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Web Mapping and Geospatial Web Services



Assignment 4

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# Introduction

## GeoPackage (GPKG)

A .gpkg file is a geographical information system that is implemented as an SQLite database container and contains data and metadata tables with standard definitions, format limitations, integrity assertions, and content constraints. It was defined by the OGC (Open Geospatial Consortium) on behalf of the US military and published in 2014. The GeoPackage has widespread support from a variety of government, commercial, and open-source organizations [1].

### GPKG file format

A standard defines a set of rules (required conventions) for [1]:

* Keeping imagery in tile matrix sets
* Characteristics of vector
* At various scales, raster maps
* Schema and metadata

The extension rules described in clause 2.3 of the standard can be used to extend a GeoPackage. The goal of creating a GeoPackage was to create a database that was as light as possible and include it in a single file that was ready to use. This makes it ideal for off-line mobile apps and quick sharing via cloud storage or USB storage devices, among other things [1].

## Canada Geospatial Data Extraction Tool

Natural Resources Canada's Canadian Geospatial Data Extraction tool is a useful tool that all geospatial users in Canada should be familiar with. It enables users to extract continuous geospatial open data based on a user-defined geographic area and data options. While downloading authoritative topographic and elevation data for use in their projects, this gives the user complete control [2].

Users can extract topographic data from the CanVec series, which includes over 60 topographic features organized into eight main themes, using the Canadian Geospatial Data Extraction tool (transportation features, administrative features, hydrographic features, land features, man-made features, elevation features, resources management features, and toponymic features). It is based on the most up-to-date data sources and provides high-quality topographic data in vector format that meets international geomatics standards. CanVec data can be used for extensive spatial analysis as well as cartographic design because of its many attributes [2].

## QGIS

QGIS (until 2013 known as Quantum GIS) is a free and open-source cross-platform desktop geographic information system (GIS) application that supports viewing, editing, and analysis of geospatial data [3].

QGIS functions as geographic information system (GIS) software, allowing users to analyze and edit spatial information, in addition to composing and exporting graphical maps. QGIS supports both raster and vector layers; vector data is stored as either point, line, or polygon features. Multiple formats of raster images are supported, and the software can georeferenced images [3].

QGIS supports shapefiles, coverages, personal geodatabases, dxf, MapInfo, PostGIS, and other formats. Web services, including Web Map Service and Web Feature Service, are also supported to allow use of data from external sources [3].

# Metadata

The following is the metadata of the CanVec hydrographic and transportation features extracted for the Gloucester, NB geographic area:



Figure 1: Metadata

## Road Junction Layer

The following is a visualization of the road junction layer of the Gloucester, NB geographic area GeoPackage file, as well as an excerpt from the attribute tables:

Text

Description automatically generated

Figure 3: SHOW TABLE mytable2

## Output of the query: SELECT \* FROM mytable2

Graphical user interface, text

Description automatically generated

Figure 4: SELECT\* FROM mytable2

# Task2

## Average execution time of the warm runs of Q3, Q4 and Q14 with Stado

Runtime results:

Q3:

1st:

Response time: 0m 8s 22ms Total time: 0m 10s 710ms

2nd:

Response time: 0m 7s 776ms Total time: 0m 10s 505ms

3rd:

Response time: 0m 7s 196ms Total time: 0m 10s 3ms

4th:

Response time: 0m 6s 730ms Total time: 0m 9s 391ms

Average execution time: (10505 + 10003 + 9391) / 3 = 9966.33

Q4:

1st:

Response time: 0m 4s 40ms Total time: 0m 4s 41ms

2nd:

Response time: 0m 4s 48ms Total time: 0m 4s 48ms

3rd:

Response time: 0m 3s 705ms Total time: 0m 3s 705ms

4th:

Response time: 0m 3s 708ms Total time: 0m 3s 712ms

Average execution time: (4048 + 3705 + 3712) / 3 = 3821.66

Graphical user interface, text

Description automatically generated

Figure 5: Q4 executed with Stado

Q14:

1st:

Response time: 0m 5s 793ms Total time: 0m 5s 793ms

2nd:

Response time: 0m 2s 323ms Total time: 0m 2s 324ms

3rd:

Response time: 0m 1s 978ms Total time: 0m 1s 978ms

4th:

Response time: 0m 2s 43ms Total time: 0m 2s 45ms

Average execution time: (2324 + 1978 + 2045) / 3 = 2115.66

## Average execution time of the warm runs of Q3, Q4 and Q14 with single instance PostgreSQL

Runtime results:

Q3:

1st:

Time: 53113.551 ms

2nd:

Time: 18278.821 ms

3rd:

Time: 17244.031 ms

4th:

Time: 18532.079 ms

Average execution time: (18278.821+ 17244.031 + 18532.079) / 3 = 18018.31

Q4:

1st:

Time: 15643.706 ms

2nd:

Time: 14743.495 ms

3rd:

Time: 16214.004 ms

4th:

Time: 15437.399 ms

Average execution time: (14743.495 + 16214.004+ 15437.399) / 3 = 15464.96

Q14:

1st:

Time: 11093.017 ms

2nd:

Time: 10963.869 ms

3rd:

Time: 10996.896 ms

4th:

Time: 11114.471 ms

Average execution time: (10963.869 + 10996.896 + 11114.471) / 3 = 11025.07

Graphical user interface, text

Description automatically generated

Figure 6: Q14 executed with PostgreSQL

Speedup of Q3, Q4 and Q14 achieved with Stado against single instance PostgreSQL

Speedup = [2]

Q3:

Stado Average execution time: 9966.33

PostgreSQL Average execution time: 18018.31

Speedup:(18018.31/9966.33) = 1.80

Q4:

Stado Average execution time: 3821.66

PostgreSQL Average execution time: 15464.96

Speedup:(15464.96/3821.66) = 4.04

Q14:

Stado Average execution time: 2115.66

PostgreSQL Average execution time: 11025.07

Speedup:(11025.07/2115.66) = 5.21

# REFERENCES

[1] M. Umar, “GPKG - GeoPackage format files,” *GPKG - GeoPackage Format Files*. Jul. 2021, [Online]. Available: https://docs.fileformat.com/gis/gpkg/.

[2] Canadian GIS and Geomatics, “Canadian {Geospatial} {Data} {Extraction} {Tool},” *Canadian GIS \& Geomatics*. Dec. 2019, Accessed: Mar. 13, 2022. [Online]. Available: https://canadiangis.com/canadian-geospatial-data-extraction-tool.php.

[3] Wikipedia, “QGIS,” *Wikipedia*. Jan. 2022, Accessed: Mar. 13, 2022. [Online]. Available: https://en.wikipedia.org/w/index.php?title=QGIS&oldid=1064006339.

[4] K. Garry, “What is metadata and how does it work?,” *WhatIs.com*. Jul. 2021, Accessed: Mar. 13, 2022. [Online]. Available: https://whatis.techtarget.com/definition/metadata.