



ORACLE®

**Land Administration and Management:
Big Data, Fast Data, Semantics, Graph Databases, Security,
Collaboration, Open Source, Shareable Information Platform**

Steven Hagan, Vice President, Engineering

United Nation Analysis – July 2013

Initiative on Global GeoSpatial Information Management

Future Trends

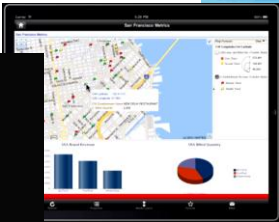
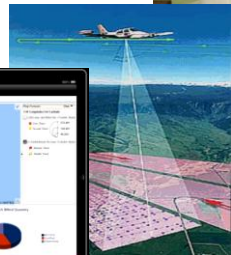
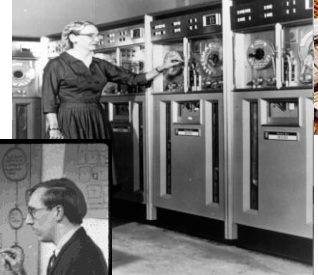
- Technology Trends in Data Creation, Maintenance, and Management
- Reliance on '*big data*' technologies
- The *right* information at the *right time*
- Machine Processable descriptions of data.
- Semantic technologies will play an important role
- Skills and Training: train the individuals is at least five years
- Requirement for enhanced data management systems



Spatial Technology Platform Evolution

Geographic Information Systems rely on the technology of the era

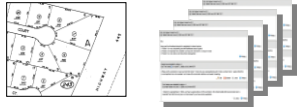
- Compass, telescope, sexton, paper maps
- Mainframe computers
- GIS Systems, Workstations
- GeoEnabled Infrastructure:
LiDAR, Raster, Video, Sensors,
Mobile, Streams, Cloud Computing
- Industrial Quality Platform



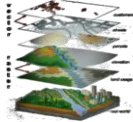
Land Administration and Management Workflow

Inputs

- Paper-based



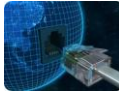
- Multiple GIS



- Multiple Databases



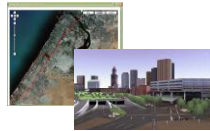
- Mobile, Web Based and Crowd sourced



- Sensors



- Geo-referenced Video, 3D, LiDAR



Complete Platform

- **Big Data, Fast Data Technologies**
- **Support ALL Data, Versioning**
- **Full Spatial Support, Persistent Topologies**
- **Semantics, Graph Technologies**
- **Powerful Analytic Capabilities**
- **On Premise, In Cloud or Hybrid**

Outputs

- Central Government
- Regional, State, City
- Organizational and Departmental
- Commercial Access
- Multiple Deliverables
 - Paper
 - Digital
 - Real-time
 - Demographic
 - Free and Open Source
 - Commercial for profit

Global Digital Data Growth: Far Exceeds Storage Mfg

Volume Growing leaps and bounds by **40+% YoY!**

You Must Make Policy Decisions on What Data to Keep



2009 = .8 Zetabytes

= .08 ZB Structured Data

= .72 ZB Unstructured Data

LEGEND



Structured Data



Unstructured Data

2020 = 35 Zetabytes

= 3.5 ZB Structured Data

= 31.5 ZB Unstructured Data*

(1 Zetabyte = 1 Trillion Gigabytes)

- Chart conservatively assumes a constant 9:1 ratio of unstructured data vs. structured data (based upon IDC's estimate that 90% of all digital data is unstructured).
- Chart does not reflect IDC's projection that unstructured data is currently growing twice as fast as structured data at the rate of 63.7% vs. 32.3% CAGR.

Source: IDC Digital Universe Study, A Digital Universe Decade – Are You Ready?, 2010

IN
60
SECONDS...

1 NEW DEFINITION IS ADDED ON URBAN

1,600+ READS ON Scribd

13,000+ HOURS MUSIC STREAMING ON PANDORA

12,000+ NEW ADS POSTED ON craigslist

370,000+ MINUTES VOICE CALLS ON skype

98,000+ TWEETS

20,000+ NEW POSTS ON tumblr.

13,000+ iPhone APPLICATIONS DOWNLOADED

QUESTIONS ASKED ON THE INTERNET...

100+ 40+ Answers.com YAHOO! ANSWERS

25+ HOURS TOTAL DURATION

600+ NEW VIDEOS YouTube

70+ DOMAINS REGISTERED

60+ NEW BLOGS

1,500+ BLOG POSTS

168 MILLION EMAILS ARE SENT

694,445 SEARCH QUERIES

1,700+ Firefox DOWNLOADS

695,000+ facebook STATUS UPDATES

50+ WORDPRESS DOWNLOADS

79,364 WALL POSTS

125+ PLUGIN DOWNLOADS

510,040 COMMENTS

320+ NEW twitter ACCOUNTS

100+ NEW Linked in ACCOUNTS

1 associated content NEW ARTICLE IS PUBLISHED

6,600+ NEW PICTURES ARE UPLOADED ON flickr

THE WORLD'S LARGEST COMMUNITY CREATED CONTENT!

Rapid Evolution of Geospatial Technology: Drivers:

- BIG DATA GENERATION: – Terabytes, Petabytes, Exabytes, Zettabytes, Yottabytes
 - Sensors, RFID, VIDEO, LIDAR, Raster, 3D, Internet Of Things
 - SDIs, INSPIRE, Terrain and City Models
 - Social Media, Tagged Data, History / Archive / Version Data
 - Linked Open Data – Persistent Relationships, Semantics, Ontologies
- BIG but Inexpensive Hardware:
 - CLOUD Platforms – Public and Private
 - More powerful – Clusters of Commodity Servers, Virtualization: = Greener
 - Massively parallel database machines – Software Enablement – e.g. Hadoop
- BIG, FAST, SECURE Software –
 - REAL TIME Analytics –Biggest value from fastest response – Streams and Events – Spatially Aware System – no separate GIS
 - Location Enable All Applications: ERP, CRM, Business Intelligence, Public Sectors
 - CyberSecurity, Encryption, Privacy
 - Support Standards – W3C, OGC, ISO, Wide Range

Shareable, Repurposable Location Data

- Data / Information –
 - Volume is too much to store it all
 - Velocity: Arriving too fast for humans – Must be Machine Processable
 - Must use Real Time Filtering and Analytics
 - This is the Big Data / Hadoop filtering & CEP - Complex Event Processing
 - Set policies on what to keep
 - Must share data among your many Organizations, enabling Aggregation
 - Geography/Mapping/Location, Health Care, Statistics, Commerce, Taxation
 - Sharing requires Interoperability and Semantics / Ontologies / LOD.
 - Versioning is needed for History, Time dimension

Land Administration: Absorb All Data

External Data Sources

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



Real-time Data Streams, Crowdsourcing



Search, Presentation, Report, Visualization, Query



Enterprise Data Management Infrastructure

Secured

GeoSpatial

POIs

Documents

Historical Records, Archives

Demographics
Customer Data
Call Records

Automatic Responses and Publishing



SMS



Console Alerts



EV Grid Management



Workflow Initiation



Real-time Dashboards

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You Get Order And Efficiency 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

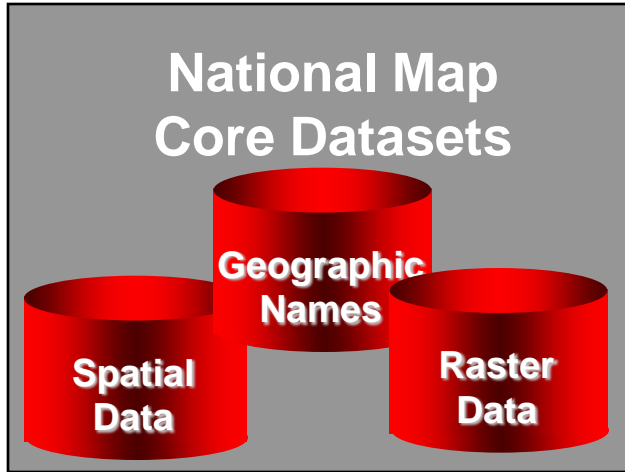
- ISO
 - TC 211
 - TC 204
- Open Geospatial Consortium
 - Simple Features
 - GML
 - Web Services
- De-facto Standards
 - SHP, MGE, DXF, KML
- Professional Standards
 - ISPRS, FIG, WMO
- Java, .NET, Flash
- TAGGED METADATA – agree on tags



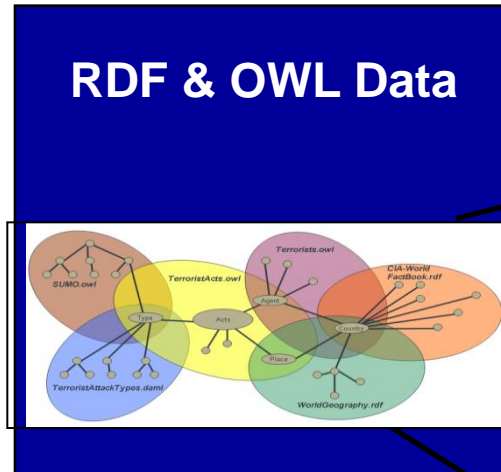
SQL3/MM Spatial

Ontology-driven Geospatial Applications - Actionable Knowledge

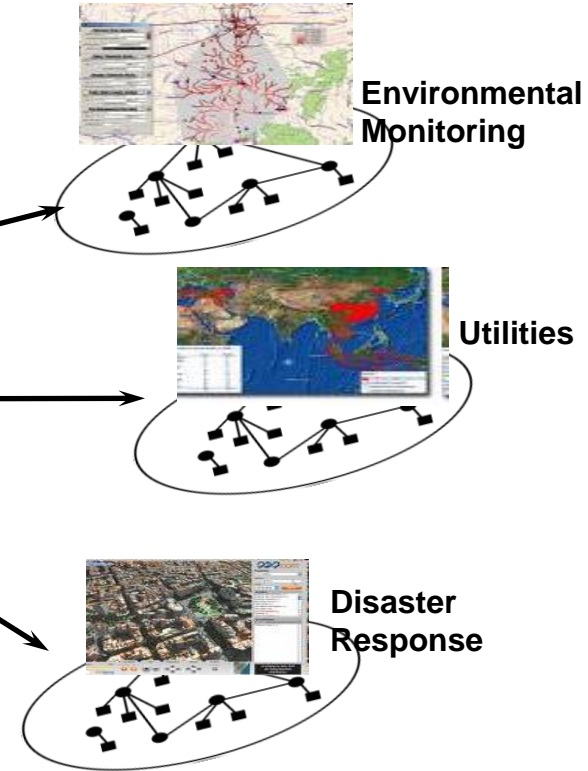
Application Ontologies



- Simple Features
- GeoRaster
- Topology
- Networks
- Gazetteers




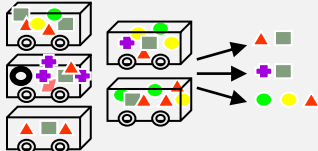
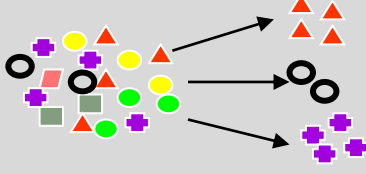
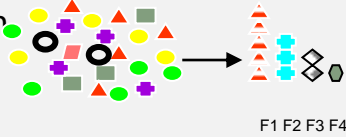
- Data Integration
- National Map schemas
- Geographic names
- Temporal
- Naïve Geography



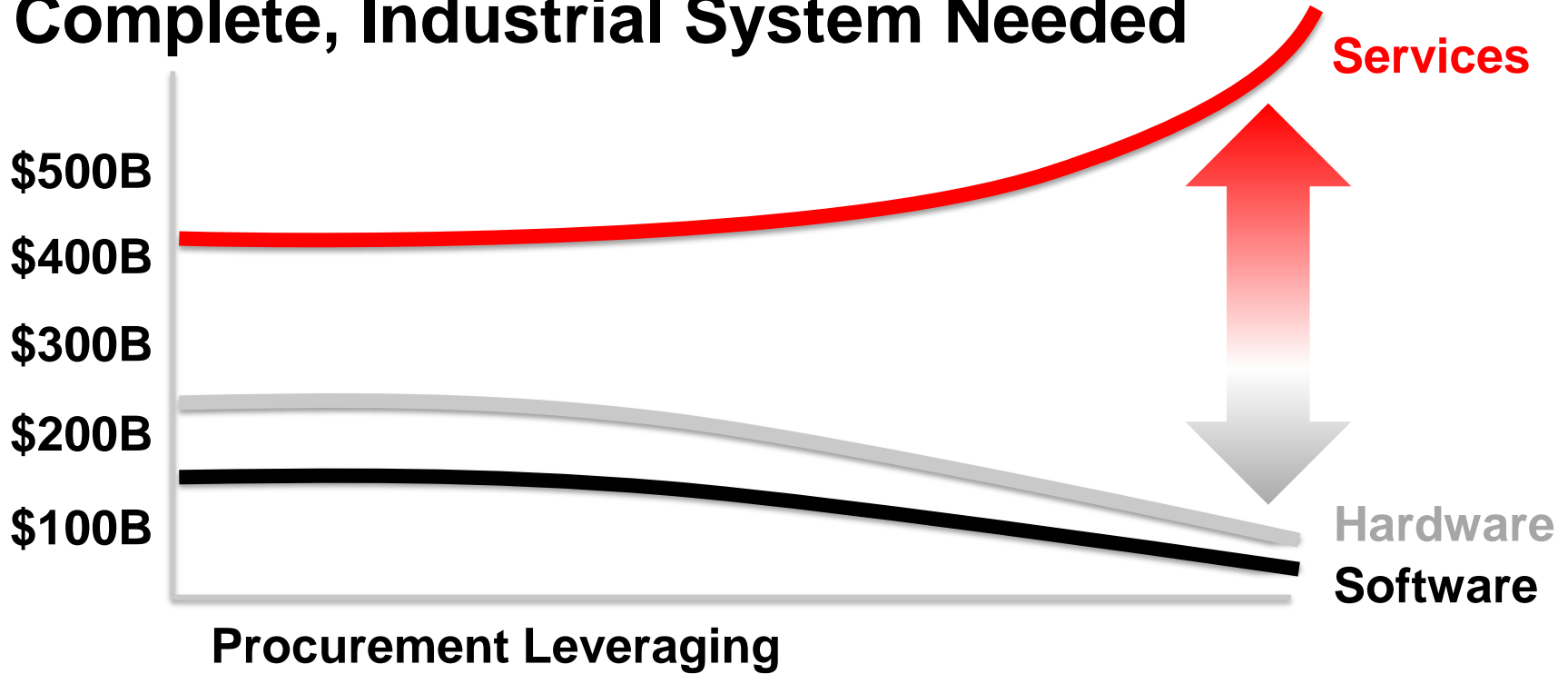
Graph Technology Needed: What terms to look for: Buzzwords For Apps & Workflows

- Semantic Web
- W3C RDF/OWL/SPARQL
- Graph Data Management
- Social Network Analysis (SNA)
- Knowledge Discovery
- Knowledge Mining
- Big Data
- Taxonomy/Terminology Mgmt
- Faceted Search
- Inferencing / Reasoning
- Property Graphs
- Sentiment Analysis
- Text Mining
- NoSQL Database

Collaborations: Tools – Understand Data Quickly Discovery & Predictive Analysis

Problem Classification	Sample Problem
<p>Anomaly Detection</p>  <p>A scatter plot with axes labeled x1 and x2. Most data points are clustered in the center, but several points are significantly separated from the main group, representing anomalies.</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 baskets are shown on the left, each containing different combinations of items (represented by colored shapes). Arrows point from these baskets to a set of items on the right, illustrating the discovery of associations between items.</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 is shown on the left. Three arrows point from different groups of shapes to three distinct clusters on the right, representing the process of grouping similar data points.</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 labeled F1, F2, F3, and F4 on the right, representing the process of identifying key characteristics from the data.</p>	<p>Given demographic data about a set of customers, group the attributes into general characteristics of the customers</p>

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



Open Source: Why Build a Land Mgmt System?

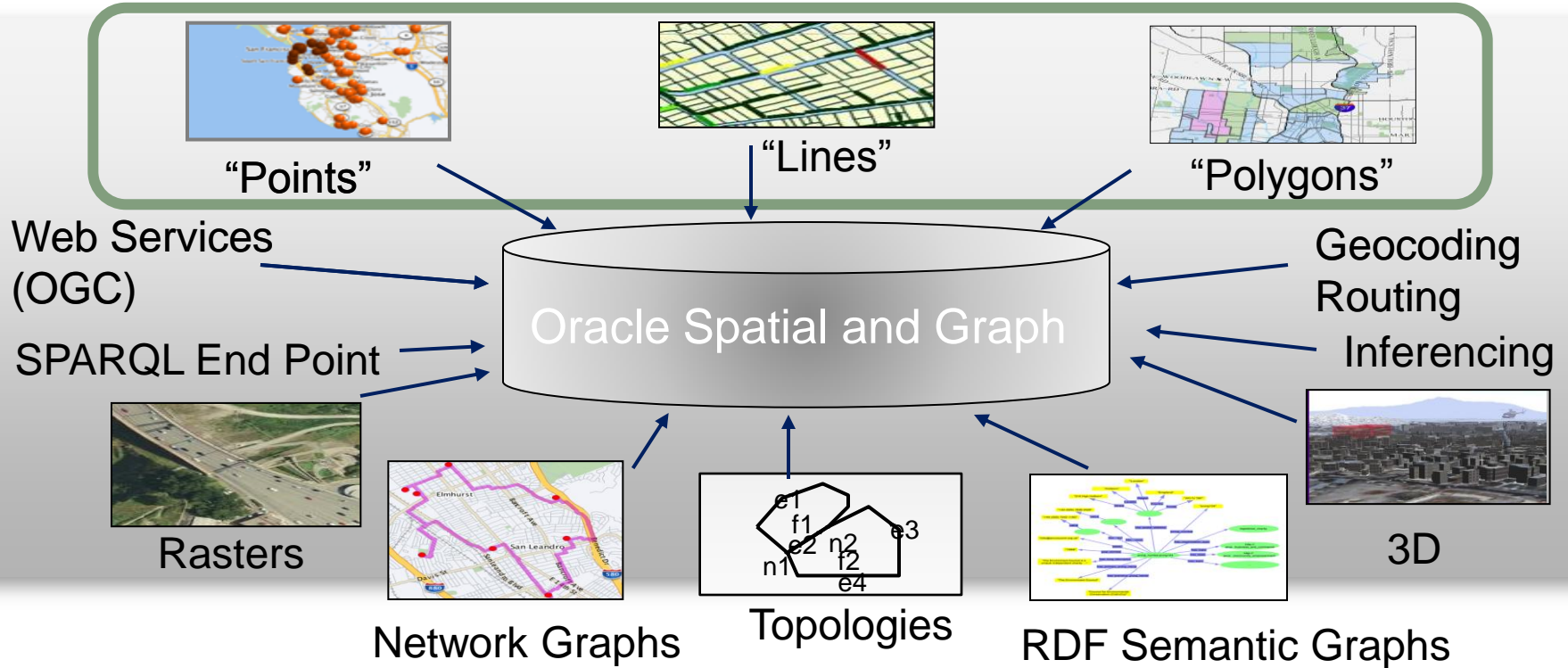
UN-GGIM: “train the individuals is at least five years”



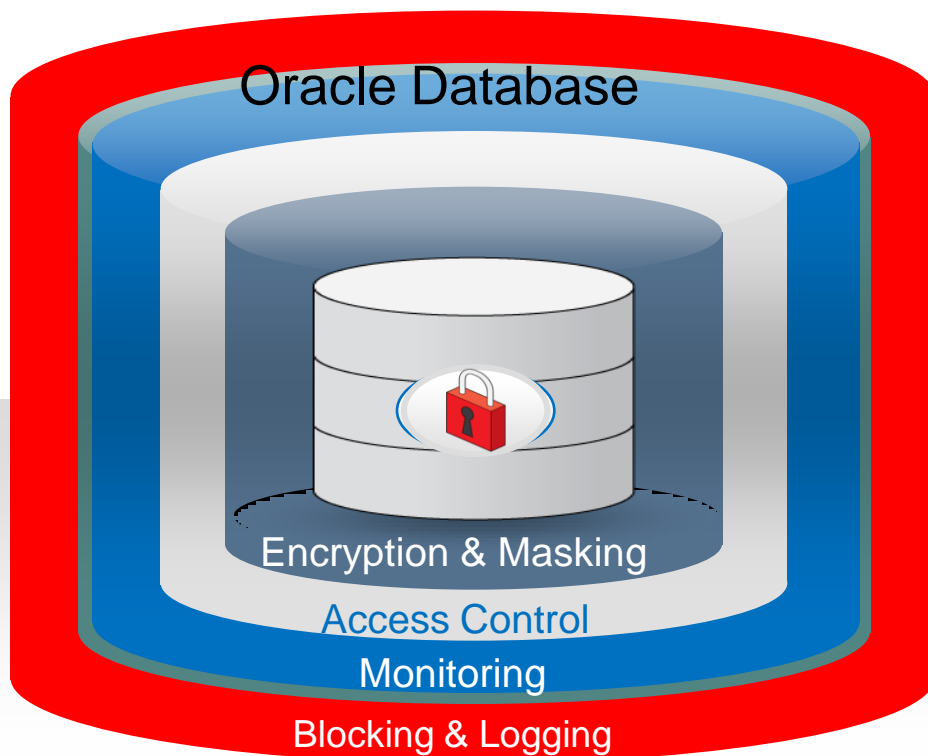
Time to Build
Optimizations
Maintenance

Oracle Spatial and Graph

Securely manage all spatial content



Land Management Requires a Platform with: 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, Redaction

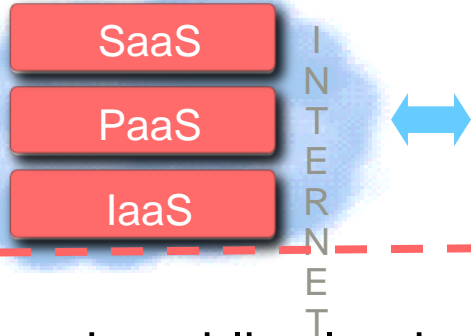
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Cloud Choices from Oracle: Public, Private

ORACLE
ON DEMAND

Cloud Services

Public Clouds



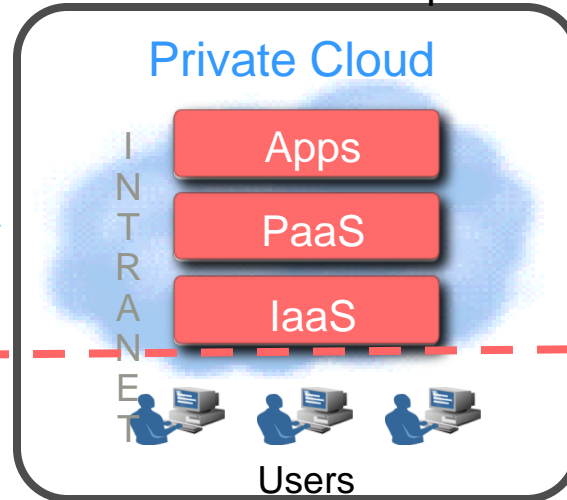
Oracle Technology in public clouds

- Enterprise deployment option
- Power 3rd party public clouds

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APPLICATIONS

Run on private shared platform
or public SaaS model

Private Cloud



Oracle Private
Cloud Platform

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Land Administration and Management Best Success Requires Complete Platform

Big & Fast Data



Volunteered
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