HEXAGON

White Paper

LuciadFusion

Benchmarking Against GeoServer and MapServer

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Contents

1. Abstract

LuciadFusion lets you manage your data intelligently, store and process a multitude of data formats, and feed data to numerous applications, putting the power of your data at your fingertips. Features including powerful automatic cataloging and quick and easy data publishing allow you to design, portray, process, and set up advanced maps in a few simple clicks.

This white paper reports benchmarking performance for WMS services for GeoPackage and GeoTIFF files for LuciadFusion, GeoServer, and MapServer. It addresses common questions from prospective customers, including:

- How fast is LuciadFusion compared to GeoServer for WMS services for GeoPackage and GeoTIFF files?
- How fast is LuciadFusion compared to MapServer for WMS services for GeoPackage files?

2. Benchmarking Performance

Benchmarking for LuciadFusion OGC® services was designed to test the performance of LuciadFusion against GeoServer and MapServer. For this purpose, LuciadFusion, GeoServer, and MapServer were installed on a machine with the following specifications:

- Java Version: Java 8 or higher
- RAM: 16 GB
- OS: Windows 10 OS 64-bit
- Win2019, Proxmox KVM hypervisor with Intel(R) Xeon(R) CPU E5-2630 v2 @ 2.60GHz CPUs

3. Creating Test Plans

The open-source pure Java software JMeter was used to perform benchmarking. JMeter is designed to test functional behavior and measure performance. JMeter allows its users to create test plans that define the calls that will be made to the GeoServers whose performance will be tested. While the specific parameters that are required to perform a test depend on the type of the service to be tested, the following parameters are required for all test plans:

- URL of the service to be connected to (including the port)
- Number of users for which calls are going to be made
- Number of calls that are going to be made for each user

In addition to these parameters, depending on the service type, bounds, image type, reference system, and more may have to be specified.

It should be noted that to make sure that the results of this benchmarking study were reliable, the test plans made for the same dataset for different GeoServers had all the same parameters. The only differences between the test plans were the URL and the port to be used to connect to the service.

4. Evaluating Results

JMeter uses the test plans created by its users. The outcome of the tests created to benchmark the performance of LuciadFusion, GeoServer, and MapServer was interpreted based on the throughput and the response time of the server, or latency.

Throughput is defined as requests per unit of time and is calculated from the start of the first sample to the end of the last sample. Latency is measured as the time before sending the request to just after the first response has been received.

5. Test Results

Benchmarking was performed by using several datasets that vary both in size and in data format.

5.1. GeoServer

GeoServer[1] is a Java-based open-source software server that allows users to view and edit geospatial data. It supports the OGC standard and thus can serve data via WMS, WFS, and WCS.

5.1.1. Test #1: WMS – SHP

Data Format	Esri Shapefile
Reference	EPSG:25831
Geometry Type	Point
Data Size	3 KB

WMS

This dataset was served by LuciadFusion and GeoServer with its full bounds. The results of these two services are shown below:

GeoServer LuciadFusion

This dataset was used for the test plans created for LuciadFusion and GeoServer. The WMS test plan created for this dataset used 512 as its width and height and the bounds of the data itself. As can be seen below, the

[1] GeoServer website: http://geoserver.org/

performance of LuciadFusion and GeoServer was very similar; they resulted in the same ranges of throughput and latency.

Input

Parameters	Width	Height	Number of Users	Number of Calls
Values	512	512	5	100

Results

Software	Throughput (req/sec)	Latency(ms)
LuciadFusion	<10	<50
GeoServer	<10	<50

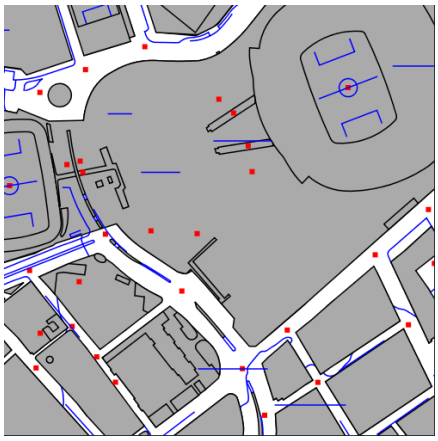
5.1.1.1. Test #1: Conclusion

The performance of LuciadFusion and GeoServer for WMS services for shapefiles is very similar.

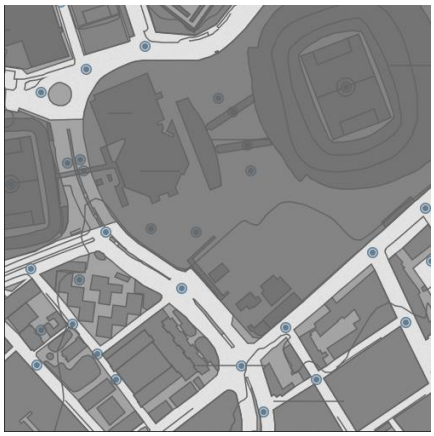
5.1.2. Test #2: WMS – GPKG

Data Format	GeoPackage
Reference	EPSG:25831
Data Size	10.5 GB

This dataset was served by LuciadFusion and GeoServer with its full bounds. The results of these two services are shown below:



GeoServer



LuciadFusion

This dataset was used for the test plans created for LuciadFusion and GeoServer. The WMS test plan created for this dataset used 500 as its width and height and the bounds of the data itself. As can be seen below, LuciadFusion was more performant than GeoServer.

Input

Parameters	Width	Height	Number of Users	Number of Calls
Values	500	500	5	100

Results

Software	Throughput (req/sec)	Latency (ms)
LuciadFusion	<10	<200
GeoServer	<10	<300

5.1.2.1. Test #2: Conclusion

LuciadFusion is faster than GeoServer for WMS services for GeoPackages.

5.1.3. Test #3: WMS – Sentinel-2

Data Format	GeoTIFF
Reference	EPSG:25831
Data Size	38.9 GB

This dataset was served by LuciadFusion and GeoServer with its full bounds. The WMS test plan created for this dataset used 1020 as its width and 836 as its height and the bounds of the data itself. As can be seen from the latency values below, LuciadFusion was almost as twice as fast as GeoServer.

Input

Parameters	Width	Height	Number of Users	Number of Calls
Values	1020	836	5	10

Results

Software	Throughput (req/min)	Latency (ms)
LuciadFusion	<25	<12500
GeoServer	<20	<20000

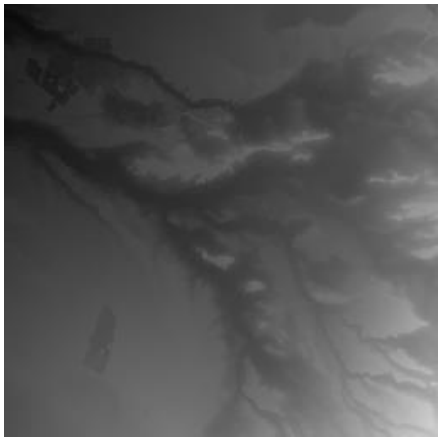
5.1.3.1. Test #3: Conclusion

LuciadFusion is faster than GeoServer for WMS services for GeoTIFF.

5.1.4. Test #4: WMS – Elevation Model

Data Format	GeoTIFF
Reference	EPSG:25831
Data Size	1.27 GB

This dataset was served by LuciadFusion and GeoServer with different bounds, as mentioned below for each test. The results of the services that cover the full bounds of the data are shown below:



LuciadFusion

GeoServer

The WMS test plan created for this dataset used 256 as its width and height. As can be seen below, LuciadFusion WMS services were more performant than GeoServer. The tests were conducted for 3 different bounds.

Input

Parameters	Width	Height	Number of Users	Number of Calls
Values	256	256	5	10

Results

Overview: 35.07469187430878609,01.596073332959752,45.70977242701011,12.96641937413856

Software	Throughput (req/sec)	Latency (ms)
LuciadFusion	<5	<25
GeoServer	<1	<1000

Zoom Level 1: 42.00469187430878609,01.596073332959752,42.71077242701011,3.06641937413856

Software	Throughput (req/sec)	Latency (ms)
LuciadFusion	<5	<25
GeoServer	<1	<3000

Zoom Level 2: 41.576416,0.975037,41.656497,1.098633

Software	Throughput (req/sec)	Latency (ms)
LuciadFusion	<5	<25
GeoServer	<1	<1500

5.1.4.1. Test #4: Conclusion

LuciadFusion is faster than GeoServer for WMS services for GeoTIFFs.

5.2. MapServer

MapServer[2] is an open-source platform for publishing spatial data and interactive mapping applications to the web. It supports the OGC standard and thus can serve data via WMS, WFS, and WCS.

5.2.1. Test #1: WMS – GeoPackage

Data Format	GeoPackage
Reference	EPSG:4326
Data Size	565 MB

This dataset was served by LuciadFusion and MapServer with different bounds, as mentioned below for each test. The results of the services that cover the full bounds of the data are shown below.

[2] MapServer: https://mapserver.org/

MapServer

LuciadFusion

This dataset was used for the test plans created for LuciadFusion and MapServer, and the WMS test plan created for this dataset used 759 as its width and 575 as its height. As can be seen below, LuciadFusion WMS services were more performant than MapServer. The tests were conducted for 2 different bounds.

Input

Parameters	Width	Height	Number of Users	Number of Calls
Values	256	256	5	10

Results

Overview: 0.241699,40.275335,3.900146,42.443728

Software	Throughput (req/sec)	Latency (ms)
LuciadFusion	<5	<150
GeoServer	<5	<750

Zoom Level: 1.554565,41.008921,2.768555,41.711880

Software	Throughput (req/sec)	Latency (ms)
LuciadFusion	<5	<150
GeoServer	<5	<750

5.2.1.1. Test #1: Conclusion

LuciadFusion is faster than MapServer for WMS services for GeoPackages.

6. Conclusions

Different files were used to provide benchmarking on LuciadFusion, GeoServer, and MapServer. The results of the benchmark are summarized based on the GeoServers used for the tests.

6.1. LuciadFusion vs. GeoServer

LuciadFusion and GeoServer were tested for WMS services. Benchmarking results are noted based on the service and specific data type. The table compares LuciadFusion and GeoServer in terms of performance.

Data Source	Fastest Technology
Esri Shapefile	Similar
GeoPackage	LuciadFusion
GeoTIFF	LuciadFusion
DTM GeoTIFF	LuciadFusion

6.2. LuciadFusion vs. MapServer

LuciadFusion and MapServer were tested for WMS services. The table compares LuciadFusion Server and MapServer in terms of performance.

Data Source	Fastest Technology
GeoPackage	LuciadFusion

About Hexagon

Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous — ensuring a scalable, sustainable future.

Hexagon's Geospatial division creates solutions that deliver a 5D smart digital reality with insight into what was, what is, what could be, what should be, and ultimately, what will be.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 21,000 employees in 50 countries and net sales of approximately 4.4bn USD. Learn more at hexagon.com and follow us @HexagonAB.