

Oracle Spatial and Oracle Locator: A Location Platform for Enterprise IT

Overview

- **Platform for Spatial Solutions**
- **Oracle Spatial & Locator**
- **Customer Examples**
- **Oracle Spatial 10g:
Advanced Technology Features**
- **10g Release 2 Enhancements**

Platform for Spatial Solutions




What is spatial data?

- Business data that contains or describes location
 - Street and postal address (customers, stores, factory, etc.)
 - Sales data (sales territory, customer registration, etc.)
 - Assets (cell tower, fire hydrant, electrical transformer, etc.)
 - Geographic features (roads, rivers, parks, etc.)
- Anything connected to a physical location
- Every database in the world contains some form of business data that can be leveraged using spatial technologies
- Location is a “universal key”

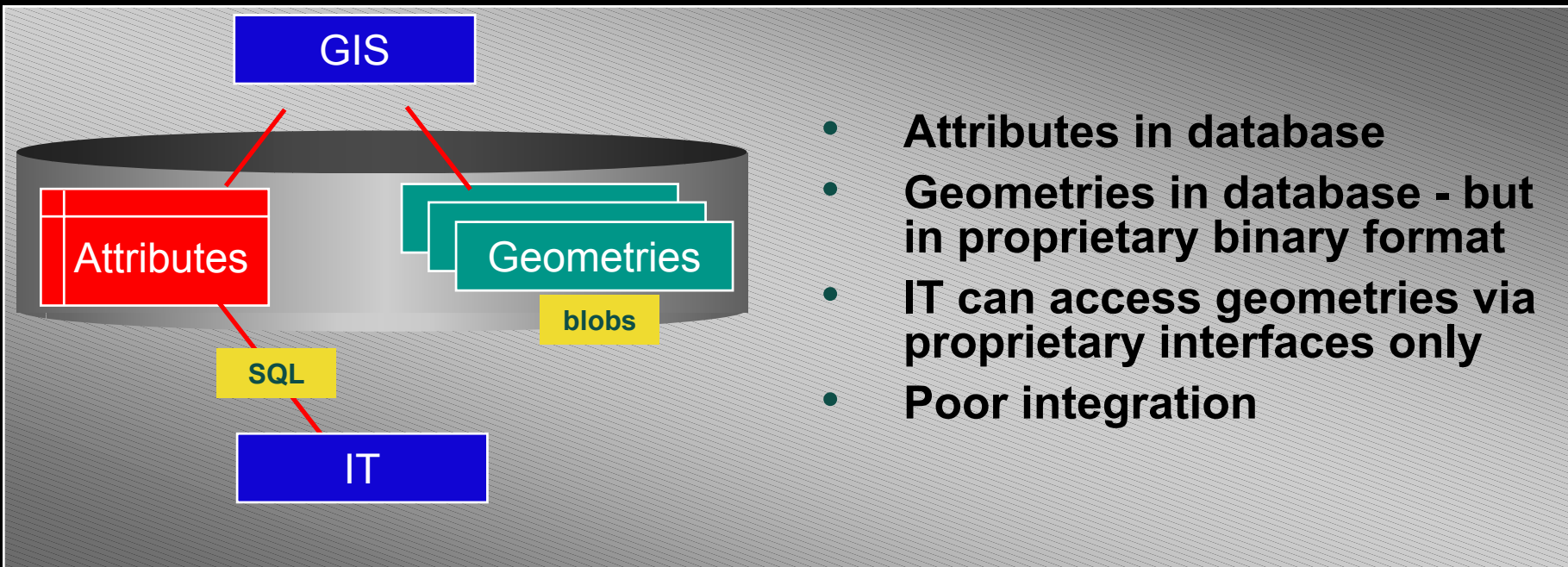
Bringing it all together

Information Type

Location-enabled Use

- Address  • Map Customers and Business Relationships
- Routes, Utility, infrastructure, etc.  • Develop Routes / Trace & Manage Field Assets
- Administrative areas (zip, tax, county, area code, real estate, sales territories etc.)  • Summarize, Compare, Drill Down Analytics, Track Assets etc.

Early Spatial Systems: Hybrids

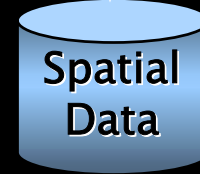


- Attributes in database
- Geometries in database - but in proprietary binary format
- IT can access geometries via proprietary interfaces only
- Poor integration

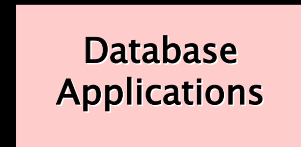
Key Challenges with Spatial Data

- Little or no information sharing
 - Intra-Organizational
 - Transportation, Public Safety, Health & Human Services, etc.
 - Inter-Organizational
 - Cities, Counties, States, Federal Govt., Utilities, etc.
- Multiple data formats and high administration costs
- Stovepipe systems
- Specialty servers for specialty applications

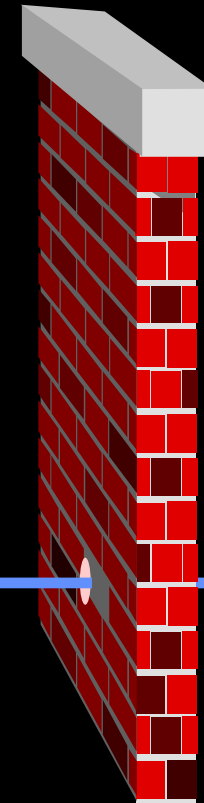
Functional Data



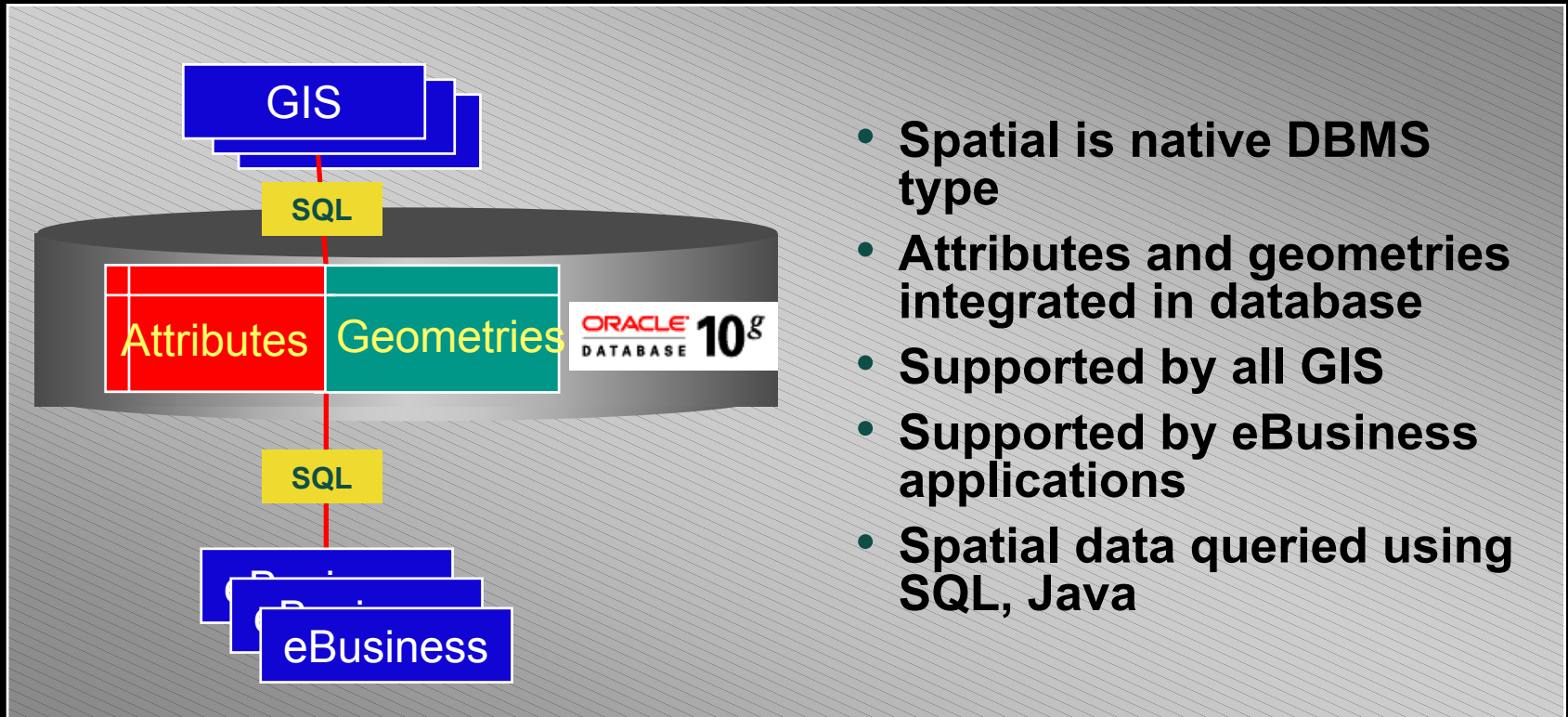
Enterprise Data



- Business Intell
- Presence
- Personalization



Open Spatial Databases



- Spatial is native DBMS type
- Attributes and geometries integrated in database
- Supported by all GIS
- Supported by eBusiness applications
- Spatial data queried using SQL, Java

Why add advanced spatial services to Oracle Database?

- Enable Integrated Operational Systems
- Manage huge volumes of machine generated data
- Apply database benefits to fundamental data management challenges; no scalability boundaries
 - Raster Images: Single images < 1 TB; Logical datasets ~ 1 Petabyte
 - Utility and transportation networks: Billions of Nodes/Links; millions of graphs
 - Point Clouds: Terabytes of point data to be indexed and analyzed
 - Topology: data validation for seamless national datasets
 - Geocoding, Routing, Mapping: single dataset for all functions for telco, call center, telematics applications, ITS
- Common user management, administration, security

The Spatial Platform for IT

- Ubiquitous Spatial services in IT infrastructure
 - Dramatically lower costs
 - Simplify application development
 - Integrate operational systems
- Allow Spatially-enabled solutions to focus on business context, not infrastructure services
 - Database and Application Server manage deployment infrastructure
 - Transactions, Versioning, Security, Backup/Recovery
 - Scalability
 - Standards compliance
 - Load Balancing, Failover
 - Hardware / Software dependencies
 - Support multiple application models with common data model
 - Java, GML, .Net, Web Services

Benefits of Using a Spatial Database

Lower Cost of Ownership

- Store spatial data centrally & eliminate separate file systems – reduce maintenance, hardware support costs
- Reduce training costs

Reduce Risk

- Open – no proprietary data types – supported by every leading GIS vendor
- Scalable: Supports Terabytes of Data & transparent scaling through RAC
- Secure and Reliable

Improve Decision Making and Customer Service

- Access to spatial data by more people /departments/ organizations
- Access to better quality data
- High Performance - no Middleware
- Supports 1000s of Users
- Business applications can take advantage of location analysis

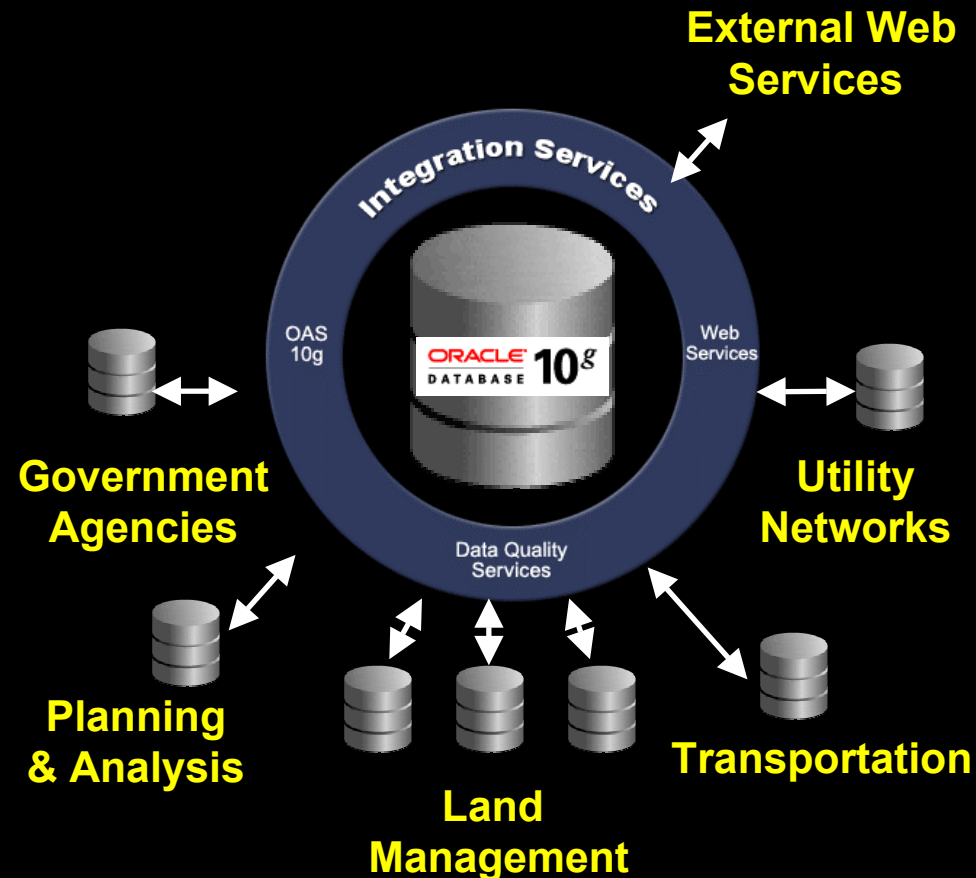
Easy to Program

- SQL and Java, leverage existing DBA and application development skills

Oracle10g Value Proposition

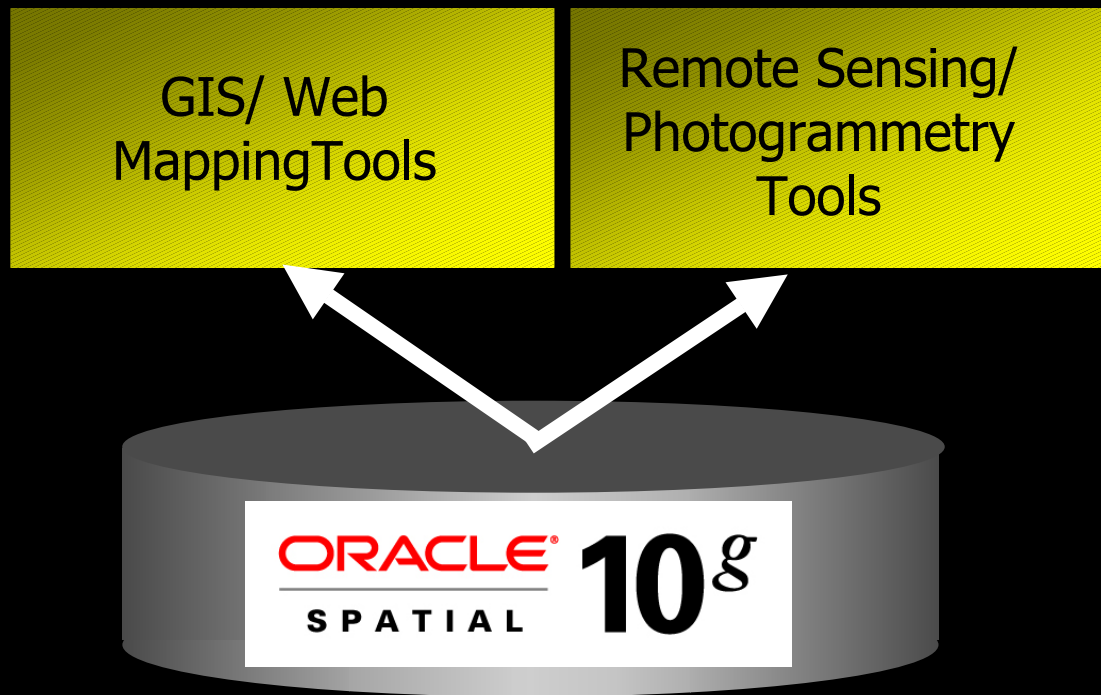
Integrated and Assured Information Sharing

- Single source of truth
- Strong Security
- Real-time information updates
- Interoperable data and location-aware processes
- Integrated spatial information from multiple sources
- Enhanced Business and Operational Intelligence
- Creation of a Network Centric, Spatially Enabled, Real Time Enterprise



Spatial Platform for GIS, LBS, Imaging

Technology



Task

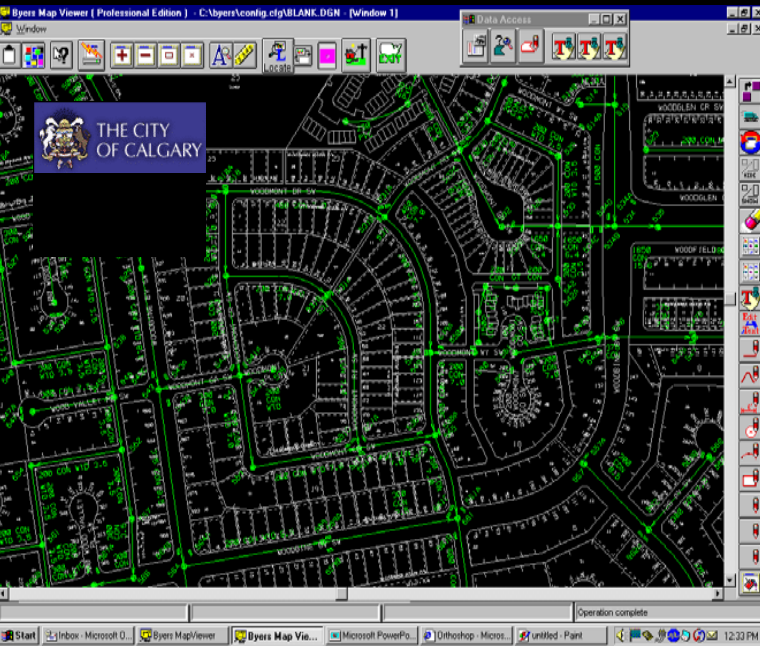
- Data loading
- Editing
- Visualization
- Image processing
- Analysis
- Business Processes

- Storage & Admin
- Indexing
- Security
- User Mgmt
- Query
- Versioning
- Scalability

Oracle's Approach to Market: Broad Platform for Geospatial Solutions

- **Enterprise Geospatial (Specialized)**
 - Leverage Internet Computing Platform
 - Planning and Land Management
 - Facilities Asset Management
 - Defense & Intelligence Surveillance
 - Energy Exploration
- **LBS & Business Applications (General)**
 - Map-enabled Business Applications
 - Web Mapping, Map Portals
 - CRM (Sales, Marketing, Call Centers)
 - ERP (Supply Chain, Asset Management, Financials)
 - Tracking & Logistics (RFID, Sensor Web)

Specialized Applications



Oracle10g Features

Geometry

Topology

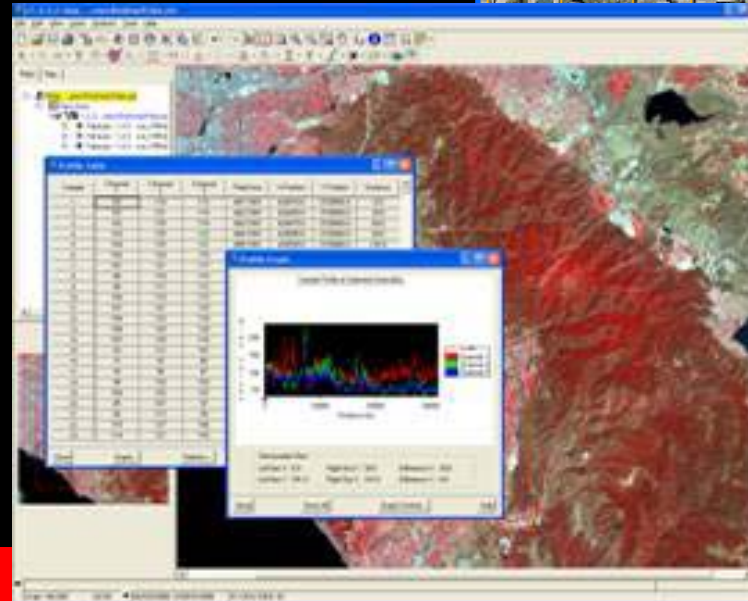
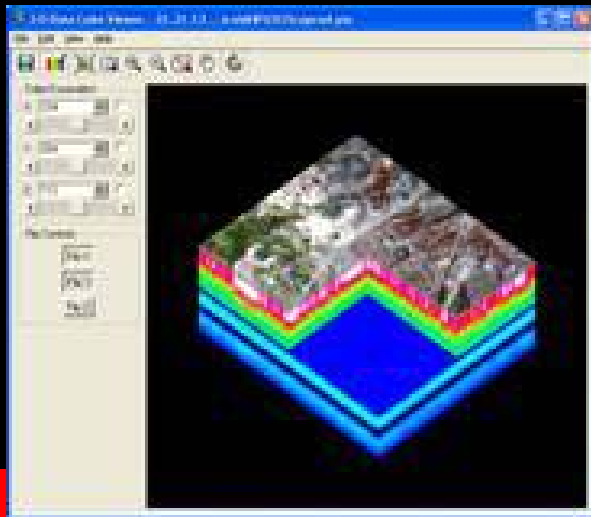
GeoRaster

Networks

LRS

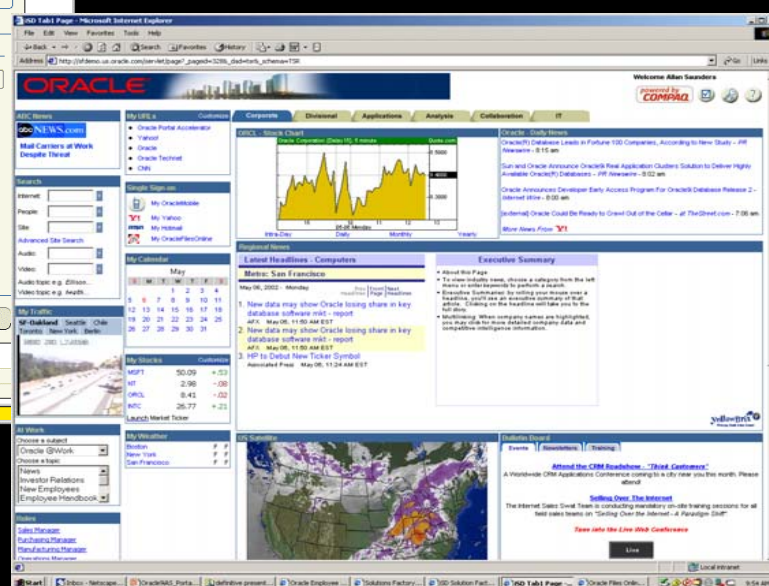
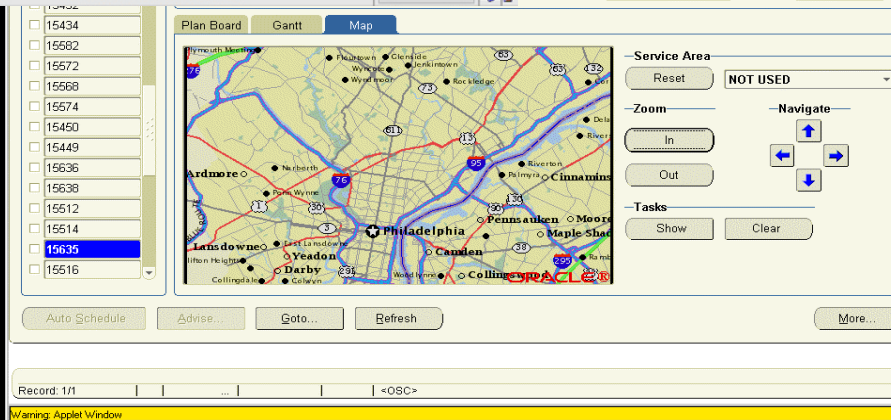
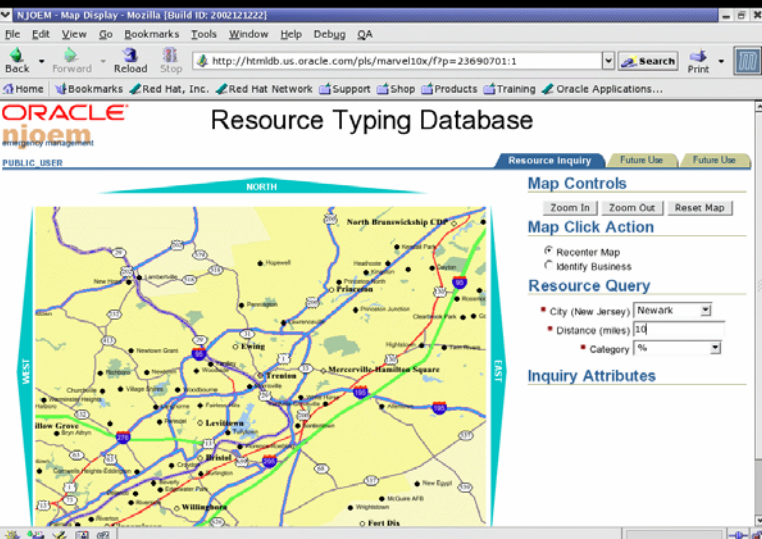
Geodetic

Long Transactions



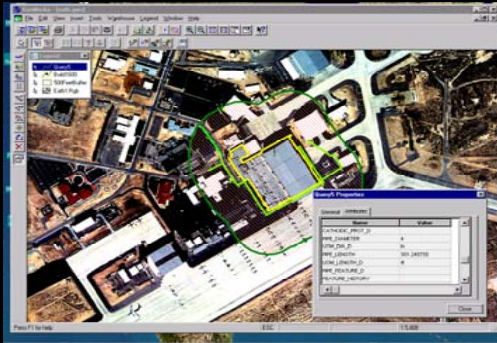
General Business Applications

Oracle10g Features
Simple Feature Geometries
Spatial Operators
Geocoding
Routing
Web Mapping
Portal/SOA Integration

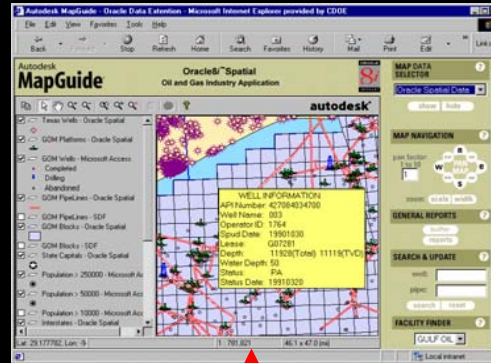


Combined Specialized & General Applications

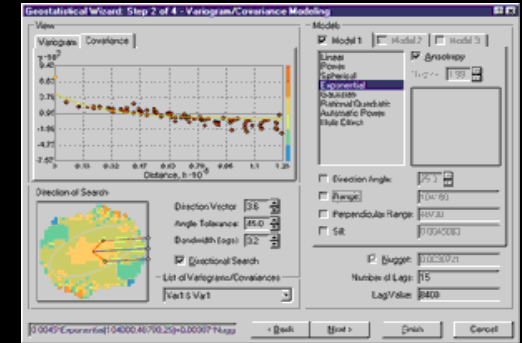
Asset Management



Environmental Planning



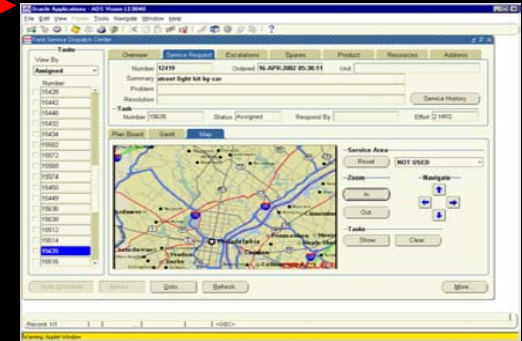
Business Intel



Land Management



Logistics



Enhance Any Business Intelligence Platform

BI Sales by Geography - OracleBI Discoverer - Microsoft Internet Explorer

File Edit View Format Tools Help

Dialog 11 B U

PIPELINE BY STATE AND
Date Run: 07-APR-2005
Page: 1

Page Items: Customer State: CA

Customer Name	Pipeline
Business World	2,100,110
Axis Software	1,325,700
Lipton Technologies	1,274,250
Goodway	1,136,996
Costova Networks	331,192
Sun Microsystems	300,000
Sneider Associates	187,996
Cando Research Tech	Customer Location
Global Enterprises	NULL

2,400K
1,600K
800K
0K

Business World Axis Software

Workbook: BI Sales by Geography
Worksheet: Pipeline by State and City

http://se0029.oracleads.com:7778/mapviewer

File Edit View Favorites Tools Help

Address: http://se0029.oracleads.com:7778/mapviewer/tcademo/maincustid.jsp?zoom=.05&custid=70489

Base map[apps_demo] Center[-122.5000, 37.8000]
© Oracle, Navteq, Skyline and AirphotoUSA

Map Legend
● Prospect
× Competitor
★ Customer
Sales

Local intranet

start Connect to Discoverer... BI Sales by Geograph... http://se0029.oracle... DISC RELATIONAL 9:11 AM

OracleBI Discoverer, Oracle Spatial & MapViewer

Supporting Open Standards

- OGC (Simple Features, GML, OpenLS...)
- ISO TC211 (Spatial Schema, Metadata, Coordinate Systems...)
- W3C Consortium (XML/SVG...)
- Sun (Java)
- ISO/IEC JTC1 SC32 (SQL-1999 – SQL/MM-Spatial)
 - Oracle Locator & Spatial support SQL-MM-style types & operators
- Open Mobile Alliance-Location Working Group (cell phone locations)

Partners Supporting Oracle Spatial/Locator

Autodesk®

INTERGRAPH



Leica
Geosystems

Geodan



Skyline
DELIVERING THE DIGITAL EARTH™



e|spatial
spatially enabling business

NAVTEQ™

MapInfo.

BENTLEY

AED SICAD
AKTIENGESELLSCHAFT



exor

ionic
SOFTWARE

Acquis

caris

STAR-APIC



POWEL | miniMax

SAFE SOFTWARE

ObjectFX

Laser-Scan

What the Analysts are Saying about Oracle Spatial...

“In four separate surveys since 1999, IDC has found that Oracle holds about an 80-90% share of the overall geospatial database management market within medium-sized and large organizations.”

IDC, February 2005

ORACLE[®]
DATABASE **10^g**

A Service-Oriented Architecture Platform for Geospatial Solutions

Importance of Web Services Infrastructure

- By 2008 web services will be a preferred method to publish and query spatial data stores
- Simplifies and expands access to valuable geographic data and location based services
- Open, standard, easy access methods
- Low computation environments
- Consumer-oriented or specialist information

Why build on an SOA Platform?

- Scalability
- Load balancing
- Managing service integration complexity
- Orchestration of services in a workflow
- Security for sensitive information
- Transaction management
- Semantic interoperability
- Monitoring and management of multiple services

Geospatial Web Services Architecture



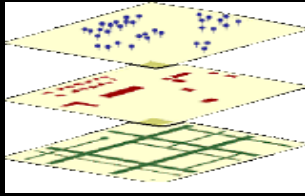
- Simple Features
- GeoRaster
- Topology
- Networks
- Spatial Data Mining
- Geocoding
- Routing
- Versioning
- DBMS Rules

- J2EE Container
- SOAP Web services
- Orchestration & Workflow
- Security provisioning
- Policy based resource mgmt
- Workload scaling
- Workload redistribution
- Portal
- Wireless & Sensor

- Business Logic
- Industry Models
- Visualization
- Interactive Editing
- Industry Specific APIs
- Industry Knowledge
- Packaged Solutions



Securing Spatial Information



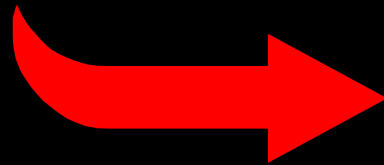
Points of Interest
Buildings
Infrastructure

Boundaries

User Security



Authenticate



Network Security



ORACLE DATABASE 10g

Privacy & integrity of communications

Data Security

ORACLE DATABASE 10g ORACLE DATABASE 10g ORACLE DATABASE 10g

Boundary a	Boundary Point a	
Infrastructure	Building a	
Building I Infra B	Point b	
Point b	Boundary c	
Boundary c	Building C	
Build D Infra C	Infrastructure D	
Point c		

Access control

Privacy & integrity of data

Comprehensive auditing

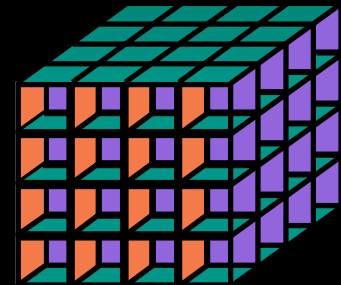
Oracle Spatial & Locator

What is a Spatial Database?

Spatial Analysis



Spatial Indexing

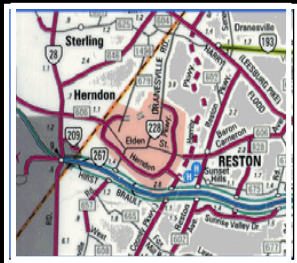


Fast Access to Spatial Data



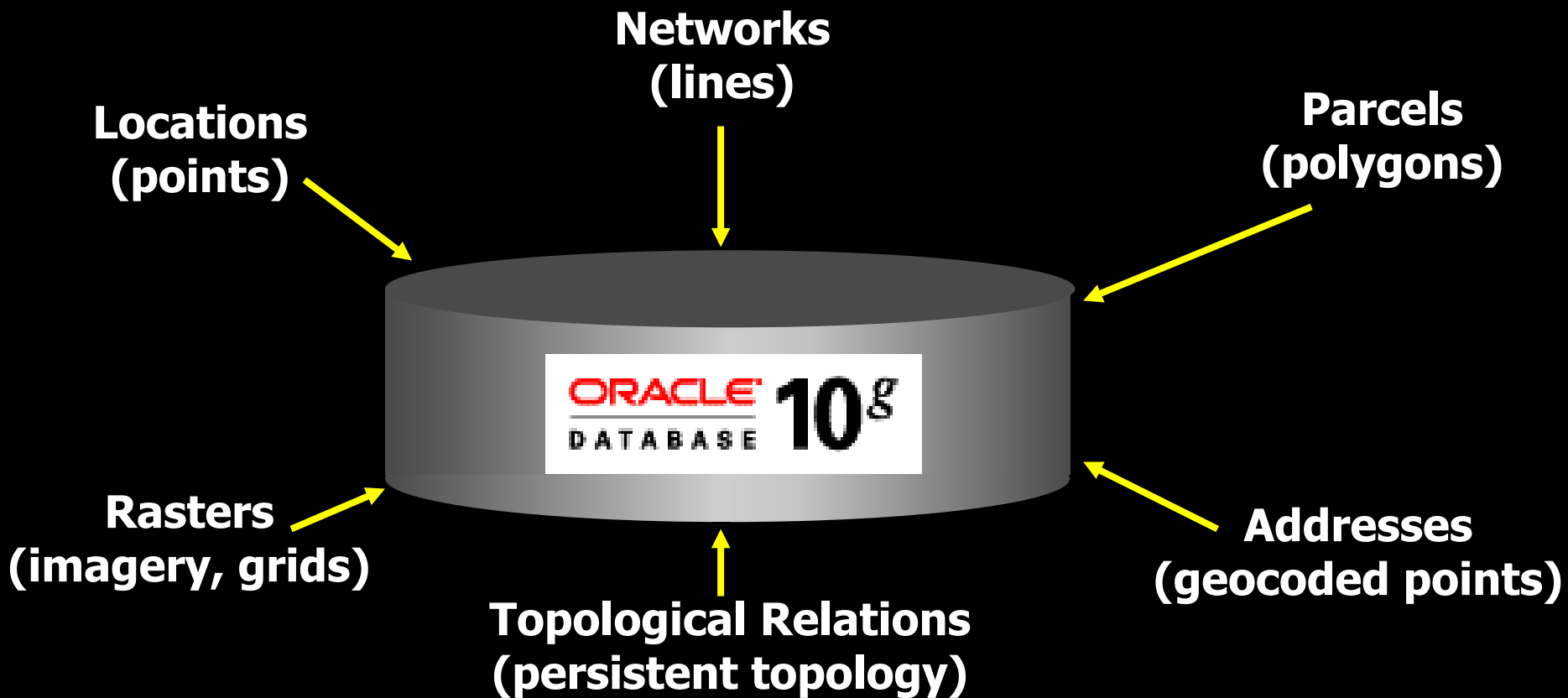
Spatial Access Through SQL

Spatial Data Types



All Location/Spatial Data Stored in the Database

All Spatial Types in Oracle 10g



Geospatial Map Data in Oracle Tables



Road

Data Types and Models:

Vector [SDO_GEOMETRY
SDO_TOPO_GEOMETRY
Raster | SDO_GEORASTER

ROAD_ID	NAME	SURFACE	LANES	LOCATION
1	Pine Cir.	Asphalt	4	
2	2nd St.	Asphalt	2	
3	3rd St.	Asphalt	2	

Spatial Operators

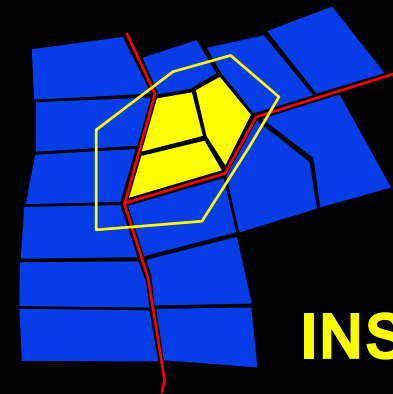
- Full range of spatial operators
 - Implemented as functional extensions in SQL
 - Topological Operators
 - Inside
 - Touch
 - Covers
 - Equal
 - Distance Operators
 - Within Distance
 - Nearest Neighbor

Contains

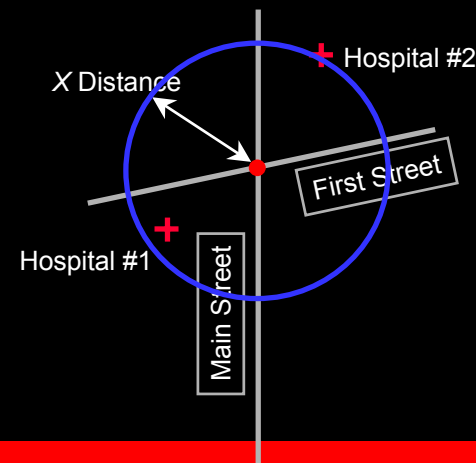
Disjoint

Covered By

Overlap Boundary



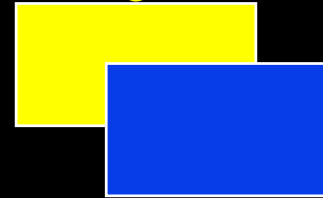
INSIDE



Spatial Functions

- Return a geometry
 - Union
 - Difference
 - Intersect
 - XOR
 - Buffer
 - CenterPoint
 - ConvexHull
- Return a number
 - Length
 - Area
 - Distance

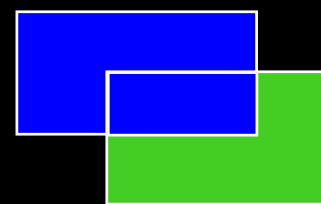
Original



Union



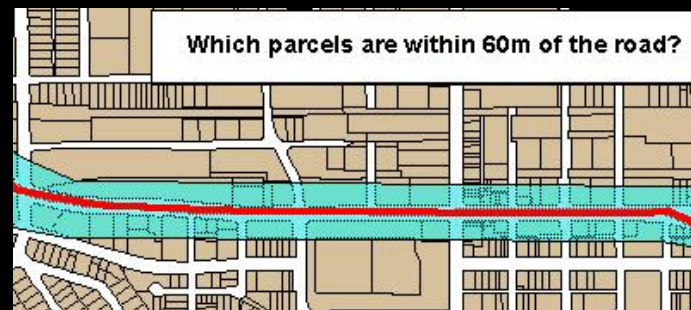
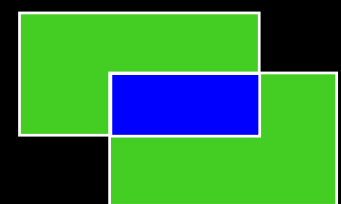
Difference



Intersect



XOR



Oracle: Defining the Spatial DBMS

- SQL Spatial Type
- R-Tree Index
- Spatial Operators
- Spatial Reference System
- Coordinate System Support Based on EPSG Model (New with 10g Release 2)
- Geodetic (lat/long) Support
- Linear Referencing
- Spatial Aggregates
- Long Transactions
- Parallel Index, Query, Load
- Transportable Tablespaces
- GeoRaster Type
- Network Data Model
- Topology Data Model
- Geocoding Engine
- Routing Engine
- eLocation Quick Start (New with 10g Release 2)
- Spatial Data Analysis / Mining
- GML 2.0 and 3.0
- SVG Support
- Oriented Point / Text Geometry

Oracle Locator and Spatial: Typical Deployments

Locator Usage

- **Most location-based business applications**
- **Simple GIS applications**
- **Partner-supported GIS**

Spatial Usage

- **Business applications requiring geocoder, routing engine in database**
- **Complex GIS applications**
- **Intensive database-driven geoprocessing**
- **Network modeling**
- **Raster data management**

Oracle Locator & Spatial Features

Locator – bundled in Express, Standard, Standard One, Enterprise Editions

- Support for all geometry types
- 2D, 3D, 4D data
- All Spatial Operators
- Distance and validation functions
- Coordinate Systems support (incl. explicit transformations[†])
- Utility & tuning packages[†]
- Long Transactions
- Parallel spatial query and index builds*
- Table Partitioning*
- Object Replication*

[†]New to Locator in 10g Release 2

* Require EE and/or EE options

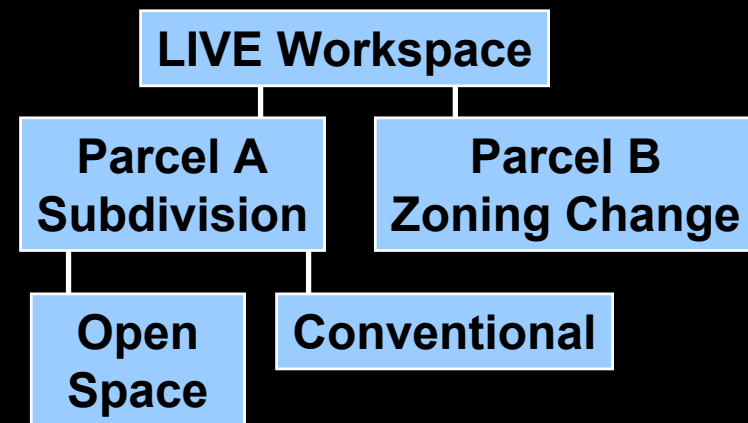
Spatial – priced option of Enterprise Edition

- All Locator features
- Spatial Functions
 - area/length calculation
 - buffer, centroid, union, etc
- Linear Referencing Support
- Spatial Aggregates
- GeoRaster Support (10g)
- Topology Data Model (10g)
- Network Data Model (10g)
- Geocoder (10g)
- Spatial Analytical Functions (10g)
- eLocation Quick Start (New with 10g Release 2!)

Workspace Manager

Oracle Database feature that version-enables tables and creates virtual workspaces to manage long transactions with isolation, history and “what if” scenarios:

- Workspace hierarchies any size
- No changes to application SQL
- Continually Refreshed workspaces
- Multi-Parent Workspaces
- Optimistic and pessimistic persistent workspace locks
- Differencing and Conflict detection/resolution
- Partial and Full Merge/Refresh of workspace/table
- Garbage collection operations to optimize version storage

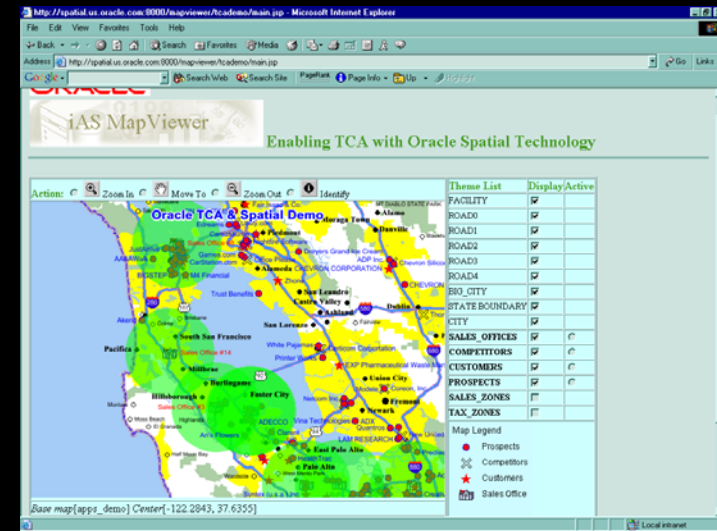


Oracle Database 10g Enhancements for Workspace Manager

- Oracle Spatial topology versioning
- Valid time (Effective Dating)
- Multiparent workspaces
- System parameters to enforce global settings
- Workspace event notification
- More Database feature support:
 - Import / export, SQL*Loader, unique constraints, nested tables, Virtual Private Database, `TIMESTAMP WITH TIME ZONE` type, more DDL on versioned tables

Oracle Application Server MapViewer

- Build / visualize custom maps using XML APIs, Java and JSP tag libraries
- Executes in OC4J
- Supports business geographics and spatial analysis
 - Identify / query complex data
 - Uses Oracle Spatial / Locator
- Designed for integration with Location-based Services, Business Applications, Wireless platforms
- Feature of Oracle Application Server Java, Standard and Enterprise Editions



Customer Examples

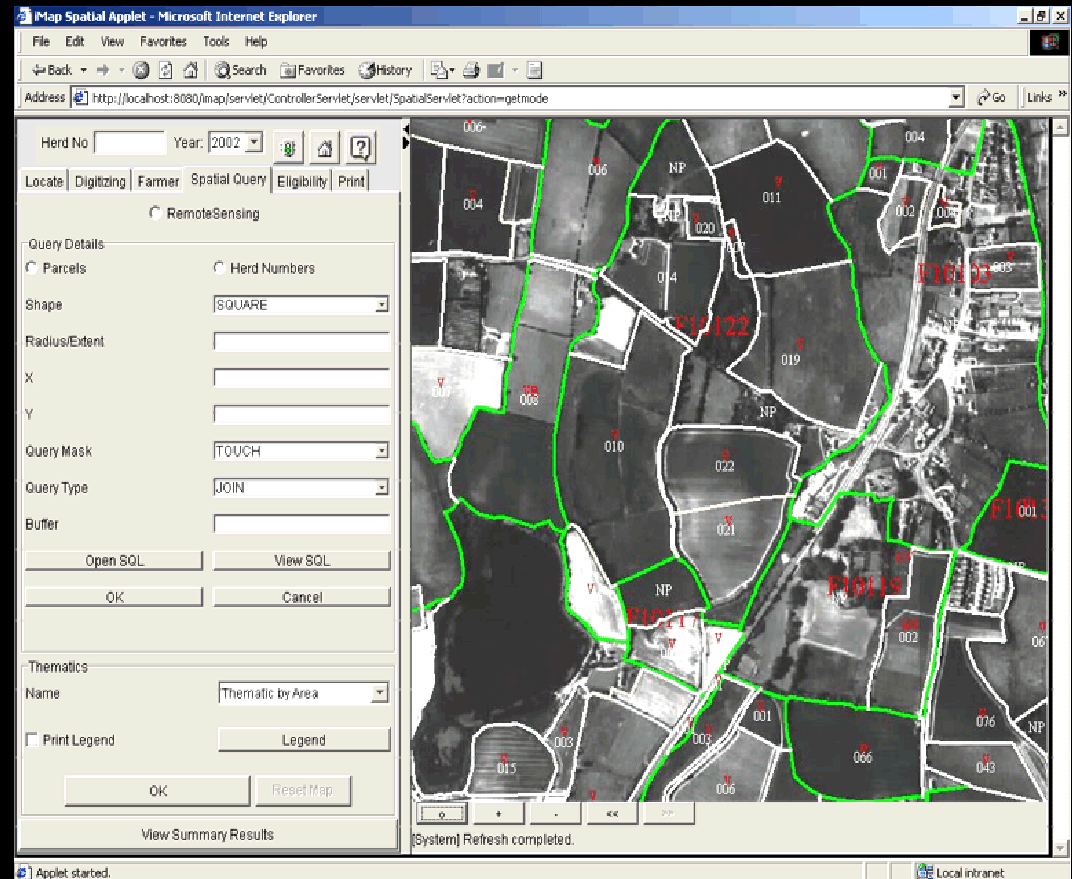


- 999 (Trinity) – Emergency response
 - Locate caller, route call to first responders
 - High performance boundary matching
 - 100,000 calls/day
- Network Records, Maintenance, Fault locator
 - Used by 17,000 field engineers for 6.1 M customers visits/year
- Spatial data hub for multiple applications
 - Coverage maps
 - Marketing, product/service bundle campaigns
 - Network planning, maintenance
- Built using Oracle Spatial 10g, Network Data Model, AS 10g MapViewer

Ireland Department of Agriculture

Monitoring Correlation of Land Valuation and Boundaries

- Single, integrated web-enabled information system
- Key Benefits
 - Improved public service
 - Support for accurate and efficient payment administration
 - Remote farm inspection
 - Fast identification of land use inconsistencies
 - Web access to dataset



New York City

- Department of Information Technology & Telecommunications
 - Developed standardized digital basemap for all agencies
 - 6,000 miles of underground pipes
 - 1 million water/sewer connections
 - 32,000 sq. miles of Infrastructure Data
 - 7,500 digital photographs
 - Use ESRI, Bentley, MapInfo, GE Smallworld
- The Office of Emergency Management created a public site for emergency preparedness

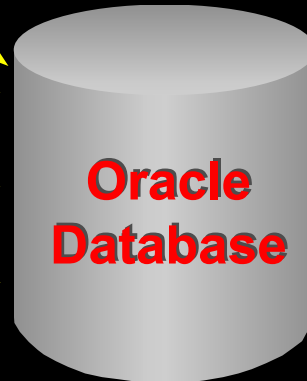


Integrated NYC Spatial Architecture

GIS Specialist Systems



Core Spatial & Business Data Repository



Topographic/Raster
Cadastral
Geo-coded Address
Street Center
Assets
Environmental
Transport
Health/Social services
Education
Crime

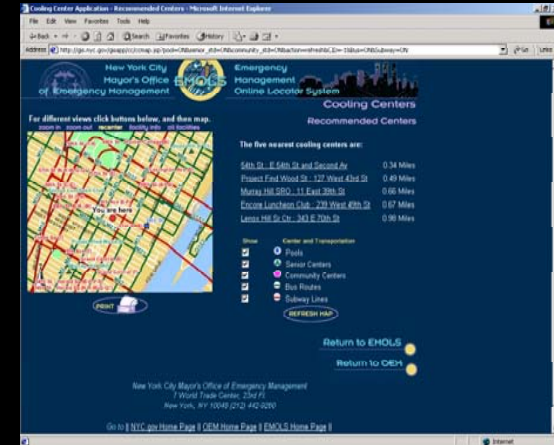
Spatially Enabled Business Applications



Business Benefits to NYC



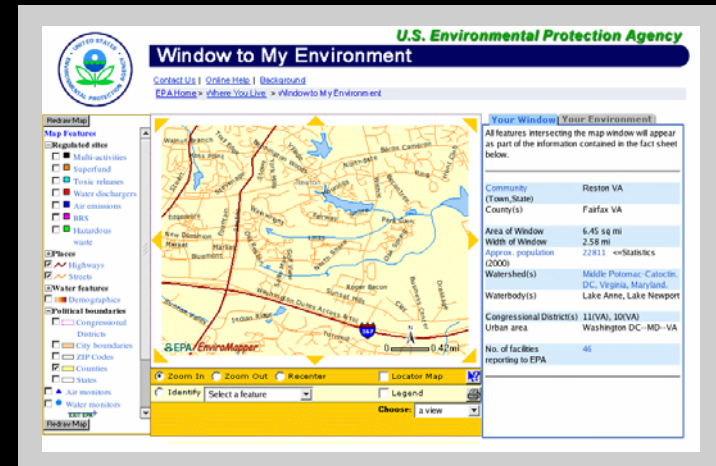
- **Scalability**
 - Platform is enterprise and Internet oriented
- **Multi-User GIS**
 - Requirements were for multi-user update access for many users
- **Interoperability**
 - Corporate enterprise implementation strategy involved multiple mapping and GIS vendors.
 - ESRI, MapInfo, Intergraph and Smallworld software are all used on the Oracle Spatial warehouse
- **Openness**
 - When you need open access to and interoperability with multiple Oracle applications
- **Enable eGovernment**



US Environmental Protection Agency

- EnviroFacts

- Oracle Spatial manages location data associated with EPA regulated facilities
- Data collected from federal, state and regional sources
- Public Internet access to environmental data (Window to My Environment)



<http://www.epa.gov/enviro/wme/>

- NEPAssist

- Web application that facilitates environmental review process
- Prototype available for New York and New Jersey



Ordnance Survey



- Ordnance Survey is Britain's National Mapping Agency, and an internationally recognized leader
- Open repository standardized on Oracle Spatial
- Its "Maia" database system stores the digital mapping base of Great Britain
- Foundation for its current and future products in the OS MasterMap line
- Strategic enterprise software within Ordnance Survey
- Around 1 terabyte database, will grow to over 2 terabytes in first year
- Oracle Spatial is key to its profitability

The Most Popular Spatial Database

- **Utilities**

- Georgia Power, Omaha Public Power, Reliant, US DoE, Western Power Corp, Severn Trent, Beijing Power, Copenhagen Energy, Electrabel, Gaz de France, Hydro-Quebec, Equitable Resources, Nova Naturgas, Sao Paulo Electric

- **National Mapping, Cadasters & Agricultural Agencies**

- NGA, USGS, US Army, Ordnance Survey (UK, IR, NI), Denmark, Sweden, The Netherlands, Poland, Australia, Greece

- **Transportation Management**

- Iowa, Florida, Maine, Maryland, Minnesota, Nevada, New York, Oklahoma, Pennsylvania, Tennessee, Utah, Alabama, Alberta, London Rail, Netherlands Transport, Australia, Austrian Rail, German Rail

- **Telco & Wireless LBS**

- AT&T, Bell South, British Telecom, Cingular, DoCoMo, KDDI, Intrado, JPhone, Nextel, Sprint, T-Mobile, Telkom, Telenor, Telstra, Telus, Telia, Cellcom, Verizon, Vodafone, Wind

- **Local Authorities**

- New York City, Chicago, Los Angeles, San Jose, San Mateo, Washington DC, Cleveland, Detroit, Phoenix, Winnipeg, Vancouver, Edmonton, Stockholm...

Oracle Spatial 10g: Advanced Technology Features

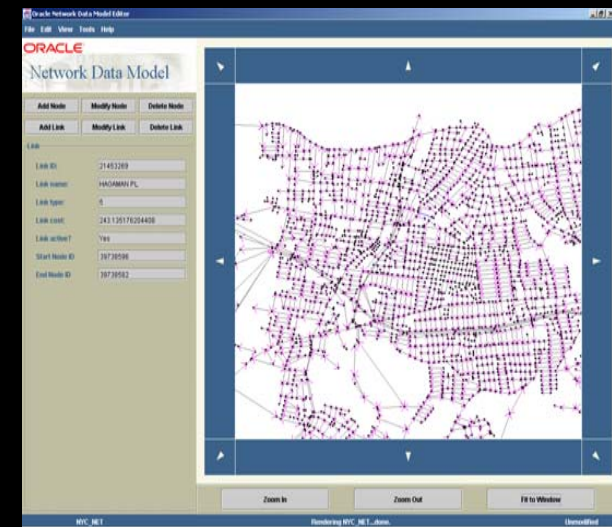
ORACLE[®]
SPATIAL 10^g

Overview

- Network Data Model
- Topology Data Model
- GeoRaster
- Geocoder
- Routing Engine
- eLocation Quick Start (New for 10g Release 2!)
- Spatial Analytic Functions

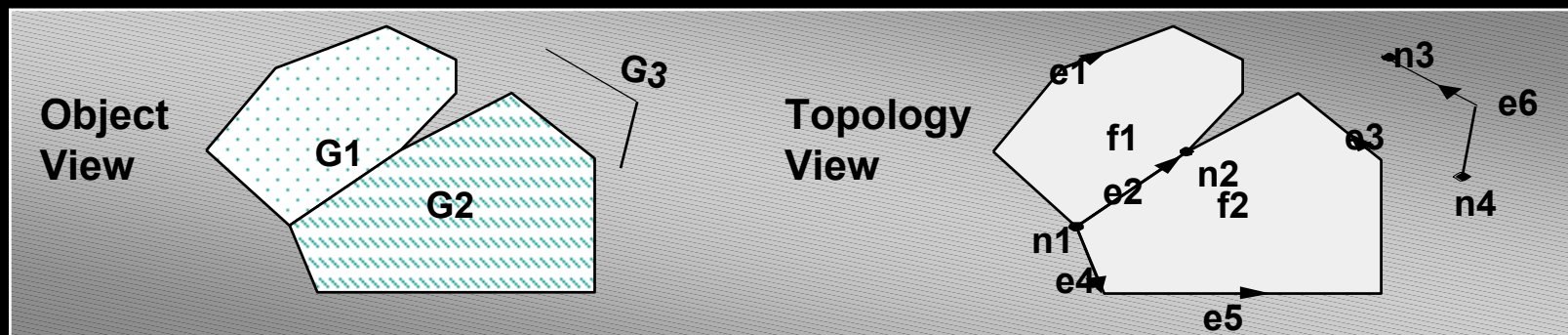
Network Data Model

- **Network Data Model**
 - A data model to store network (graph) structure in the database
 - Explicitly stores and maintains connectivity of the network
 - Attributes at link and node level
- **Supports Network Solutions (Tracing & Routing)**
 - Transportation and Transit Solutions
 - Field Service, Logistics
 - Location-Based Services, Telematics
- **Bio-Info Pathways (Life Sciences)**
 - Hierarchical Networks
 - Scale-free Networks



Topology Data Model

- **Data model to store *persistent* topology**
 - Easier to check for data consistency in this model
 - Example: when the road moves, the property boundary automatically moves with it
- **Topology Data Model and Schema**
 - Describes how different spatial features are related to each other
 - A land parcel shares the boundary with a road
- **10g continues to support transient topology**
 - Topology computed on demand
 - Customers have choice of 2 topology management capabilities



GeoRaster

GeoRaster

- A new data type to store raster data
 - Satellite images, remote sensing
- An XML schema to store metadata
 - Data source, layer information
- Georeferencing system
 - Relates image pixels to a longitude/latitude on Earth's surface



Functionality

- Open, general purpose raster data model
- Storage, indexing, query & analysis of raster data
- No size limit for each raster object
- Publish as JPEG, GIF images
- Compression support (New with 10g Release 2)
 - JPEG baseline (lossy)
 - DEFLATE (lossless)

Geocoder

- Generates latitude/longitude (points) from address
- International addressing standardization
- Formatted and unformatted addresses
- Tolerance parameters support fuzzy matching
- 100% Java, open and scalable
- Record-level and batch processes
- Data provided by leading data vendors

Routing Engine

- Enables the hosting of XML-based Web services that
 - Given a route request that includes start location and an end location (address information or latitude/longitude), returns route information (which can include directions, driving distances, estimated drive times, and geometry information) between the two locations
 - Given a batch route request consisting of a single start location and multiple end locations, can return information (driving distances and estimated drive times) for each of the start and end location pairs
- Supports international routing
- Integrated with geocoding engine capability

eLocation Quick Start (New for 10g Release 2)

- Location service Java and XML APIs
- Enables application developers to quickly and easily deploy mapping, geocoding, and routing services right “out of the box” from data stored in Oracle Spatial
- Ships with sample HTML interfaces to jump-start creation of driving directions, mapping, and geocoding applications
- Sample data & data sets in Oracle Spatial 10g format available from leading data providers
 - Visit <http://www.oracle.com/technology/products/spatial> for more info
- May be used by OracleAS MapViewer, many third party mapping tools, or user-developed applications

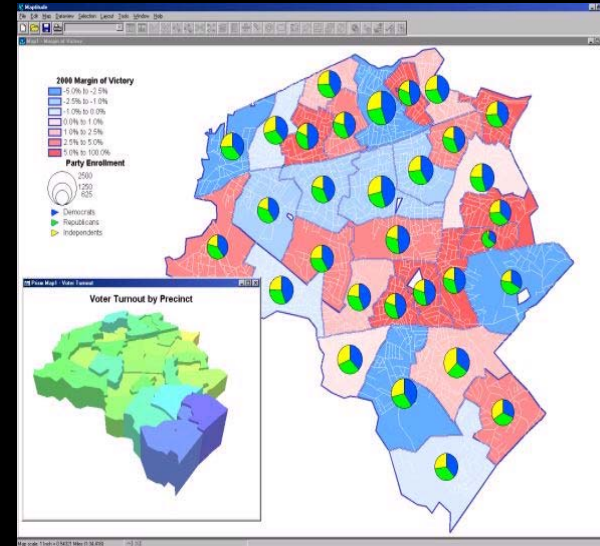
Spatial Analytic Functions

- **Discovery based on Spatial Patterns**

- Explicitly materialize spatial relationships

- **Usage**

- Insurance risk analysis, crime analysis
- Demographic analysis, customer profiling
- Epidemiology, facility placement
- Insurance risk analysis:
 - cluster house-holds based on high risk neighborhoods
- Identify business prospects across a region:
 - examine the average incomes across different regions of the space



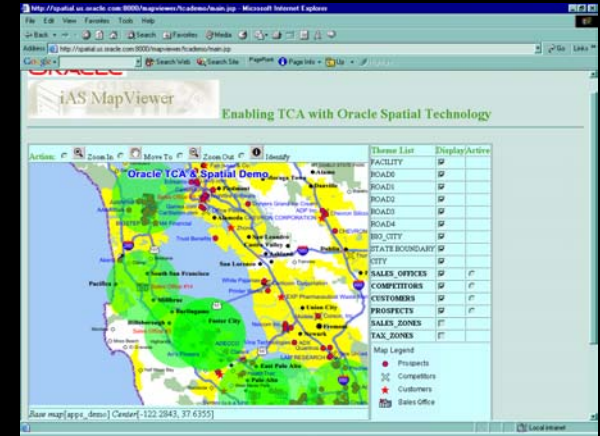
Oracle Application Server 10g MapViewer Enhancements

Oracle Application Server 10g MapViewer Enhancements

- Note: MapViewer is a component of Oracle Application Server

New Features:

- Support for Spatial 10g new features
 - GeoRaster
 - Topology data model
 - Network data model
- Workspace Manager support
- SVG, JPEG, transparent PNG, HTML imagemap support
- Open Geospatial Consortium's Web Map Service 1.1 interface
- Dynamic coordinate transformations, multiple datasources per map, and temporary styles in a map request



Oracle Locator & Oracle Spatial: 10g Release 2 Enhancements

Oracle Locator: 10g Release 2 Enhancements

- Coordinate system support for European Petroleum Survey Group (EPSG) specification
- Explicit coordinate transformations (new to Locator in 10g Release 2)
- Utility package (new to Locator in 10g Release 2)
- Tuning functions and procedures (new to Locator in 10g Release 2)

Oracle Spatial: 10g Release 2 Enhancements

- Coordinate system support for European Petroleum Survey Group (EPSG) specification
- eLocation Quick Start
- GeoRaster compression
 - JPEG baseline (lossy)
 - DEFLATE (lossless)
- Topology Data Model – feature level spatial transactions
- Network Data Model – PL/SQL interface for creating, editing, analyzing network data
- Routing engine support for Western Europe
- Reverse & batch geocoding
- RDF Data Model

Summary

Oracle Spatial, Locator and MapViewer

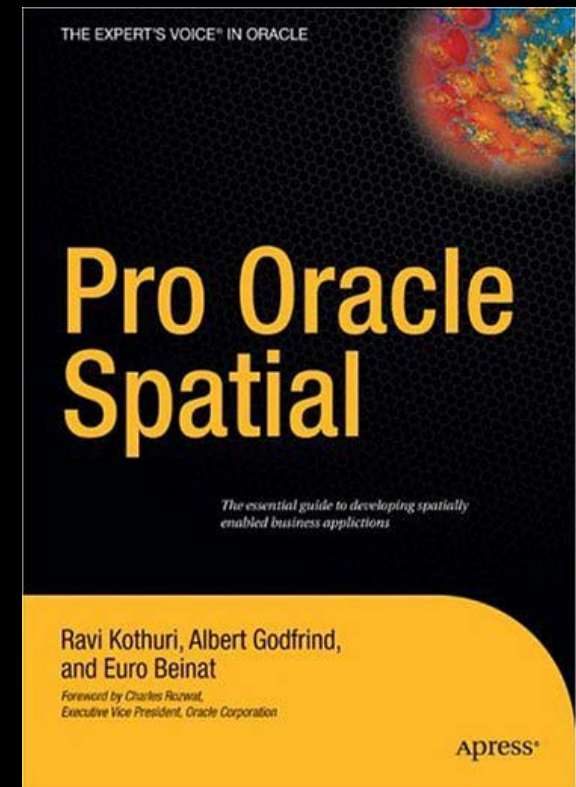
- One platform for general and specialized location applications
- Manage ALL your spatial data with scalability, security, performance and reliability
- Leverage industry-standard SOA platform
- Utilize choice of GIS and LBS partner tools

Location-Enable Your Enterprise

To find out more...

<http://www.oracle.com/technology/products/spatial/>

The screenshot shows a web browser window with the address <http://www.oracle.com/technology/products/spatial/index.html>. The page features the Oracle logo and "TECHNOLOGY NETWORK" header. A navigation menu includes "PRODUCT CENTERS", "TECHNOLOGY CENTERS", and "COMMUNITY". The main content area is titled "ORACLE DATABASE 10g Oracle Spatial & Oracle Locator: Location Features for Oracle Database 10g". It contains a detailed introduction to the location features, a "Technical Information" section with a link to "Spatial and Locator—Data Sheet (HTML)", and several sidebars. The "Oracle Spatial and Locator Resources" sidebar lists links for Documentation, Software, Sample Code, Training, and Discussion Forum. The "Quick Picks" sidebar highlights recent updates, including "New for 10g Download PC! Geomatics raster data loader and free viewer" and "New for 10g Sample data from NAVTEQ for Oracle Spatial geocoder". The "News & Information" sidebar lists an update to "What People Are Saving".



Examples, white papers, downloads, discussion forum, sample data, customer successes, partner information, more

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