XML to NTEXT	False
Convert MAX data types to N	False

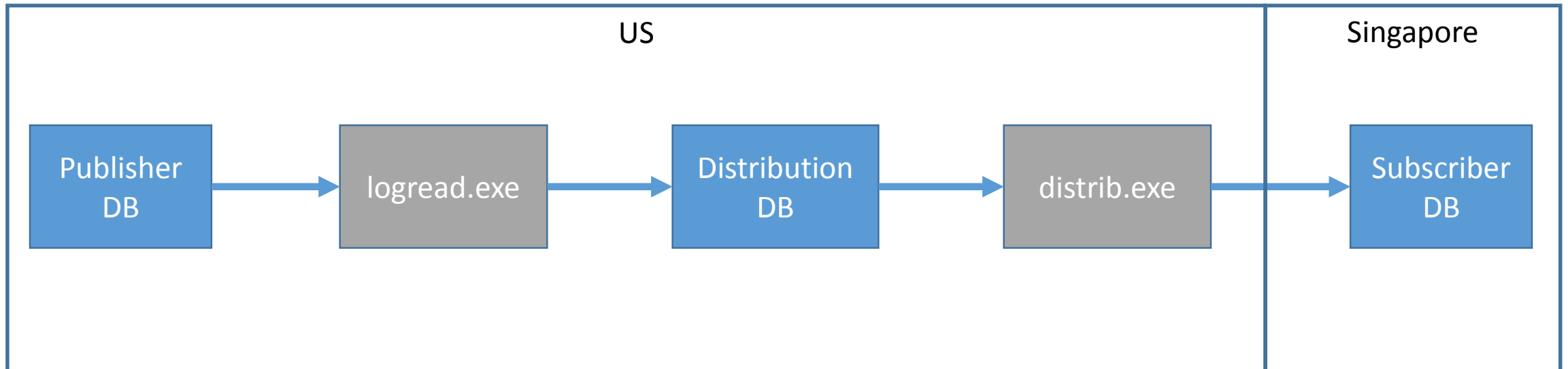
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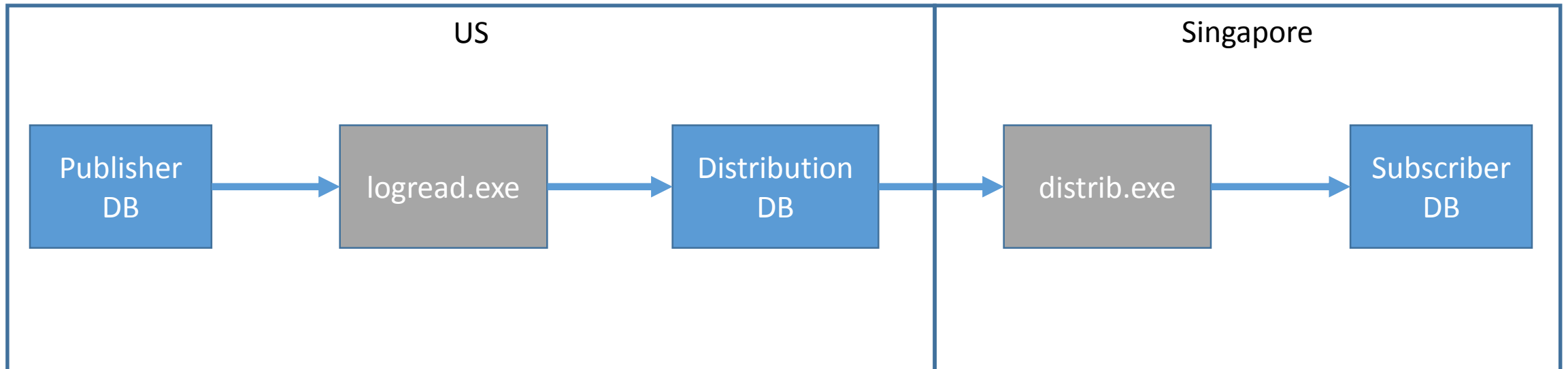
Subscription Type Latency Benchmark US to Singapore



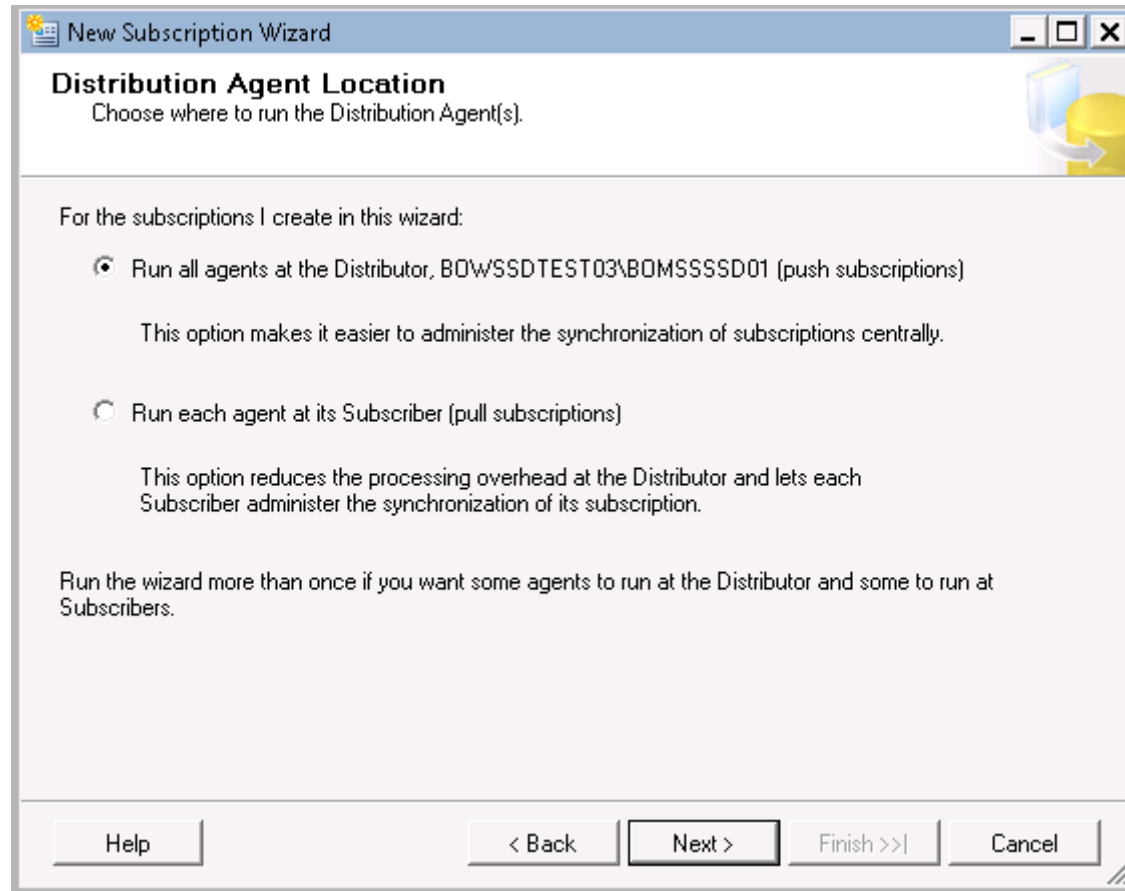
Push Subscription



Pull Subscription



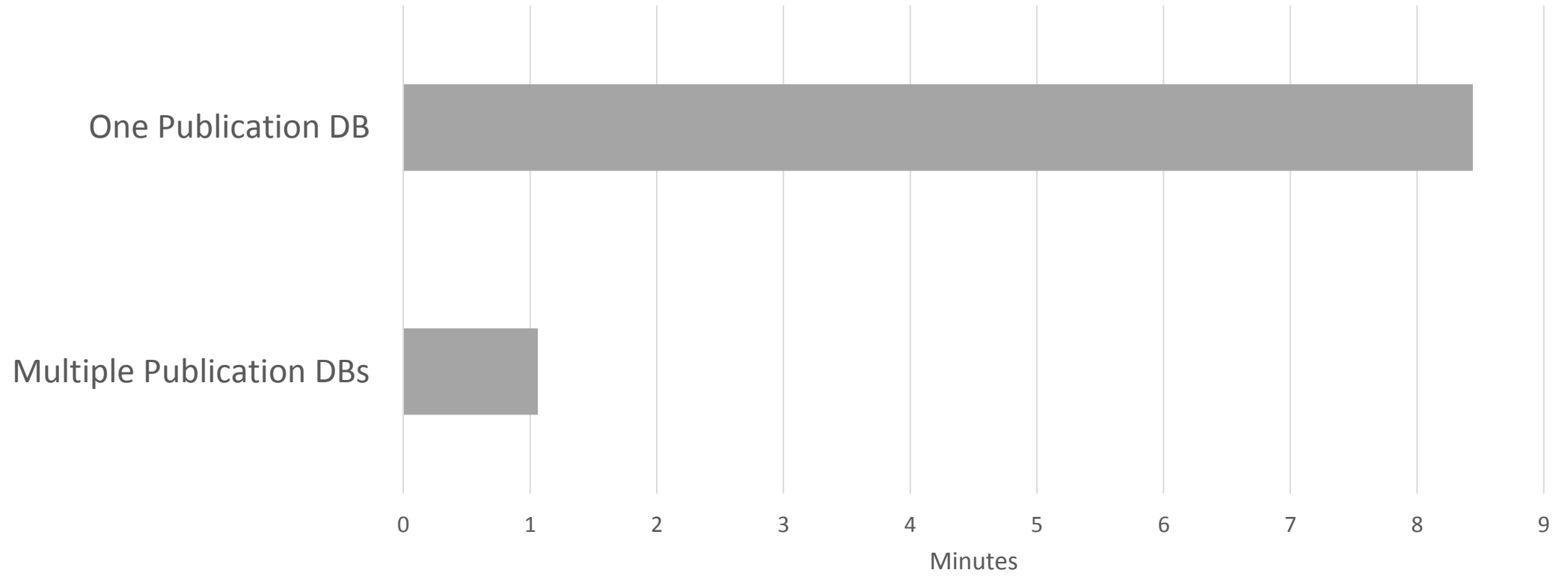
Push / Pull Subscription Configuration



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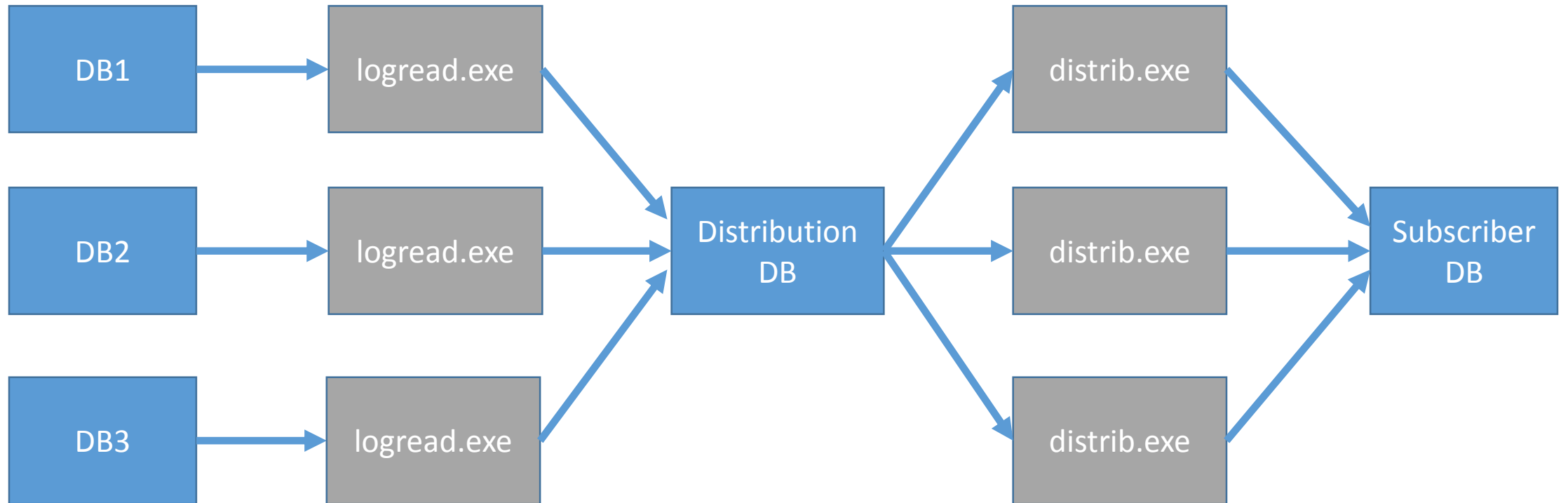
Log Reader Agent Topology Latency Benchmark



One Publication DB



Multiple Publication DBs



Agenda

- The Moving Parts
- The Bottlenecks
- The Tuning Knobs
- **Take Away**

Take Away

- Understand the limitations
- Know your workload
- Change properties or topology to meet your workload

What would you do?

The screenshot shows the SQL Server Replication Monitor interface. The left pane displays a tree view of publishers under 'My Publishers', including 'BOWSQLTEST2016A\BOMSSTEST20...'. The right pane shows the 'Tracer Tokens' tab, which includes an 'Insert Tracer' button, a 'Time inserted' dropdown menu set to '9/9/2017 9:12:57 PM', and a table of subscriptions.

Replication Monitor

File Action Go Help

Replication Monitor

My Publishers

- BOWSQLTEST2016A\BOMSSTEST20...
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 - [tpcc_pub_paul_1]: customer
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 - [tpcc_pub_paul_1]: orders
 - [tpcc_pub_paul_1]: stock
 - [tpcc_pub_paul_1]: warehouse
 - [tpcc_pub_paul_2]: all_exec
 - [tpcc_pub_paul_3]: all_tables
 - [tpcc_pub_paul_4]: all_tables
 - [tpcc_pub_paul_5]: all_tables
 - [tpcc_pub_paul_6]: all_tables
 - [tpcc_pub_paul_7]: all_tables
 - [tpcc_pub_paul_8]: all_tables

Last refresh: 9/9/2017 9:13:04 PM

All Subscriptions Tracer Tokens Agents Warnings

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Insert Tracer Time inserted: 9/9/2017 9:12:57 PM

	Subscription	Publisher to Distributor	Distributor to Subscri...	Total Latency
	[BOWSQLTEST20...	Pending...	Pending...	Pending...
	[BOWSQLTEST20...	Pending...	Pending...	Pending...
	[BOWSQLTEST20...	Pending...	Pending...	Pending...