IBM MQ 9.0.5

Managed File Transfer Performance Report for – Number of Agents connecting to Agent Queue Manager

Configuration and Measurements for the following products:

IBM MQ MFT 9.0.5

IBM Corporation
IBM MQ Performance Team
Aug 2018

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First Edition, August 2018.
This edition applies to the Managed File Transfer component of IBM MQ for Windows V9.0.5.0 (and to all subsequent releases and modifications until otherwise indicated in new editions).

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How this document is arranged

Performance Headlines
Pages: 2-18

Chapter 2 details the performance headlines for the two scenarios. Each scenario is detailed fully with diagrams in this section. The headline tests show how the file size and number of transfers affect the cpu consumption of various machines involved.

Tuning Recommendations
Page: 20

Chapter 4 discusses the appropriate tuning that should be applied to both the IBM MQ network and Managed File Transfer agents.

Measurement Environment
Page: 21

Chapter 5 gives an overview of the environment used to gather the performance results. This includes a detailed description of the hardware and software.

Contents

1 Overview

The Managed File Transfer (MFT) component of IBM MQ is a managed file transfer product that uses IBM MQ as its transport layer. This is a performance report for performance testing carried out on Windows.

This performance report details IBM MQ MFT in a range of scenarios, giving the reader information on transfer times and CPU utilisation. The report is based on measurements taken from Intel hardware, running Windows Server 2016 operating systems.

At the end of each block of results is a summary of the findings. It should be noted that results obtained and the inferences made depend on the test infrastructure hardware and any change could alter the results significantly. The reader is urged to use the findings in this report only as guidelines – this is particularly true for results where all of the values are very close.

2 Performance Headlines

The objective of the test is to see how many numbers of agents can connect to a Agent QM and how the Agent QM and Coordination QM performs. The measurements for the performance headlines are based on this factor using the associated CPU cost & the time taken to transfer a set of files. A single performance measurement is based on the number of agents considered and the size of the files varying as follows:

- 10MB
- 100MB

Agent count is as follows,

- 100 agents
- 200 agents
- 300 agents
- 400 agents
- 500 agents

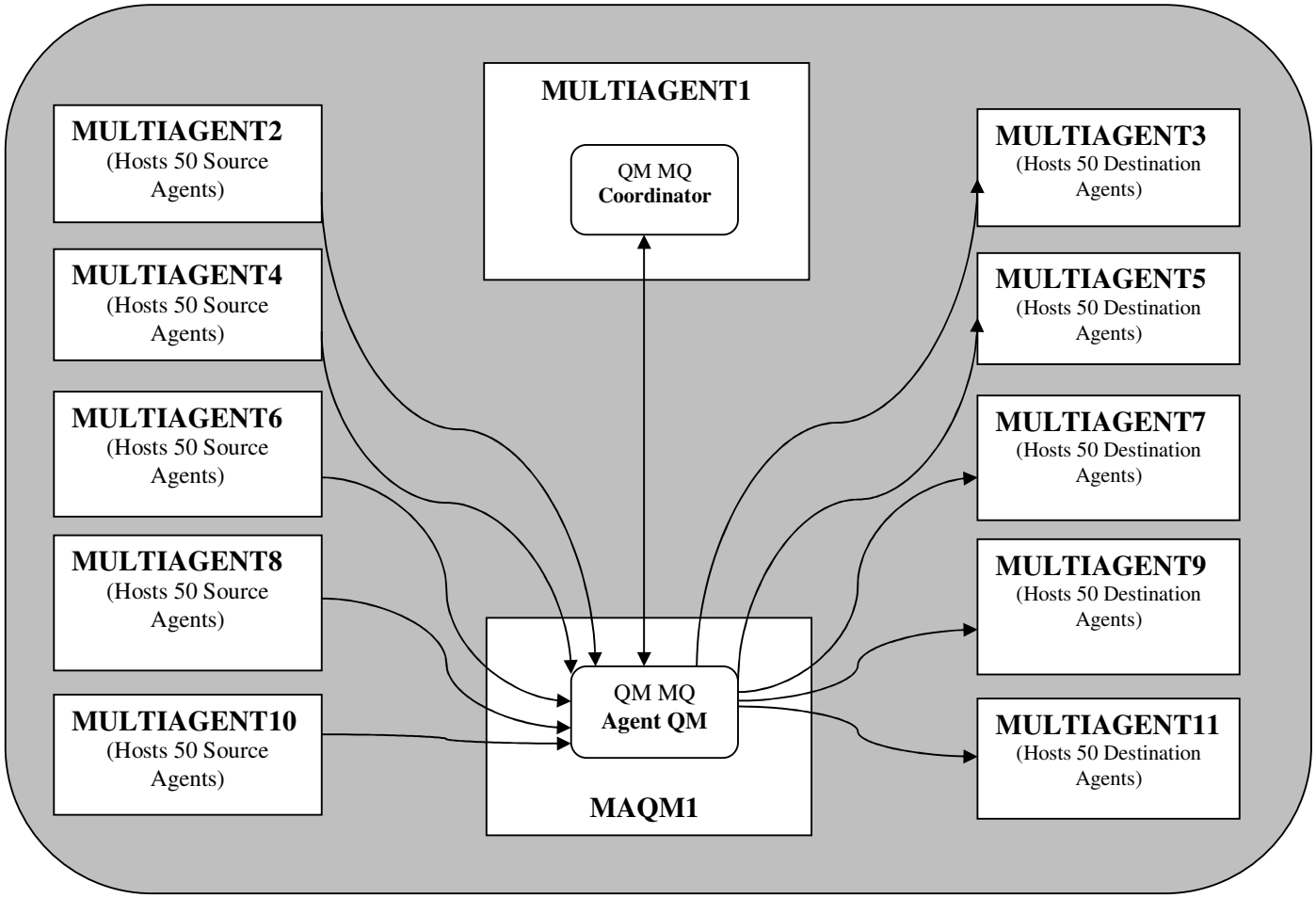
Please note that the number of agents is inclusive of both source and destination agents. For example, if the count is 100 it means the test involved 50 source agents and 50 destination agents. In the case of a 100 agent-100MB scenario, there is a transfer of a total of 50 transfers x 100MB = 5GB of data.

The performance headlines demonstrate the effect of altering the agent count and size of the data getting transferred on the load (cpu cost) of the agent queue manager and coordination queue manager.

To demonstrate the capability of the agent, All these will be a multiple transfer test, i.e., multithreaded. The multiple transfer test divides the number of files transferred across the source-destination agent pairs and submitted them at the same time.
All files were transferred using text mode. Each file transferred was the same size for a given performance run but contained random data. Transfers were submitted using the documented XML format.

The results are laid out in the chapters 2.1 and 2.2. Each test case has its own results table and associated graph. The first set of tables and figures show the reader the results for the above considered criteria.

Diagrammatic representation of the multi-agent testing
In this scenario each agent is connected to the same single remote queue manager in client mode. A second queue manager is placed on forth machine to act as the coordination queue manager. This coordination queue manager is not highly utilised as it is not directly involved in the transfers and so will have little or no effect on the Sender CPU values that are collected. The coordinator queue manager and agent queue manager and all the rest of the participant agent machines are grouped (stack name is ‘MULTIAGENT’). The following diagram details the exact scenario:


MULTIAGENT1
QM MQ
Coordinator
MULTIAGENT2
(Hosts 50 Source Agents)
MULTIAGENT3
(Hosts 50 Destination Agents)
MULTIAGENT4
(Hosts 50 Source Agents)
MULTIAGENT5
(Hosts 50 Destination Agents)
MULTIAGENT6
(Hosts 50 Source Agents)
MULTIAGENT7
(Hosts 50 Destination Agents)
MULTIAGENT8
(Hosts 50 Source Agents)
MULTIAGENT9
(Hosts 50 Destination Agents)
QM MQ
Agent QM
MULTIAGENT10
(Hosts 50 Source Agents)
MULTIAGENT11
(Hosts 50 Destination Agents)
MAQM1

2.1 Multi-Agent scenarios

2.1.1 100 agents - each transferring 10 MB of files

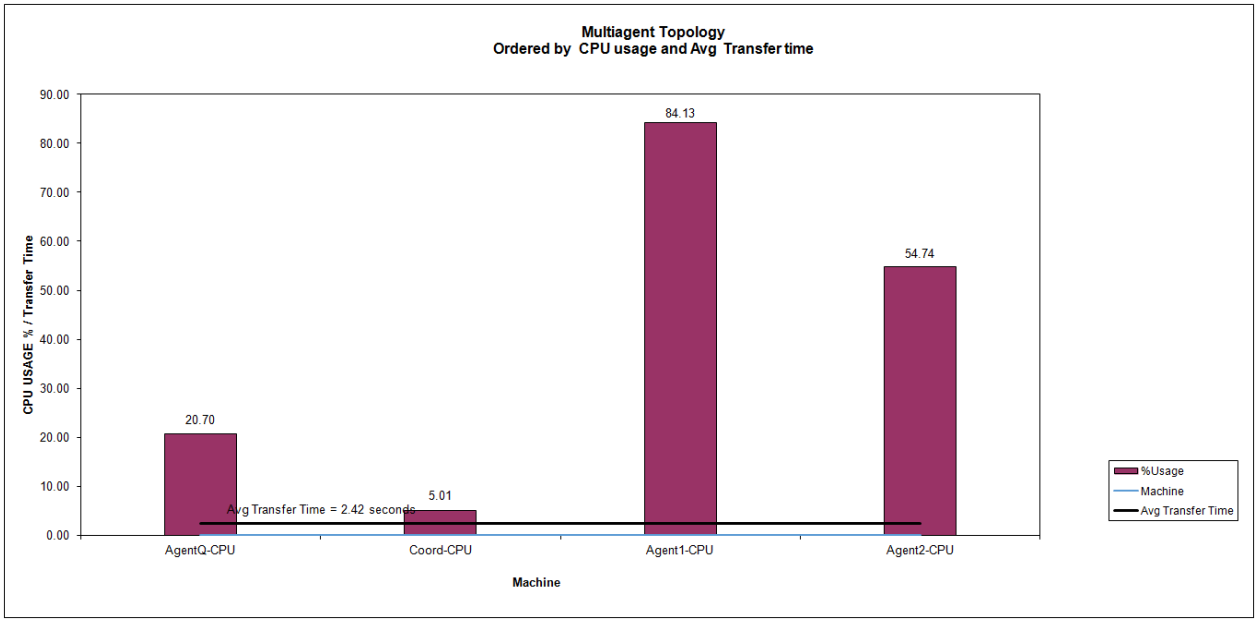
This transfer involves 100 agents with 50 parallel transfers. They will be transferring a total of 500 files of total size 500MB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine – CPU utilization	20.70%
Coordination Queue Manager Machine	5.01%

Average Transfer Time per transfer = 2.42 seconds

Source agent and destination agent machine's cpu consumption given below,

Source Machine (A total of 50 agents)	84.13%
Destination Machine (A total of 50 agents)	54.74%



2.1.2 200 agents - each transferring 10 MB of files

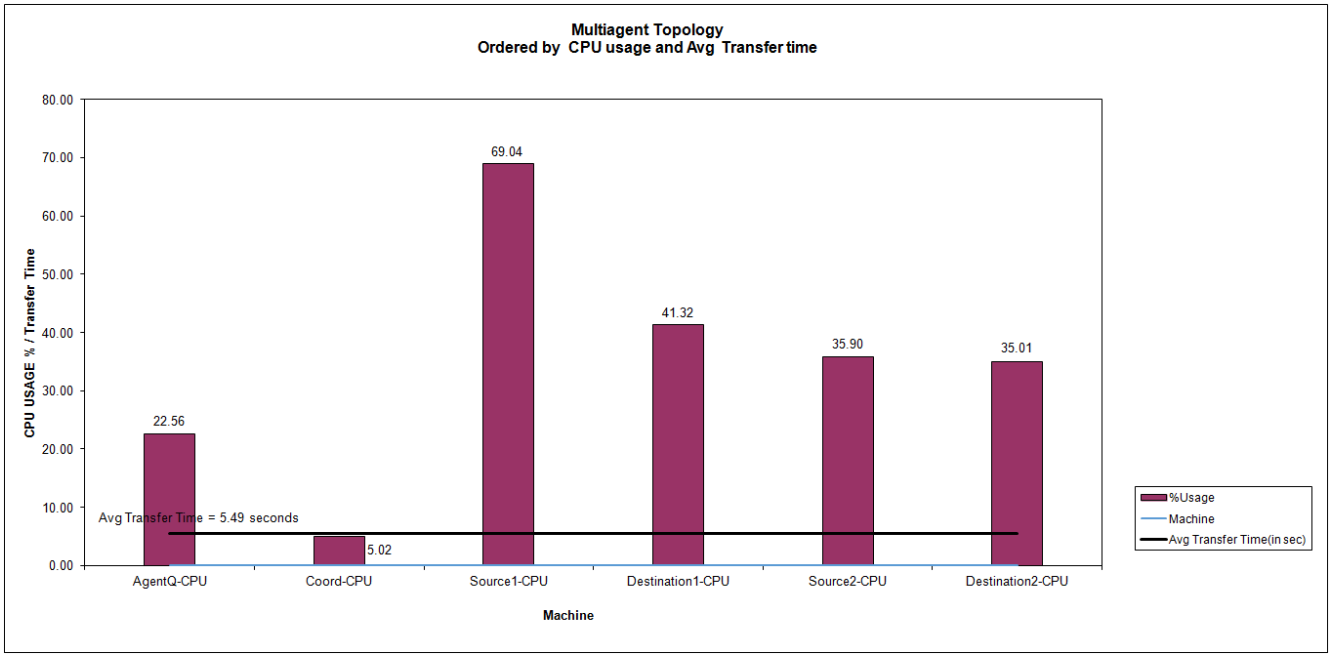
This transfer involves 200 agents with 100 parallel transfers. They will be transferring a total of 1000 files of total size 1GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine	22.56%
Coordination Queue Manager Machine	5.02%

Average Transfer Time per transfer = 5.49 seconds

Below is the list of of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	69.04%
Destination1 Machine (A total of 50 agents)	41.32%
Source2 Machine (A total of 50 agents)	35.90%
Destination2 Machine (A total of 50 agents)	35.01%



2.1.3 300 agents - each transferring 10 MB of files

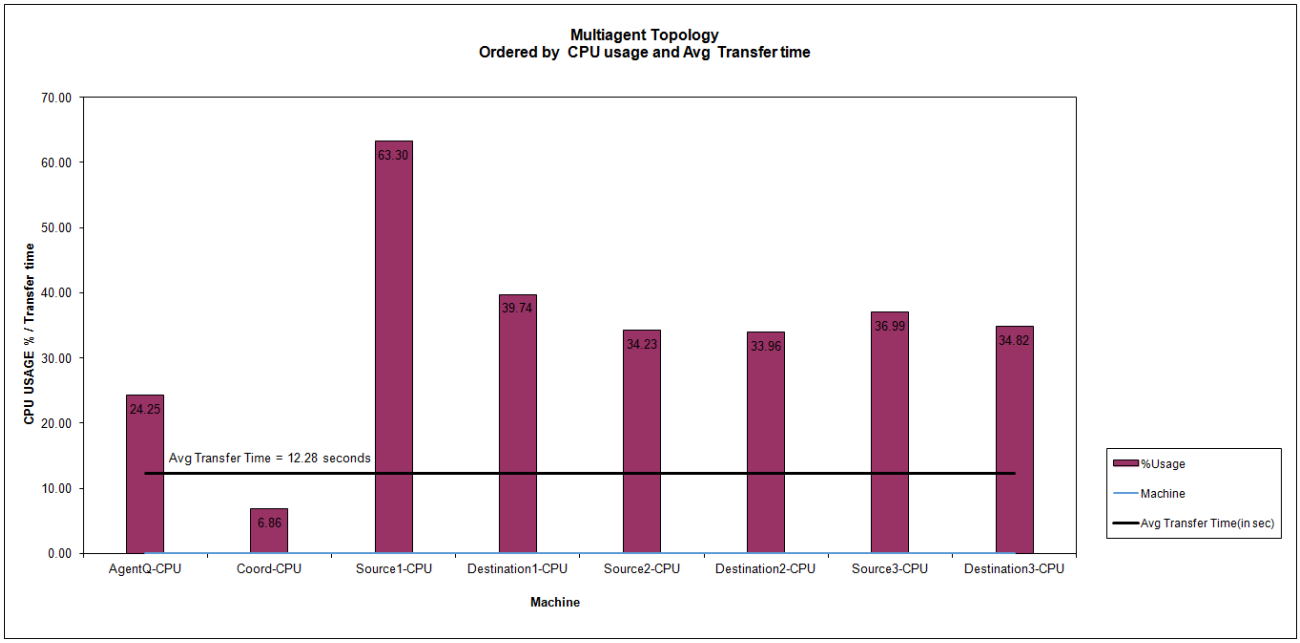
This transfer involves 300 agents with 150 parallel transfers. They will be transferring a total of 1500 files of total size 1.5GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine	24.25%
Coordination Queue Manager Machine	6.86%

Average Transfer Time per transfer = 12.28 seconds

Below is the list of of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	63.30%
Destination1 Machine (A total of 50 agents)	39.74%
Source2 Machine (A total of 50 agents)	34.23%
Destination2 Machine (A total of 50 agents)	33.96%
Source3 Machine (A total of 50 agents)	36.99%
Destination3 Machine (A total of 50 agents)	34.82%



2.1.4 400 agents - each transferring 10 MB of files

This transfer involves 400 agents with 200 parallel transfers. They will be transferring a total of 2000 files of total size 2GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

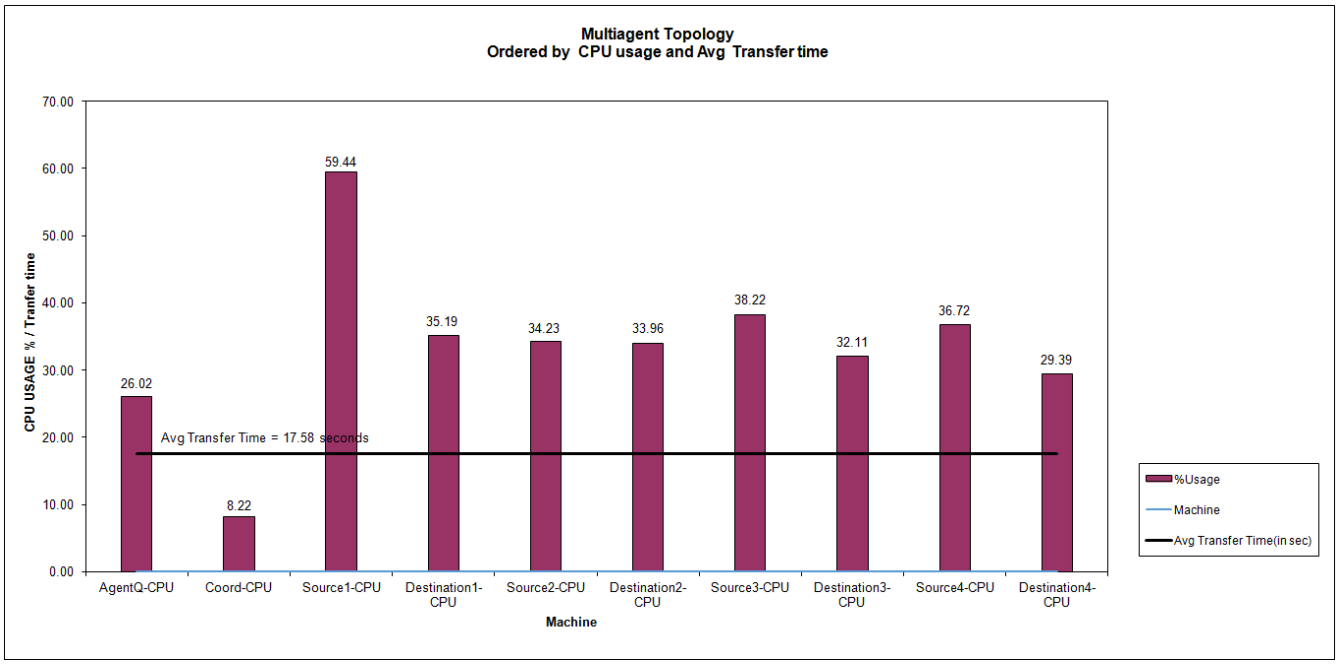
Machine	CPU Percentage Usage
Agent Queue Manager Machine	26.02%
Coordination Queue Manager Machine	8.22%

Average Transfer Time per transfer = 17.58 seconds

Below is the list of of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	59.44%
Destination1 Machine (A total of 50 agents)	35.19%
Source2 Machine (A total of 50 agents)	34.23%
Destination2 Machine (A total of 50 agents)	33.96%
Source3 Machine (A total of 50 agents)	38.22%

Destination3 Machine (A total of 50 agents)	32.11%
Source4 Machine (A total of 50 agents)	36.72%
Destination4 Machine (A total of 50 agents)	29.39%



2.1.5 500 agents - each transferring 10 MB of files

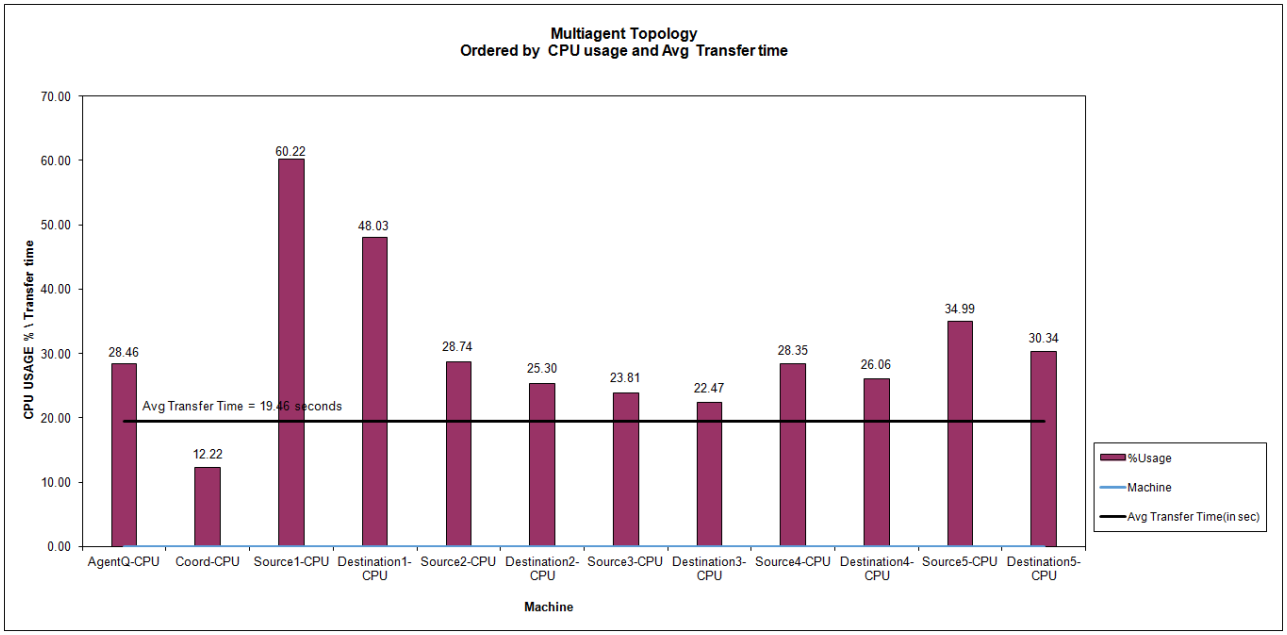
This transfer involves 500 agents with 250 parallel transfers. They will be transferring a total of 2500 files of total size 2.5GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine	28.46%
Coordination Queue Manager Machine	12.22%

Average Transfer Time per transfer = 19.46 seconds

Below is the list of of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	60.22%
Destination1 Machine (A total of 50 agents)	48.03%
Source2 Machine (A total of 50 agents)	28.74%
Destination2 Machine (A total of 50 agents)	25.30%
Source3 Machine (A total of 50 agents)	23.81%
Destination3 Machine (A total of 50 agents)	22.47%
Source4 Machine (A total of 50 agents)	28.35%
Destination4 Machine (A total of 50 agents)	26.06%
Source5 Machine (A total of 50 agents)	34.99%
Destination5 Machine (A total of 50 agents)	30.34%


Multiagent Topology
Ordered by CPU usage and Avg Transfer time
CPU USAGE % \ Transfer time
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
28.46
12.22
60.22
48.03
28.74
25.30
23.81
22.47
28.35
26.06
34.99
30.34
Avg Transfer Time = 19.46 seconds
AgentQ-CPU
Coord-CPU
Source1-CPU
Destination1-CPU
Source2-CPU
Destination2-CPU
Source3-CPU
Destination3-CPU
Source4-CPU
Destination4-CPU
Source5-CPU
Destination5-CPU
Machine
%Usage
Machine
Avg Transfer Time(in sec)

2.1.6 100 agents - each transferring 100 MB of files

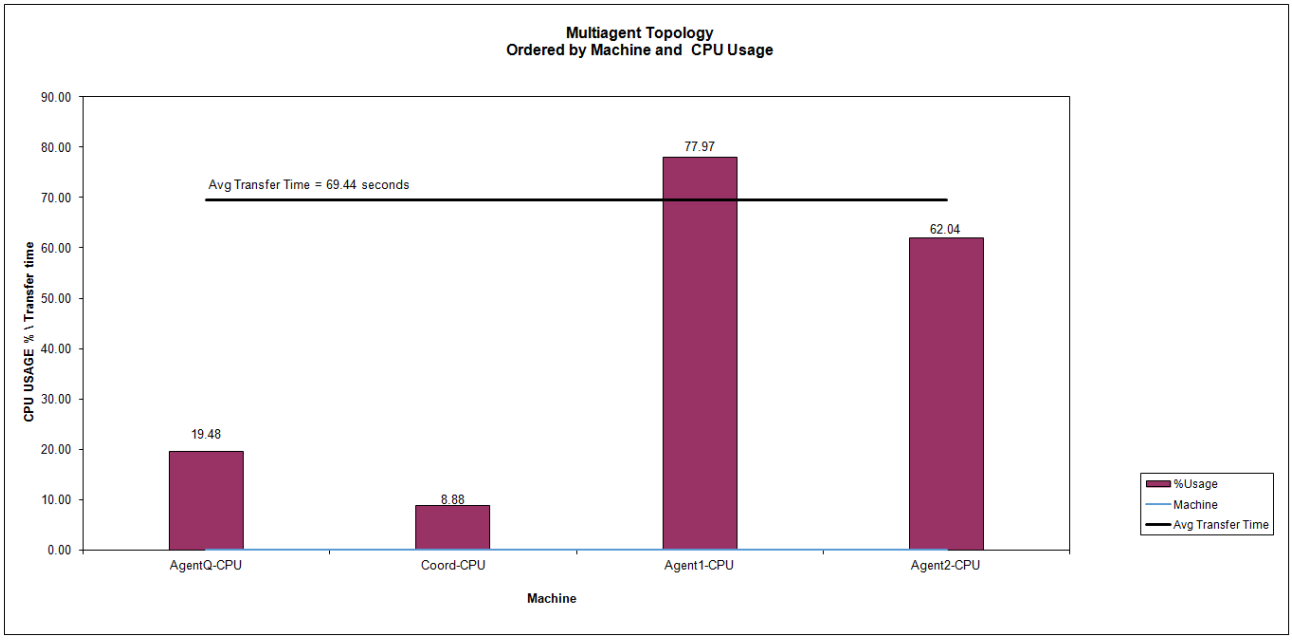
This transfer involves 100 agents with 50 parallel transfers. They will be transferring a total of 500 files of total size 5GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine – CPU utilization	19.48%
Coordination Queue Manager Machine	8.88%

Average Transfer Time per transfer = 69.44 seconds

Below is the list of of agent machine's usage just for reference.

Source Machine (A total of 50 agents)	77.97%
Destination Machine (A total of 50 agents)	62.04%



2.1.7 200 agents - each transferring 100 MB of files

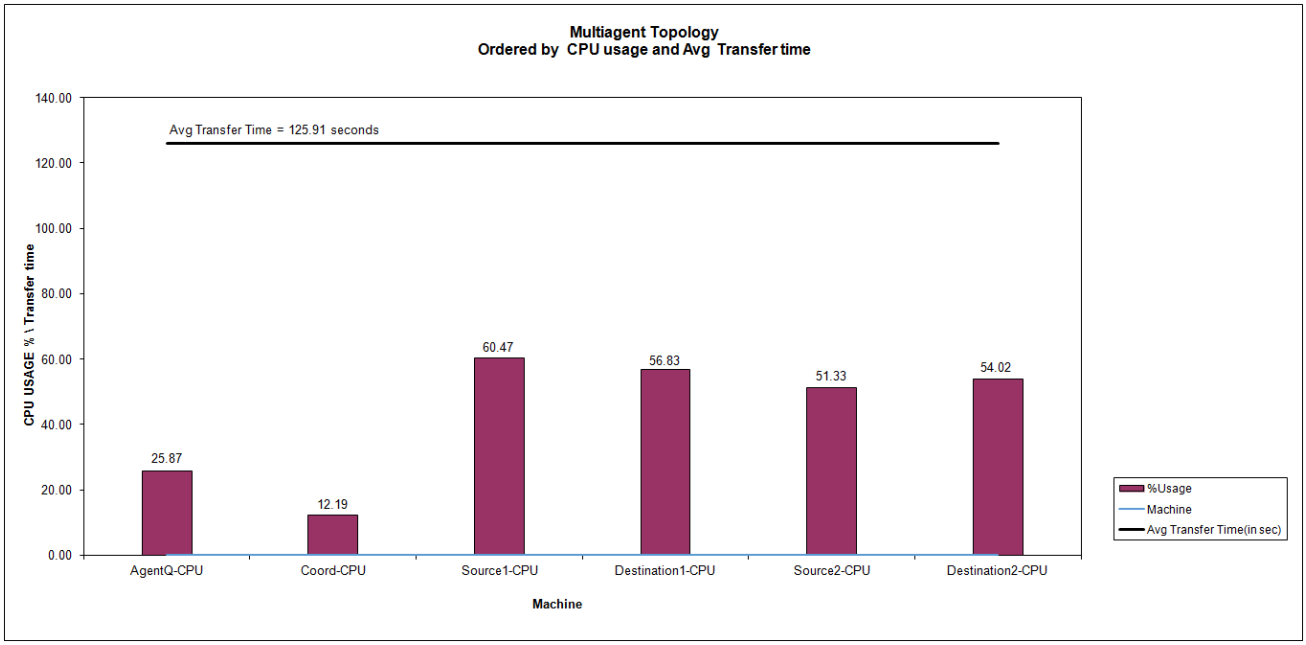
This transfer involves 200 agents with 100 parallel transfers. They will be transferring a total of 1000 files of total size 10GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine	25.87%
Coordination Queue Manager Machine	12.19%

Average Transfer Time per transfer = 125.91 seconds

Below is the list of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	60.47%
Destination1 Machine (A total of 50 agents)	56.83%
Source2 Machine (A total of 50 agents)	51.33%
Destination2 Machine (A total of 50 agents)	54.02%



2.1.8 300 agents - each transferring 100 MB of files

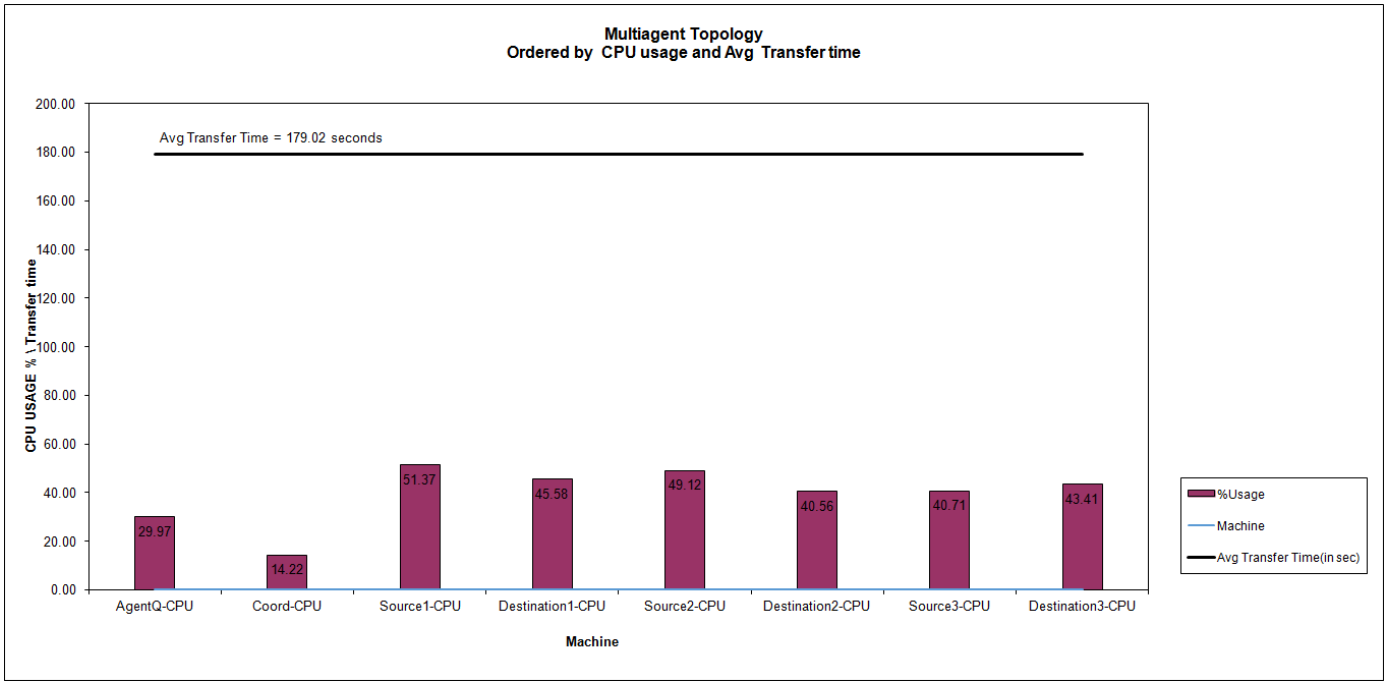
This transfer involves 300 agents with 150 parallel transfers. They will be transferring a total of 1500 files of total size 15GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine	29.97%
Coordination Queue Manager Machine	14.22%

Average Transfer Time per transfer = 179.02 seconds

Below is the list of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	51.37%
Destination1 Machine (A total of 50 agents)	45.58%
Source2 Machine (A total of 50 agents)	49.12%
Destination2 Machine (A total of 50 agents)	40.56%
Source3 Machine (A total of 50 agents)	40.71%
Destination3 Machine (A total of 50 agents)	43.41%



2.1.9 400 agents - each transferring 100 MB of files

This transfer involves 300 agents with 150 parallel transfers. They will be transferring a total of 1500 files of total size 15GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

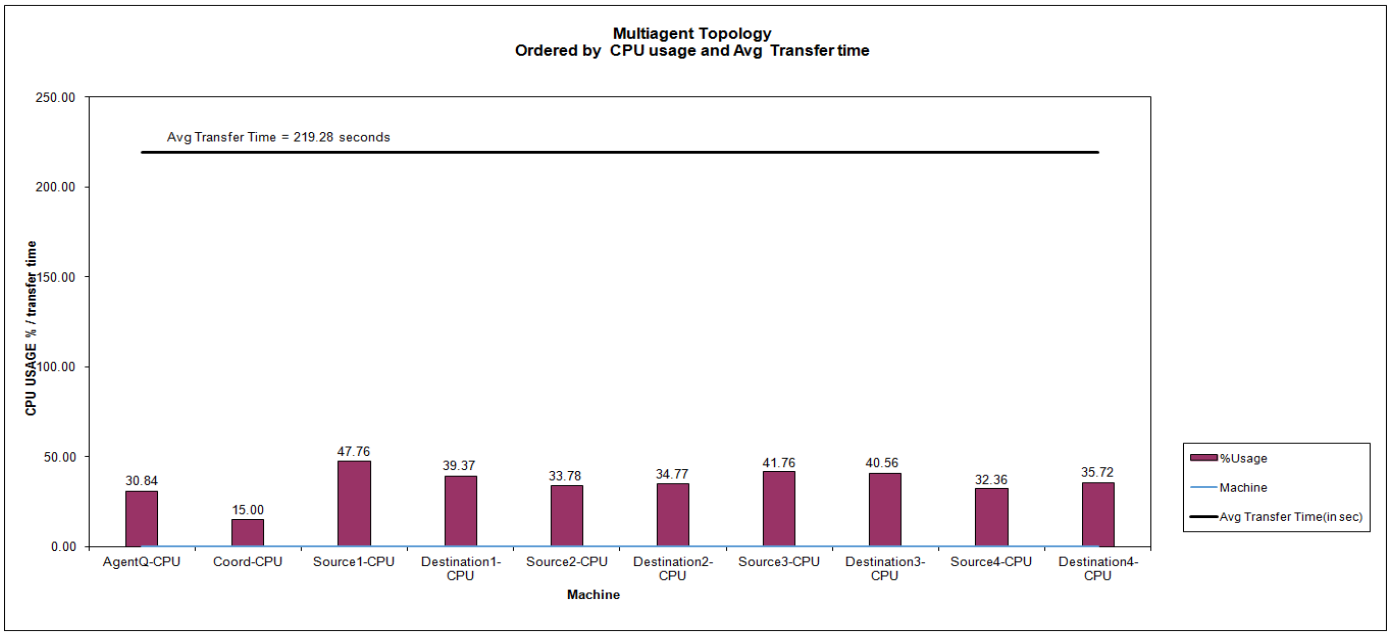
Machine	CPU Percentage Usage
Agent Queue Manager Machine	30.84%
Coordination Queue Manager Machine	15.00%

Average Transfer Time per transfer = 219.28 seconds

Below is the list of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	47.76%
Destination1 Machine (A total of 50 agents)	39.37%
Source2 Machine (A total of 50 agents)	33.78%
Destination2 Machine (A total of 50 agents)	34.77%

Source3 Machine (A total of 50 agents)	41.76%
Destination3 Machine (A total of 50 agents)	40.56%
Source4 Machine (A total of 50 agents)	32.36%
Destination4 Machine (A total of 50 agents)	35.72%



2.1.10 500 agents - each transferring 100 MB of files

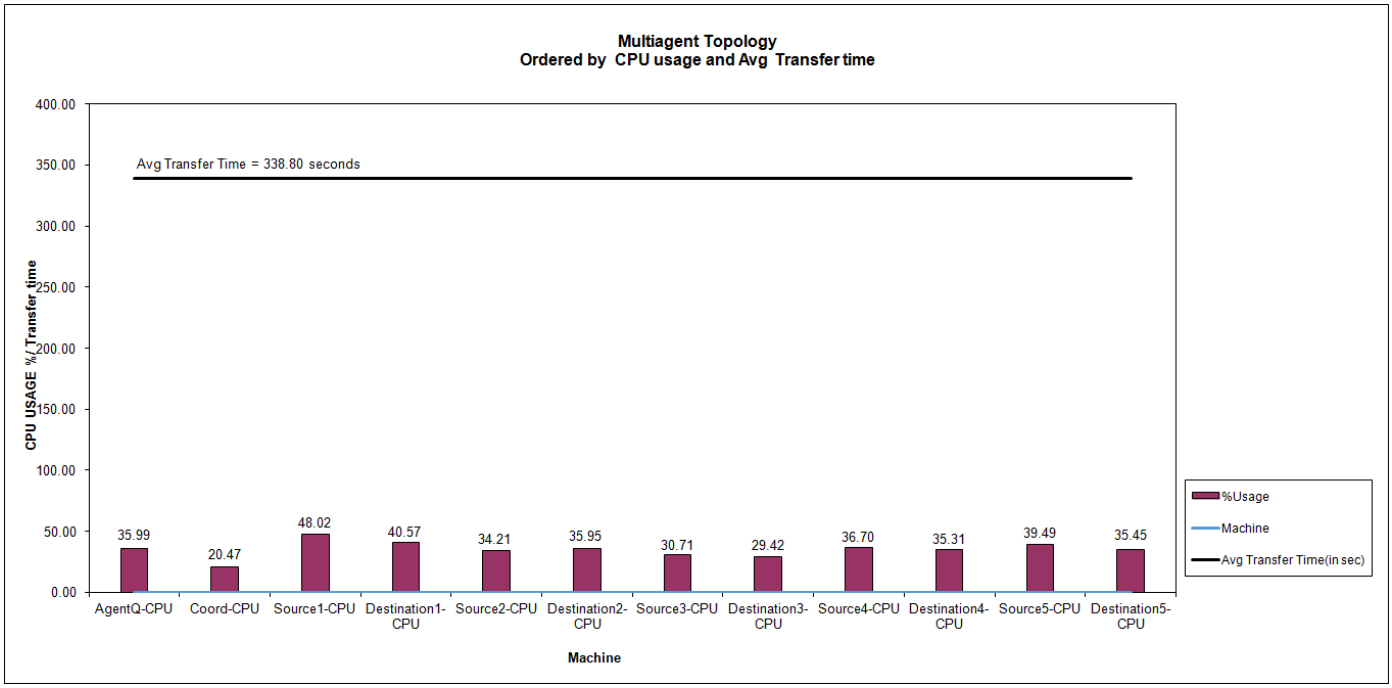
This transfer involves 300 agents with 150 parallel transfers. They will be transferring a total of 1500 files of total size 15GB. The table and chart below show the relevant times and CPU utilisation for the above said case.

Machine	CPU Percentage Usage
Agent Queue Manager Machine	35.99%
Coordination Queue Manager Machine	20.47%

Average Transfer Time per transfer = 338.80 seconds

Below is the list of agent machine's usage just for reference.

Source1 Machine (A total of 50 agents)	48.02%
Destination1 Machine (A total of 50 agents)	40.57%
Source2 Machine (A total of 50 agents)	34.21%
Destination2 Machine (A total of 50 agents)	35.95%
Source3 Machine (A total of 50 agents)	30.71%
Destination3 Machine (A total of 50 agents)	29.42%
Source4 Machine (A total of 50 agents)	36.70%
Destination4 Machine (A total of 50 agents)	35.31%
Source5 Machine (A total of 50 agents)	39.49%
Destination5 Machine (A total of 50 agents)	35.45%

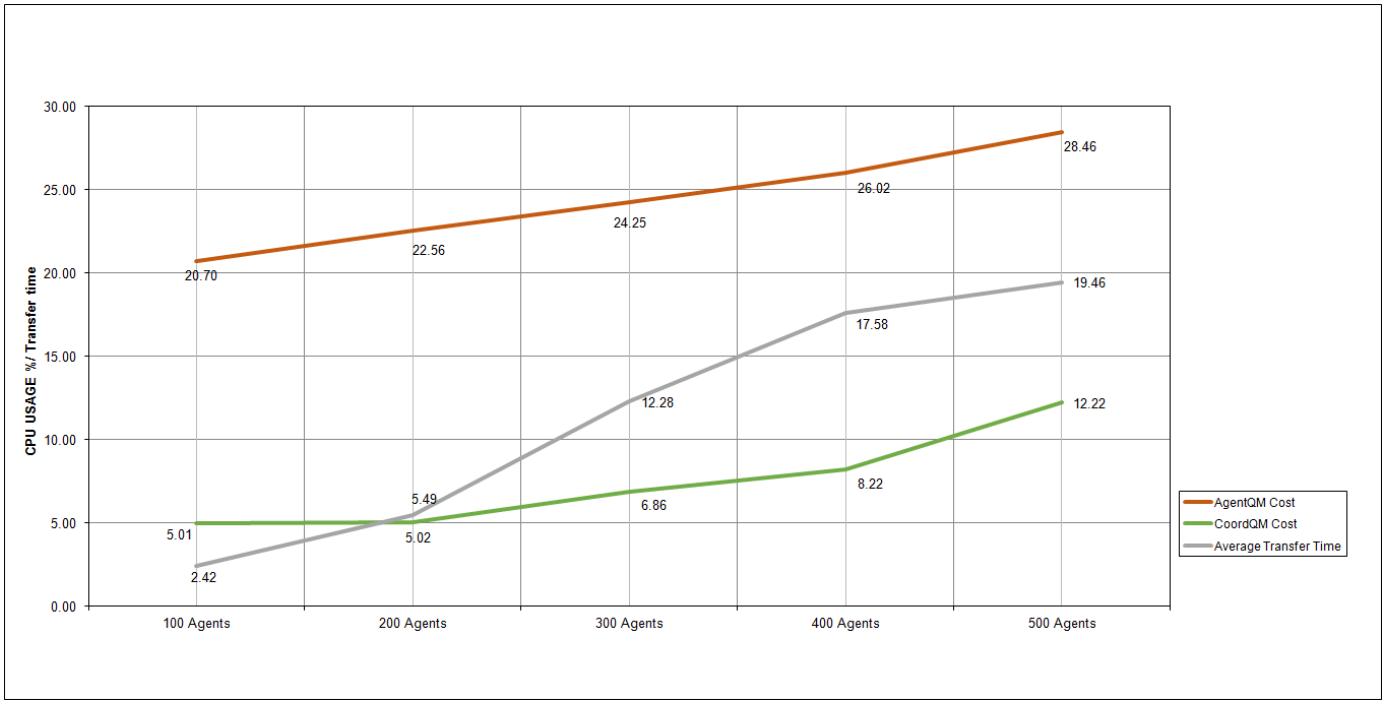

Multiagent Topology
Ordered by CPU usage and Avg Transfer time
Avg Transfer Time = 338.80 seconds
CPU USAGE %/ Transfer time
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
35.99
20.47
48.02
40.57
34.21
35.95
30.71
29.42
36.70
35.31
39.49
35.45
AgentQ-CPU
Coord-CPU
Source1-CPU
Destination1-CPU
Source2-CPU
Destination2-CPU
Source3-CPU
Destination3-CPU
Source4-CPU
Destination4-CPU
Source5-CPU
Destination5-CPU
Machine
%Usage
Machine
Avg Transfer Time(in sec)

3 Test Summary

Below tables list the summary of the all the test results. The areas of interest for us would be agent queue manager machine's cpu cost, coordination queue manager machine's cpu cost and average transfer time per transfer.

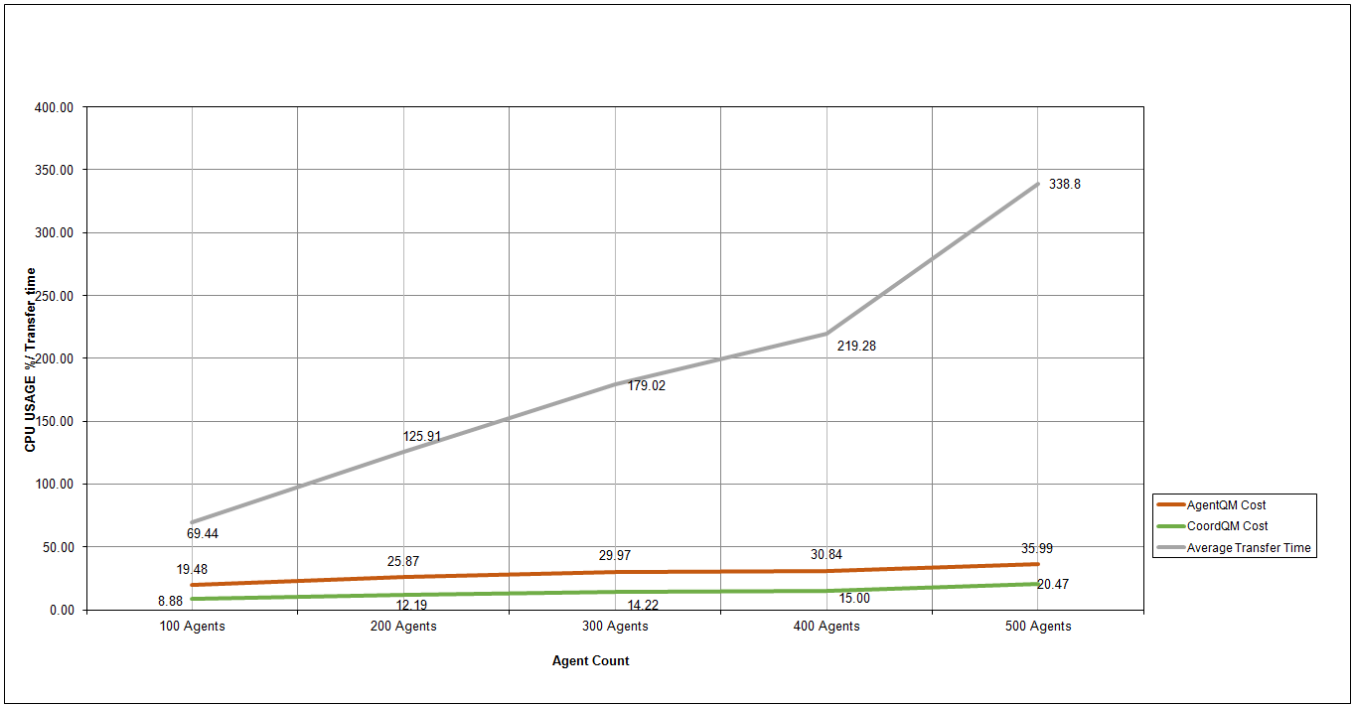
3.1 10MB Multiagent Transfers

Agents involved	Agent QM CPU Usage	Coordination QM CPU Usage	Average Transfer Time
100 agents	20.70%	5.01%	2.42 s
200 agents	22.56%	5.02%	5.49 s
300 agents	24.25%	6.86%	12.28 s
400 agents	26.02%	8.22%	17.58 s
500 agents	28.46%	12.22%	19.46 s



3.2 100MB Multiagent Transfers

Agents involved	Agent QM CPU Usage	Coordination QM CPU Usage	Average Transfer Time
100 Agents	19.48%	8.88%	69.44 s
200 Agents	25.87%	12.19%	125.91 s
300 Agents	29.97%	14.22%	179.02 s
400 Agents	30.84%	15%	219.28 s
500 Agents	35.99%	20.47%	338.80 s



4 Tuning Recommendations

4.1 IBM MQ Setup

Readers of this performance guide should make themselves familiar with the IBM MQ Performance Supportpacs that are continually released. In this case it would be for MQ 9.0.5 windows of particular interest.

For this performance report, advice was taken from the aforementioned (MPL3) and applied to the queue managers created accordingly. Queue managers were created using the following crtmqm command:

```
crtmqm -q -u SYSTEM.DEAD.LETTER.QUEUE -lp 16 -lf 16384 <QueueManagerName>
```

Once the queue manager was created, tuning parameters were added to the queue managers' qm.ini as follows:

```
Channels:
MQIBindType=FASTPATH

TuningParameters:
DefaultPQBufferSize=1045876
DefaultQBufferSize=1048576
```

Note that the qm.ini was updated before the queue manager was started (and therefore before the IBM MQ Managed File Transfer objects were created).

By increasing the amount of memory available to queues for persistent and non-persistent messages, you can help to avoid writing messages out to disk unnecessarily. Turning on FASTPATH for channels removes the channel process, and enables the channel to run within the main queue manager process. Please consult your documentation to understand what this means for your IBM MQ installation.

For more information on tuning a IBM MQ queue manager, please refer to the Supportpacs mentioned above.

5 Measurement Environment

5.1 Agents

- IBM MQ Managed File Transfer Version 9.0.5 was used for this report.
- Default properties were used for agents.
- Agents were reading/writing files to the local file system, not the SAN.

5.2 IBM MQ

- IBM MQ Version 9.0.5 was used for all machines.
- Queue managers created in accordance with Performance report.

5.3 Operating System

- Windows Server 2016 Standard 64bit.

5.4 Hardware

Systems:	MULTIAGENT1 to MULTIAGENT11
Machine Type:	x64 based Processor, virtual
Processor:	Westmere E56xx/L56xx/X56xx (Nehalem-C) 2.39GHz
Architecture:	4 CPU
Memory (RAM):	8 GB
Disk:	Internal disk hosting OS – 250 GB

System:	MAQM1
Machine Type:	x64 based Processor, virtual
Processor:	Westmere E56xx/L56xx/X56xx (Nehalem-C) 2.39GHz
Architecture:	8 CPU
Memory (RAM):	16 GB
Disk:	Internal disk hosting OS – 250 GB