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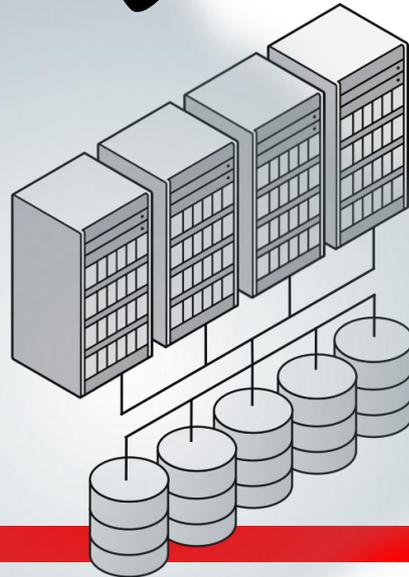
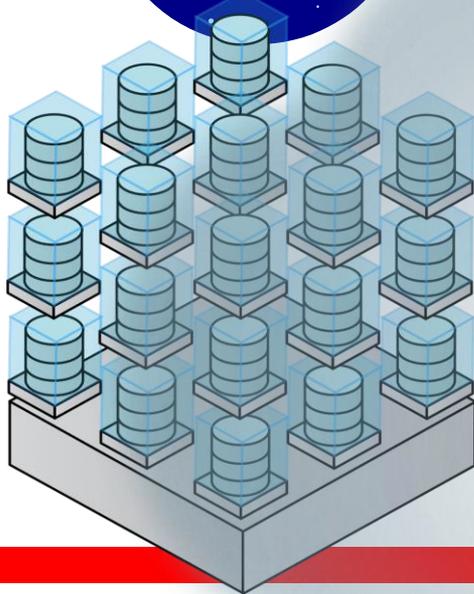
Sustainable Development with Geospatial Information Leveraging the Data and Technology Revolution

Steven Hagan, Vice President, Server Technologies

Oracle Key Partner in China = Wuhan University

- Joint Research Projects
- Met 2 Recent Graduates here at UN-GGIM
 - Now at Geoway and WudaGeo

ALL APOLLO < 1 Cell Phone <<< Compute Clouds



It is no longer about

Compute Power

It is all about the

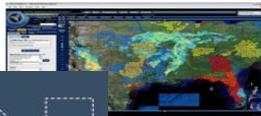
**DATA
&
BIG DATA**

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Data Volume & Variety Explosion Continues - Terabytes, Petabytes, Exabytes, Zettabytes



Aeronautical
Geodesy and
Geophysics
Geographic Names
GEDINT Analysis
GEDINT Standards
Imagery Sources
Nautical
Hydrography and

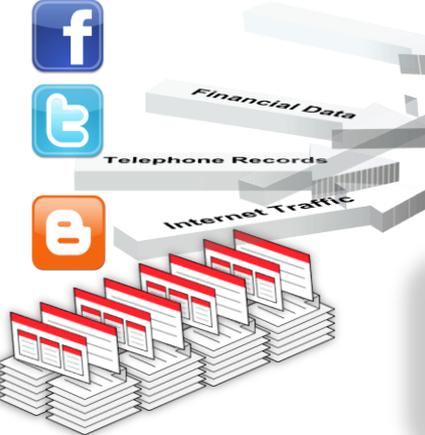


- Sensors, RFID, LIDAR, Raster, 3D, Crowdsourcing, SDIs
- Terrain Models and 3D city models for planning, maintenance, emergency response, tourism
- New data products for consumers, mobility, defense, intelligence, land and water mgmt, transportation, environment, agriculture, and constituent services
- Tagged Data , Semantics , Ontologies -- Location is a Powerful Organizing Principle
- Integrate Social Media (Video, Audio, Text, Wikis, Facebook, Twitter, Imagery) with Spatial; HADOOP Support
- 2020 = 35 Zettabytes Generated by Us

Sustainable Development: Geospatial at Core

External Data Sources

Transactional & Operational Systems
 Contents Repository
 Databases
 Web resources
 Blogs, Mails, news
 Crowdsourcing



Real-time Data Streams

Filter, Cleanse, Search, Query, Report, Visualization, Presentation

Text Files * Binary Images * XML * HTML * PDF * Excel * Map Files * Shape Files * User Sessions

Tables Relationships Charts Timelines Geospatial

Enterprise Data Management Infrastructure

Secured

GeoSpatial	POIs	Documents
Historical Records	Demographics	
	Customer Data	
	Call Records	

Automatic Responses and Publishing

SMS Console Alerts

EV Grid Management

Workflow Initiation

Real-time Dashboards

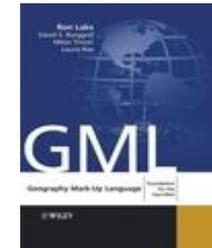


Spatial Data Infrastructure: Optimized By Using Standards

"We intend to complete development for a new suite of tools for developing the next generation of applications. And there are several interesting things with the next generation of tools, but perhaps the single most interesting thing about them is that for the first time a major application company is going to commit to an absolute standards-based development environment."

– Larry Ellison

- ISO
 - TC 211
 - TC 204
- Open Geospatial Consortium
 - Simple Features
 - GML
 - Web Services
- De-facto Standards
 - SHP, MGE, DXF, KML
- Professional Standards
 - ISPRS, FIG, WMO
- Java, .NET, Flash
- TAGGED METADATA – agree on tags

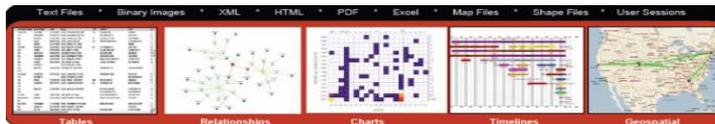


SQL3/MM Spatial

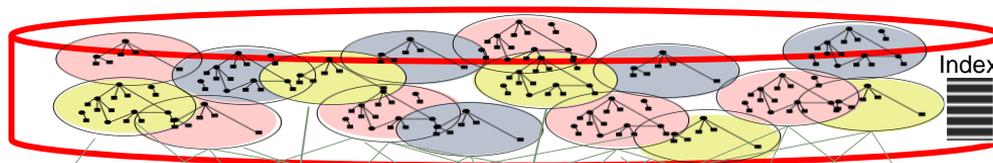
Leveraging Semantics (While Standards Evolving)

RDF / OWL used for Evidence-Based Decisions

Access & Presentation Layer



RDF metadata layer
(integrated graph metadata)



Data Servers



Data Sources / Types
Mobile Devices



Machine Generated Data



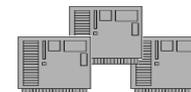
Social Media



Human Sourced
Information



Subscription Services



Transaction Systems

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Harmonizing Electronic Health Care Ecosystem

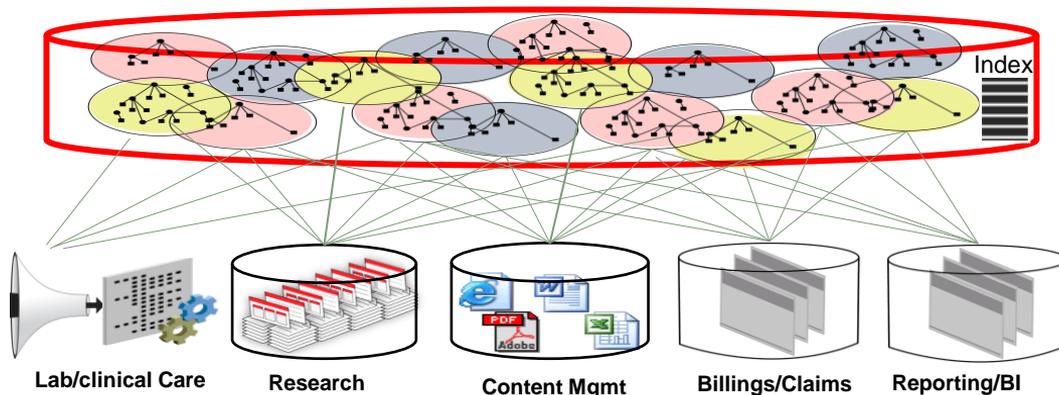
Evidence-Based Decision Making is Mandatory

Enterprise-wide, Patient-centric, longitudinal Record System



Domain Ontologies

- **SNOWMED ;Gene Ontology**
- **ICD; KEGG**

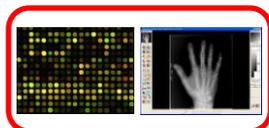


Data Servers

Data Sources /
Data Types



Social Media



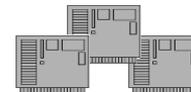
Medical Devices



Lab Information Systems



Subscription Services



Legacy Patient Records

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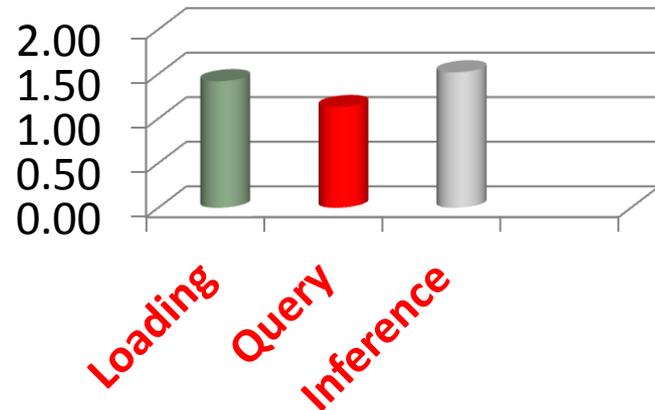
Fastest Big Data Graph Benchmark

1 Trillion Triple Benchmark with Oracle Spatial and Graph

- **World's fastest data loading performance**
- **World's fastest query performance**
- **World's fastest inference performance**
- **Massive scalability: 1.08 trillion edges**
- **Platform:** Oracle Exadata X4-2 Database Machine
- **Benchmark details:**
w3.org/wiki/LargeTripleStores

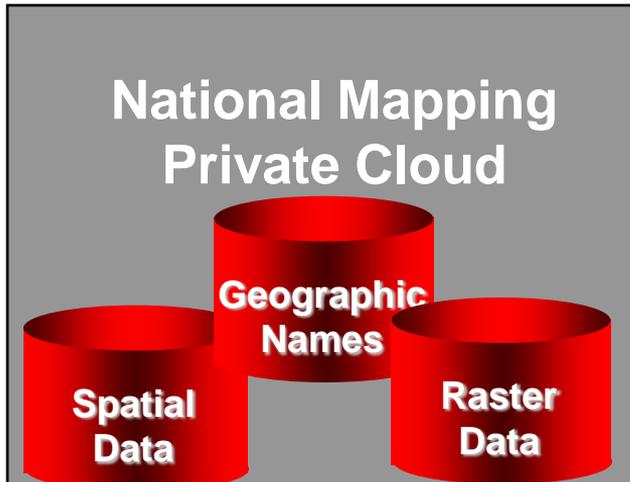
Oracle Database 12c can load, query and inference millions of graph edges per second

Millions of triples / Sec

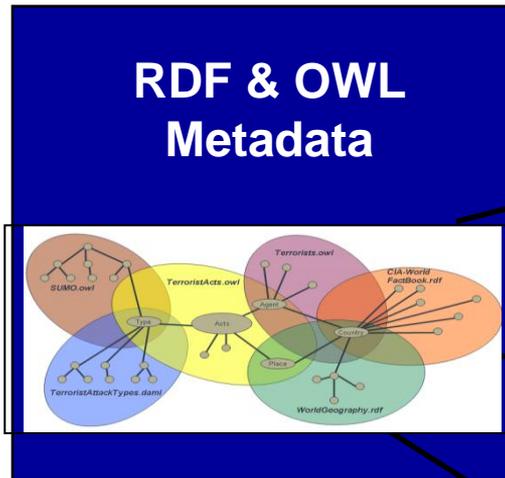


Ontology-driven Geospatial Applications - Actionable Knowledge

Application Ontologies



- Simple Features
- GeoRaster
- Topology
- Networks
- Gazetteers



- Data Integration
- National Map schemas
- Geographic names
- Temporal
- Naïve Geography



Environmental Monitoring

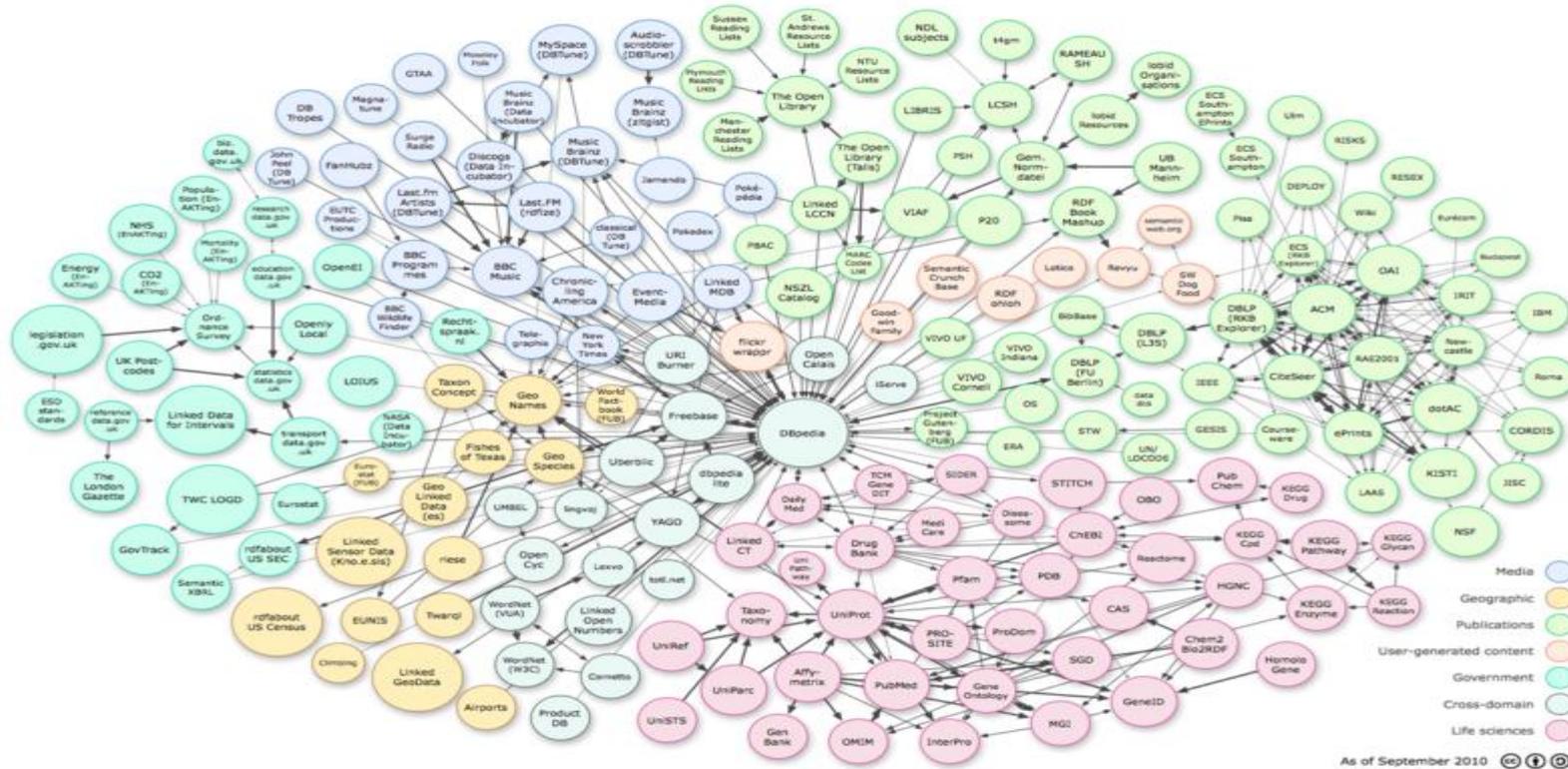


Famine Relief

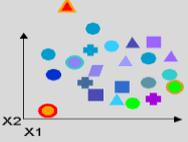
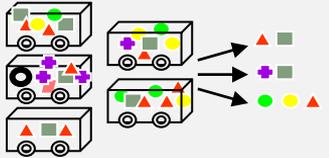
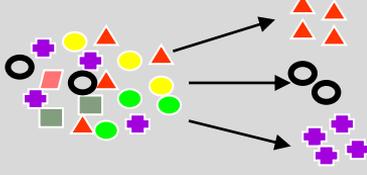
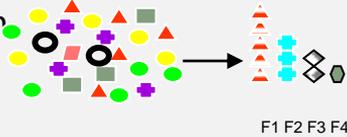


Disaster Response

Linked Open Data: Connecting With other Services and Clouds



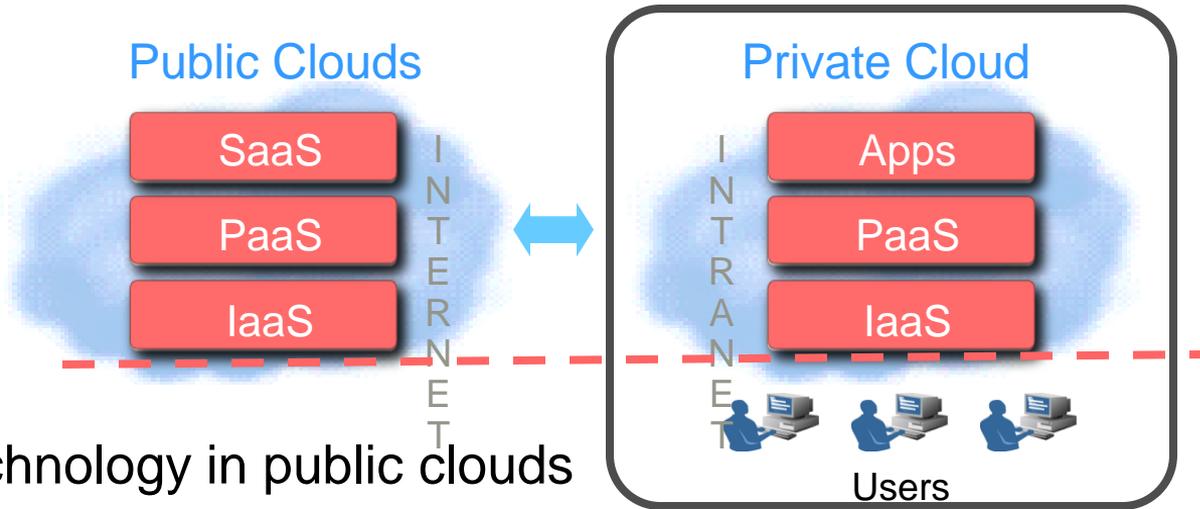
Discovery & Predictive Analysis; Data Mining Aggregation / Disaggregation / Slice / Dice

Problem Classification	Sample Problem
<p>Anomaly Detection</p>  <p>A scatter plot with a vertical axis labeled x2 and a horizontal axis labeled x1. Most data points are clustered in the center-left area. One point is significantly separated from the rest, located at the bottom right, representing an anomaly.</p>	<p>Given demographic data about a set of customers, identify customer purchasing behavior that is significantly different from the norm (Fraud?) . For Sensors, Events – problem? Good News?</p>
<p>Association Rules</p>  <p>Three shopping carts are shown on the left, each containing different combinations of items (represented by colored shapes). Arrows point from these carts to a collection of items on the right, illustrating the process of identifying items that are frequently purchased together.</p>	<p>Find the items that tend to be purchased together and specify their relationship – market basket analysis</p>
<p>Clustering</p>  <p>A collection of various colored shapes (circles, triangles, squares) is shown on the left. Three arrows point from different groups of these shapes to three separate clusters on the right, illustrating the process of segmenting data into groups.</p>	<p>Segment demographic data into clusters and rank the probability that an individual will belong to a given cluster. For customers / govt constituents, what do they want to know about?</p>
<p>Feature Extraction</p>  <p>A collection of various colored shapes is shown on the left. An arrow points to a set of four features on the right, labeled F1, F2, F3, and F4, illustrating the process of reducing data to its most important characteristics.</p>	<p>Given demographic data about a set of customers, group the attributes into general characteristics of the customers</p>

CLOUD Choices: Public, Private

Cloud Services

Run on private shared platform



Oracle Technology in public clouds

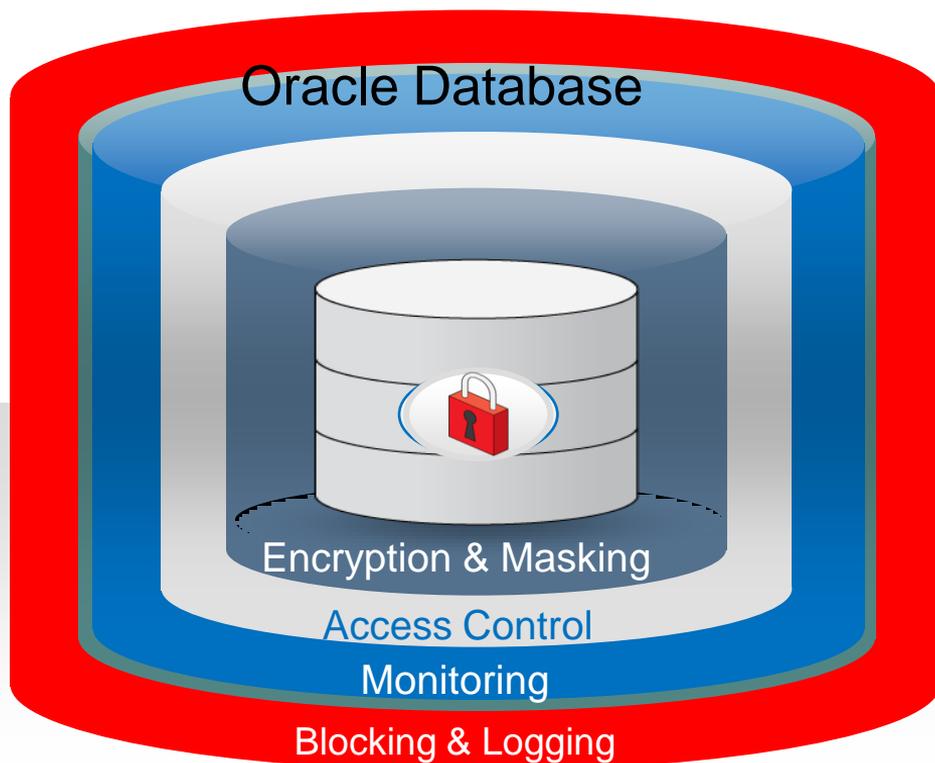
- Enterprise deployment option
- Power 3rd party public clouds

Oracle Private
Cloud Platform

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Integration: CYBERSECURITY is Major Challenge

Information Security and Privacy



Monitoring

- Configuration Management
- Audit Vault
- Total Recall

Access Control

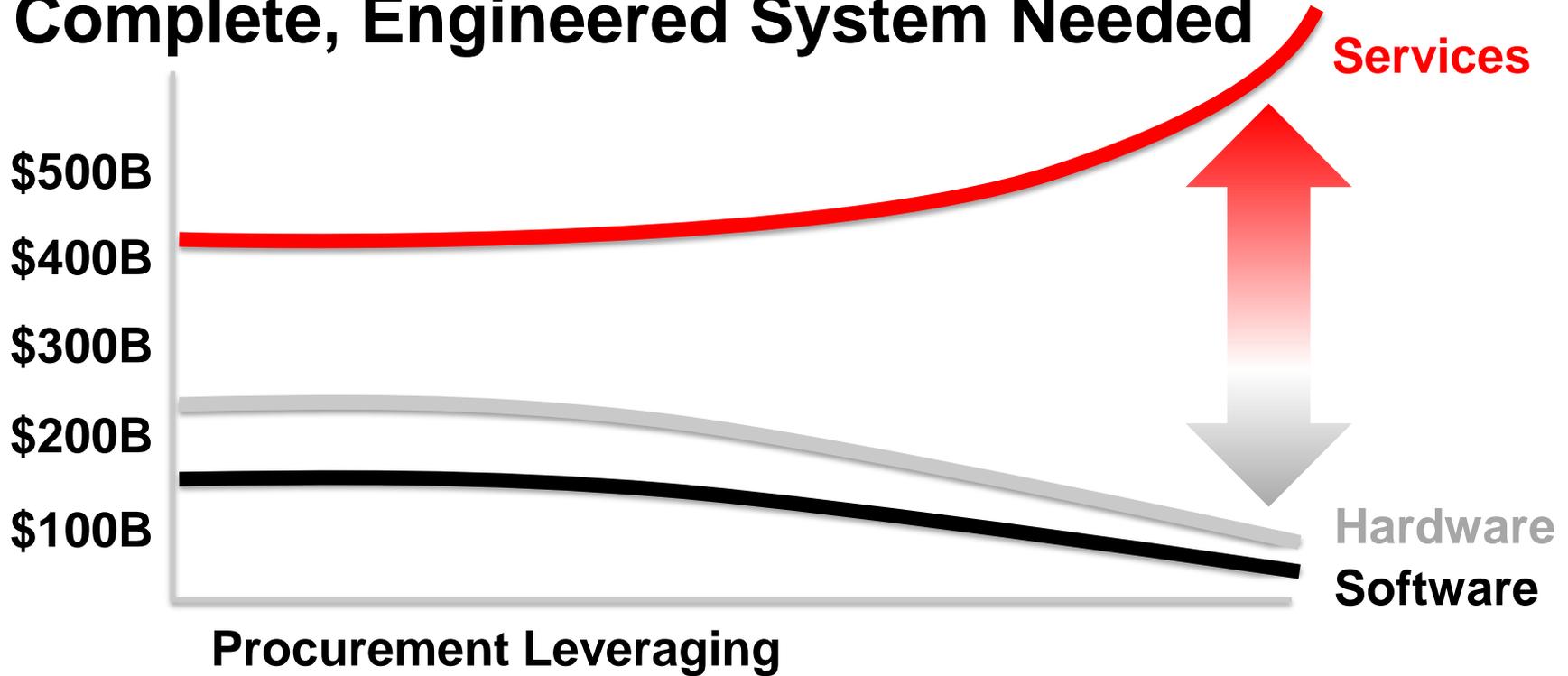
- Database Vault
- Label Security

Encryption & Masking

- Advanced Security
- Secure Backup
- Data Masking

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HW/SW Efficiencies: But Labor Costs Growing - Complete, Engineered System Needed



Open Source ? Does This Actually Cost More ? How soon is it Usable? Who Maintains it?



Time to Build
Optimizations
Maintenance

Integration of Reliable Consistent Data: Easiest: Use Complete Geospatial Enabled Platform

Big Data



Generated
Geographic
Information



Sensors
Streaming Data



Geo-
referenced
Video,
3D, LiDAR

Simplified Spatial IT



Support for
Open Standards



Spatial Database,
Application Server,
BI, tools



Support by
Leading Partner
solutions



Spatially-
enabled
Engineered
Systems



Deep Analytics



Real-time Spatial
Event Processing



Dense
Visualization



Spatial Analysis

On Premise, On Cloud, Shared Services



Shared GeoSpatial Services
Location Aware Everything

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