IBM Informix

Reference Documentation on Why Informix Spatial for GIS Projects

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Compliant with OGC

Addressing the SQL standards

The Open GIS Consortium, Inc. (OpenGIS or OGC) is the world's dominant organization that builds standards for interoperability of spatial technology at many different levels. IBM Informix is compliant with OGC standards. The GIS of the past were spatially centric and focused on gathering spatial data and attaching non-spatial attribute data to it. The IBM Informix Spatial integrates spatial and non-spatial data, providing a seamless point of access using SQL

Following are the versions of Simple Feature Specifications (SFS) of OGC, against which IBM Informix is compliant with:

- SFS (TF) 1.1 compliant
- SFS (BG) 1.1 (compliant)
- OGC/SQL-MM

Native Spatial, Intuitive Data Types

IBM Informix Spatial data types embed a geographic information system (GIS) within the IBM Informix database server. IBM Informix Spatial data types implement OGC's SQL specification of User-defined Data Types (UDTs). These data types can store spatial data such as the location of a landmark, a street, or a parcel of land.

IBM Informix implements, the familiar basic types, Point, LineString and Polygon, all derived from a supertype called Geometry. In addition, collections of the basic types are supported as well. The geometry supertype allows the user to create a column that contains values that are not necessarily all points, or all multi-polygons, but any one of the subtypes. And, in object-oriented fashion, it makes it easy to define a method like Intersects that does the right thing no matter what combination of types it is given as input. The "ST_" prefix stands for Spatial Type; it was proposed by the ISO/IEC Committee on SQL Multimedia and Application packages.

IBM Informix Spatial data types are divided into two categories: the base geometry subclasses and the homogeneous collection subclasses.

The base geometries are:

- ST_Point
- ST_LineString
- ST_Polygon

The homogeneous collections are:

- ST_MultiPoint
- ST_MultiLineString
- ST_MultiPolygon

Homogeneous collections are collections of base geometries; in addition to sharing base geometry properties, these homogeneous collections also have their own properties, that the user can leverage of.

Powerful Capabilities of Informix Spatial

Flexibility in External representation of GIS data eases Integration

Flexibility offered by IBM Informix Spatial to represent the spatial data, to and from, WKT, WKB, GML, KML & Shape eases the integration with various partner and customer products and thus significantly reduces the learning curve. WFS adds to the consumption of spatial data as service - Native Spatio-Temporal types that support both space and time and the fact that they are integrated at the kernel, all the more, enhances the performance.

- Well-Known Binary (WKB),
- Well-Known Text (WKT),
- ESRI Shape (SHP)
- Geographic Markup Language (GML)
- Keyhole Markup Language (KML)
- Web Feature Service - Transactional (WFS-T)

Efficient Indexing technology

R-Tree index forms one of the powerful indexing technologies to work with location based data. IBM Informix Spatial has a built-in, multidimensional, highly-concurrent, and high-performance index called "R-Tree". The R-tree is used for both spatial and time data management and provides an efficient indexing technology to access and work with spatial or location based data sets. The R-Tree index implements concepts such Nearest-Neighbor and Bounding Box and does not require the grid size to be set, to determine the granularity of the data as R-Tree index implementation is smart enough to readjust its internal structures and optimize paths, as the data changes

Built-in functions to perform complex operations that are hard to perform using traditional SQL

IBM Informix Spatial provides over 80 built-in routines that help the end user to determine spatial relationships, transform geometries, execute complex queries and perform analytics on the available spatial data, that are hard or impossible to achieve using standard traditional SQL. Support to parallel query execution help/assist in performing analytical query processing. In addition, Informix Spatial provides DataBlade Development Kit (DBDK) which helps end users to custom build API's, UDT's and UDR's to perform complex analysis that suit their organization's requirements.

- **Functions That Determine Spatial Relationships**: You can use some spatial data type functions to determine whether a specific relationship exists between a pair of geometries.

- **Functions That Produce a New Geometry**: Some functions compare two existing geometries and return a new geometry based on how the two geometries are related.

- **Functions That Transform Geometries**: Some spatial data type functions generate a new geometry from an existing geometry and a formula.

- **The Dimensionally Extended 9 Intersection Model (DE-9IM)**: DE-9IM is a mathematical approach that defines the pair-wise spatial relationship between geometries of different types and dimensions. This model expresses spatial relationships among all types of geometry as pair-wise intersections of their interior, boundary, and exterior with consideration for the dimension of the resulting intersections.

- Apart from these, **you have over 70 built-in functions** that perform complex analysis on location data sets:
    - Generate geometries from WKT and WKB representations, ESRI Shape representation, GML and KML representations
    - Convert a geometry to an external format
    - Obtain parameters of a geometry
    - Nearest-Neighbor queries
    - Manipulate data types
    - Manage collections and Spatial reference system
    - Administration

Tailored to ESRI's ArcSDE (v9.x to the latest of v10.1)

IBM Informix Spatial is specifically tailored to ESRI's ArcSDE application server. It supports additional functions, provides support for annotation, SDE format, etc. The Informix Spatial is based on ESRI's geometry engine (Shape library). The spatial data extension has new functions from the ESRI SDE 10.1 libraries. Additional set of new functions support overlapping IDs for spatial referencing definitions. The integration provides consistent results of spatial operations on all software tiers: database, middle (ArcSDE), client (ArcGIS, ArcIMS). ESRI, is an IBM strategic partner and undisputed leader in the GIS software business.

Leverages all the features of IBM Informix, as it is integrated at kernel level

- Continuous Availability Feature - Informix Clustering and Replication technologies prove vital, as they ensure data availability and business continuity.
- Integrates with security protocols - International Common Criteria for Information Technology Security Evaluation
- Compression
- Enterprise Replication (ER) distributes real-time information anywhere, anytime, on any IDS node in the world, without requiring local administration resources.
- Seamlessly delivers location services anywhere in the world on the SOA Enterprise Service Bus.
- Time Series processes high volume streaming location & RFID data in real-time, available in real-time, with timing information to track trends.

Advantage of Parallel Database Query (PDQ) feature

Executing queries in parallel distributes the work for one aspect of a query among several processors and can dramatically improves performance. You can use any of the spatial data type functions in a parallel query. To do so, you must ensure to use the IBM Informix Parallel database query (PDQ) feature. The database server creates and maintains various database objects to manage the execution of spatial queries in parallel. To take full advantage of the performance enhancement PDQ provides, you need to use fragmented tables, where table fragmentation allows you to store parts of a table on different disks.

Has strong Partner / Customer relationships

IBM Informix maintains strong relationships with partners. To name a few are:

- Environmental System for Research Institute (ESRI)
- MapInfo
- Safe Software
- AutoDesk

Automatic Validation of Spatial Data during Insertions

Automatic validation is one of the distinguishing features of IBM Informix Spatial. A spatial feature is validated before being inserted into the database. This makes Informix efficient in maintaining clean data within the database

R-Tree Index - Stand-out feature of IBM Informix

- **R-Tree index allows parallelism**. Running queries in parallel distributes the work for one aspect of a query among several processors and dramatically improves performance.
- R-Tree index is **not proprietary technology**. Different researches have found this as best indexing technique for multidimensional data like spatial. Almost all the database have understood this and have implemented it, suitable to their architecture
- R-tree indexes are **dynamic and self-tuning**. This means that an R-tree index maintains itself during updates, inserts, and deletes of the indexed table. In addition, **user do not need to know anything** about the amount of data or the range of values, selection criteria or pattern of queries, in the column to be indexed before you create an R-tree index. Which mean **zero database maintenance**.
- The R-tree index significantly reduces the **time to build** and maintain the indexes.
- The R-tree access method provides **support for nearest-neighbor searches**, that is, querying for objects in a spatial database that are closest to a specified object or location. Traditionally, without nearest-neighbor support, these kinds of **searches are awkward** to perform and involve several iterative stages.
- R-Tree has height balanced tree structure that organizes the data in pages and is designed to **optimize the storage on disk**

- R-tree index structure is a **physical disk page**. The R-tree index is designed to minimize the number of pages that need to be fetched from disk during the execution of a query. Thus significantly reducing the Disk I/O, which eventually increases the performance
- Bottom-up build approach ensures **enhanced performance** and reduces the usage of memory and temporary dbspace
- R-Tree index uses Heuristic algorithms for insertion and node split, which adds to the self-tuning ability of R-Tree indexes to **manage the data load and support heavy workloads**.
- **BOUNDING BOX** features helps execute complex queries with ease, which otherwise, is hard or impossible to achieve using other indexing techniques.

Customer References

Waterways GIS (WaGIS), Germany: Federal Waterways and Shipping Administration

"IBM's collaborative relationship with ESRI and [ESRI business partner] con terra, which includes the integration of state-of-the-art geospatial technology with IBM Informix Dynamic Server, assures that we will have a robust, high-performance platform for extending the uses of WaGIS far beyond the original concept."

- Dr. Manuela Osterthun, General Project Manager, Central Water and Shipping Directorate

Swedish Meteorological and Hydrological Institute (SMHI), Sweden

""Our data warehouse stores information from complex numerical models and weather observations in real time, and IDS provides the flexible retrieval mechanisms we need to produce tailored weather reports for our customers."

- Esa Falkenroth, Database Architect, SMHI

"Informix DataBlade technology lowers development costs by providing a foundation for us to create applications to easily handle our spatial data."

- Ingemar Mattison, manager of MHO data at SMHI (MHO: meteorological, hydrological and oceanographic)

Barrodale Computing Services Ltd, Canada

"We considered both Oracle and Microsoft SQL Server as the information management platform for our product. But IDS was the only database that was both cost-effective and explicitly designed to handle the complex data types and analyses on which our clients rely."

- Ian Barrodale, President and Owner, Barrodale Computing Services Ltd.

Additional References

- **Australia: New South Wales Lands**
  - Stuart McCann (stuart.mccann@land.nsw.gov.au)
  - IDS + Spatial DataBlade + ESRI ArcGIS/ArcSDE
- **New Zealand: Land Information New Zealand (LINZ)**
  - Brett Priddey
  - IDS + Spatial DataBlade + ESRI ArcGIS/ArcSDE
  - http://www.linz.govt.nz/
- **USA: Bureau of Land Management**
  - NILS application
  - Leslie Cone
  - IDS + Spatial DataBlade + ESRI ArcGIS/ArcSDE
- **South Africa: National Department of Agriculture**
  - Jimmy Weir-Smith
  - IDS + Spatial DataBlade + ESRI ArcIMS/ArcSDE