

# Oracle Spatial and Graph in Oracle Database 19c: Spatial Features



# Multimodel Database

- Oracle Database supports multiple models
  - Relational, In-memory, Sharded
  - Document Store
    - JSON
    - XML
    - Text
    - OLAP
  - Spatial Database
  - Graph Database and Triple Store
- Oracle Database support multiple languages and access protocols



# Spatial Analysis – It is about relationships



- Are things in the same location? Who is the nearest? What tax zone is this in? **Where can deliver in 35 minutes?** What is in my sales territory? Is this built in a flood zone?

# Oracle Spatial and Graph 19c

## Three major features



**Spatial**



Property Graph



RDF Graph

# Oracle Spatial and Graph

On Premises, Cloud and in Autonomous Database



# Oracle Spatial and Graph

Location and graph analysis with secure storage for enterprise data

Deployable Services



Mapping

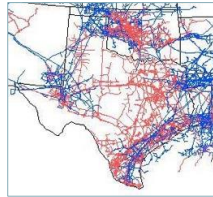
Geocoding

Routing

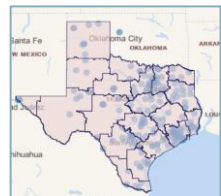
Web Services (OGC)



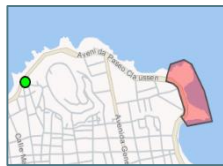
Points



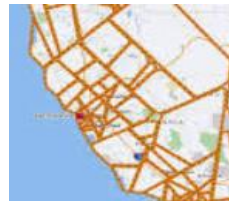
Lines



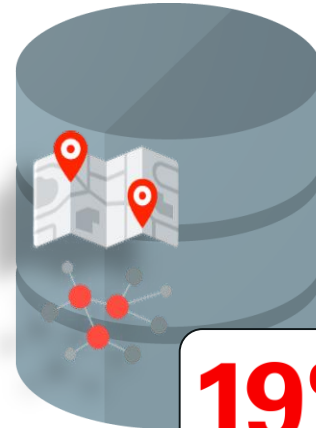
Polygons



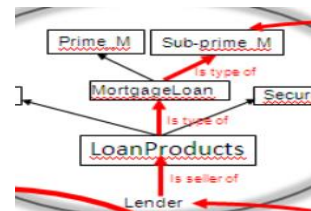
Location Tracking  
(Geofencing)



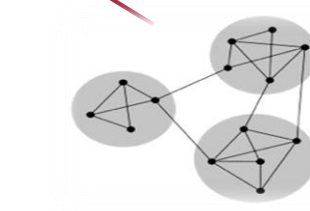
Networks



19<sup>c</sup>



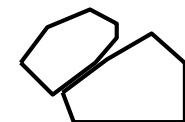
RDF Graphs



Property Graphs



3D / LiDAR



Topologies

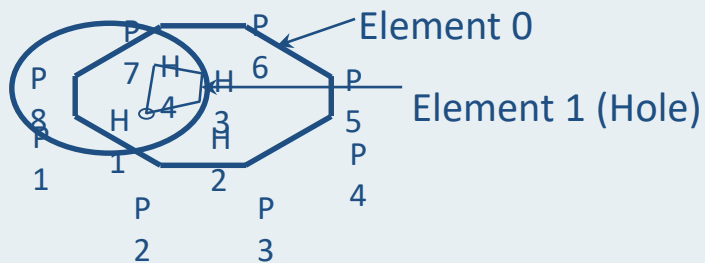


Raster

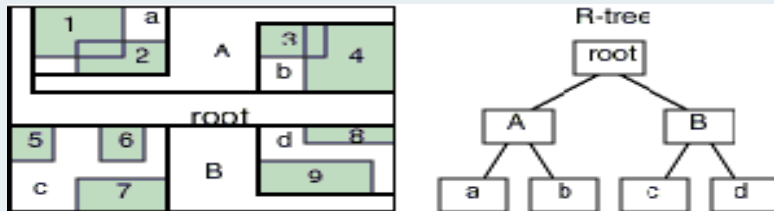
# Spatial Processing in Oracle Database

## Native Geometry Data Types

Points, Lines, Polygons, etc.



## Spatial Indexing



## Operators and Functions



Select, within distance, nearest neighbor, intersection, union, centroid, ...

## Geometries in Oracle Tables

ROADS

RNAME	ID	TYPE	LANES	GEOM1	GEOM2
M40	140	HWY	6		
M25	141	HWY	4		

## SQL Query and Analysis

```
SELECT a.owner_name, a.acquisition_status
FROM properties a, projects b
WHERE sdo_within_distance
(a.property_geom1, b.project_geom,
'distance = .1 unit = mile') = 'TRUE' and
b.project_id=189498;
```

# Spatial Analysis

- 100's of SQL spatial analysis operators
  - Filter
  - Combine
  - Transform
  - Measure

## Spatial Analysis Operations

[All](#)[Filter](#)[Combine](#)[Transform](#)[Measure](#)

**Calculate area**  
SDO\_GEOM.SDO\_AREA  
[More information](#)

**Add a buffer of a specified distance**  
SDO\_GEOM.SDO\_BUFFER  
[More information](#)

**Calculate minimum distance between shapes**  
SDO\_GEOM.SDO\_DISTANCE  
[More information](#)

**Calculate length or perimeter**  
SDO\_GEOM.SDO\_LENGTH  
[More information](#)

**Determine if shapes are within a specific distance of each other**  
SDO\_GEOM.WITHIN\_DISTANCE  
[More information](#)

**Combine a set of shapes into one**  
SDO\_AGGR\_UNION  
[More information](#)

**Add a buffer of a specified distance**  
SDO\_GEOM.SDO\_BUFFER  
[More information](#)

**Return shapes nearest to another**  
SDO\_NN  
[More information](#)

**Create point in the middle of a shape**  
SDO\_GEOM.SDO\_CENTROID  
[More information](#)

**Return shapes having any spatial interaction with another**  
SDO\_ANYINTERACT  
[More information](#)

**Return shapes that contain another**  
SDO\_CONTAINS  
[More information](#)

**Return shapes that are inside another**  
SDO\_INSIDE  
[More information](#)

**Combine a set of shapes into one**  
SDO\_AGGR\_UNION  
[More information](#)

**Return shapes within a specified distance of another**  
SDO\_WITHIN\_DISTANCE  
[More information](#)

[Advanced](#)



# Advanced Spatial Data Models

- Spatial networks for roads, transport, pipelines, telcos and other geographically connected analysis
- Topology for mapping, land management and cadastre applications

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Analysis Result:  
From: 575456205  
To: 575491535

Drive/Walk to:  
"CONNECTICUT AV and WYOMING AV"  
(31 meters).

[1]  
Board Route 227 (Inbound)  
At "CONNECTICUT AV and WYOMING AV"  
Dep. Time : 10:10:42

Get down at "NW CONNECTICUT AV and NW 20TH ST";

[2]  
Transfer to Route 86  
Board Route 86 (Outbound)  
At "NW CONNECTICUT AV and NW 20TH ST"  
Dep. Time : 10:21:00

Get down at "NW H ST and NW JACKSON PL";

[3]  
Transfer to Route 75  
Board Route 75 (Inbound)  
At "NW H ST and NW JACKSON PL"  
Dep. Time : 10:32:42

Get down at "SE INDEPENDENCE AV and SE 1ST ST";

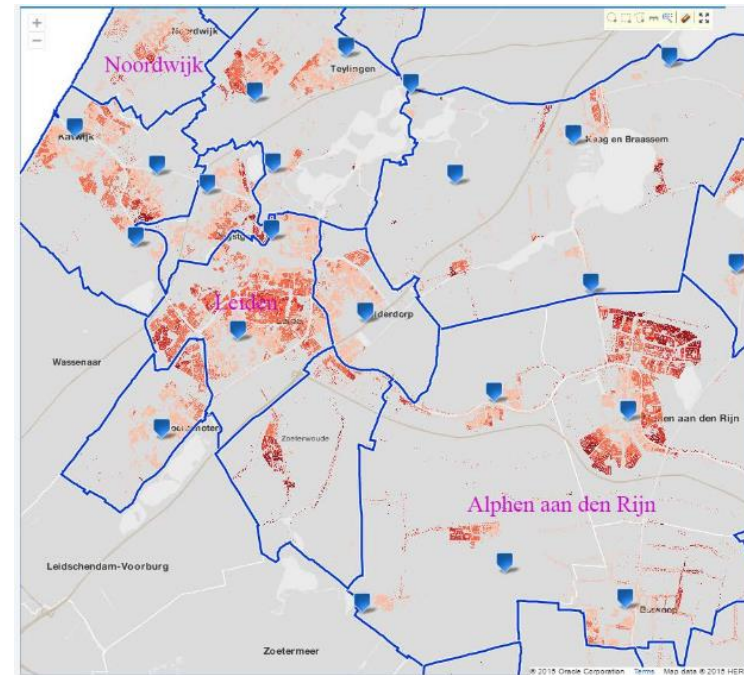
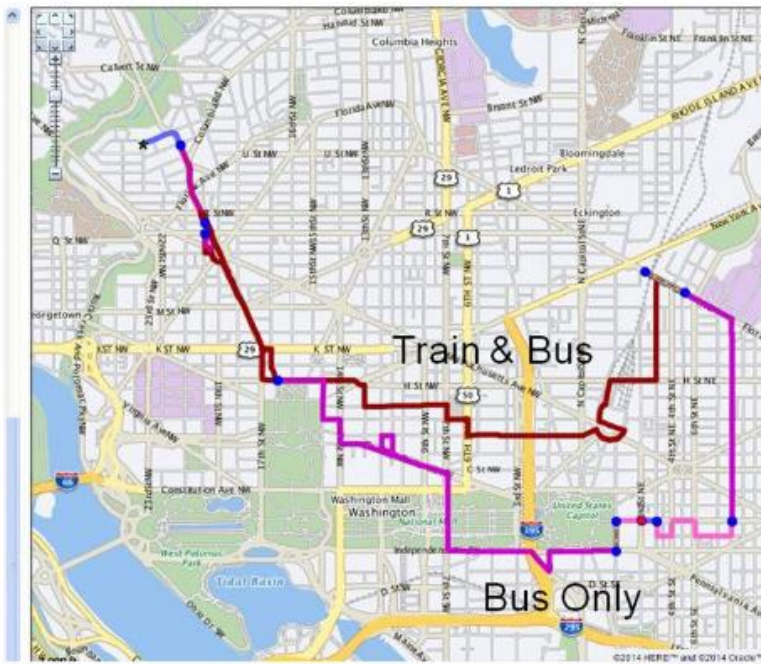
[4]  
Transfer to Route 131  
Board Route 131 (Outbound)  
At "E CAPITOL ST and SE 1ST ST"  
Dep. Time : 11:01:06

Get down at "E CAPITOL ST and SE 3RD ST"  
At 11:02:00

Drive/Walk from:  
"E CAPITOL ST and SE 3RD ST"  
(0 meters) to destination.

Trip Travel Time: 51 minutes.

Number of Bus Routes: 4

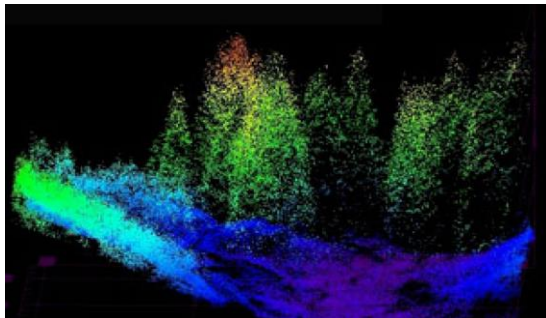


# Raster, 3D, Point Clouds and LiDAR support

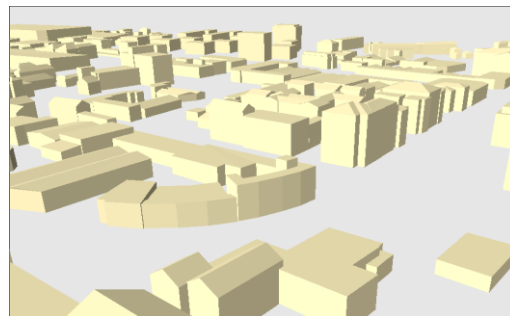
Raster



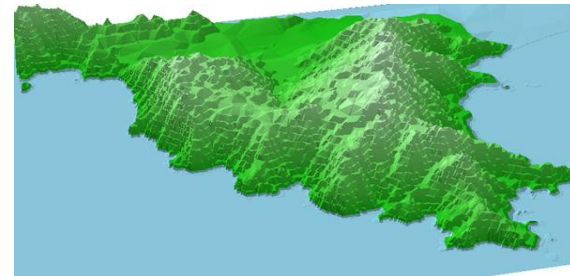
Point Clouds



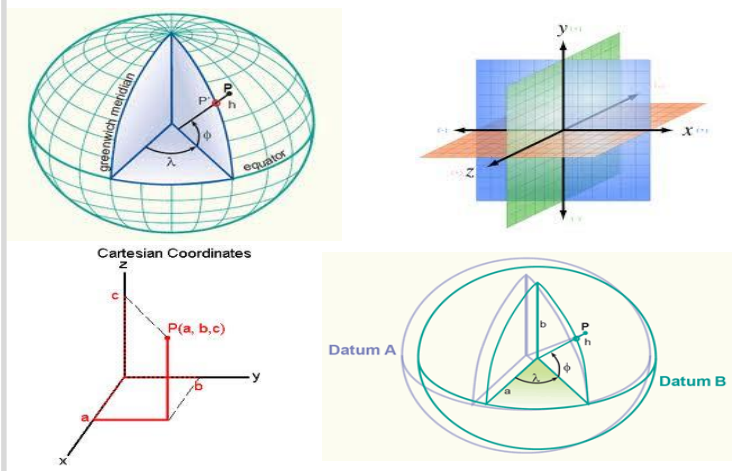
Solids



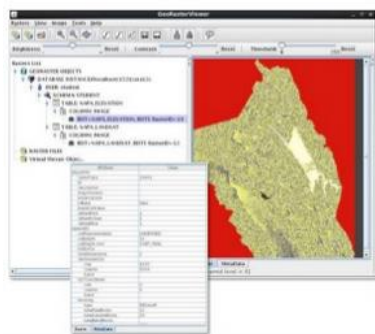
Triangular  
Irregular



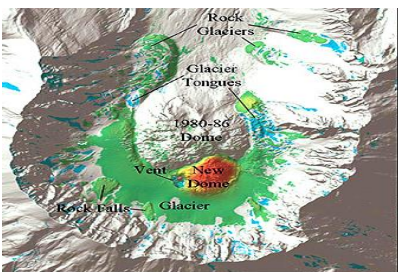
3D Coordinate Systems



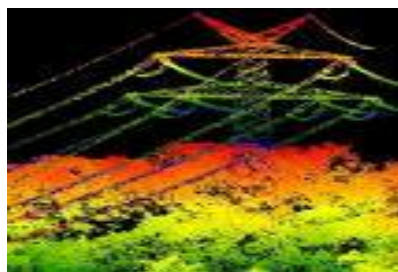
Raster and 3D Queries



Raster Analysis and  
Operations



Volumetric Analysis



Visibility queries

# Major New Spatial Features

## Ease of Use

- JSON and Oracle REST Data Services improvements
- Improved web services user interface, CSW and WFS enhancements
- Self-service development tool

## Performance

- Ability to use spatial operators without a spatial index
- Spatial index performance improvements
  - Enhancements to CBTree index to use the data layer directly for Spatial index access.
  - 3x faster query performance for large point data sets.

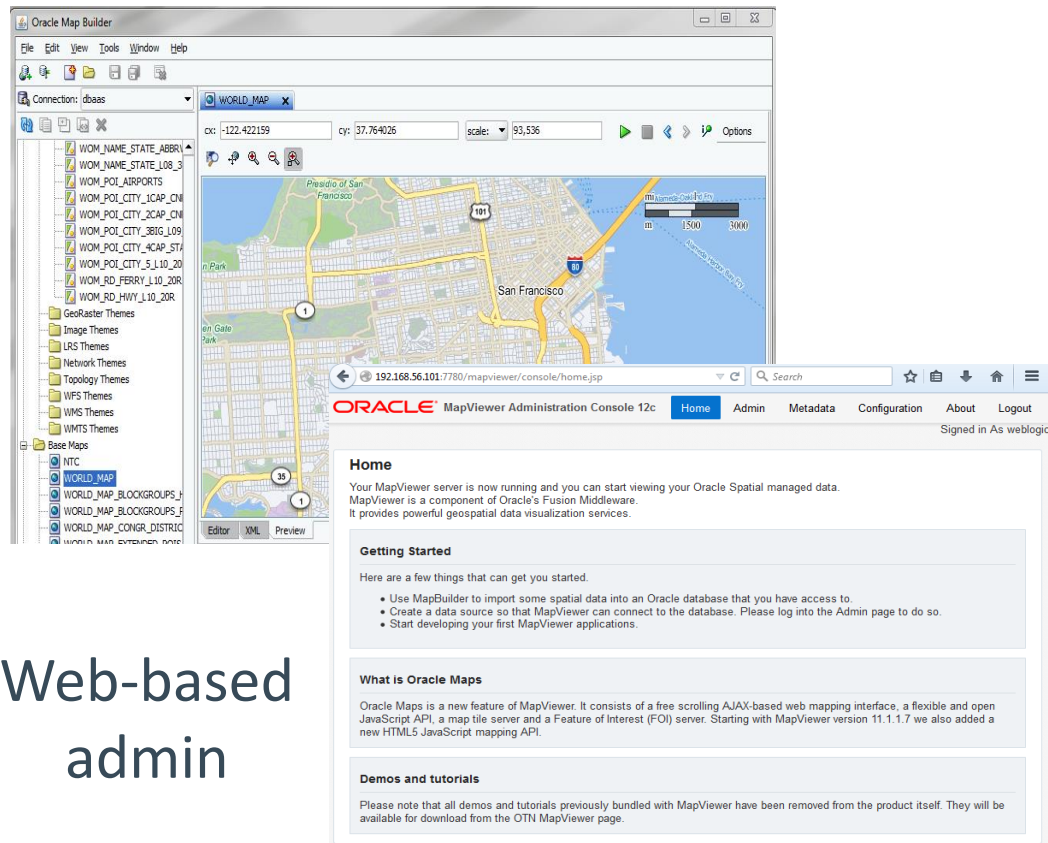
## Improved Database Support

- Spatial support for distributed transactions
- Spatial support for database sharding



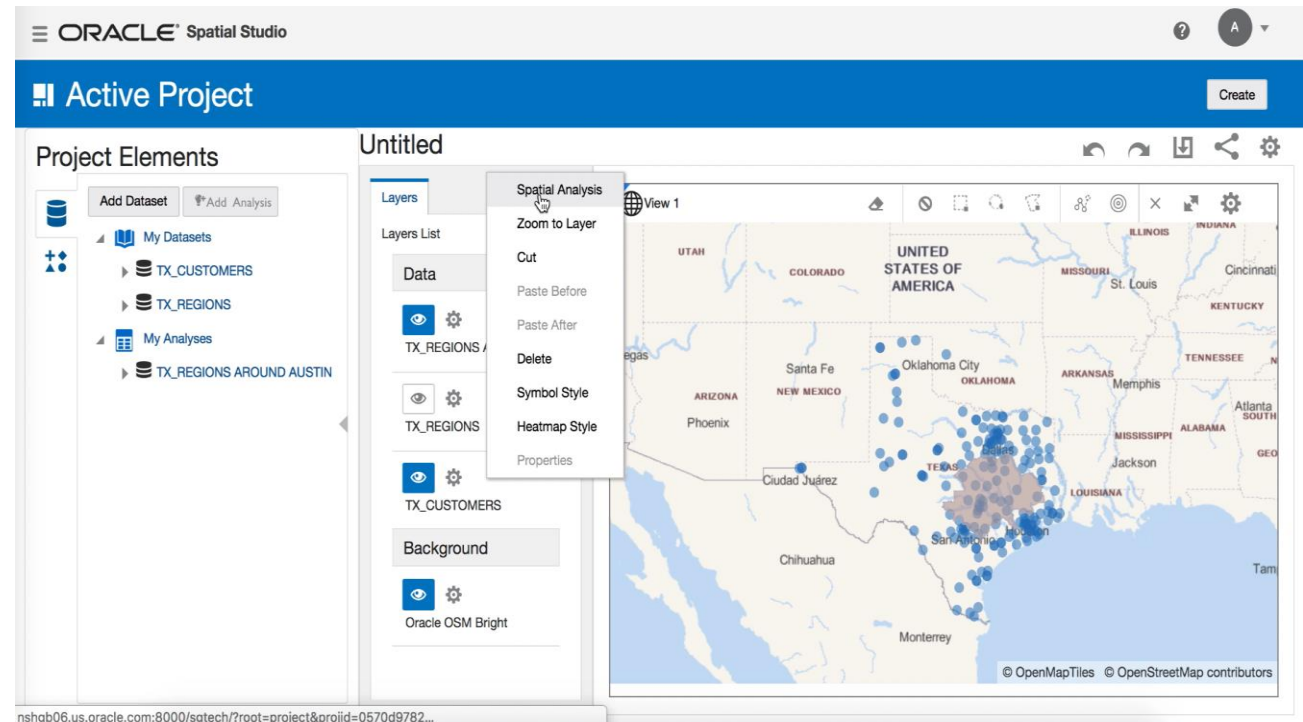
# Spatial Visualization

## Map authoring tool



## Web-based admin

## Self-service spatial analytics



# Summary

By treating spatial and graph data the same as other business data, Oracle Spatial and Graph enables enterprises to realize these benefits:

- Integrate analysis in the IT infrastructure
- Reduce operational costs
- Minimize strategic risk
- Reduce development effort





# Resources

## Oracle Spatial and Graph – Spatial Features

 Product homepage: [oracle.com/database/technologies/spatialandgraph.html](https://oracle.com/database/technologies/spatialandgraph.html)

 Blog: [blogs.oracle.com/oraclespatial](https://blogs.oracle.com/oraclespatial)

 Forum:  
[community.oracle.com/community/database/oracle-database-options/spatial](https://community.oracle.com/community/database/oracle-database-options/spatial)

 Oracle Spatial and Graph Group: [linkedin.com/groups/1848520/](https://linkedin.com/groups/1848520/)

 YouTube Channel: [youtube.com/c/OracleSpatialandGraph](https://youtube.com/c/OracleSpatialandGraph)

 Twitter: [@SpatialHannes](https://twitter.com/SpatialHannes)