Geospatial Practices in National Development Projects

Latin America Geospatial Forum 2016

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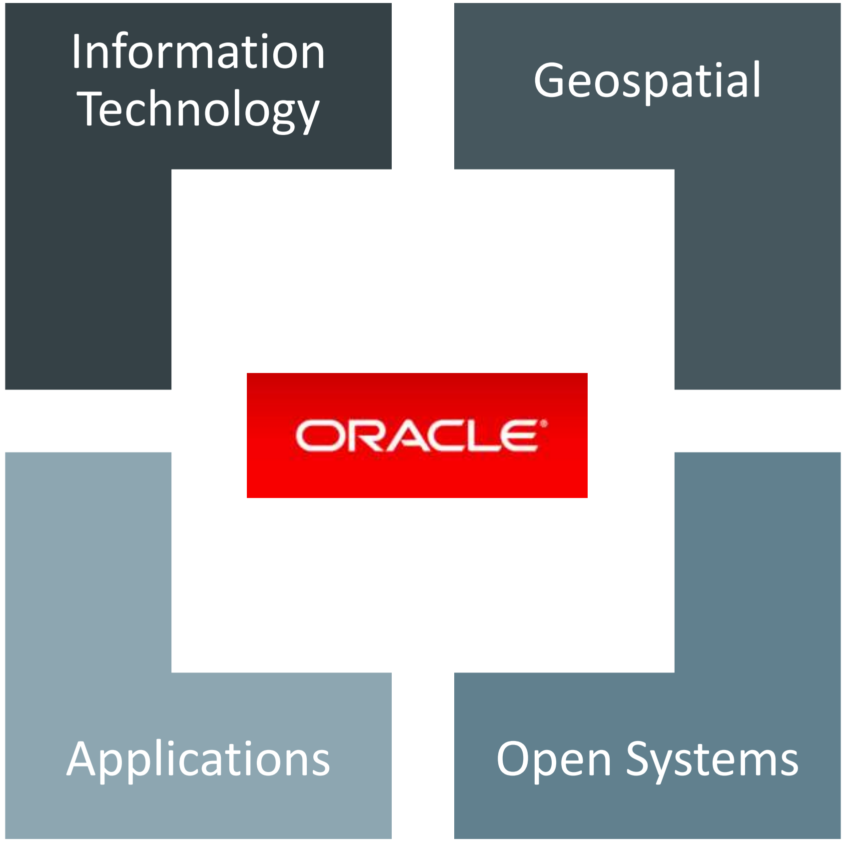
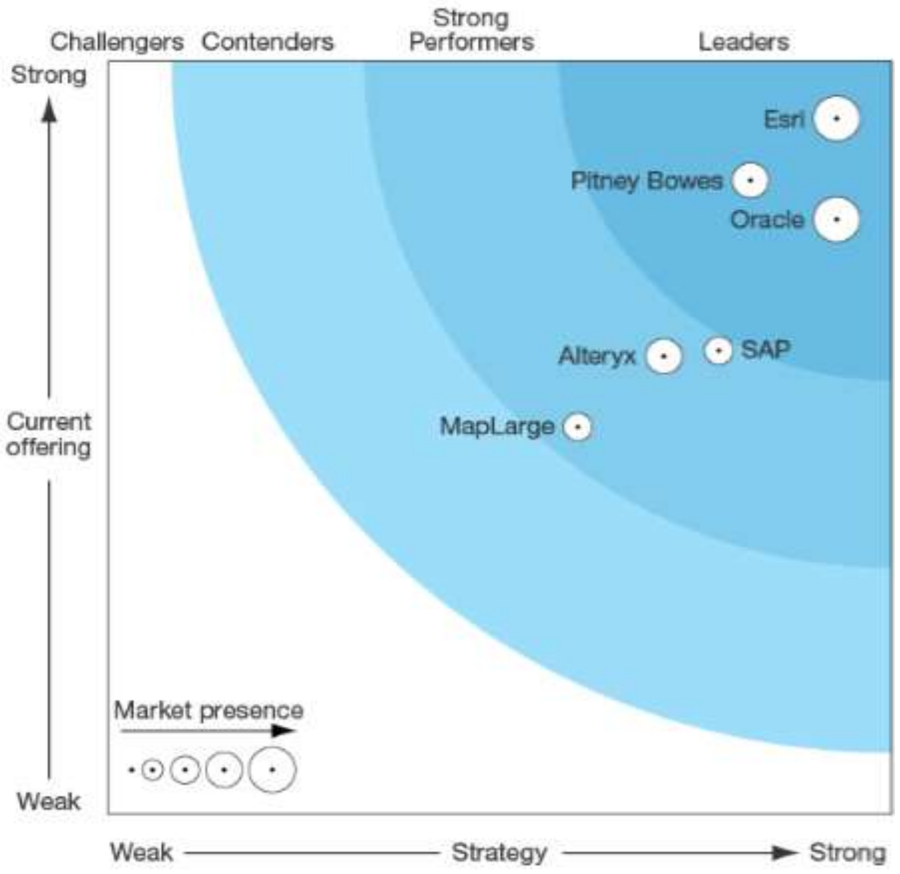
How do we fit in?



The Forrester Wave™:
Geospatial Analytics Tools And Platforms, Q3 2016



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"While hardcore GIS professionals may start their work in other applications, when they want to solve spatial problems in production and with web- and IoT- scale data, Oracle gives them the platform to do so."

Analysts: Rowan Curran with Holger Kisker, Ph.D. and Emily Miller
September 1, 2016

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Five major challenges of spatial infrastructure projects

- Integrating spatial data into operational and organizational processes
  - Automated workflows between systems, rather than spatial data in silos
- Interoperability between servers and various clients
  - Supplying more than one solution with geospatial data
- Managing various kinds of geospatial data
  - Vector data in 2D and 3D, raster imagery, point cloud data plus metadata
- Scalability
  - Supporting larger user communities and larger data volumes
- Application-level integration through maps
  - Using Location information and maps in business applications

Program Agenda

1. Process Integration
2. Interoperability
3. Heterogeneous Data
4. Scalability
5. Application Integration

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Program Agenda

1 Process Integration

2 Interoperability

3 Heterogeneous Data

4 Scalability

5 Application Integration

Integrating spatial data into business processes

Typical issues today

- GIS systems disconnected from operational systems
  - Dedicated, specialized systems
  - High training cost
  - Costly operations and maintenance
- Manual effort in delivering location-related information
  - Labour intensive, time consuming, error prone
  - Not scalable for large infrastructure projects
- Not making use of the full value of geospatial information

Solution approach

With spatial data seamlessly integrated

- Implementing automated workflows across systems
  - Including the GIS System(s)
- Making use of standard IT development paradigm
  - Structured SOA approach, resulting in reduced cost through reuse
  - Using graphical design tools for rapid application development
  - Deployment through Cloud architecture
- Operational benefits
  - Real-time monitoring
  - Integrated administration
  - Comprehensive security mechanisms

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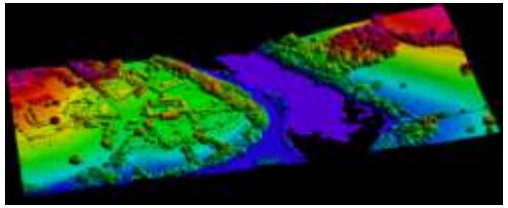
Ordnance Survey Ireland
Prime2 Spatial Data Re-engineering

BRIEF ORGANIZATIONAL OVERVIEW

Ordnance Survey Ireland is the Irish national mapping agency.

- Established in 1824, OSi is mandated to create & maintain the definitive; authoritative spatial reference platform for the Irish State



BUSINESS CHALLENGES / OPPORTUNITIES

A database platform that can provide scalability, redundancy and performance for the supply of national spatial datasets

- The use of Exadata to allow for the analyses of large data sets.
- The ability to publish our geospatial platform via the semantic web
- Replacement of current human workflows with automated processes for map generation

ORACLE TECHNOLOGIES USED

- Oracle Database 12c Enterprise Edition Exadata
  - Spatial & Graph, Workspace Manager
  - Partitioning, RAC, Tuning Pack, Diagnostics Pack
  - Oracle Enterprise Manager
- Oracle Fusion Middleware
  - MapViewer, WebLogic, Bpel

BUSINESS BENEFITS REALIZED BY ORACLE SOLUTION

- The implementation of Oracle engineered systems had a number of key benefits
  - Single source for all spatial data
  - No manual update cycles for silo systems
  - Scalability, Reliability, Performance
- The new features in 12c Spatial and Graph will allow for the automation of products, dramatically reduced the number of man hours required and decreased the time to market.
- Oracle Enterprise Manager reduces the workload for our DBA & Middleware team.

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Interoperability

Typical issues today

- More than one GIS or mapping component in the organization
  - Need to share data online
- Adding more components to the infrastructure
  - Specific tools for various purposes
  - Open source or commercial software
- Need to access location information from business applications
  - Providing valuable data to non-GIS user community
- Demand to integrate maps and data from cloud-based services
  - making use of available datasources

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Solution approach: Open standards on all levels

OGC standards for Geospatial data

- Using open standards at database level
  - OGC Simple Features specification, ISO SQL/MM
  - Allowing data access from many tools and components through SQL
  - Conversion to and from GML or KML
- Using OGC Webservices standards
  - WMS to provide maps, WMTS to provide map tiles
  - WFS and WFS-T to retrieve or manipulate data
  - WCS for coverages (data together with their detailed descriptions)

Solution approach: Defacto standards and Cloud Architecture

- Integration of microservices through
  - REST APIs
  - NODE.js engine, relational, NoSQL
  - JSON / GeoJSON data representation

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Managing various kinds of geospatial data

Typical issues today

- Different kinds of data are held in files or speciality data stores
  - Need different skill sets for each specialized system
  - Making integrated analysis difficult
- Support for new datatypes is required
  - LiDAR data collection growing particularly rapidly
- Finding the appropriate dataset is challenging
  - Metadata are either incomplete or not accessible/searchable
- Datasets are semantically inconsistent
  - Identical terms do not necessarily mean the same thing

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Solution approach: Data integration

Combining all kinds of geospatial data, metadata and attribute data

- Integrated storage allows joint analysis
  - Without moving potentially large datasets between systems
  - Including metadata for efficient search
- Database offers semantic technologies for further analysis
- Using a single system simplifies application development significantly
  - Same development paradigm and toolset
- Operational benefits
  - Consistent platform for administration
  - Comprehensive security mechanisms

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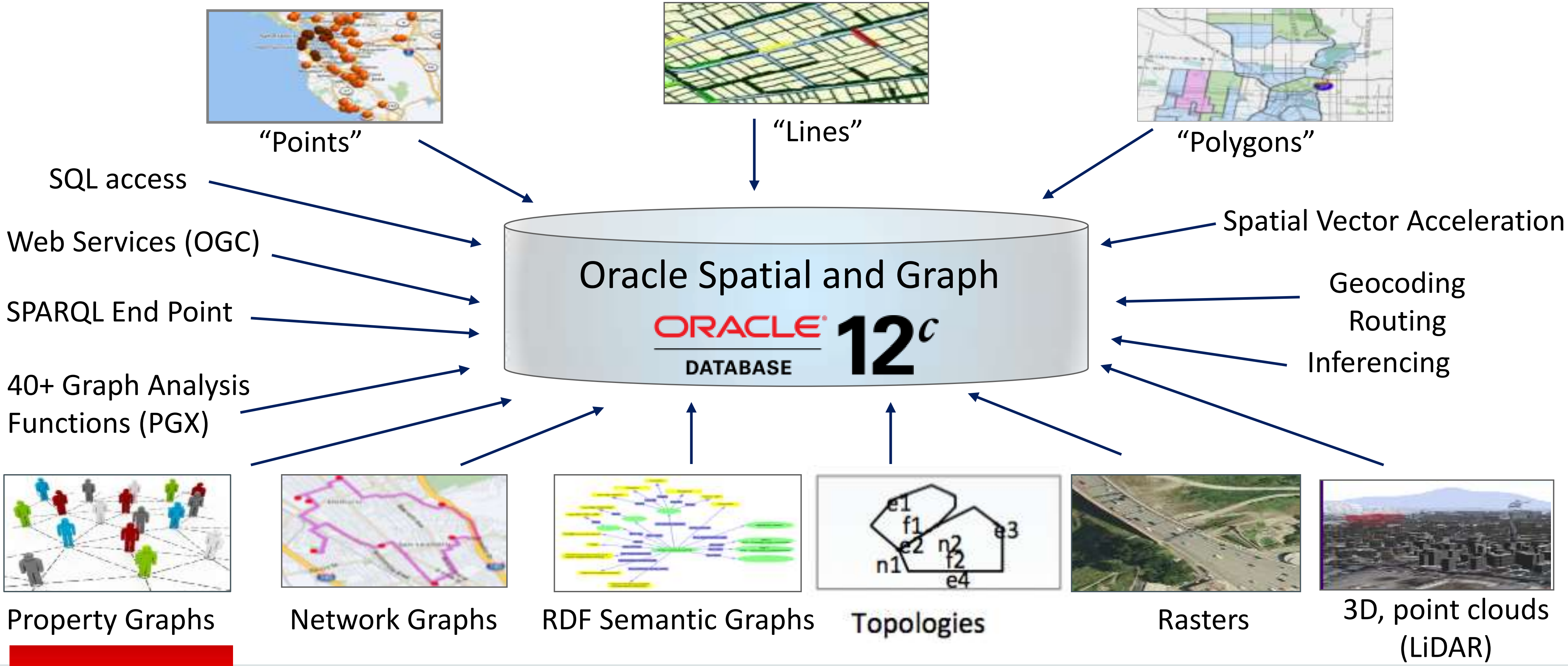
Shared “multi-model” Spatial Database

Location and Graph analysis with Secure, scalable storage for enterprise data



Case Study: Crossrail, UK

Shared Spatial Data Warehouse, Bentley and Esri clients

- Largest Engineering & Construction project in Europe
- 21 km twin tunnel under City of London, 90 km of new railway line
- Visualization and Analysis, incl. 3D data management
- Oracle Spatial and Graph as “single source of truth”
  - Database for 300+ staff and contractors as well as the public
  - Serving Bentley Map, Geo Web Publisher, ESRI ArcMap
  - 500+ layers of information, 45,000,000+ records
  - integrated security
- Using London Survey Grid for accuracy

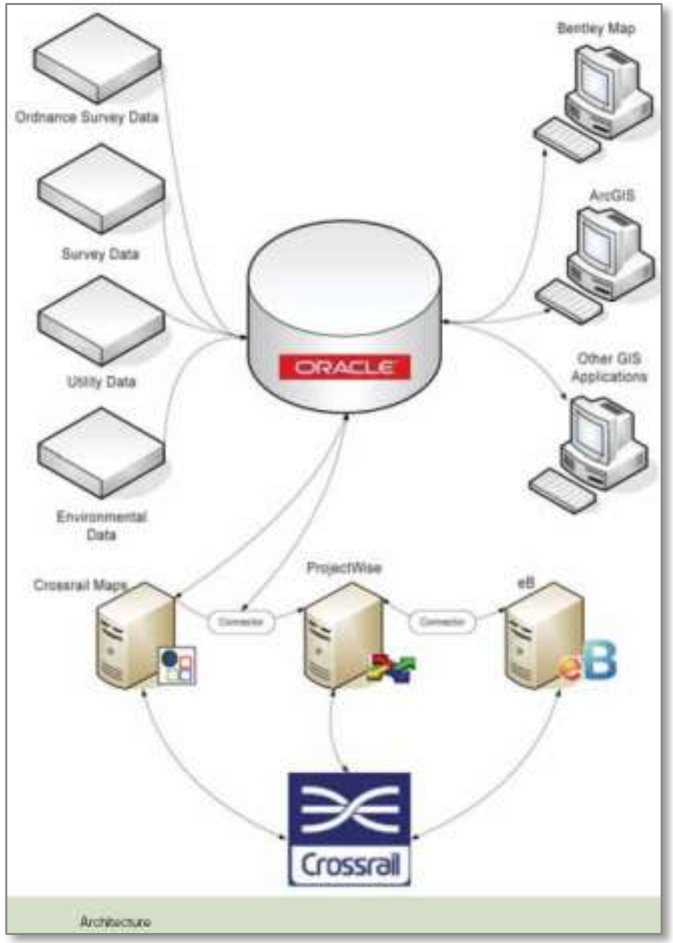
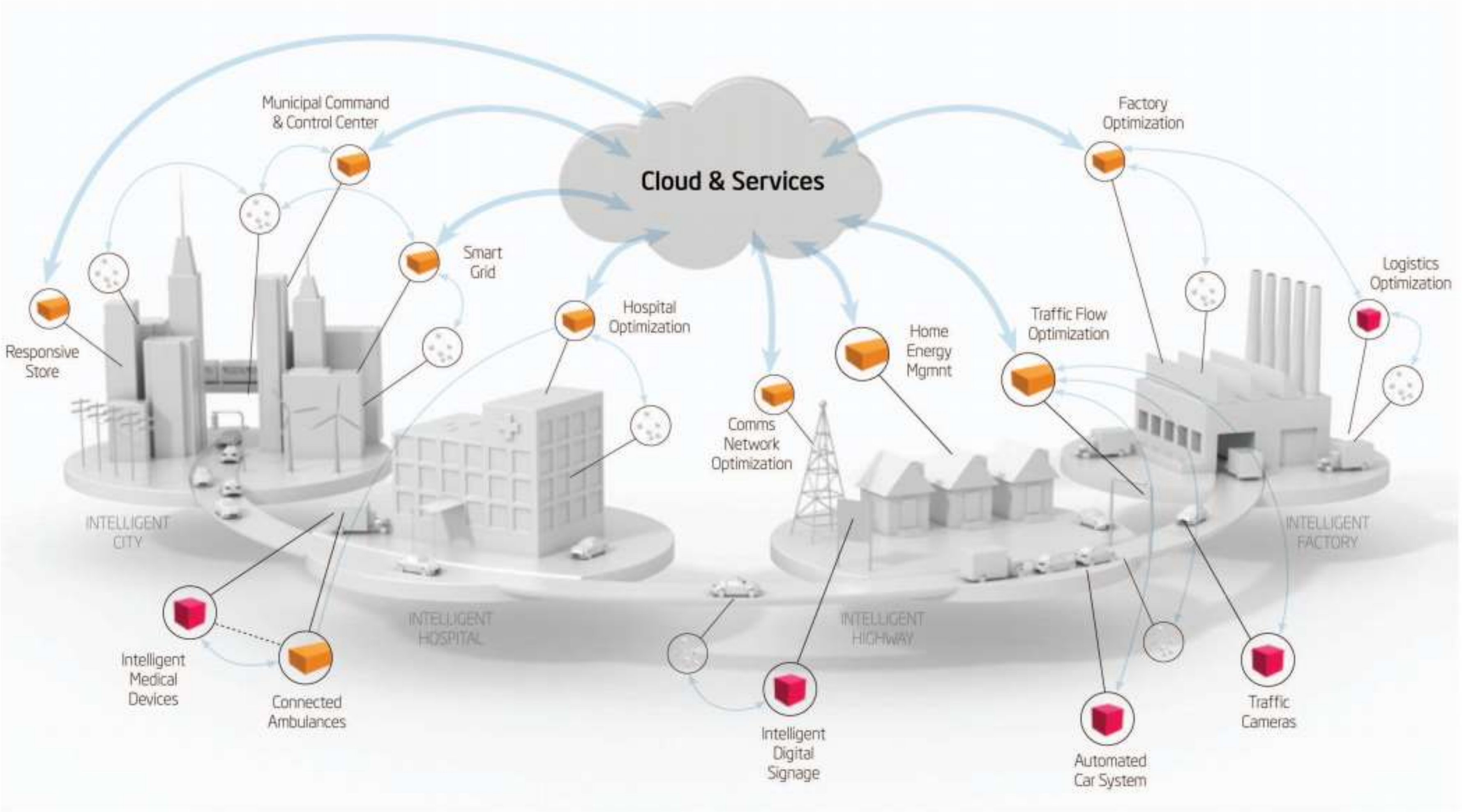


Image courtesy of: Crossrail, UK

Integration through services and microservices



Program Agenda

1. Process Integration
2. Interoperability
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4. **Scalability**
5. Application Integration

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Scalability

Typical issues today

- Massive increase in spatial data collected
  - Through sensor measurements, sometimes coming in as streams (eg. GPS)
  - Through growing popularity of 3D data
- More demand for highly parallel processing
  - Driven by Big Data scenarios
- Growth of user communities requiring location information
  - Mobile workers
  - Business users

Solution approach: Big Data, Database and Engineered Systems

With spatial data seamlessly integrated

- Use mature database capabilities such as
  - In-database processing (PL/SQL, Java, JSON)
  - Parallelism and Clustering
  - Partitioning
  - Compression
- Use horizontal scalabililty of Big Data Hadoop or NoSQL where appropriate
- Deploy optimized combinations of hard- and software
  - Using capabilities of Oracle Exadata, Big Data Applioance
  - Move towards dynamic allocation of resources through cloud computing

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Case study: AHN2 dataset (Rijkswaterstraat, NL)

- LiDAR data acquisition at 6-10 pts/m²
  covering all of the Netherlands
- 12TB of data, >60000 LAS files
- Analysis on Exadata X4-2 full rack
  – Direct load of 640bn records in 4h40
  – Requiring 2.25TB storage in database
  – Query on compressed data („query high“ mode) without indexes, using partitioning
  – Typical data extraction queries running sub-second mostly, scaling extremely well
  – Full paper will be published in „Computers & Graphics“

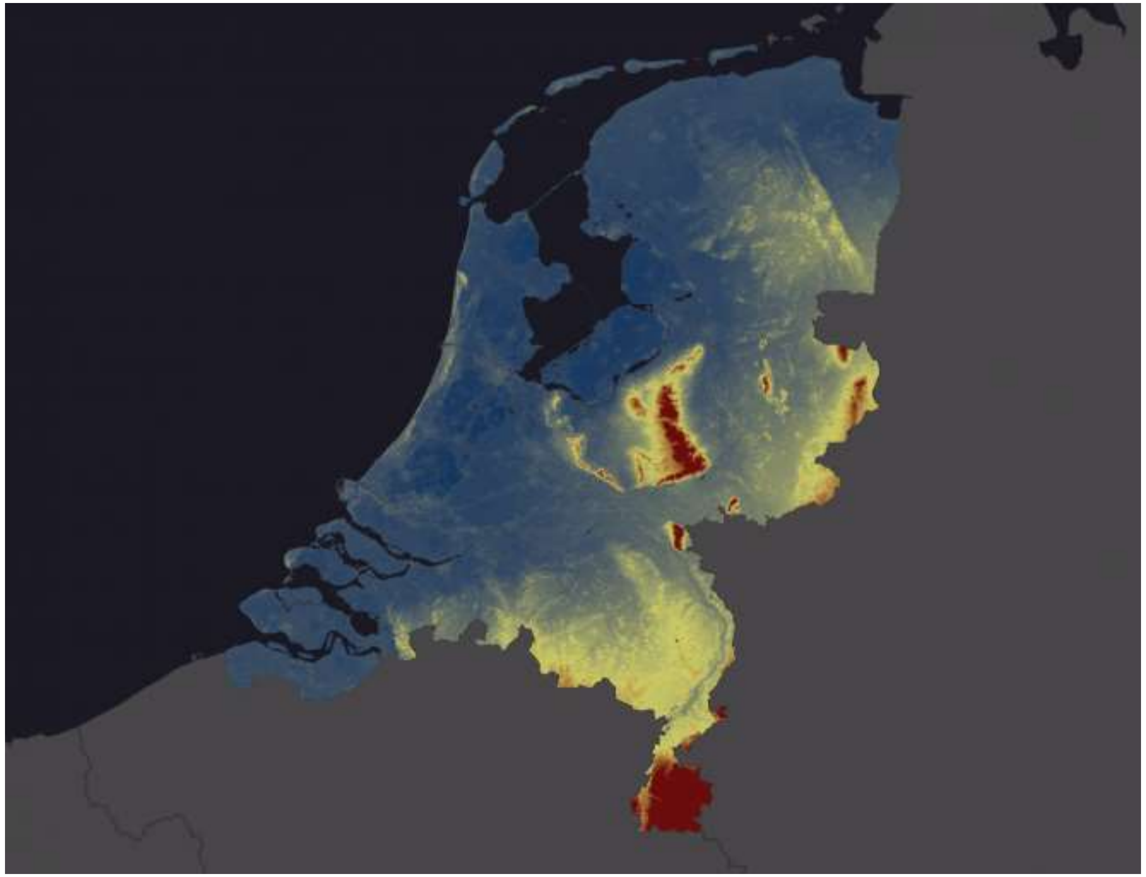

Image courtesy of: PDOK, NL

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Application-level integration

Typical issues today

- Mapping systems disconnected from business systems
  - Business users would already benefit from simple maps
- Lack of integrated use of location information in decision-support systems
  - Missing relevant relationships
- Local datasets not necessarily fit for purpose
  - Integration of cloud-based services and microservices may be more adequate

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Solution approach: Applications with maps pre-integrated

Considering location information as strategic asset

- Use data models with spatial data explicitly included
  - Not only implicitly as addresses
- Accommodate external systems and 3rd party datasets
  - Street network for Geocoding, Routing, as well as statistical/socio-demographic data
  - Wide range of languages, tools and APIs – SQL, JAVA, Scala, Ruby, Python, REST, etc.
  - Standards-based (HTML5, JSON, OGC Web Services, ...)
- Choose or build applications with maps pre-integrated
  - Common visualization component
  - Cloud-based services pre-integrated

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Case study: DPR COSEA

- Consortium building high-speed railway line from Tours to Bordeaux
- centralized spatial data repository for collaborative construction planning, synchronization and analysis
  – Project Management , Document Management, GIS, Business Intelligence
  – high-availability platform, serving 2500 users
  – Autodesk as GIS client, using LRS
- Primavera P6 for project portfolio management consolidating all project plans
- Partners: IBM, Qualora

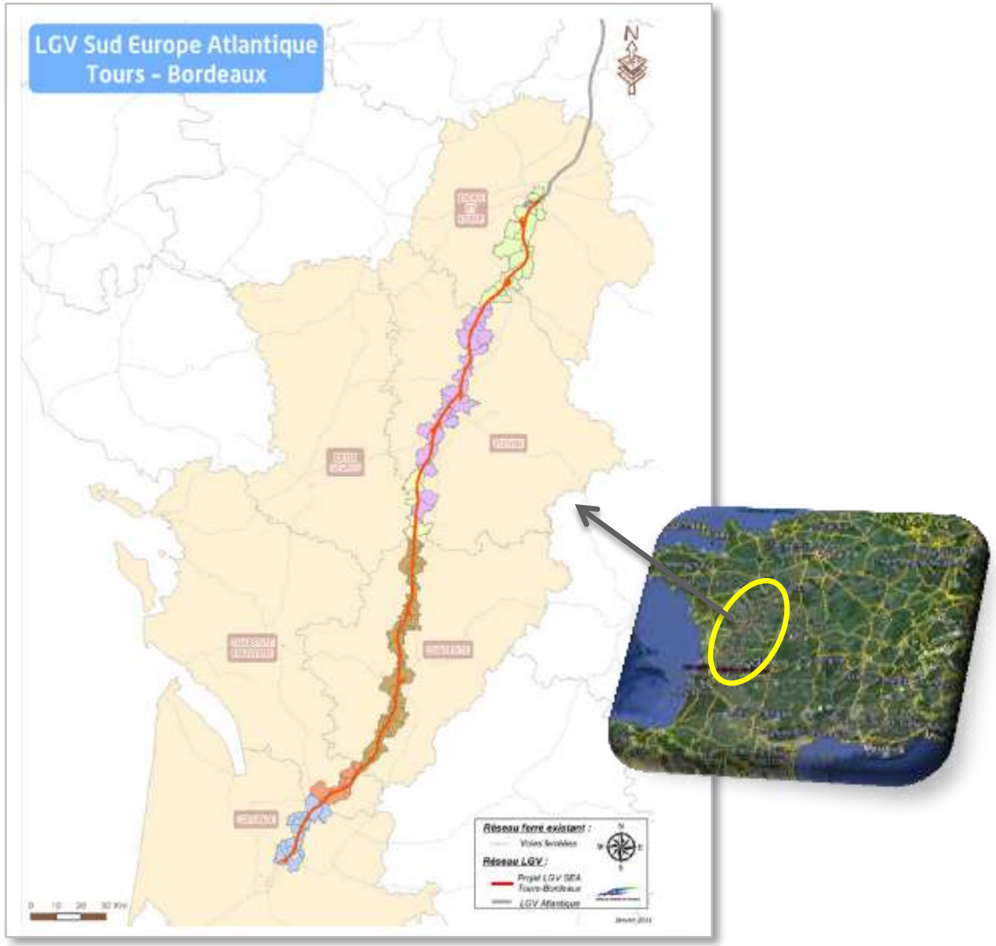


Image courtesy of: VINCI, France

Case study: Unicoop Firenze

BRIDGE Consulting
Information Technology

OVERVIEW

- Incorporates all of Business Intelligence systems and all of departmental systems
- Supports Marketing, Development and Management divisions

CHALLENGES / OPPORTUNITIES

- Need to have a simple to use, standardized, complete and shared solution
- Need to integrate disparate data sets (statistical & internal)
- Need to relate more than 1.2 Million records with lat/long coordinates
- Need to decrease operational time cost

SOLUTIONS

- Oracle Database Enterprise Edition on Exadata ¼ Rack
  - Spatial Option with Network Data Model, Partitioning
- Oracle Fusion Middleware
  - MapViewer, Oracle Business Intelligence Enterprise Ed.

RESULTS

- Consolidation of geo data and network data model
- Standardization of all addresses and coordinates in a consistent format and datum
- The Organization now better understands activities in context of location and directs marketing and assortment policies of the stores
- The Organization now explains the business events dependent on territorial characteristics
- The solution allows to save 35% of operational costs of the people involved

Summary

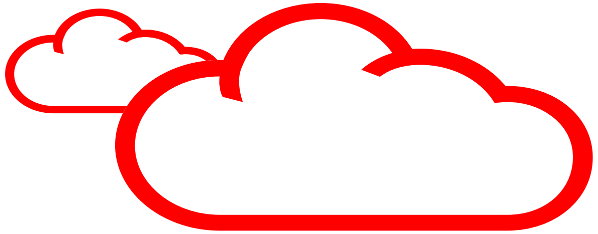
Commercial-quality Spatial technology for every Platform

Spatial NoSQL, Hadoop, Spark

Spatial Database

Cloud

Commercial-quality Spatial technology for every Platform

Oracle Big Data Spatial and Graph		Oracle Spatial and Graph Database	Oracle Public Cloud
			

Summary

Benefits of integrated spatial technologies

- Integrated use of geospatial data in the IT infrastructure
  - Adding value by combining all kinds of 2D and 3D data with attributes and metadata
- Reduced operational cost
  - Making use of IT and data management capabilities of database and middleware
- Minimized strategic risk
  - Enabling interoperability through open standards support
  - Using capabilities of a mature technology stack such as scalability, reliability, security
- Reduced development effort
  - Allowing developers to concentrate on business requirements rather than infrastructure
  - Using an integrated, consistent IT architecture with common paradigms, tools and APIs

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