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Database Design Factors for a Server-Based, Whole-Earth Rendering Engine

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This paper describes recent work to develop a worldwide GIS data manager that simplifies storage of very large-scale GIS data while providing efficient retrieval for rendering the data. We have based our solution on open data sources, such as OpenStreetMap and available government sources, in order to keep data up to date and to keep costs low. The database must also store GIS data that is minimally processed in order to ease the storing of new data, and to support interoperability by making the data useful to the widest range of runtimes. The internal database is versioned and supports reliable transaction system properties, i.e., a "real" database. All data layers necessary for simulation — elevation, imagery, vector features, model features, land use classification — must be representable in the database in default open source formats, e.g., GeoTIFF for raster data and well-known binary (WKB) for vector data. The format is extensible so that new data sources, such as point cloud data, weather data, and proprietary model formats, can be stored. Extensibility should also support the storage of internal, runtime-specific data so that a runtime can create intermediate forms of the data that may be more efficiently rendered. Finally, the database provides efficient direct access, or it can be streamed to remote hosts from a server. Sharing the database, or a subset of it, to disconnected clients is simplified by sharing a database file.

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