TOWARDS THE DEFINITION OF A BENCHMARK FOR WMTS

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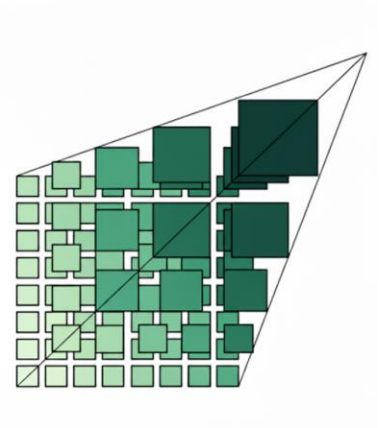
Agenda

- Motivation and Context
- Research Gap
- Proposed Framework
- Example
- Conclusions and Future Works

The Challenge: WMTS and Big Data

→ WMTS is fundamental for Geospatial Big Data Visualization



The ***fitness-for-purpose***

- The volume, heterogeneity, and use cases of geospatial data, especially for **AI agents** and services, are rapidly expanding.
    - E.g., Dynamic tile generation is often required based on specific requests and styling.
- Consequently, ***assessing the performance*** of the WMTS is a critical factor.

The Gap: Lack of a WMTS Benchmark

→ WMTS is ubiquitous, but benchmarks are lacking

Our Goal: 

- Propose a framework to study which aspects a WMTS benchmark should be considered.
- Identify some factors that impact test outcomes through empirical evaluation of WMTS solutions.

→ End purpose: Create a definition of a standardized, context-aware benchmarking framework to promote open science and interoperable solutions.

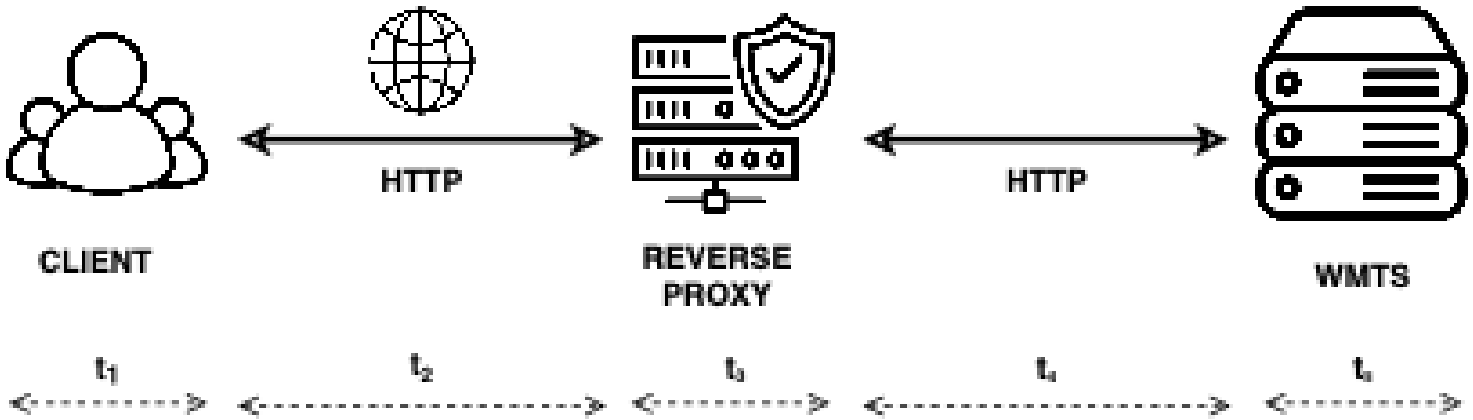
Proposed Benchmarking Framework

Main elements:

- Replicable experimental setup → E.g. Docker containers
  - Assess potential bottleneck → E.g. First assess single components capacity
- Define performance indicator → Response Time (RT)
- Hypothesis critical performance variables
- Test performance against multiple WMTS given similar setting

→ If the test results are significantly different then these aspect needs to be accounted in the benchmark

Methodology and Experimental Setup



→ **Performance indicator:** Total Response Time (RT) = $\sum t_i \sim o(t_5)$

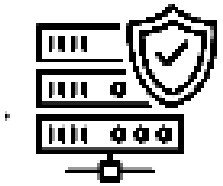
→ **Input Data (Space Data Example):** Sentinel-2 Level-2A

Methodology and Experimental Setup

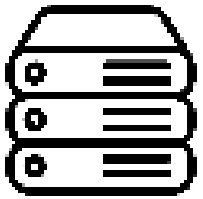
CLIENT

LOCUST

Each virtual user initiates a session and requests a batch of **10 tiles**.



REVERSE PROXY



WMTS

GeoServer

Open-source, long-running project (Java)

tilegeo

JRC in-house development
(Python, FastAPI, GDAL, Mapnik)

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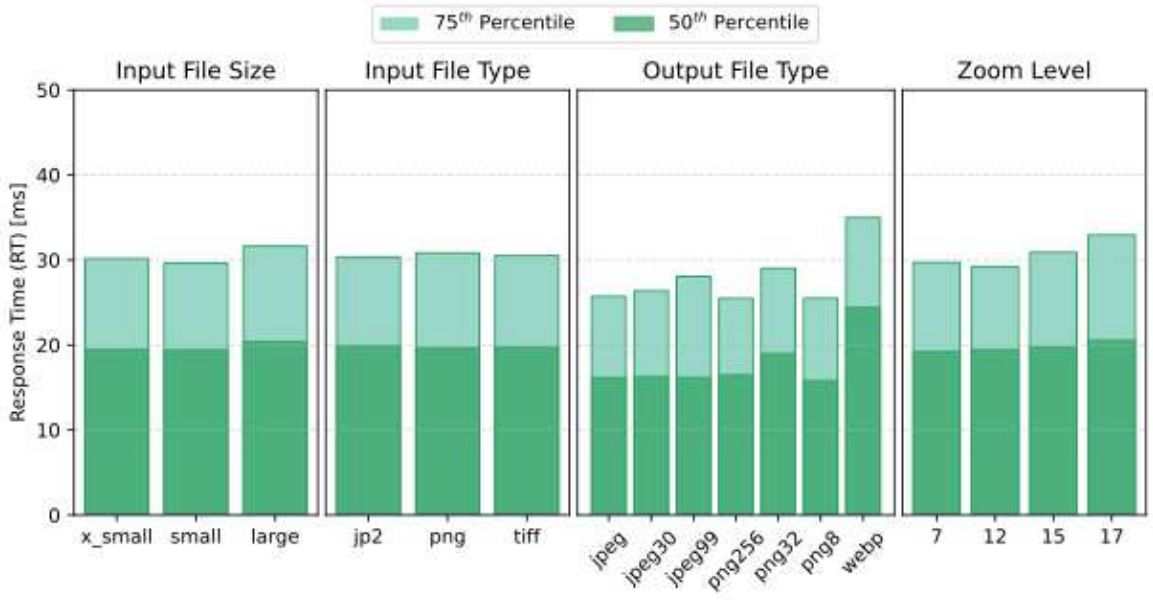
Critical Performance Variables Hypotheses

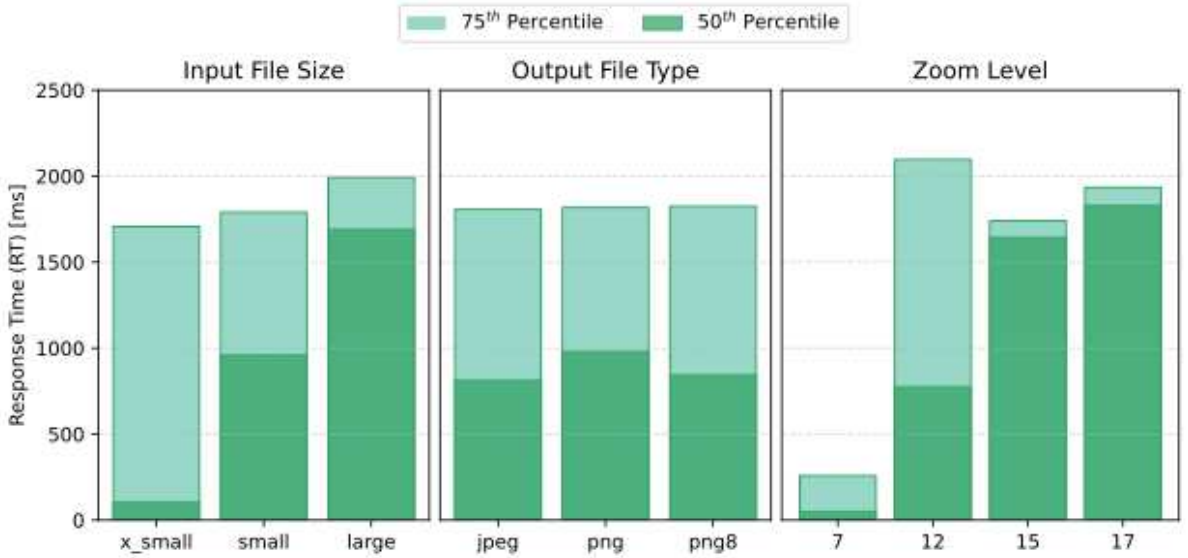
- **Input File Size:** Impact of input payload volume. (Extra-small, Small, Large file)
- **Input Data Format:** Decoding complexity and file size (GeoTIFF, JPEG2000, PNG)
- **Output Image Format:** Image optimization processes, e.g., format and compression (PNG, JPEG, WebP)
- **Requested Zoom Level:** Influence of scale, tile resolution, and rendering complexity (levels 7, 12, 15, 17)

Results

tilegeo



GeoServer



→ Looking for intra and extra inconsistency

→ Not interested in absolute performance rather variation

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Conclusions & Next Steps

- WMTS is a critical part of the digital infrastructure for the visualization of big geospatial data
- We propose an initial framework for a replicable WMTS benchmark
- Empirical testing of open-source WMTS revealed that input file size, output encodings and zoom levels are key performance differentiators

- Incorporate more WMTS
- Investigate other elements that may impact performance

Thank you

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