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Oracle Spatial Users Conference

April 27, 2006
Tampa Convention Center
Tampa, Florida, USA

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Cary Lichtman
Solution Sales,
PCI Geomatics

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Director of R&D,
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On-Demand Mapping at the Innovation Acceleration Centre (IAC) within Natural Resources Canada (NRCAN)

A partnered PCI Geomatics and Oracle Enterprise deployment

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Agenda…

- **PCI Geomatics** – A Backgrounder
- GeoCapacity® Information Systems (GCIS)
- Natural Resources Canada - the ***'Mapping Centre***' GCIS deployment
- Role of Oracle Spatial within the *Mapping Centre* and the *Geomatica® Image Management System (GIMS)*
- A look ahead…

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PCI Geomatics…

- Privately held Canadian corporation founded in 1982.
- World-leading developer of geomatics software and enterprise solutions
- More than 21,000 licenses installed in over 135 countries at >6,000 customer sites.
- Over 80 resellers worldwide
- Certified Oracle Applications partner and developer

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PCI Geomatics…

Reputation For Innovation:

- First to include advanced classifiers, i.e. neural network
- First to release rigorous model for QuickBird
- Only company to create a rigorous model for IKONOS
- First to release rigorous model for SPOT5
- First to support JPEG 2000
- Leading edge pan sharpening technology
- The latest ATCOR technology available
- First to demonstrate a fully automated Mapping Center
- First to leverage product componentization into production flowlines
- First to market with an Extract, Transform, Load capability for **Oracle 10g** (GeoRaster ETL)

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GeoCapacity® Information Systems…

Geomatica GeoCapacity Information Systems

"A GeoCapacity® Information System (GCIS) is a spatial information production system powered by automation technology, aimed at helping users make intelligent business decisions based on specific information needs."

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GeoCapacity® Information Systems…

The Need for GeoCapacity:

- Response to evolving market forces – need for faster & cheaper processing
- Need to ingest, process and analyze of large volumes of geospatial data from a variety of sources
- Produce, manage and deliver value-added information products (soft or hardcopy)
- Open and standards-based to fully integrate with existing applications and business processes.
- Addresses need for more automated solutions
- Dissemination through the Web

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GeoCapacity® Information Systems…

Design Principles:

- Image-Centric focus
- Built on PCI's Geomatica technology (componentized); centric to the Geomatica Image Management System (GIMS).
- Modularized & Scalable
- Highly automated fusion of multiple data types (i.e Faster, Cheaper, Better)
- Leverages Enterprise Infrastructure (Oracle)
- Seamless raster/vector database for custom map production
- Interoperability and robust data management
- Standards based, web services delivery model

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GeoCapacity® Information Systems…

Benefits to Geospatial Industry:

- Automated workflows for image-centric processing (e.g. image correction system for satellite/airborne images)
- Highly automated custom product generation (e.g. just-in-time mapping)
- Simplified, repeatable management of extensive datasets
- Integration with Oracle 10g - provides one of the most powerful data management tools on the market

Example Applications:

- Map product archiving and management
- Map product server for Web Portals
- Decision Support Systems (e.g. disaster management)

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The 'Mapping Centre': GCIS at Natural Resources Canada…

- The first of 3 prototype systems built for the Canadian Government in connection with Technology Partnerships Canada (TPC).
- 3 year, $18 Million project
- Investment from Oracle (10g Enterprise Database)
- Addresses on-demand mapping requirements of **Natural Resources Canada** (NRCAN)
- The Mapping Center offers an automated, efficient, flexible and reliable mapping system – nationwide!

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The ‘Mapping Centre’: What does it do for NRCAN?

- Automatically OrthoCorrects, PanSharpens, and loads imagery into a spatial Database (Oracle 10g)
- Delivers custom image and topographic maps on demand via the web or email.
- Manages and monitors multiple incoming job requests, including logging and invoicing.

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The 'Mapping Centre': Unique Features…

- Series of automated production workflows leveraging Oracle 10g enterprise database and GeoRaster data-type
- Image-Centric solution designed specifically for high volume throughput to rapidly process Terabytes of raster data
- Production workflows controlled via a fully integrated job control system
- Customizable/interchangeable automated production workflows
- Horizontally and vertically seamless database providing custom product generation
- Unique methods of data processing (e.g. semi –automated feature extraction)

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The 'Mapping Centre': Prototype Contains…

- Oracle 10g database (housing all vector and raster data)
- 4.8 Terabytes of data
- Entire NTDB @1:50K &1:250 K
- Full DEM coverage of Canada
- 700 Ortho-corrected LandSAT7 scenes (automatically ortho'd)
- 130 pan image scenes at 5m resolution of urban areas
- Image chip database for GCP's with 50,000 image chips
- Multiple servers working together: Web, Job control, Processing (scalable), database
- Multiplatform compliant - can use/mix Windows, Linux & Solaris
- Current processing throughput 50 LandSAT7 scenes/day/CPU (fully automatic processing)
  - e.g. 4 CPU's gives 200 LandSAT7 scenes/day
- Mosaicking – 10 L7 (pan-sharp) images per hour/CPU

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The 'Mapping Centre': Database Schemas

- 73 vector layer tables. Each table represents single 1:250K layer
- 137 vector layer tables. Each table represents single 1:50K layer.
- Elevation images for all Canada in resolution 1:250K from NTDB data.
- Elevation images for all Canada in resolution 1:50K from NTDB data.
- Elevation data for all Canada in a single image.
- Color (6 channels) orthorectified images created from Landsat7 raw satellite images. Resolution 30 meters/pixel.

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The 'Mapping Centre': Database Schemas (cont)

- Panchromatic orthorectified images created from Landsat7 raw satellite images. Resolution 15 meters/pixel.
- Panchromatic images for major Canadian cities in resolution 5m/pixel.
- Sharpened images created from color and panchromatic images. Resolution 15 meters/pixel.
  .
- Mosaics of Canada: panchromatic, multi spectral and sharpened. 1 image per table.

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The 'Mapping Centre': Image Types

- Panchromatic ortho Landsat7
- Multi spectral ortho Landsat7
- Sharpened ortho Landsat7
- Panchromatic mosaics Landsat7
- Multi spectral mosaic Landsat7
- Sharpened mosaic Landsat7
- Cities 5 meters resolution
- Elevation 1:50K resolution
- Elevation 1:250K resolution
- Elevation mosaic
- Land Cover images

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The 'Mapping Centre': Image Metadata

Metadata from Raw scene

- Image name
- Sensor
- Acquisition Date /Time
- Geographic center and extent
- Landsat7 metadata extracted from Landsat7 scene

Processing metadata

- Ortho corrected
- Atmosphere corrected
- Name of source scene.
- Processing start data and time
- Processing total time.
- Name of application server processed this scene.
- JCS job code.
- Name and version of ICS script

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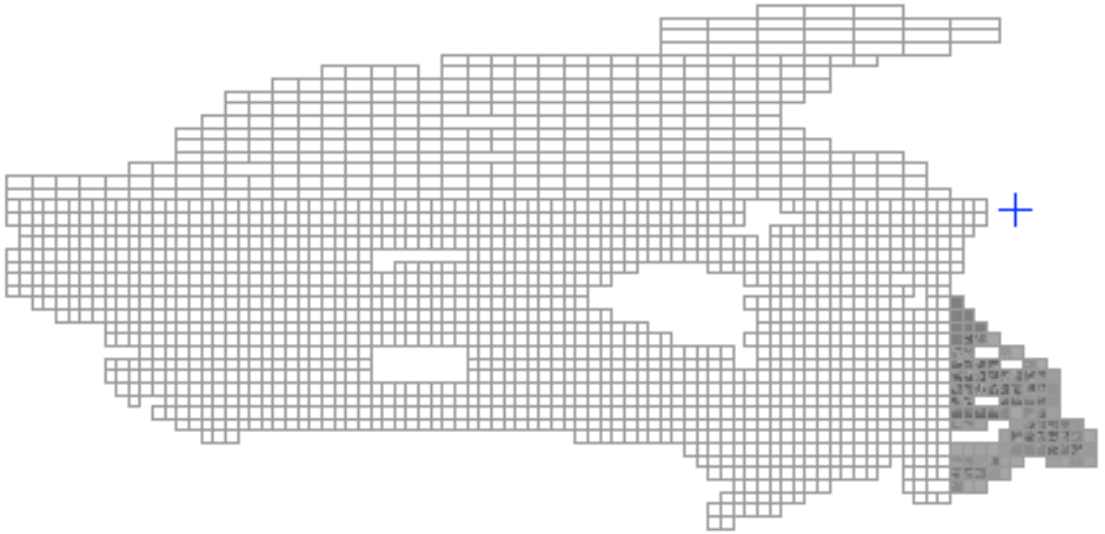
The 'Mapping Centre': NTDB 1:250K Elevation Images

Image Specifics

- 1828 individual images
- Size: 1201 x 1201 pixels
- Resolution: 0.000833 degree per pixel
- 16 bit per pixel
- Projection Geographic



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The 'Mapping Centre': Elevation Mosaic

Image Specifics

- Size: 59720 x 54814 pixels
- Resolution: 90 meters per pixel
- 16 bit per pixel
- Size on the disk: 7.2 Gb
- Projection LCC

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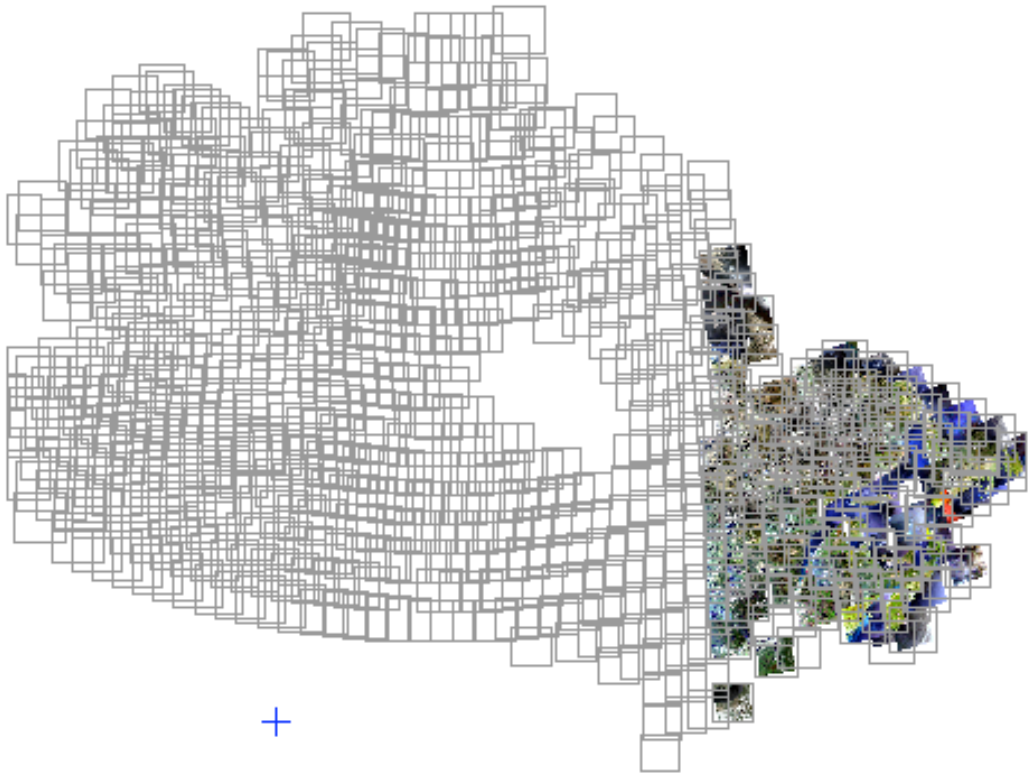
The 'Mapping Centre': Sharpened Landsat7 Orthos

Image Specifics

- 690 images
- Size: 16K x 16K pixels
- Resolution: 15 meters per pixel
- 8 bit per pixel
- Size on the disk: 850 Mb
- Projection LCC



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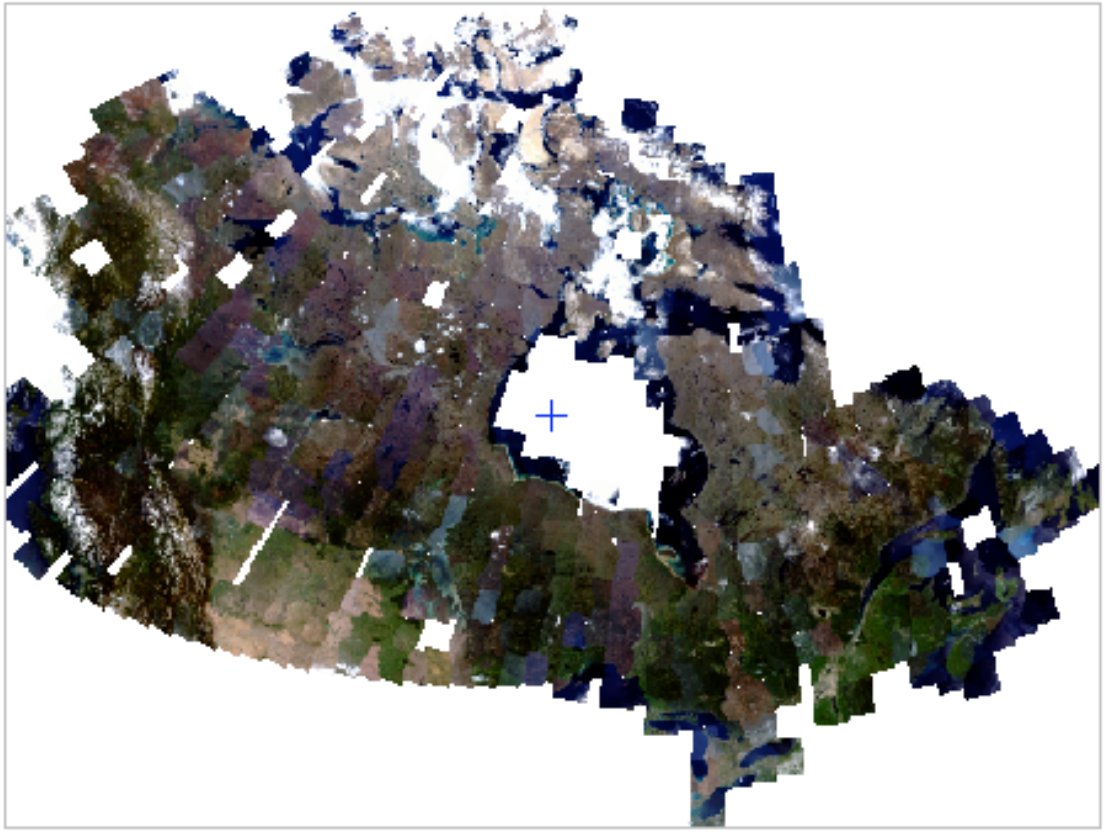
The 'Mapping Centre': Multi Spectral Mosaic

Image Specifics

- Number of channels: 6
- Size: 179295 x 134387 pixels
- Resolution: 30 meters per pixel
- 8 bit per pixel
- Size on the disk: 159 Gb
- Projection LCC
- Fully Automated!



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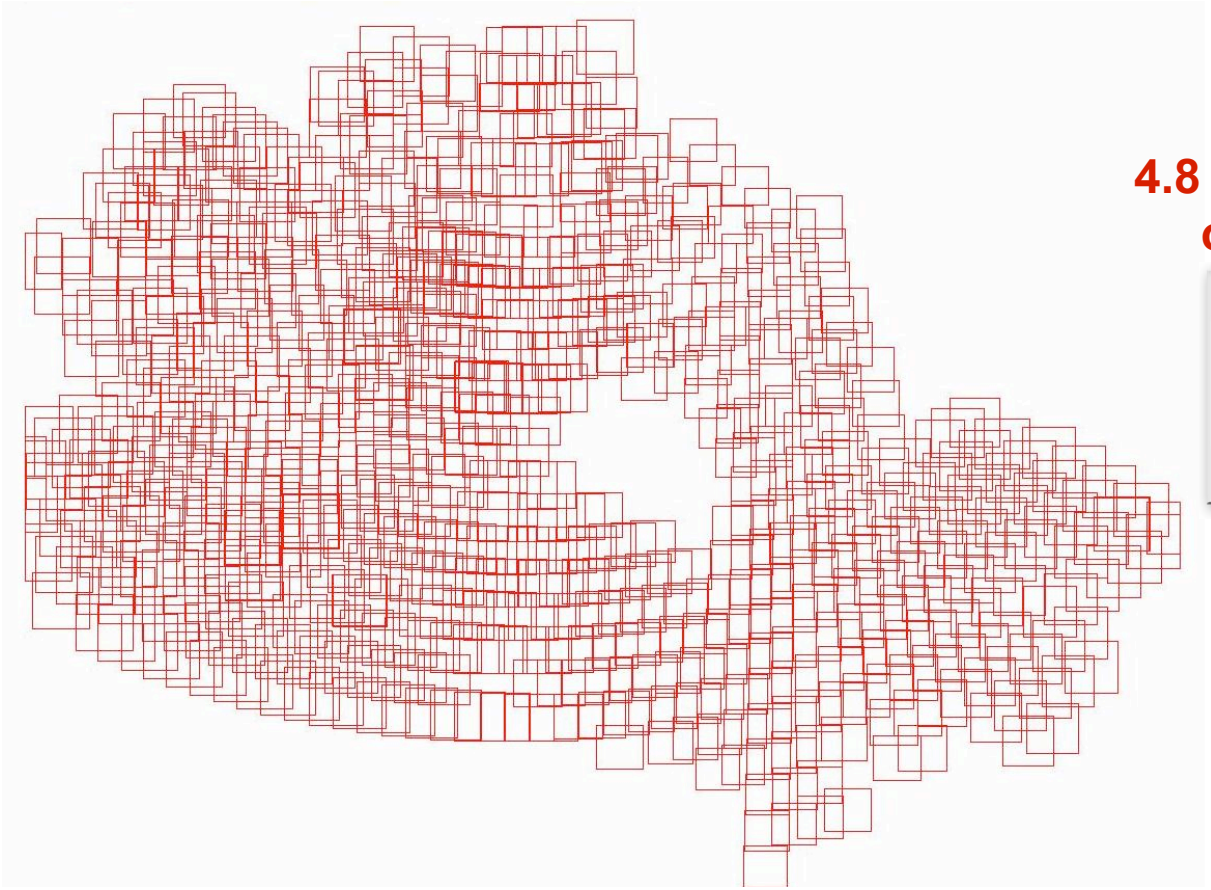
The 'Mapping Centre': Prototype Contains…



4.8 Terabytes of data!

ORACLE 10g DATABASE

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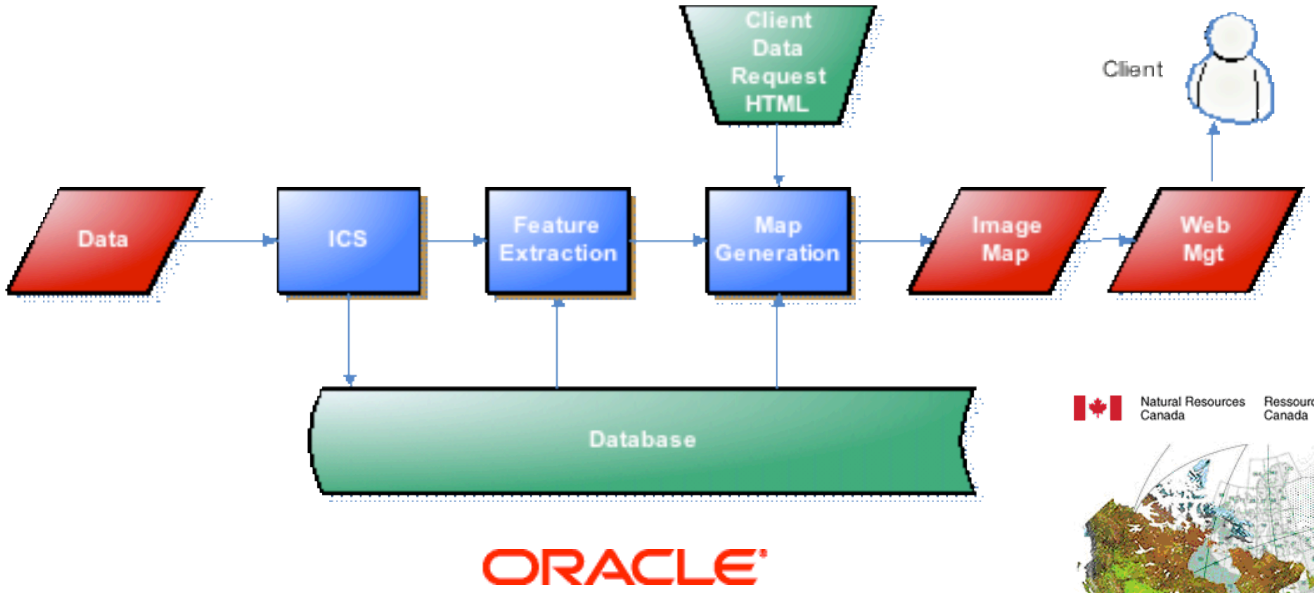
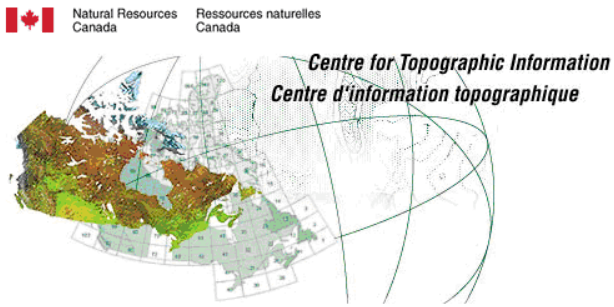
The 'Mapping Centre': Components…





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The 'Mapping Centre': Components…

- **Image Correction System (ICS)** - automates the processing and preparation of remote sensing imagery (orthorectification, pansharpening, etc.)
- **Map Generation System (MGS)** - automated map generation based on user requirements and national mapping standards.
- **Feature Extraction System (FES)** - interactive feature extraction/updating of topographic features from satellite imagery.
- **Web Services System (WSS)** - based on Open GeoSpatial Consortium (OGC) standards; enables the exchange of spatial data from anywhere, to anyone.
- **Job Control System (JCS)** - provides the tools to define, execute, and monitor jobs from the above four systems automatically.

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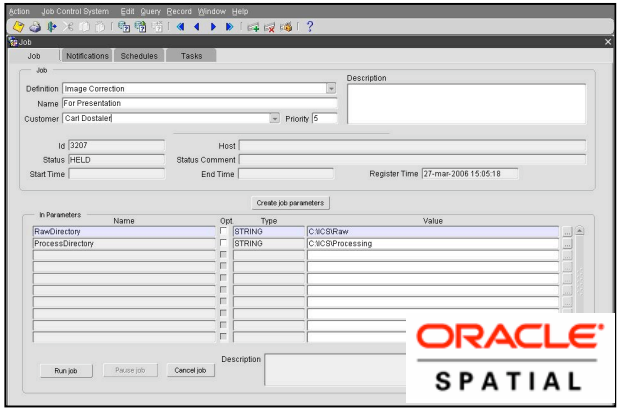
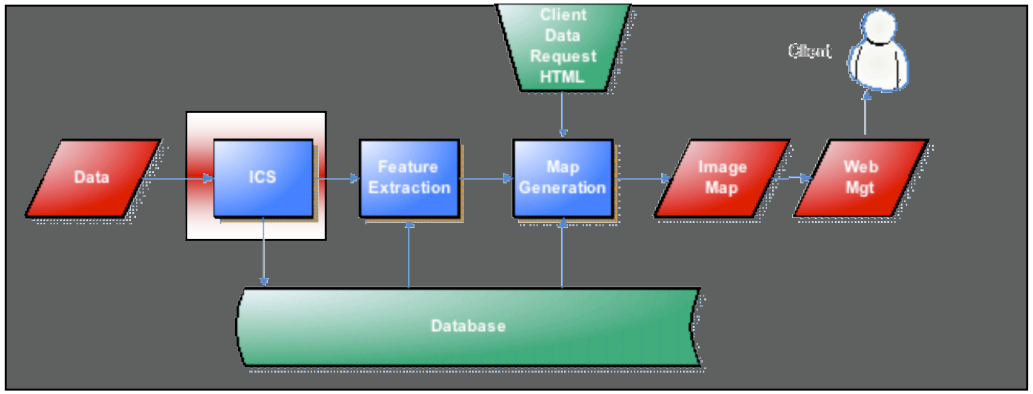
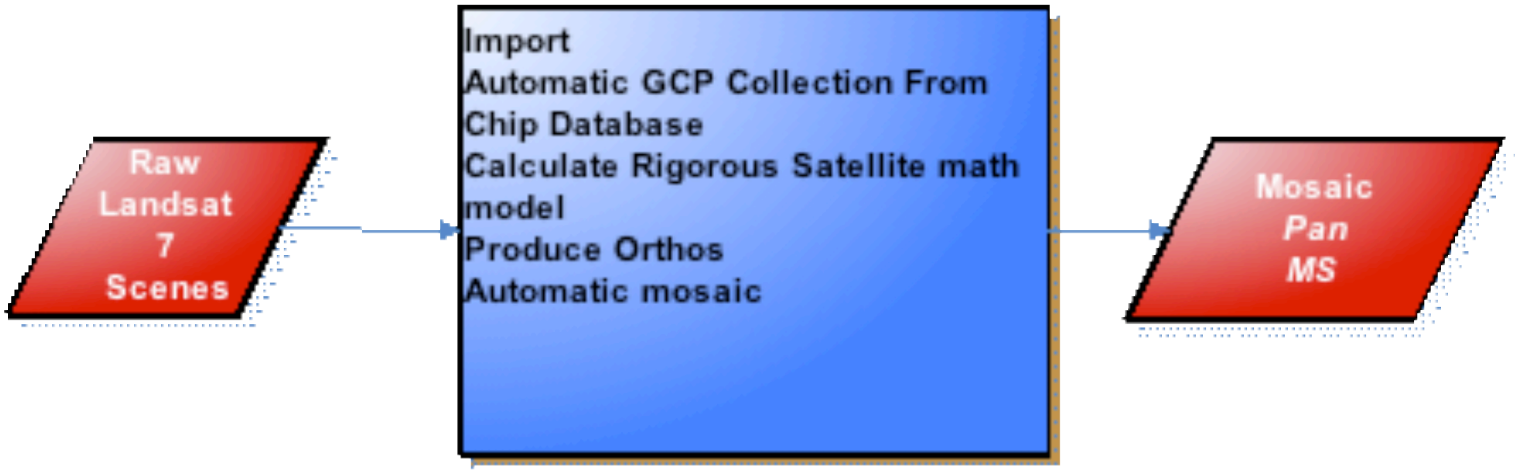
The 'Mapping Centre': Image Correction System (ICS)







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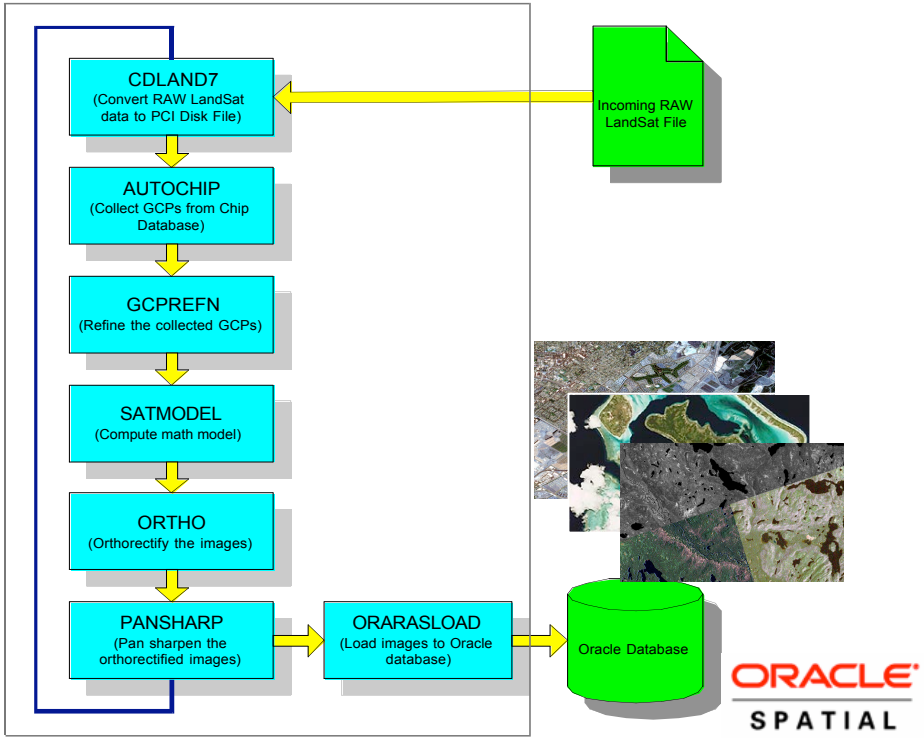
The 'Mapping Centre': Image Correction System (ICS)

Example ICS Workflow:



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- Seven PCI Pluggable Functions (PPF's) used in flowline
- Chained by Python

- **Benefits:**
- completely automatic
- easy to chain
- parallel processing

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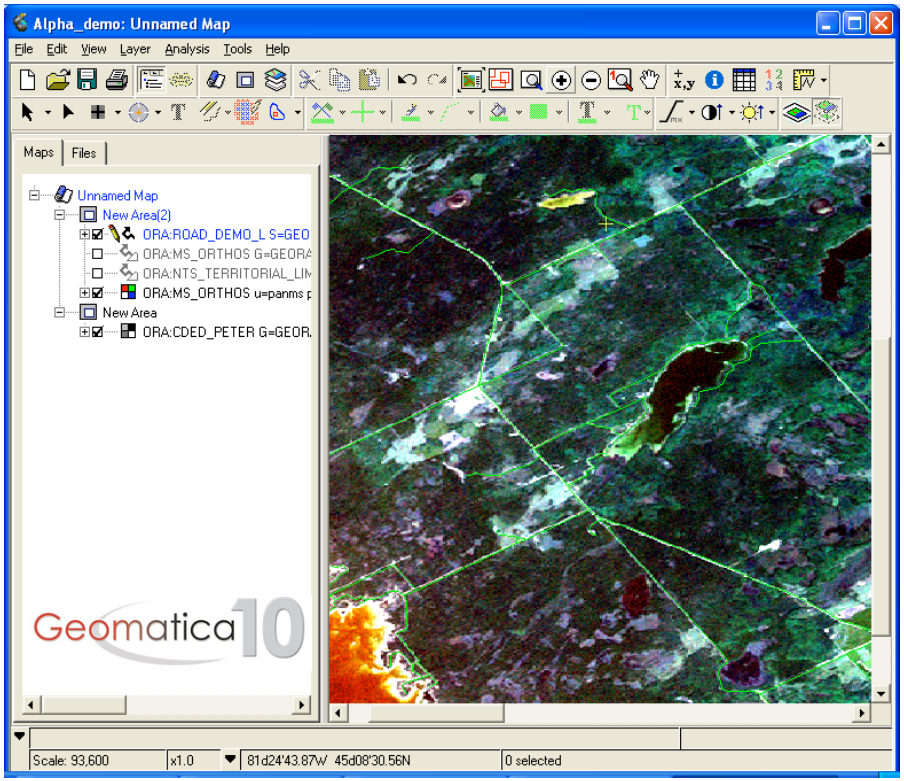
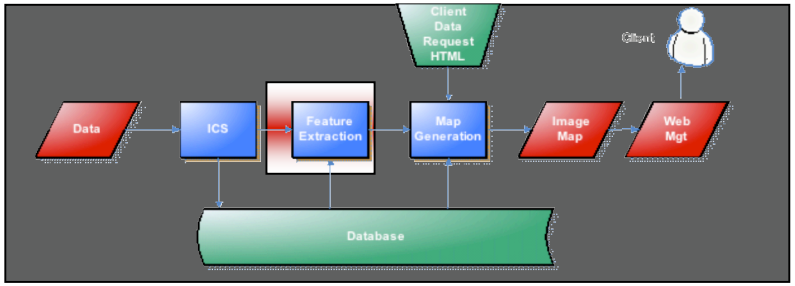
The 'Mapping Centre': Feature Extraction Service





- Vector and Raster data is opened in Geomatica Focus through SOAP server
- Vector data updated to match more recent raster datasets
- Sub-pixel accuracy attainable
- Data is automatically updated in the database when saved

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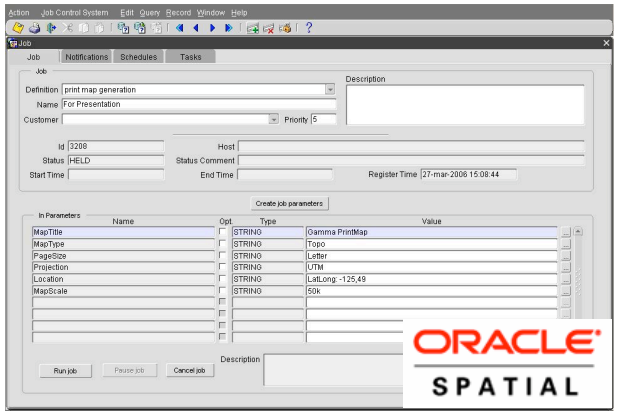
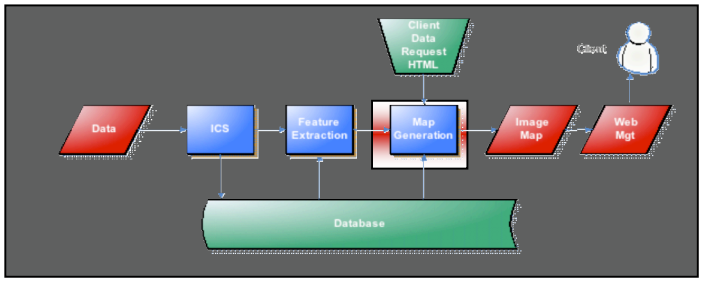
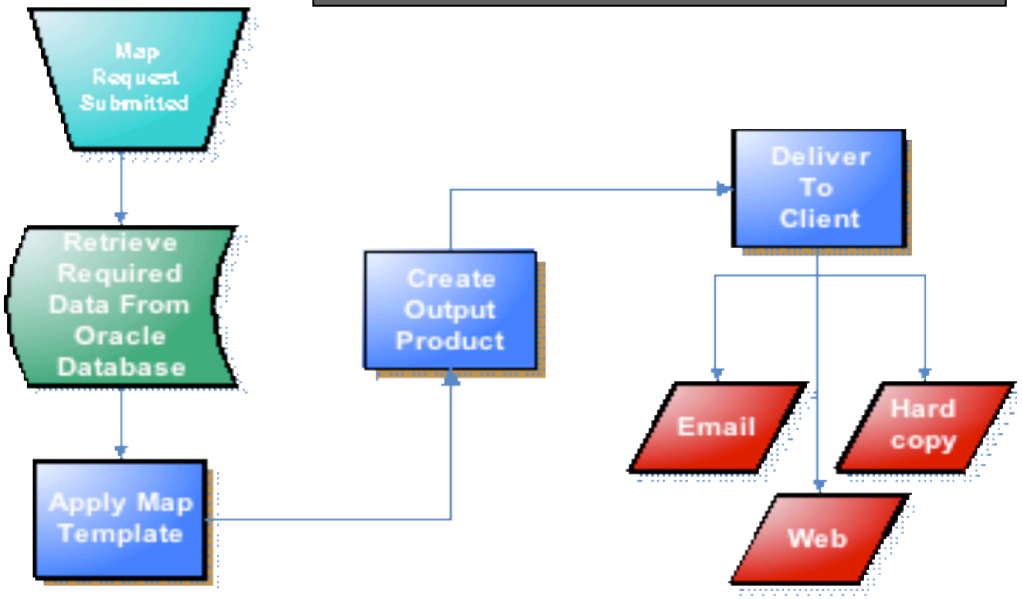
The ‘Mapping Centre’: Map Generation Service







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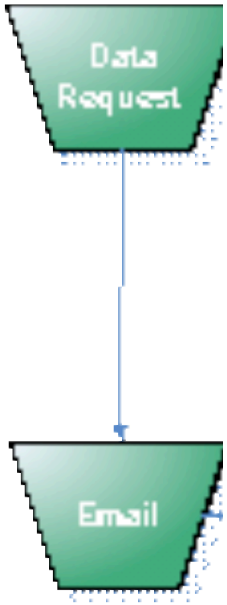
The ‘Mapping Centre’: Map Generation Service



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The Role of Oracle in PCI Geomatics Solutions

Oracle Spatial – an integral component of the Mapping Centre (MC) and the Geomatica Image Management System (GIMS)…

Oracle Provides for:

- Raster enabled database for management of raster data/gridded data and associated metadata
- Image data stored as a native data type (GeoRaster) and not as BLOBS; SQL access!
- The MC and GIMS Solutions leverage the power of Oracle 10g – backup, security, web enablement, distributed database, and more…..

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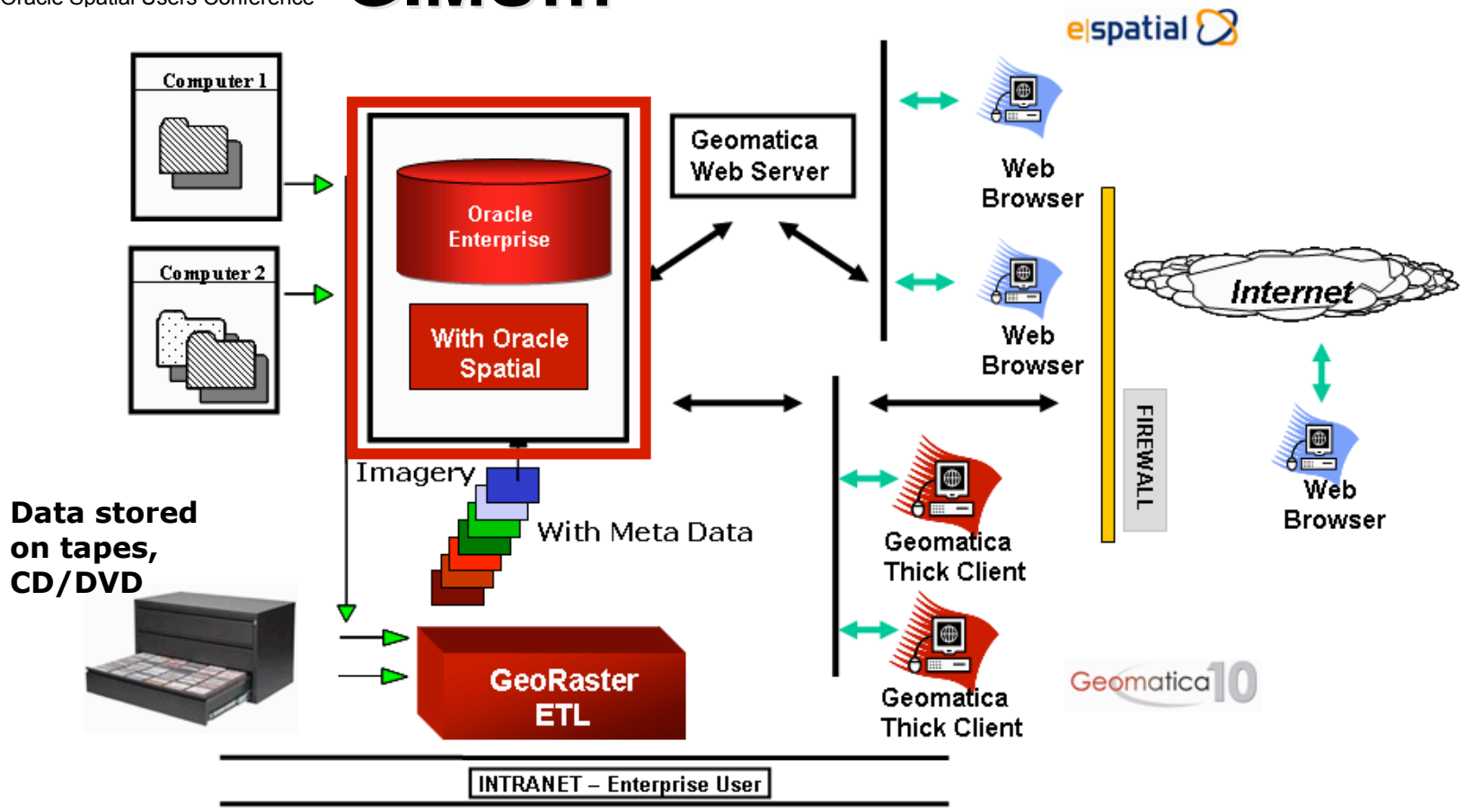
The Role of Oracle Spatial in GIMS…



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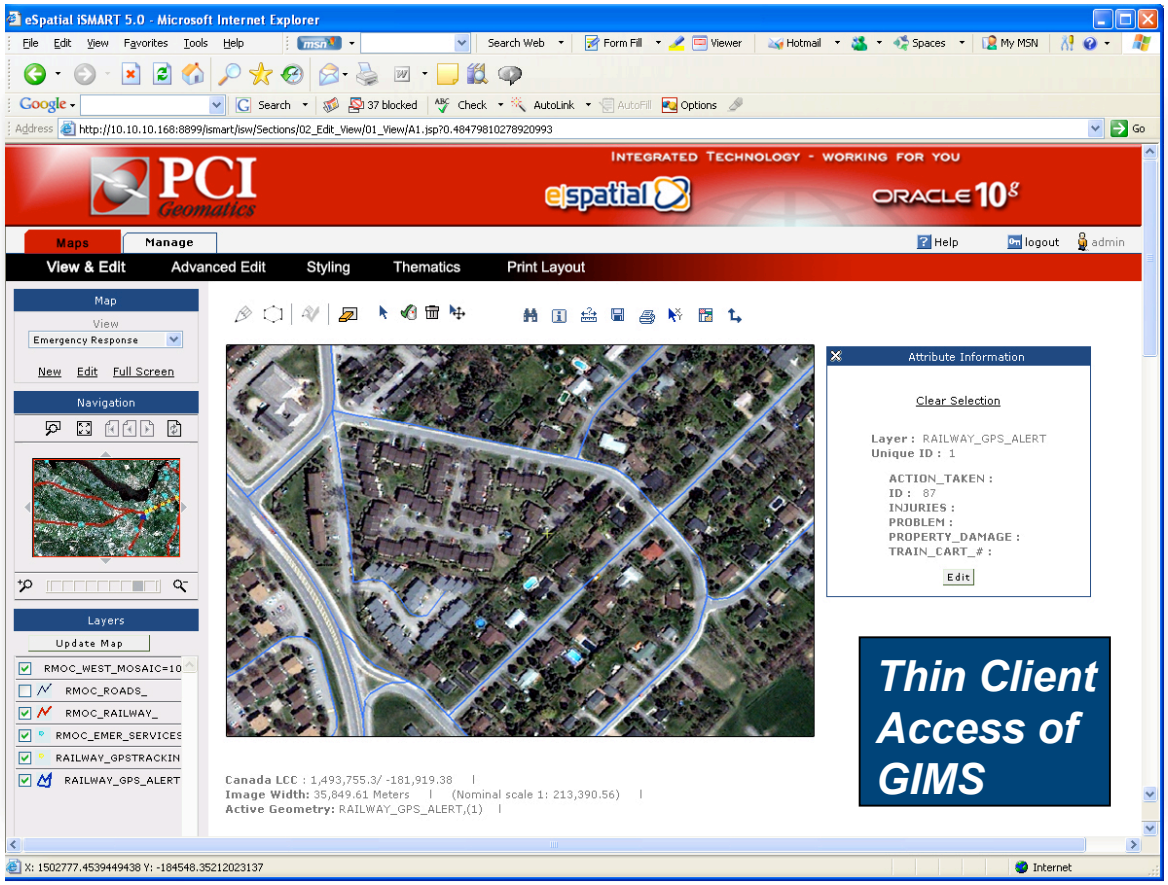
The Role of Oracle Spatial in GIMS…



- Oracle acts as the ‘house’ all thin and thick clients walk in and out of.
- Data query, network access, internet, data distribution, data backup, security, data access via user profiles…

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The Role of Oracle in the Mapping Centre…

*We're proud to have supported **PCI Geomatics** in the development of their first GeoCapacity Information System – the **Mapping Centre**. PCI's leading image-centric geomatics solutions combined with the Oracle Spatial 10g GeoRaster data management platform provide robust, scalable, secure geospatial solutions that truly empower the enterprise. We look forward to our future together, and are pleased that PCI has selected **Oracle** as their exclusive partner of choice".*

Jack Pellicci

Brigadier General (US Army, Ret.)

Group VP, Business Development
Oracle North American Public Sector

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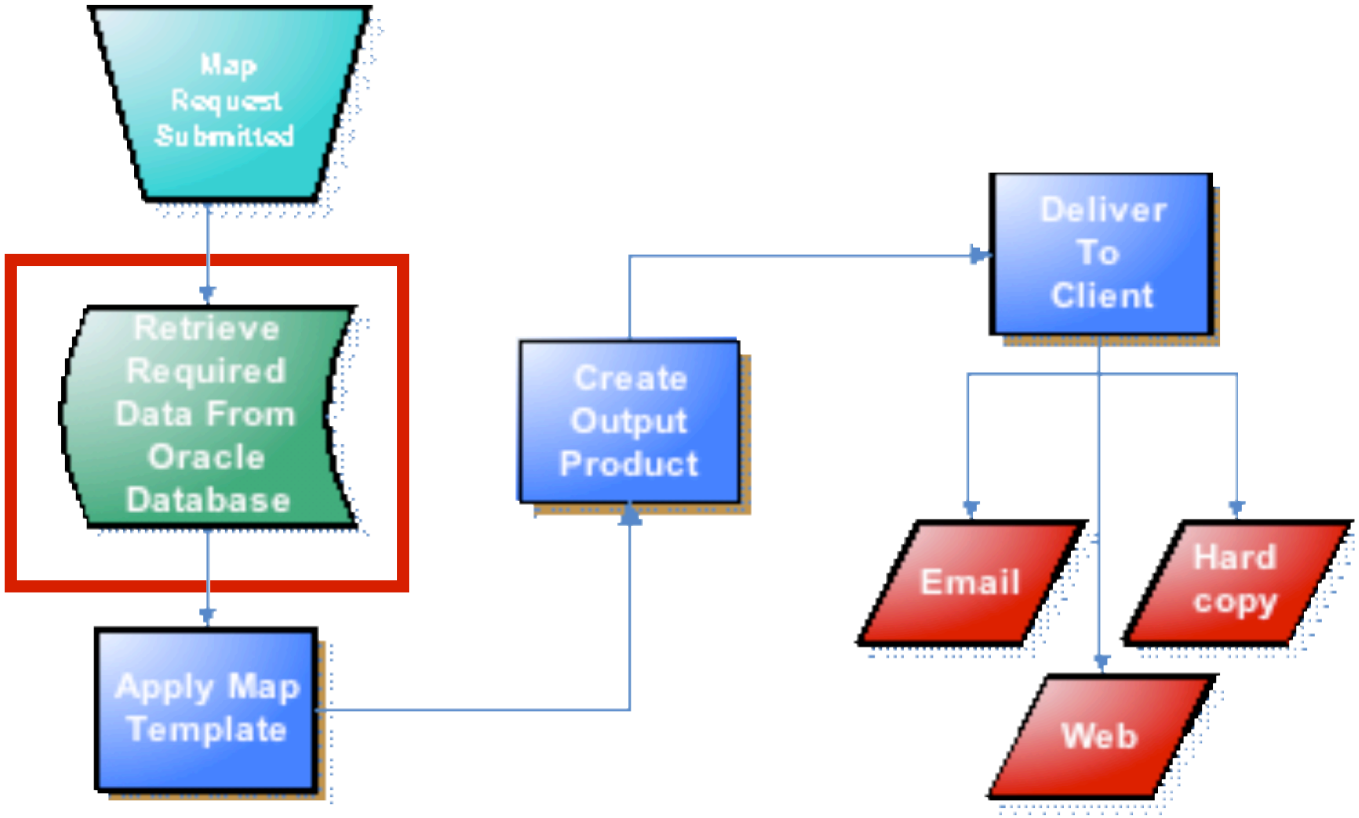

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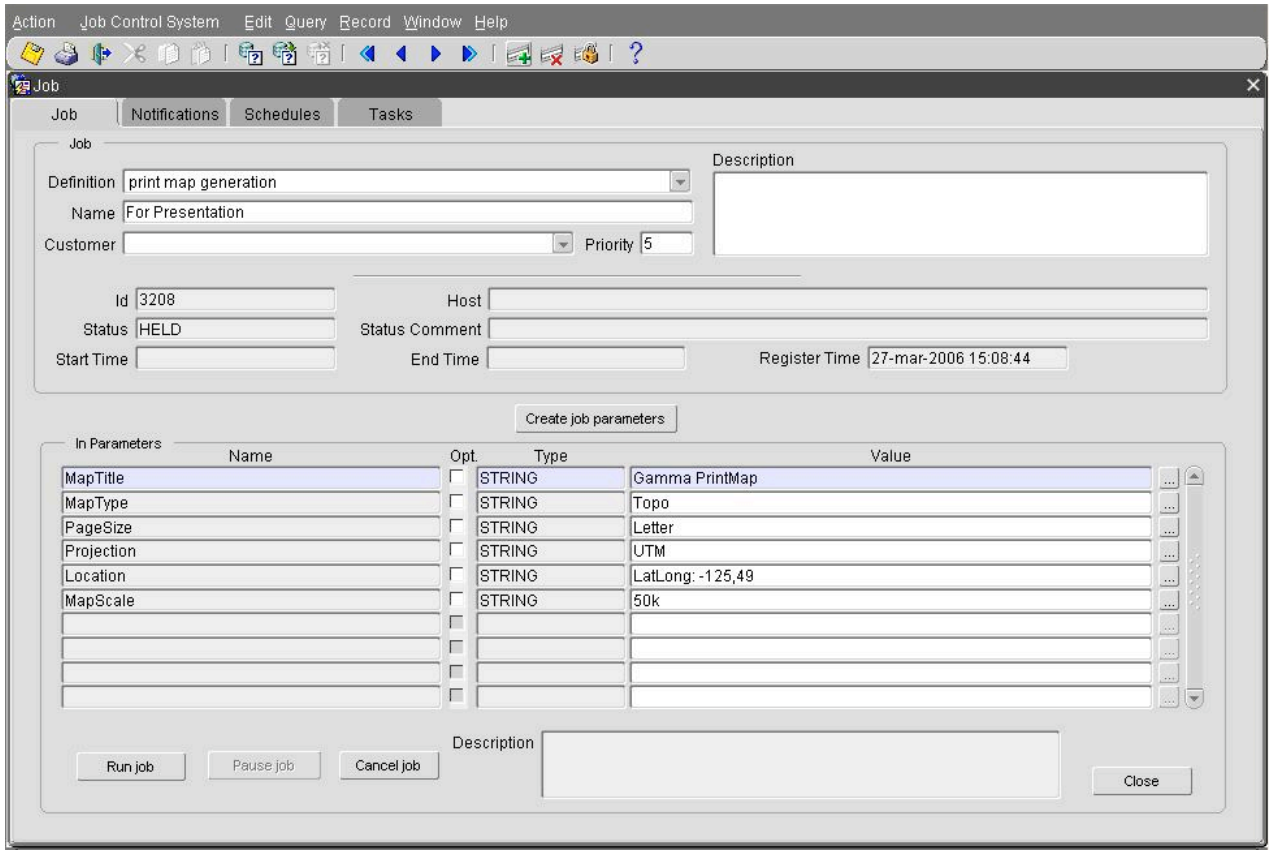
The Role of Oracle in the Mapping Centre…



- Oracle Forms control much of the database interaction
- Database driven process, Audit trail, Processing metadata
- Integration of Spatial and Non-Spatial data.

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A Look Ahead…

Prototypes for Canadian Government:

- NRCAN: Mapping Center – leverage web development further using Oracle/eSpatial technology
- Agriculture and Agri-Food (AAFC): Environmental Monitoring System built using PCI Geomatics and Oracle technology
- Public Safety and Emergency Preparedness Canada (PSEPC): Emergency Response for Homeland Security System built – Oracle centric!

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A Look Ahead…

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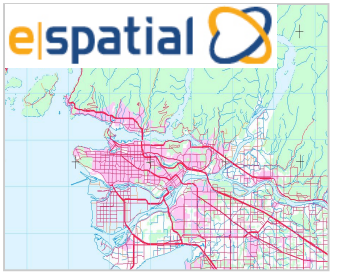
- **Public Safety and Emergency Preparedness Canada** (PSEPC): Emergency Response for Homeland Security System built – Oracle centric!
- Develop unique image centric data processing solution for agencies with large volumes of data (Governments, Data Providers, Web Sites such as Google Maps).



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Q&A

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