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Performance and Scalability Benchmark

ArcGIS Server 10 REST Dynamic Map Service Export Map

Version 2.0

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1 Objective

This benchmark's objective is to measure and present the performance and scalability of the ArcGIS Server 10 REST API map service using the Portland Metro Area dataset. The dataset was tested without the raster layers.

For details on the benchmarking process, see [Capacity Planning and Performance Benchmark Reference Guide](#).

2 Application Architecture

This benchmark will isolate the ArcGIS Server 10 REST API dynamic map service.

For details on ArcGIS Server services, see: [ArcGIS Server Web Service API](#).

3 Hardware and Software Configuration

Figure 1: Hardware Diagram

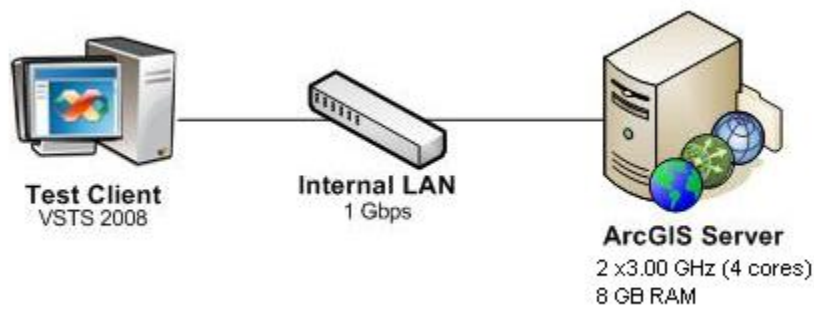


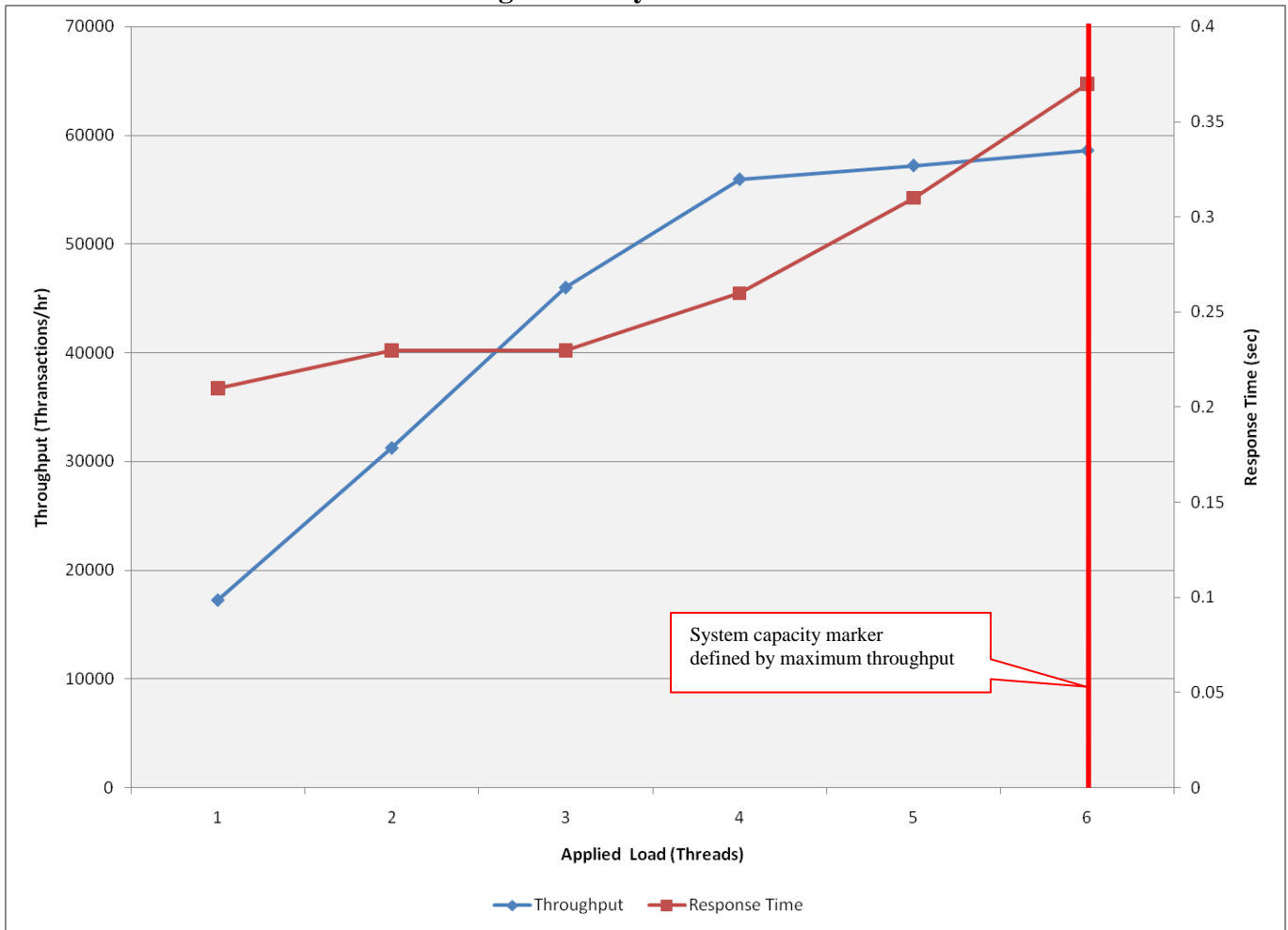
Diagram Key:				
Web	SOM	SOC	RDBMS	File

4 Benchmark Results

This section reports key performance and scalability information. For details and practical application of these results, see [Capacity Planning and Performance Benchmark Reference Guide](#).

4.1 Performance and Scalability

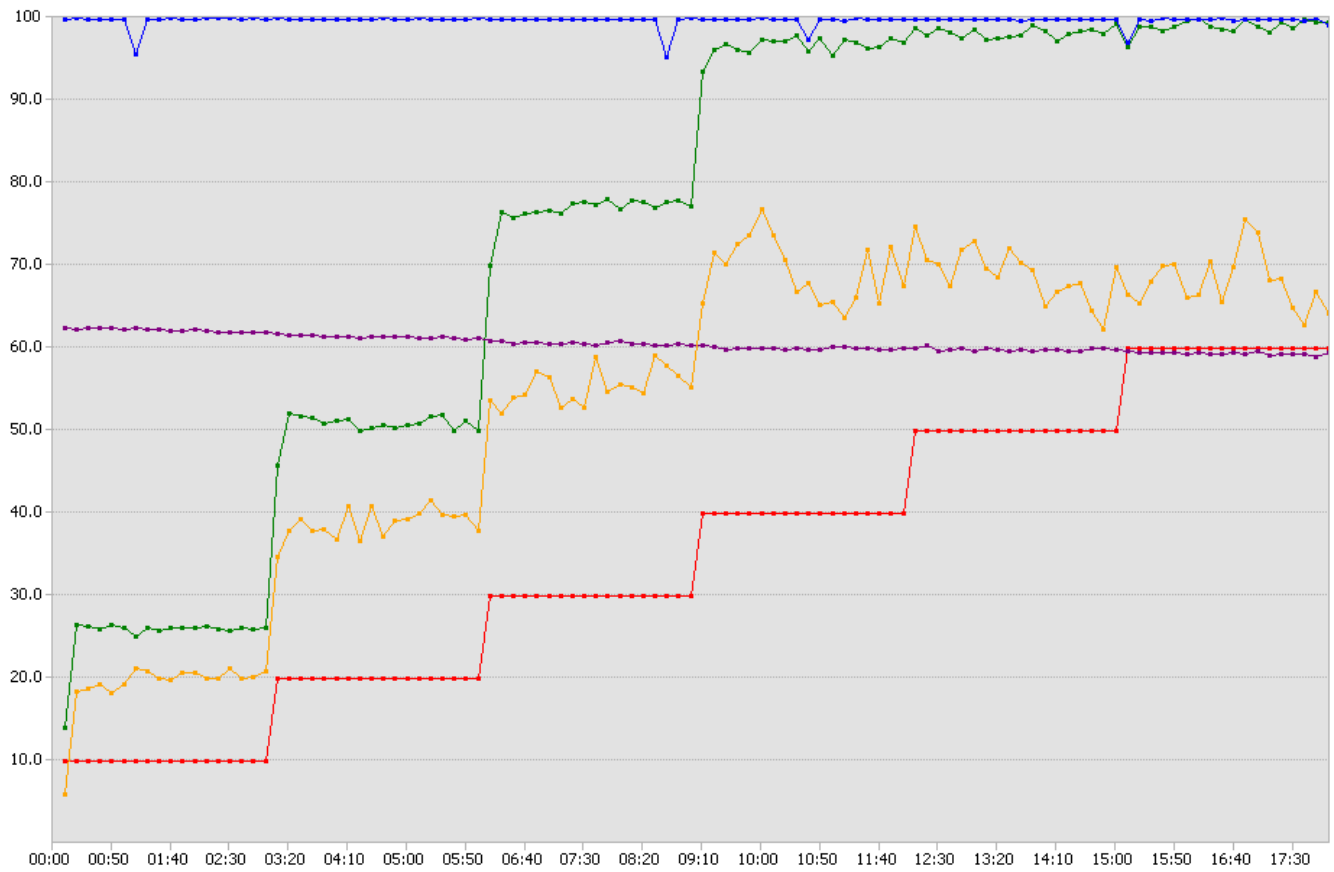
Figure 2: Key Test Results



Max Throughput (Transactions/hour)	Applied Load At Max Throughput	Avg. Response Time At Applied = 1 (Sec.)	Avg. Response Time At Max Throughput (Sec.)
58,580	6	0.21	0.37

4.2 Resource Utilization

Figure 3: Key Resource Utilization



Counter	Instance	Category	Computer	Color	Range	Min	Max	Avg
Applied Load	_Total	LoadTest:Scenario	Test Client	Red	10	1	6	4
% Processor Time	_Total	Processor	ArcGIS Server	Green	100	13.9	100	74.5
% Idle Time	0 C:	PhysicalDisk	ArcGIS Server	Blue	100	95.3	100	99.8
Available MBytes	-	Memory	ArcGIS Server	Purple	10,000	5,891	6,251	6,059
Bytes Sent/sec	Broadcom BCM5708C NetXtreme II GigE [NDIS VBD Client]	Network Interface	ArcGIS Server	Orange	1,000,000	58,248	768,797	532,772

5 Capacity Planning

This section provides the input for a capacity planning model. For details and practical application of the capacity planning information, see [Capacity Planning and Performance Benchmark Reference Guide](#).

5.1 CPU SpecRate

- SpecRate/CPU = **13.425**
- Total CPU Cores = 4

5.2 CPU Service Time

Web (Sec.)	SOC/SOM (Sec.)	Database (Sec.)
0.01	0.20	N/A: RDBMS not utilized

5.3 Transaction Size

- Average map size: **40,865 bytes**

6 Benchmark Variation – Image Format

This section provides supplemental benchmarks conducted subsequently. This benchmark has been varied by image format type.

- JPEG, 1280x1024
- PNG 8, 1280x1024
- PNG 24, 1280x1024
- PNG 32, 1280x1024

6.1 CPU SpecRate

- 4 CPU cores.
- SpecRate/CPU= **13.425**

6.2 Performance and Scalability

Variation	Maximum Throughput (Transactions/hour)	User Load At Max Throughput	Avg. Response Time At User Load = 1 (Sec.)	Avg. Response Time At Max Throughput (Sec.)
JPEG	46,860	6	0.027	0.46
PNG 8	58,580	6	0.21	0.37
PNG 24	52,880	6	0.024	0.41
PNG 32	53,280	6	0.024	0.40

6.3 CPU Service Time

Variation	Web (Sec.)	SOC/SOM (Sec.)	Database (Sec.)
JPEG	0.01	0.25	N/A: RDBMS not utilized
PNG 8	0.01	0.20	N/A: RDBMS not utilized
PNG 24	0.01	0.23	N/A: RDBMS not utilized
PNG 32	0.01	0.23	N/A: RDBMS not utilized

6.4 Transaction Size

Variation	Transaction Size (bytes)
JPEG	239,164
PNG 8	40,865
PNG 24	75,625
PNG 32	78,183

Figure 4: Image Type Variation Throughput

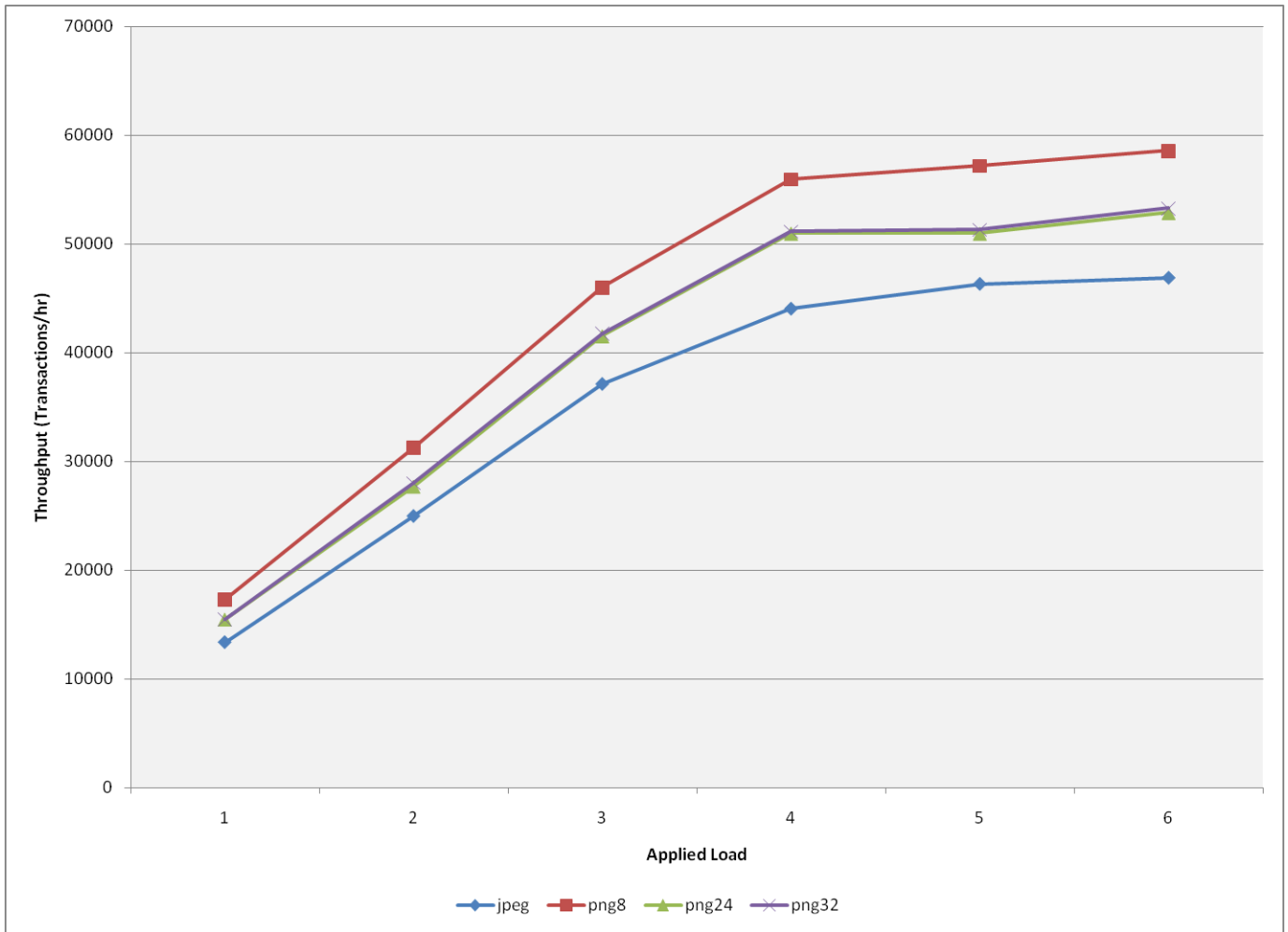
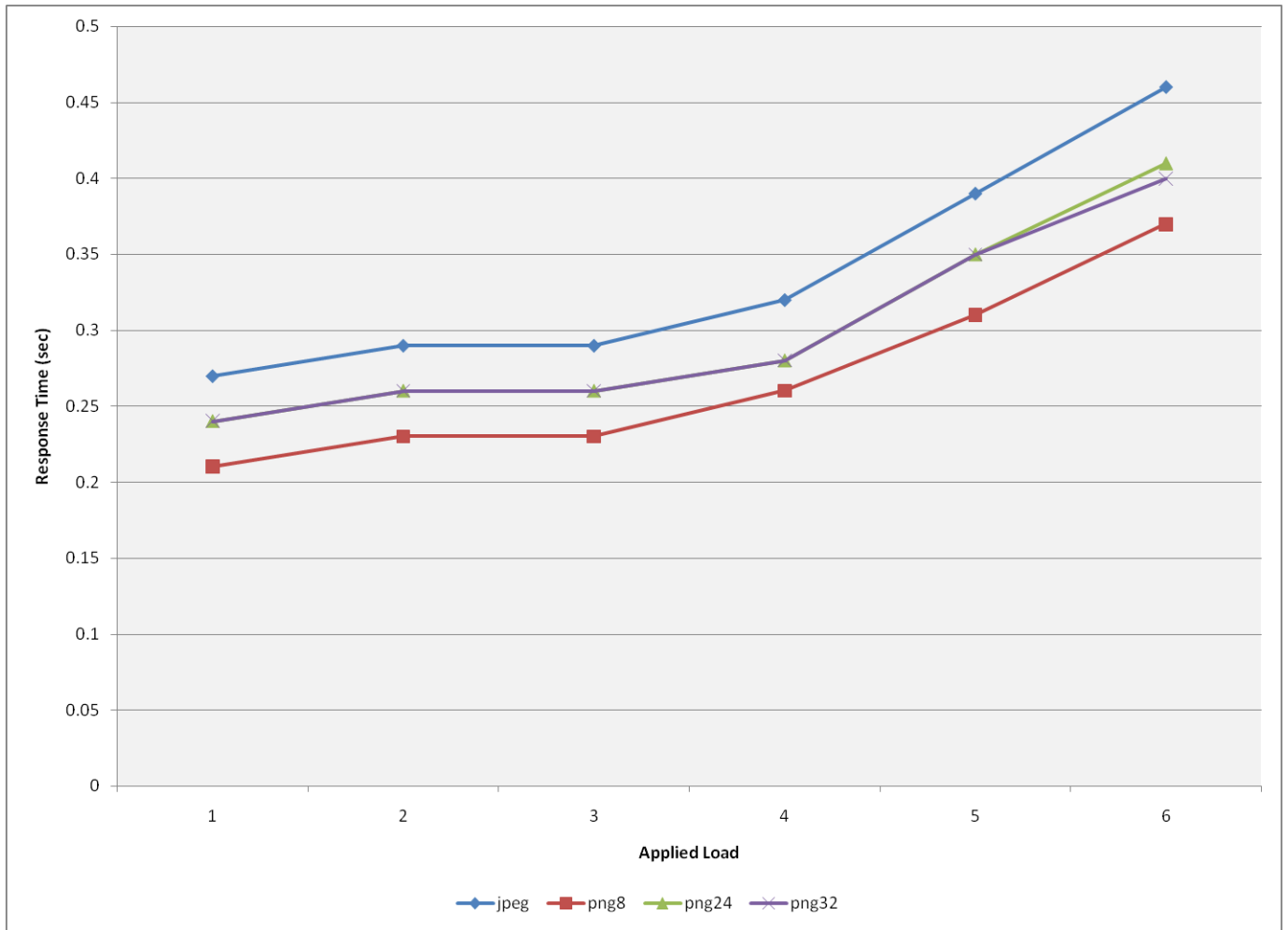


Figure 5: Image Type Variation Response Time



7 Benchmark Variation – Image Size

This section provides supplemental benchmarks conducted subsequently. This benchmark has been varied by return image size.

- 800x600, png8
- 1024x768, png8
- 1280x1024, png8

7.1 Performance and Scalability

Variation	Maximum Throughput (Transactions/hour)	User Load at Max Throughput	Avg. Response Time At User Load = 1 (Sec.)	Avg. Response Time At Max Throughput (Sec.)
800x600	172,400	5	0.07	0.10
1024x768	77,400	5	0.16	0.23
1280x1024	58,580	6	0.21	0.37

7.2 CPU Service Time

Variation	Web (Sec.)	SOC/SOM (Sec.)	Database
800x600	0.01	0.06	N/A: RDBMS not utilized
1024x768	0.01	0.16	N/A: RDBMS not utilized
1280x1024	0.01	0.20	N/A: RDBMS not utilized

7.3 Transaction Size/Time

Variation	Transaction Size (bytes)
800x600	6,310
1024x768	26,957
1280x1024	40,865

Figure 6: Image Size Variation Throughput

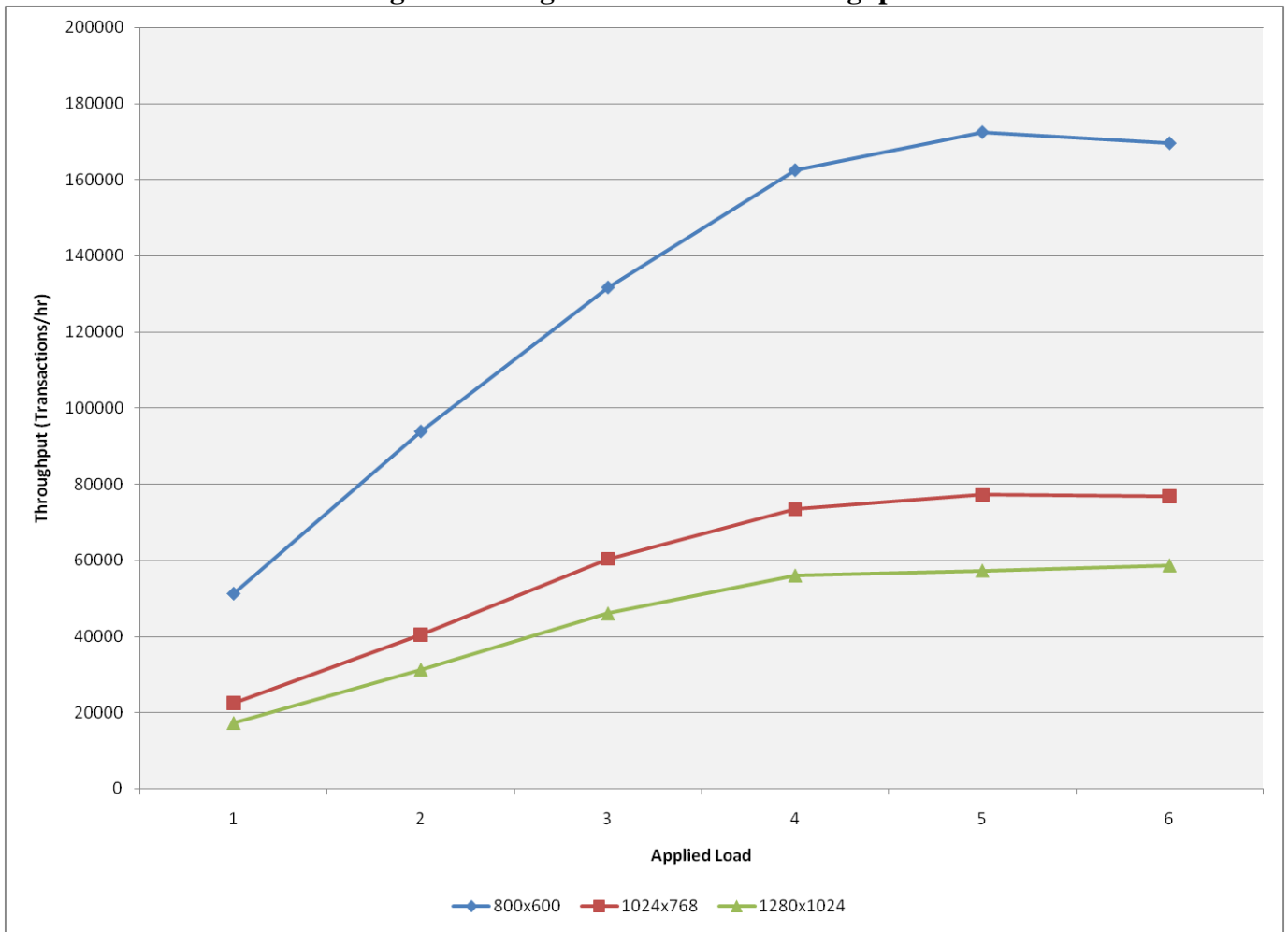
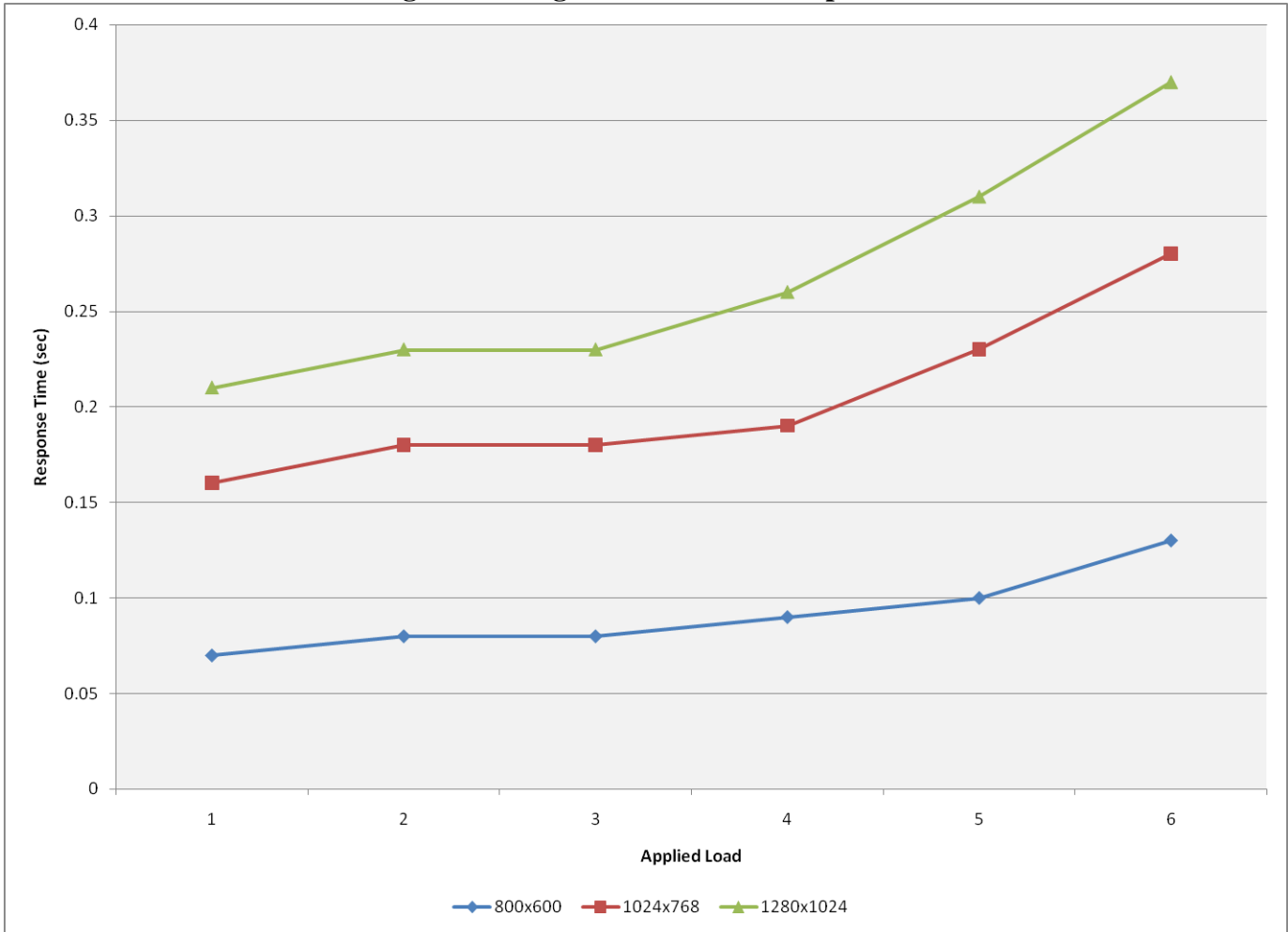


Figure 7: Image Size Variation Response Time



8 Appendixes

8.1 Benchmark Approach

This benchmark has been designed to isolate and measure the performance and scalability of ArcGIS Server 10 REST Export Map within the defined environment. This will be accomplished by applying a load using Microsoft Visual Studio 2008 System (VSTS) 2008.

The VSTS benchmark script will apply load by randomly requesting 1280 x 1024 PNG 8 images from a large pool of defined map extents. As this load is increased, the benchmark environment will react accordingly. Load will be increased at a constant rate until the performance trends are observed and key values identified.

8.2 Benchmark Configuration

Property	Value
TestID	8352
Service Type	Map Service (msd)
SOC/CPU	2.5
Think Time	0
Image Resolution	1280 x 1024
Image Format	PNG 8
Applied Load Increase	1–6, by 1

8.3 Transaction Description

A transaction is defined as one requested map extent.

8.4 Data Description

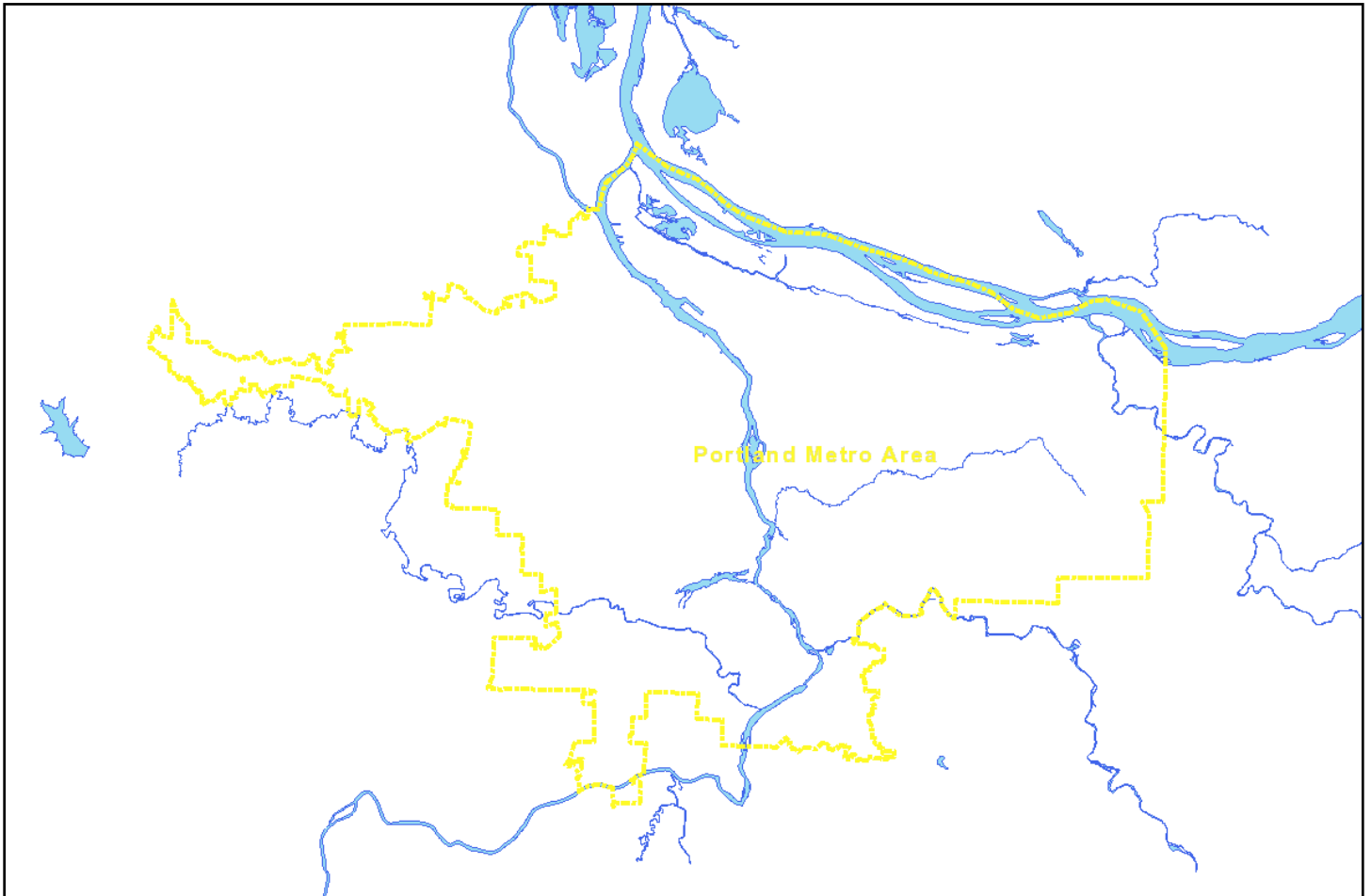
- Portland Metro Area, File Geodatabase (approx. 4.5 GB)

8.5 Testing Tools

- Microsoft Visual Studio Test System 2008 edition
- Perfmon
- SPECint2000

8.6 Application

Figure 8: Application Sample



8.7 MXD Description

Item	At Scale	Layer Name	Features	Vertices	Layer Type	Refresh Time (sec.)
1	101,814	Railroad	540	1897	esriGeometryPolyline	0.13
2	101,814	Major Roads	1382	17710	esriGeometryPolyline	0.63
3	101,814	Portland Metro	1	4919	esriGeometryPolygon	0.17
4	101,814	Rivers and Lakes	15	75113	esriGeometryPolygon	0.11
7	50,000	Park and Ride	13	0	esriGeometryPoint	0.06
8	50,000	Railroad Station	6	0	esriGeometryPoint	0.06
9	50,000	Light-rail	20	469	esriGeometryPolyline	0.06
10	50,000	Railroad	93	412	esriGeometryPolyline	0.08
11	50,000	Major Roads	746	7137	esriGeometryPolyline	0.33
12	50,000	Portland Metro	1	4919	esriGeometryPolygon	0.08

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Item	At Scale	Layer Name	Features	Vertices	Layer Type	Refresh Time (sec.)
13	50,000	Rivers and Lakes	1	42431	esriGeometryPolygon	0.09
16	24,000	Schools	27	0	esriGeometryPoint	0.06
17	24,000	City Hall	0	0	esriGeometryPoint	0.06
18	24,000	Fire Stations	1	0	esriGeometryPoint	0.06
19	24,000	Hospitals	0	0	esriGeometryPoint	0.06
20	24,000	Libraries	3	0	esriGeometryPoint	0.06
21	24,000	Airports	0	0	esriGeometryPolygon	0.06
22	24,000	Park and Ride	4	0	esriGeometryPoint	0.06
23	24,000	Railroad Station	1	0	esriGeometryPoint	0.06
24	24,000	Light-rail	0	0	esriGeometryPolyline	0.06
25	24,000	Railroad	1	7	esriGeometryPolyline	0.06
26	24,000	Major Roads	15	1069	esriGeometryPolyline	0.08
27	24,000	Portland Metro	1	4919	esriGeometryPolygon	0.06
28	24,000	Streams	602	9125	esriGeometryPolyline	0.08
29	24,000	Streams and Ponds	14	488	esriGeometryPolygon	0.11
30	24,000	Rivers and Lakes	0	0	esriGeometryPolygon	0.09
31	24,000	Parks	149	5152	esriGeometryPolygon	0.08
33	10,000	Schools	7	0	esriGeometryPoint	0.06
34	10,000	City Hall	0	0	esriGeometryPoint	0.06
35	10,000	Fire Stations	0	0	esriGeometryPoint	0.06
36	10,000	Hospitals	0	0	esriGeometryPoint	0.06
37	10,000	Libraries	1	0	esriGeometryPoint	0.06
38	10,000	Airports	0	0	esriGeometryPolygon	0.06
39	10,000	Park and Ride	0	0	esriGeometryPoint	0.06
40	10,000	Light-rail Stops	0	0	esriGeometryPoint	0.06
41	10,000	Railroad Station	0	0	esriGeometryPoint	0.06
42	10,000	Light-rail	0	0	esriGeometryPolyline	0.06
43	10,000	Railroad	0	0	esriGeometryPolyline	0.06
44	10,000	Major Roads	0	0	esriGeometryPolyline	0.08
45	10,000	Minor Streets	532	3975	esriGeometryPolyline	0.06
46	10,000	Portland Metro	1	4919	esriGeometryPolygon	0.06
47	10,000	Streams	129	2422	esriGeometryPolyline	0.06
48	10,000	Streams and Ponds	4	77	esriGeometryPolygon	0.13
49	10,000	Rivers and Lakes	0	0	esriGeometryPolygon	0.11
50	10,000	Parks	50	1450	esriGeometryPolygon	0.08
51	10,000	Zoning	230	14657	esriGeometryPolygon	0.09
54	5,000	Schools	1	0	esriGeometryPoint	0.06
55	5,000	City Hall	0	0	esriGeometryPoint	0.06
56	5,000	Fire Stations	0	0	esriGeometryPoint	0.06
57	5,000	Hospitals	0	0	esriGeometryPoint	0.06
58	5,000	Libraries	0	0	esriGeometryPoint	0.06
59	5,000	Airports	0	0	esriGeometryPolygon	0.06

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Item	At Scale	Layer Name	Features	Vertices	Layer Type	Refresh Time (sec.)
60	5,000	Park and Ride	0	0	esriGeometryPoint	0.06
61	5,000	Bus Stops	16	0	esriGeometryPoint	0.06
62	5,000	Light-rail Stops	0	0	esriGeometryPoint	0.06
63	5,000	Railroad Station	0	0	esriGeometryPoint	0.06
64	5,000	Light-rail	0	0	esriGeometryPolyline	0.06
65	5,000	Railroad	0	0	esriGeometryPolyline	0.06
66	5,000	Major Roads	0	0	esriGeometryPolyline	0.06
67	5,000	Minor Streets	148	918	esriGeometryPolyline	0.13
68	5,000	Portland Metro	1	4919	esriGeometryPolygon	0.06
69	5,000	Streams	30	552	esriGeometryPolyline	0.06
70	5,000	Streams and Ponds	3	64	esriGeometryPolygon	0.14
71	5,000	Rivers and Lakes	0	0	esriGeometryPolygon	0.13
72	5,000	Building Permits	148	0	esriGeometryPoint	0.09
73	5,000	Tax Lots	1062	14152	esriGeometryPolygon	0.11
74	5,000	Parks	6	209	esriGeometryPolygon	0.08
75	5,000	Zoning	84	5873	esriGeometryPolygon	0.09
78	1,000	Schools	0	0	esriGeometryPoint	0.06
79	1,000	City Hall	0	0	esriGeometryPoint	0.06
80	1,000	Fire Stations	0	0	esriGeometryPoint	0.06
81	1,000	Hospitals	0	0	esriGeometryPoint	0.13
82	1,000	Libraries	0	0	esriGeometryPoint	0.06
83	1,000	Airports	0	0	esriGeometryPolygon	0.06
84	1,000	Park and Ride	0	0	esriGeometryPoint	0.06
85	1,000	Bus Stops	0	0	esriGeometryPoint	0.06
86	1,000	Light-rail Stops	0	0	esriGeometryPoint	0.06
87	1,000	Railroad Station	0	0	esriGeometryPoint	0.06
88	1,000	Light-rail	0	0	esriGeometryPolyline	0.06
89	1,000	Railroad	0	0	esriGeometryPolyline	0.06
90	1,000	Major Roads	0	0	esriGeometryPolyline	0.06
91	1,000	Minor Streets	6	21	esriGeometryPolyline	0.06
92	1,000	Portland Metro	1	4919	esriGeometryPolygon	0.06
93	1,000	Streams	6	104	esriGeometryPolyline	0.06
94	1,000	Streams and Ponds	1	27	esriGeometryPolygon	0.16
95	1,000	Rivers and Lakes	0	0	esriGeometryPolygon	0.16
96	1,000	Building Permits	7	0	esriGeometryPoint	0.06
97	1,000	Tax Lots	61	976	esriGeometryPolygon	0.08
98	1,000	Parks	0	0	esriGeometryPolygon	0.08
99	1,000	Zoning	8	1439	esriGeometryPolygon	0.08

8.8 Definitions

8.8.1 *Performance and Scalability*

- Performance can be expressed as response time (RT) at a single-user load.
- Scalability is determined using one of the following criteria:
 - When first error occurs
 - When maximum throughput is reached
 - When required response time is exceeded

8.8.2 *CPU Service Time Web*

Calculated from the following process:

- W3wp.exe

8.8.3 *CPU Service Time ArcGIS SOC*

Calculated from the following process:

- ArcSOC.exe

8.8.4 *CPU Service Time DB*

- N/A: RDBMS not utilized