Multi-modal routing with Oracle Network Data Model & Oracle Mapviewer

Australian Oracle Spatial User Meeting

Melbourne, 21 August 2006

Ross Caldow
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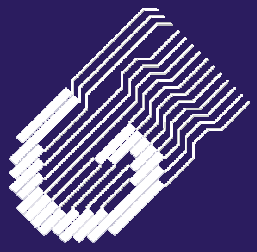

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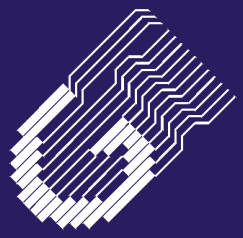
Southbank headquartered company Est. 1994, 70 staff, Brisbane office.

Leader in the provision of spatially based business solutions to government, road, rail & power utilities:

- Field based asset mapping and inspections,
- Spatial data distribution and value added reselling,
- Digital aerial imagery and terrain models,
- Enterprise GIS solutions including web & mobile technology,
- Development, implementation and support of hosted and Application Service Provider (ASP) based solutions.



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Directions Plus™ at the 2006 Melbourne Commonwealth Games

Emergency crews take to PDA guide

Volunteers have hi-tech help for tourists all in hand

GAMES volunteers wielding hand-held computers equipped with world-first technology will provide directions for visitors.

About 60 tech-savvy volunteers will be in the CBD and around venues to guide more than 90,000 visitors expected to converge on Melbourne from March 15-26.

Directions to venues, restaurants or hotels are available at the touch of a hand-held device, and can be printed out or sent to mobile phones as text and picture messages.

Want a Greek restaurant? Volunteers can find an eatery, provide a map and directions, and give you a phone number to make a booking en-route.

Up-to-the-minute information, including road closures, will be used to find the quickest way from A to B on foot, or by public transport or car.

Information and Communication Technology Minister Marsha Thomson said the technology, developed for the Games by Victorian companies Geomatic Technologies and Readify, might be used for other major events. "We have had international interest in this idea . . . There are endless possibilities," she said.

The $900,000 project was funded as part of a joint initiative between the Government and Microsoft.

KATE HAGAN

Directions Plus guide Jessica Davies helps New Zealand TV engineer Rodney Haugh. Picture: Michael Rayner

Victoria AUSTRALIA

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Directions Plus™ Television Coverage – March 2006

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Directions Plus™ Project

Business Objectives

- To showcase Victorian ICT
- To design, build, test, deploy a mobile mapping solution before 2006 Melbourne Commonwealth Games

Technical Objectives

- To acquire and build a routable public transport dataset
- To provide shortest route from selected locations using Melbourne's public transport network
- To generate meaningful travel directions and maps
- To build a mobile application to incorporate spatial web services and deliver answers via screen, print and digital messaging
- To ensure that data and application security was a high priority

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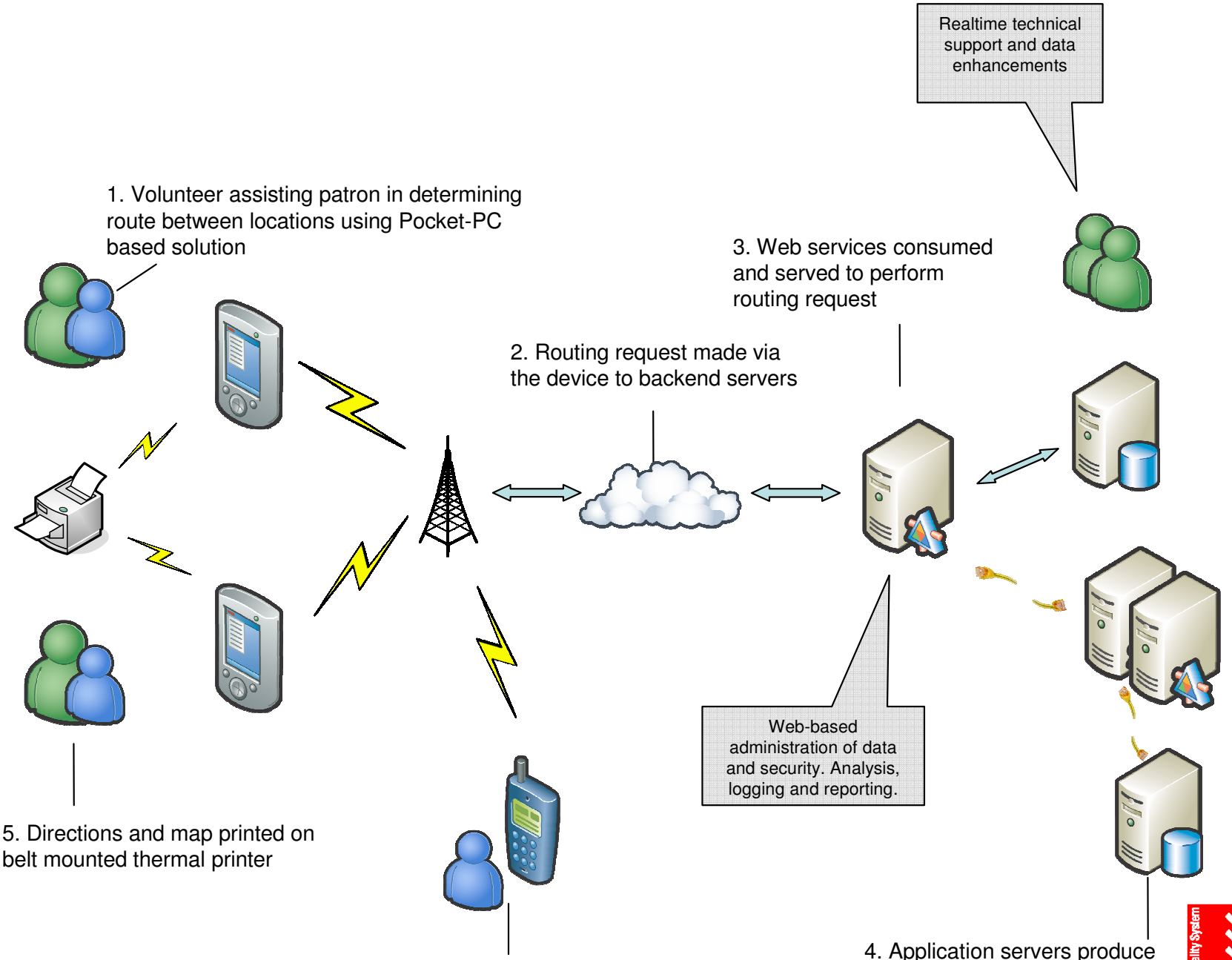

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Technologies

Oracle10g R2 and Oracle 10g AS Java Edition

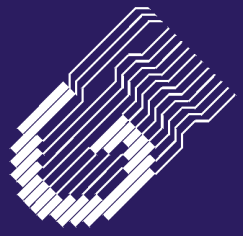
Oracle Network Data Model

- Java API
- Network Data Editor tool

Oracle MapViewer

- MapBuilder

Microsoft .NET



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Transport data in Victoria

Vicmap Transport

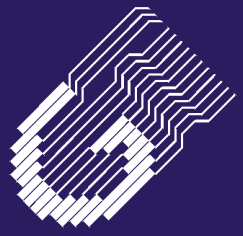
- Roads (node/links)
- Rail (Trams, Trains)

Metlink/ Dept of Infrastructure

- Tram – 29 routes,
- Bus – 289 routes, over 23,000 stops

Custom built during project

- Node/links
- Route metadata



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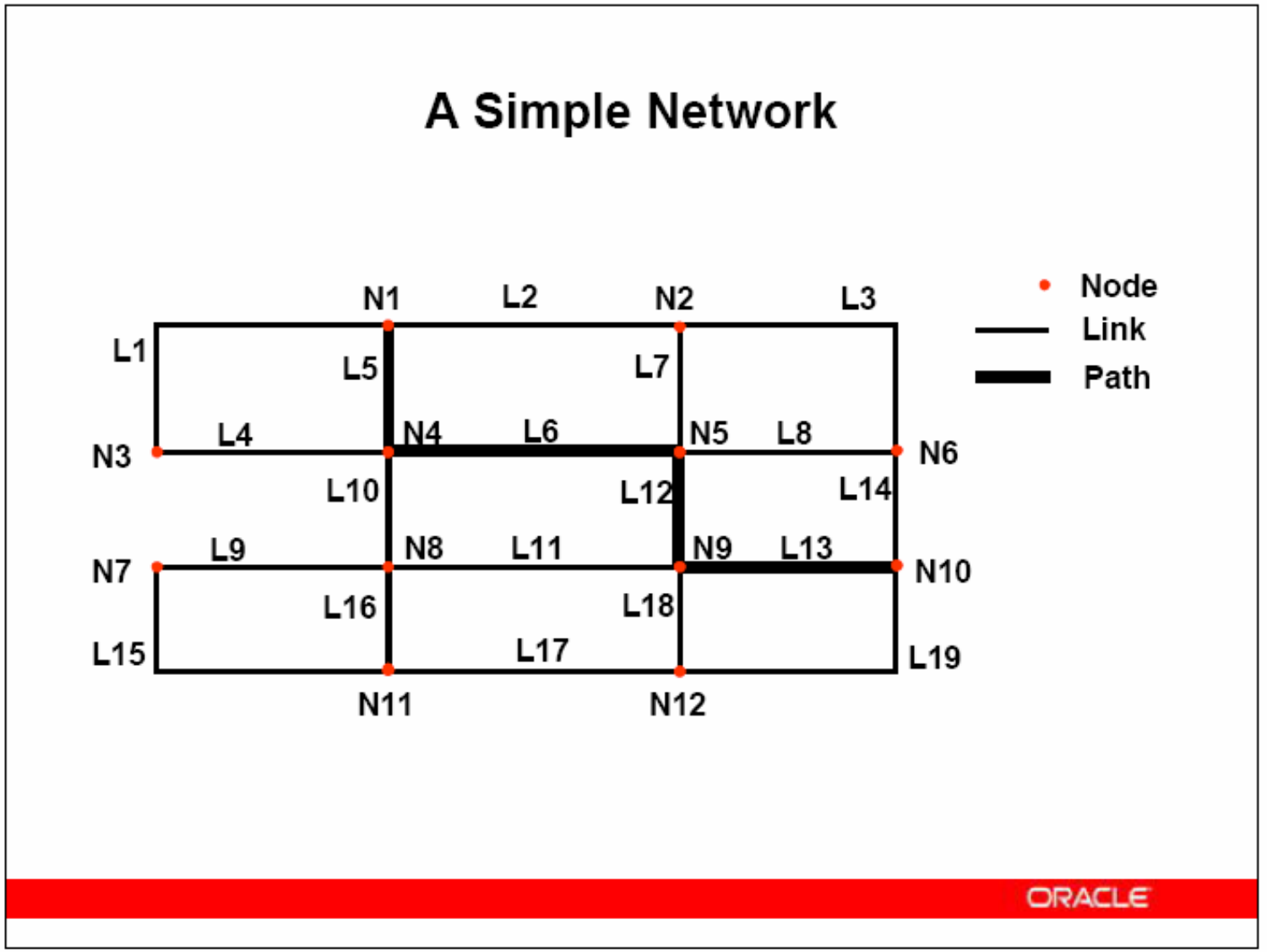
Oracle NDM Concepts



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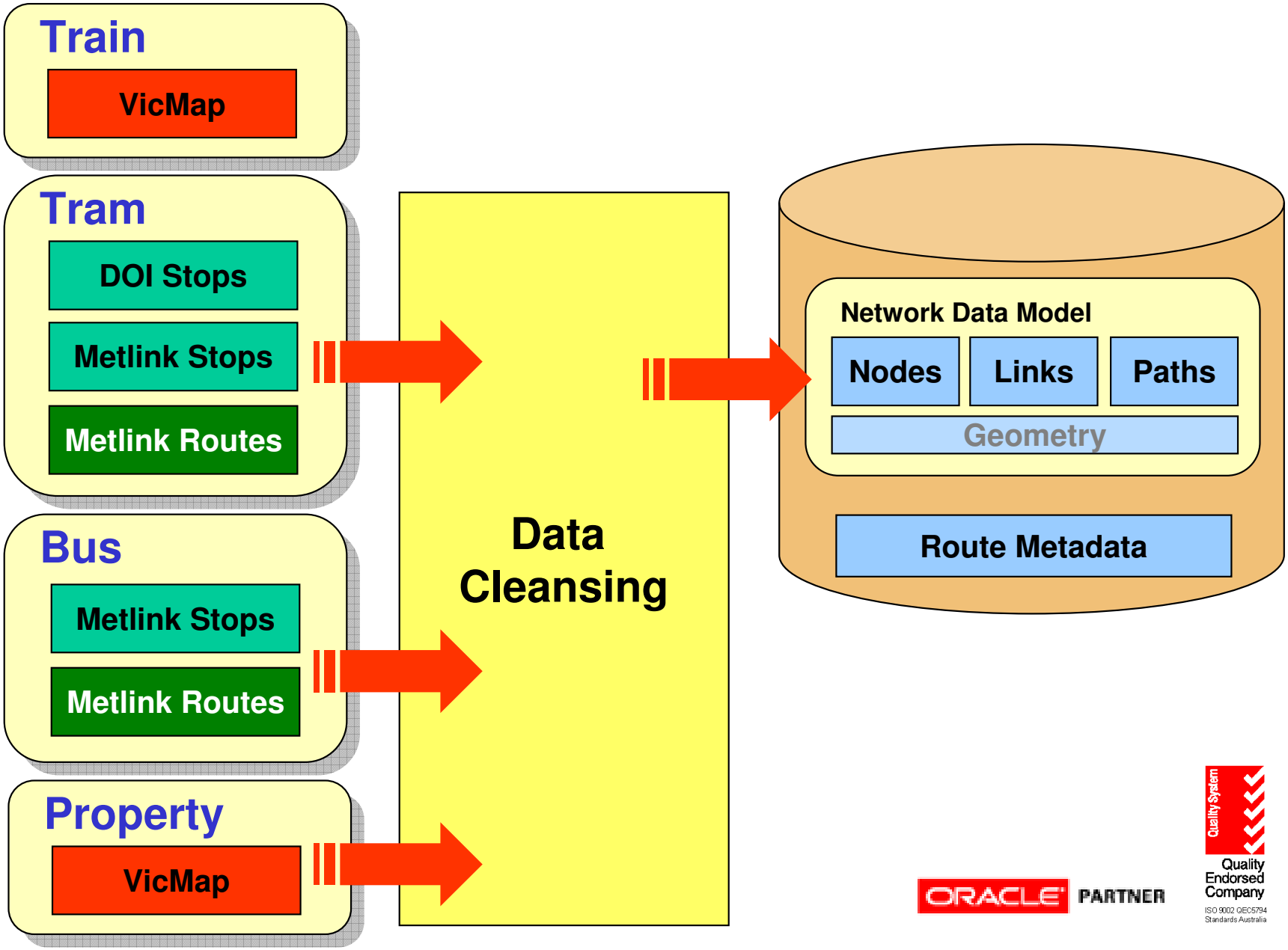
Building the routable data



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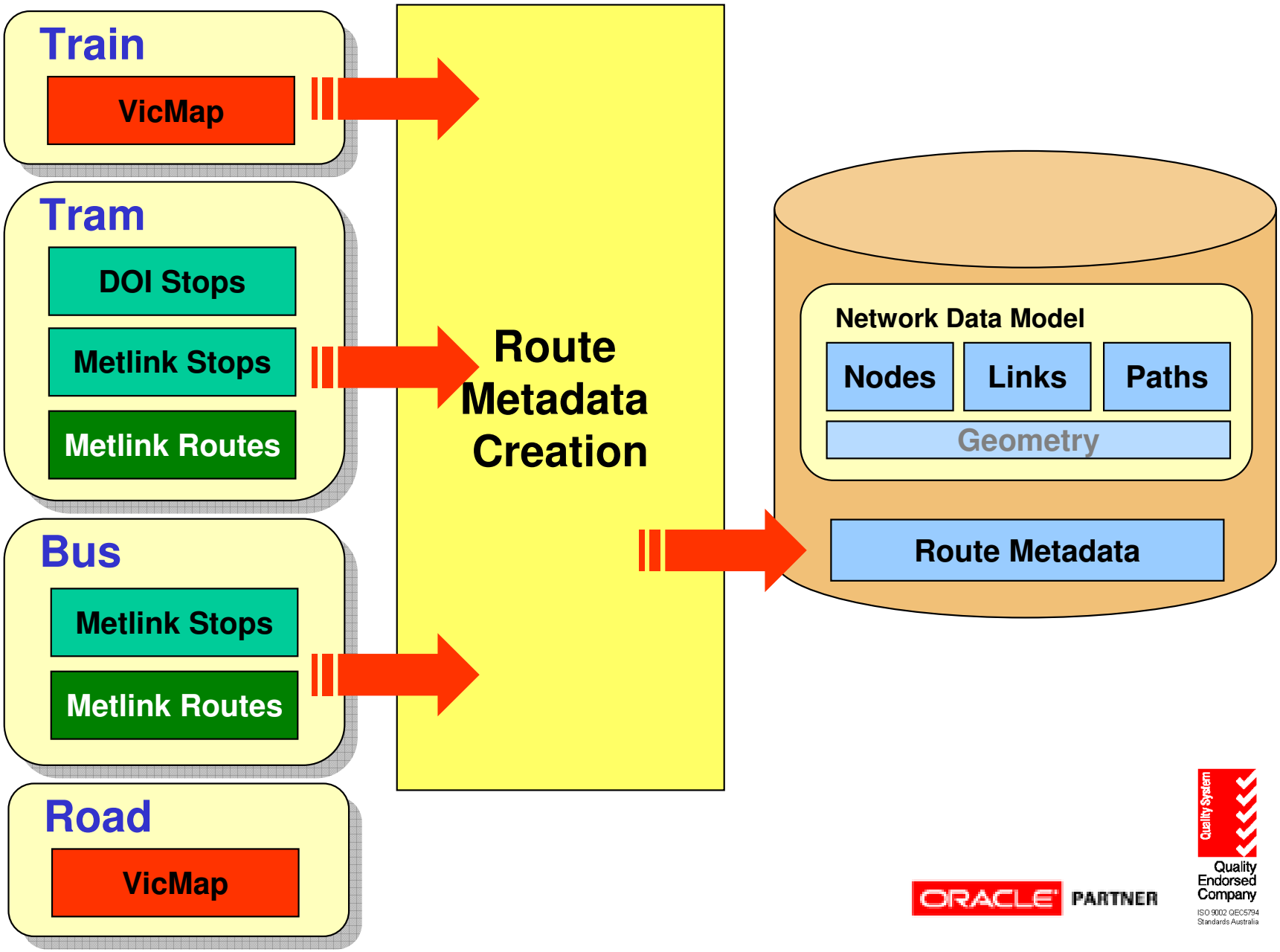
Building the routable data



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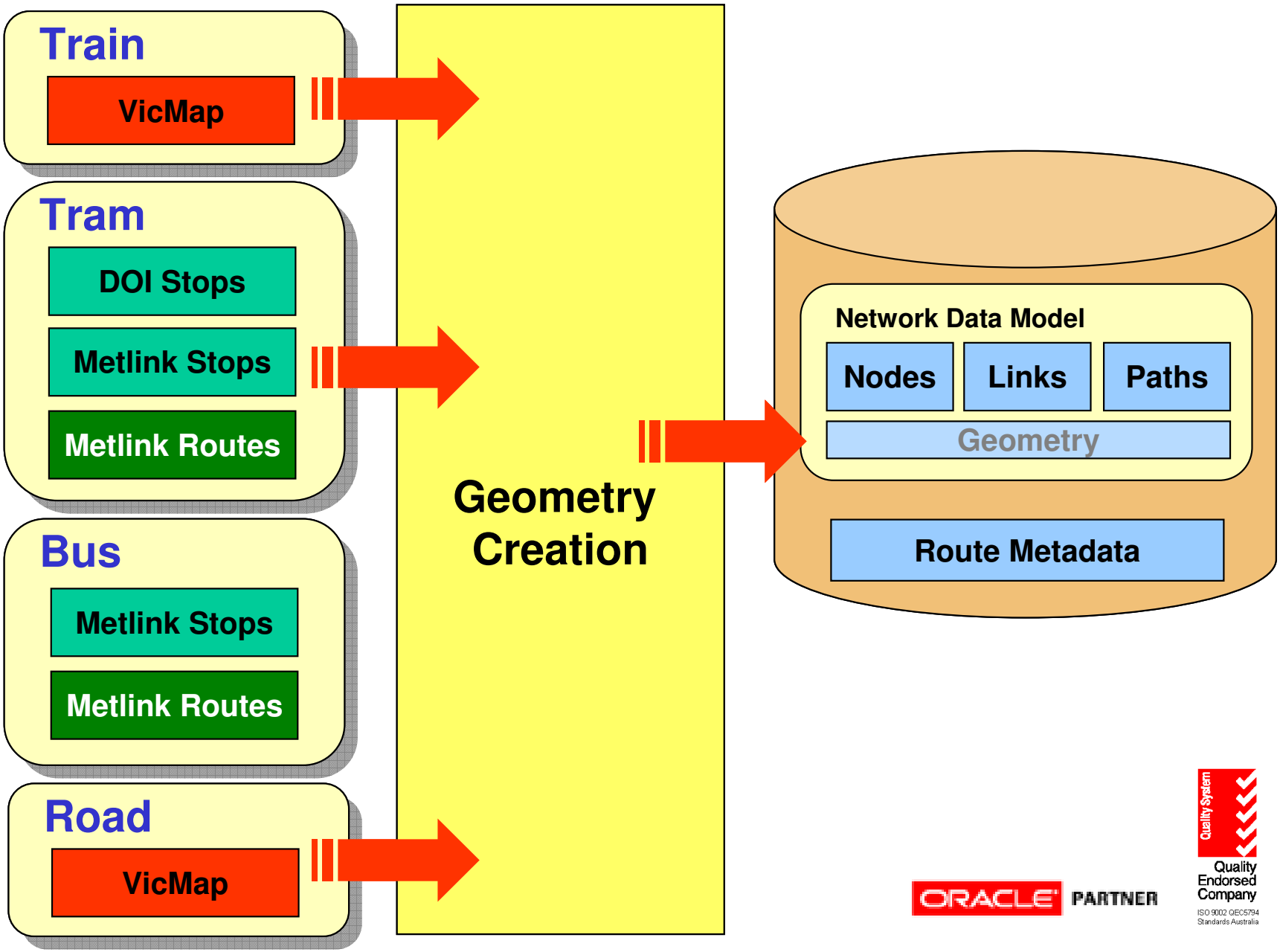
Building the routable data



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Sample Output

From : **Melbourne Observation Deck**
To : **Novotel Hotel, St Kilda**

WALK **to Stop 2 King St/Collins St (Melbourne City) (0.1km)**

TRAM **No. 109 Port Melbourne from Stop 2 King St/Collins St (Melbourne City) to Stop 125 Port Junction/79 Whiteman St (Southbank)**

TRAM **No. 96 St Kilda Beach from Stop 125 Port Junction/79 Whiteman St (Southbank) to Stop 137 Alfred Pl/The Esplanade (St Kilda)**

WALK **to Novotel St Kilda (16 The Esplanade St Kilda) (0.3km)**

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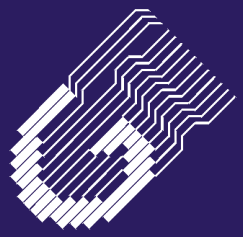
Building the network data

Data Cleansing

- Reconciliation of stops with map base
- Sequencing of stops
- Duplicate removal within routes
- Duplicate nodes between routes

Geometry

- Union of road network for route
- Splitting road segments based on stop positions
- Fixing directions of both links and geometry



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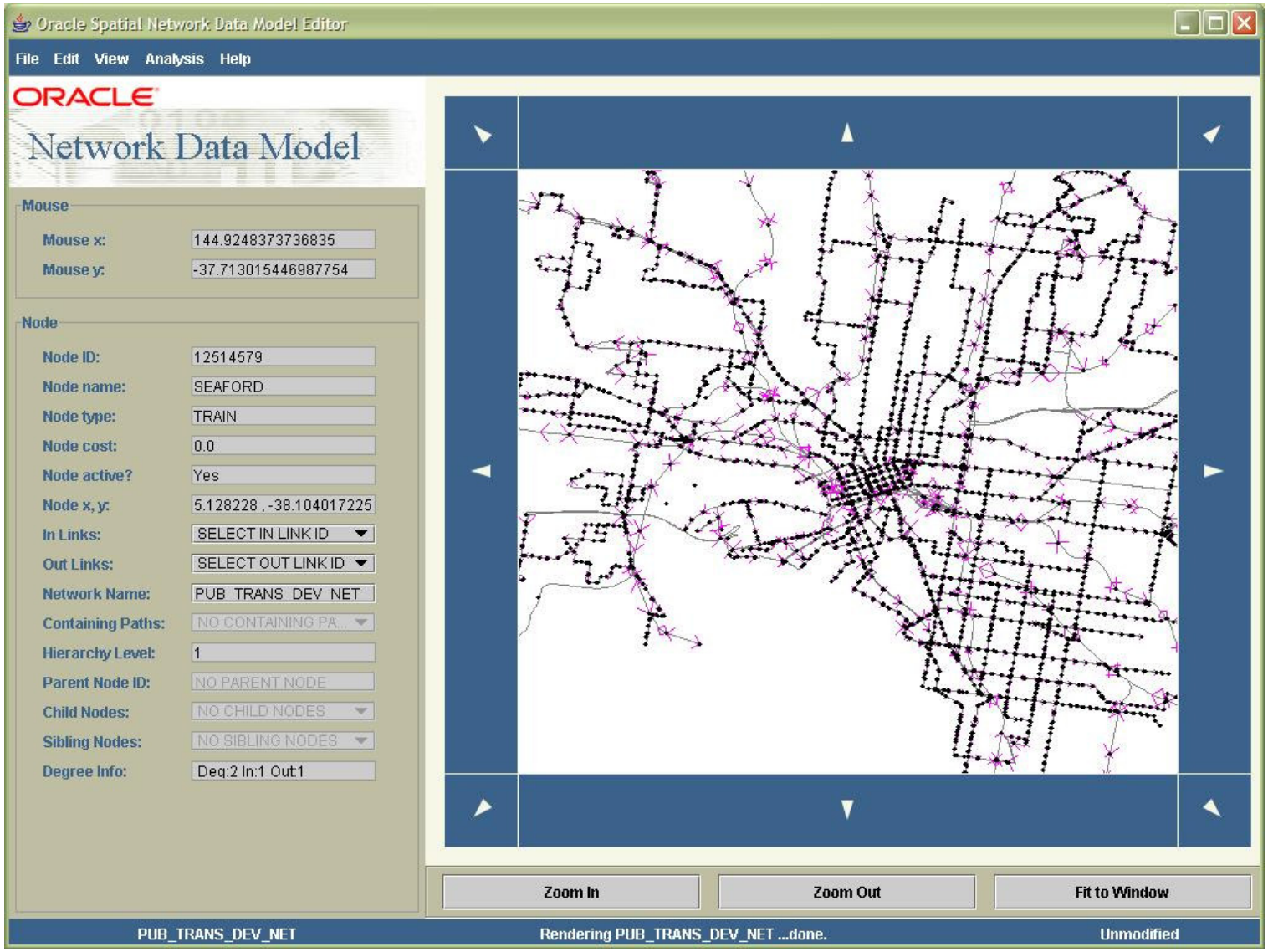
Transport Network - Logical



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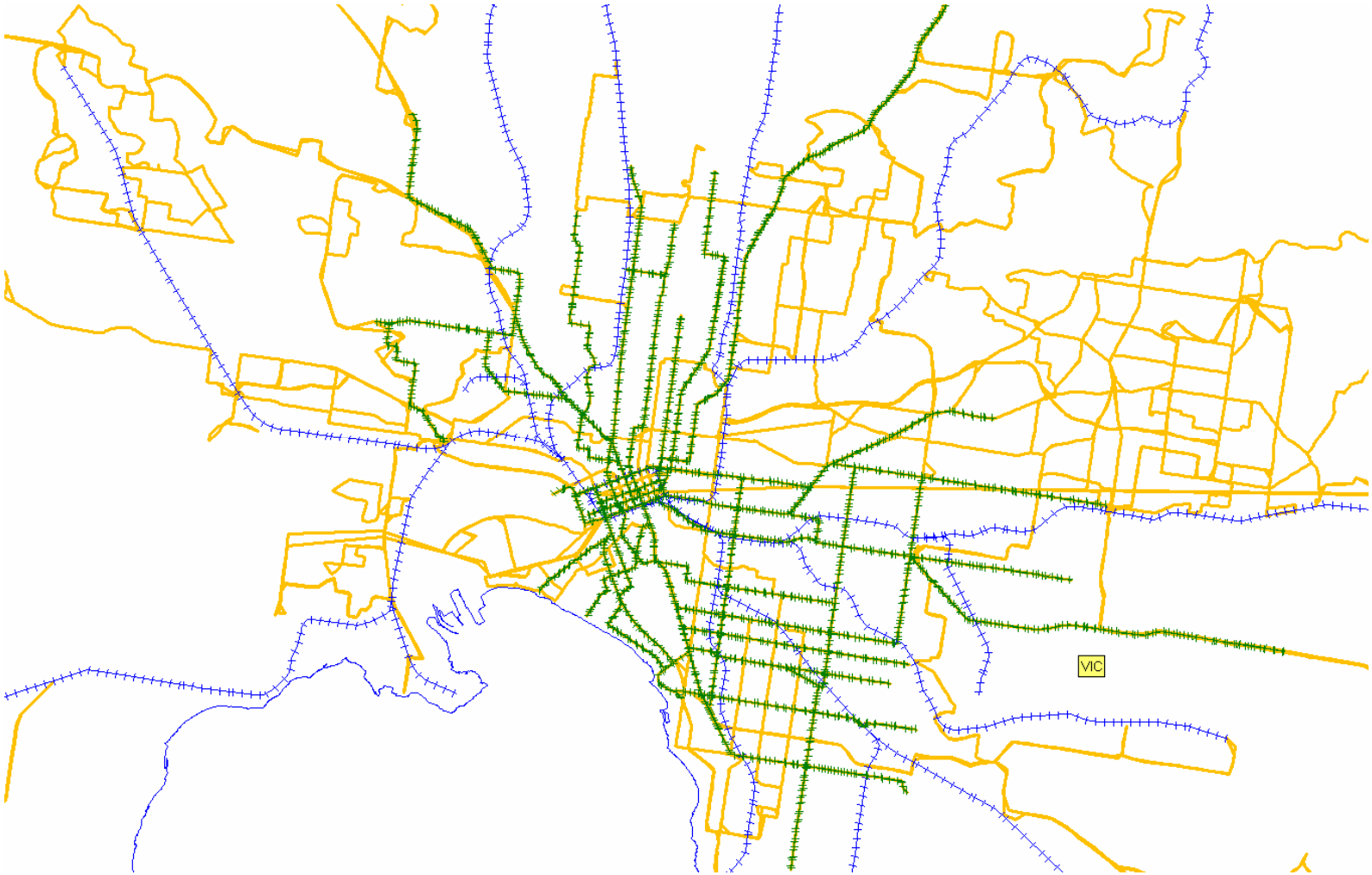
Transport Network - Physical



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Putting all the pieces together

Connections between modes

- Foot links

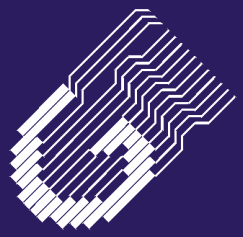
Determining the 'least cost'

- Multiple costs on links
- Travel time
- Distance

Network Management with SQL and Oracle Network Data Editor

Directions to include:

- Route Name, Destination, Stop Name, Walking distance (in kms)



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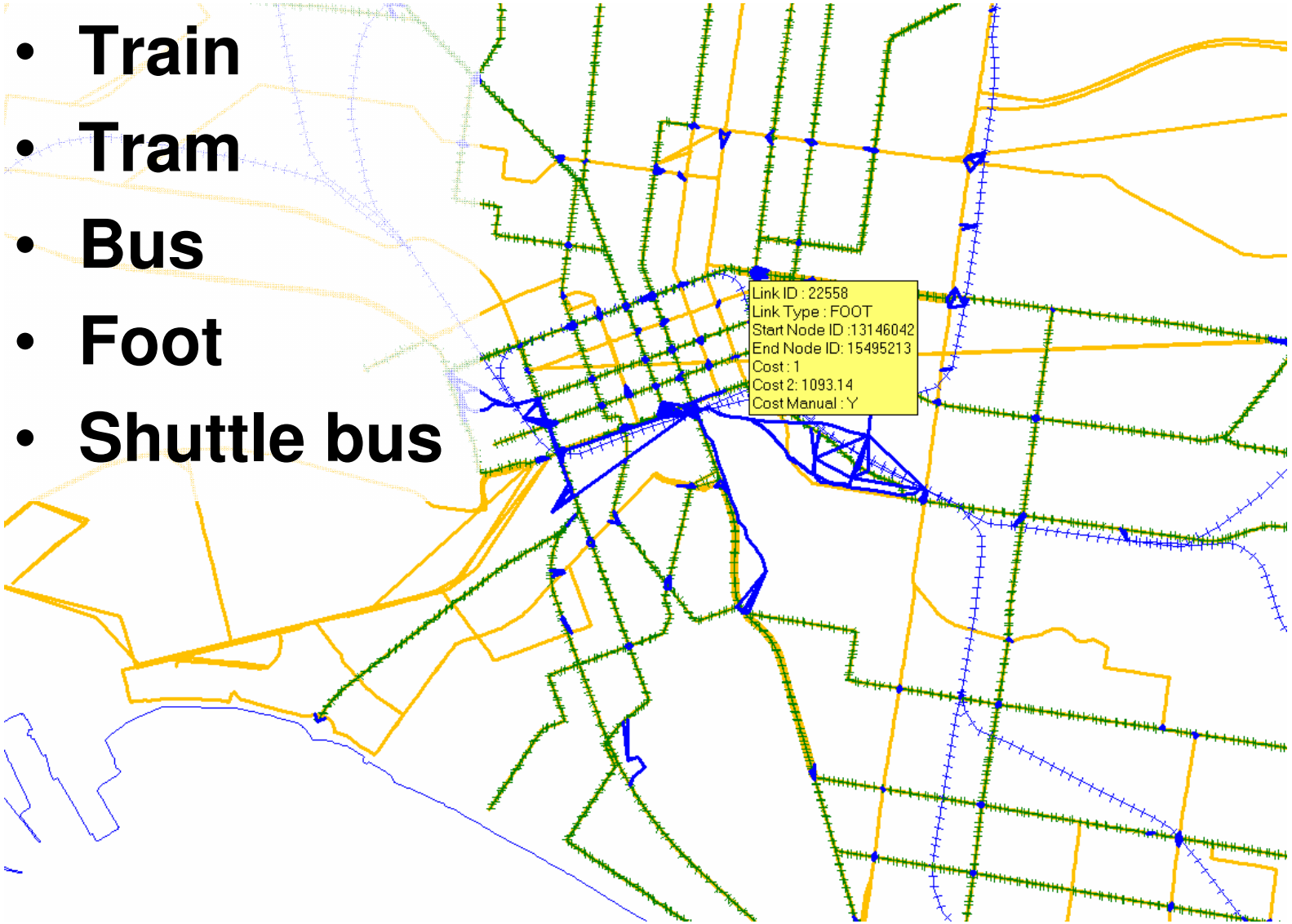
The multi-modal network

- Train
- Tram
- Bus
- Foot
- Shuttle bus



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Routing with Mapviewer

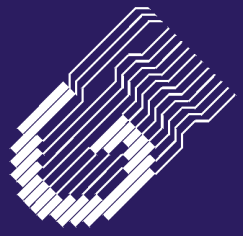
JDBC Themes for non-base data

- Route Start/End
- Route geometry

PNG output

Web service builds directions and map into single response

Map authoring with Oracle MapBuilder



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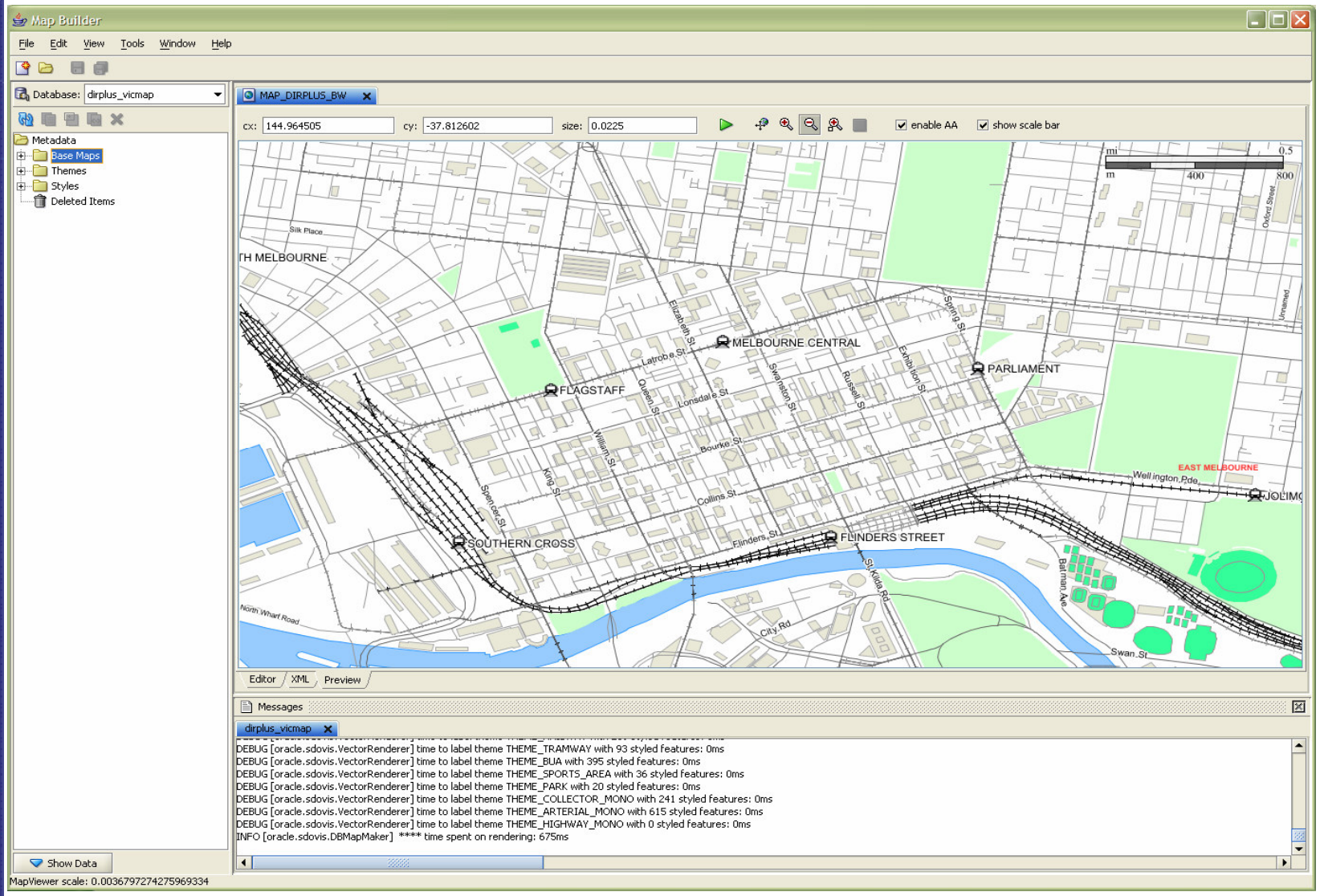
Oracle MapBuilder



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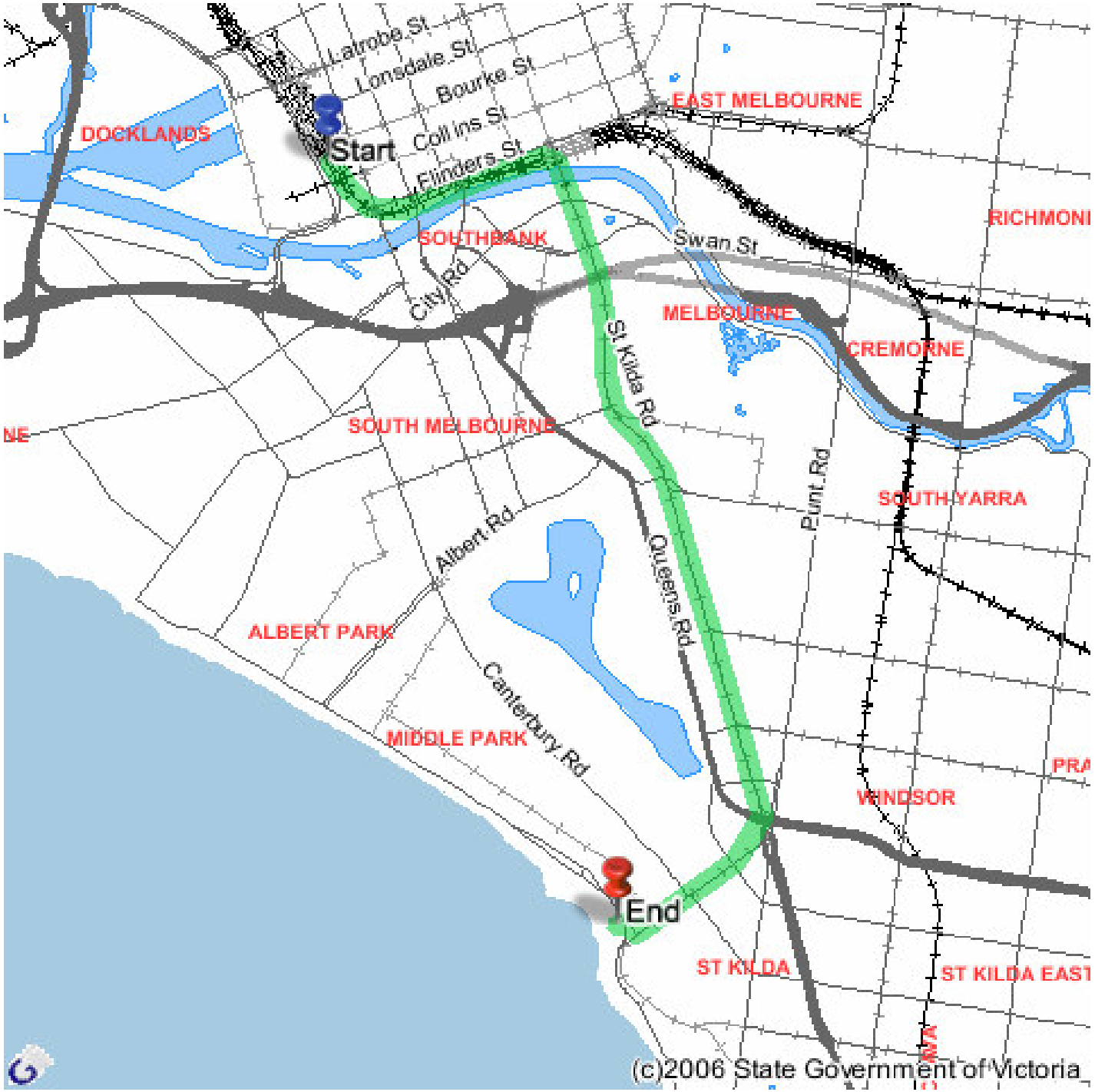

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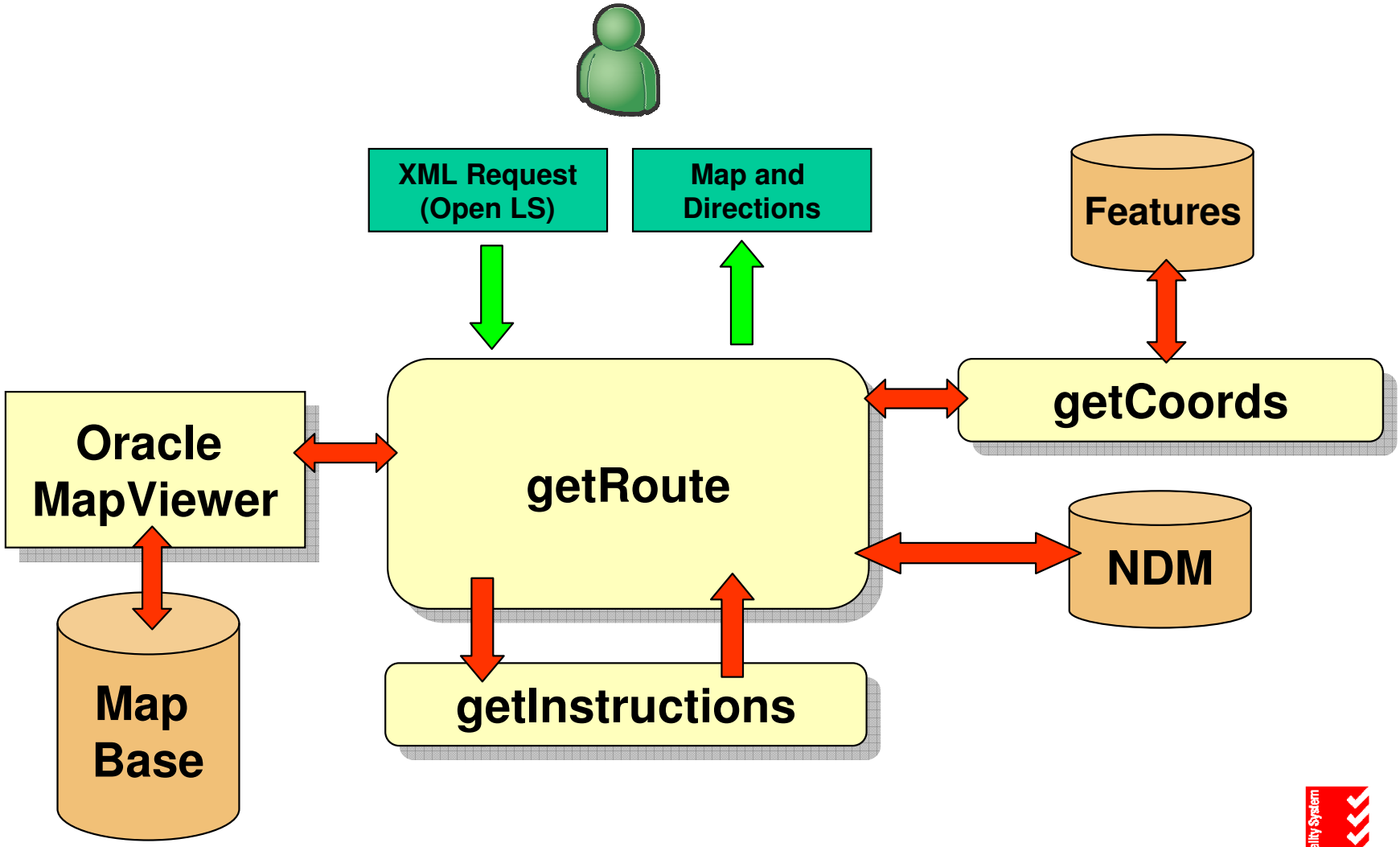
Solution Architecture



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getRoute

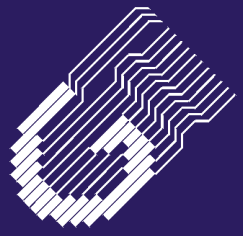
```
public DetermineRouteResponse requestRoute(double[] startPoint, double[] endPoint)
   throws Exception
 {
    ...

  Path path =
    shortestPath(getNearestNodeIDs(startPoint, 5), getNearestNodeIDs(endPoint,
                                                                     5));
  // if a path is not found between the given start and end points
   RouteGeometry routeGeometry;
  if (path != null)
  {
     // OUR METHOD to compute Geom
    path.setGeometry(computeGeometry(path));
     // Generalise route for presentation
     routeGeometry       = createRouteGeometry(path.getGeometry());
  }

  // create the route geometry
  if (routeGeometry != null)
  {
    response.setRouteGeometry(routeGeometry);
    this.setLineString(routeGeometry.getLineString());
  }

  // create the route instructions. method call()
  RouteInstructionsList instructionsList = createNetworkInstructions(path);
  response.setRouteInstructionsList(instructionsList);

  return response;
}
```



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Map Route in Mapviewer

```
public RouteMap buildMap(String format, int width, int height)
   throws Exception
 {
    ...

   MapViewer mv = new MapViewer(mvProdURL);
   mv.setImageFormat(MapViewer.FORMAT_RAW_COMPRESSED);
   mv.setMapTitle(mapTitle);
   int mapW = width, mapH = height;
   mv.setDeviceSize(new Dimension(mapW, mapH));
   double MapSize = Double.parseDouble(mapSizeString);
   mv.setDataSourceName(dataSourceString);
   mv.setBaseMapName(baseMapString);
   mv.setSize(MapSize);

    ...

   mv.setBoundingThemes(boundingThemes, 0.20, true);
   mv.addJDBCTheme(dataSourceString, "themeroute", lineStringSQL, "shape",
                   "8311", mapRouteStyle, "", "", true);
   mv.addJDBCTheme(dataSourceString, "startpt", startPntSQL, "shape",
                   "8311", mapStartPointStyle, "", "", true);
   mv.addJDBCTheme(dataSourceString, "endpt", endPntSQL, "shape", "8311",
                   mapEndPointStyle, "", "", true);

   this.setMapViewerRequest(mv);

   MapViewer prodmv = this.getMapViewerRequest();
   prodmv.run();
    Image img = prodmv.getGeneratedMapImage();

    byte[] b = baos.toByteArray();
   String base64string = Base64.encode(b);

   ...

 }
```

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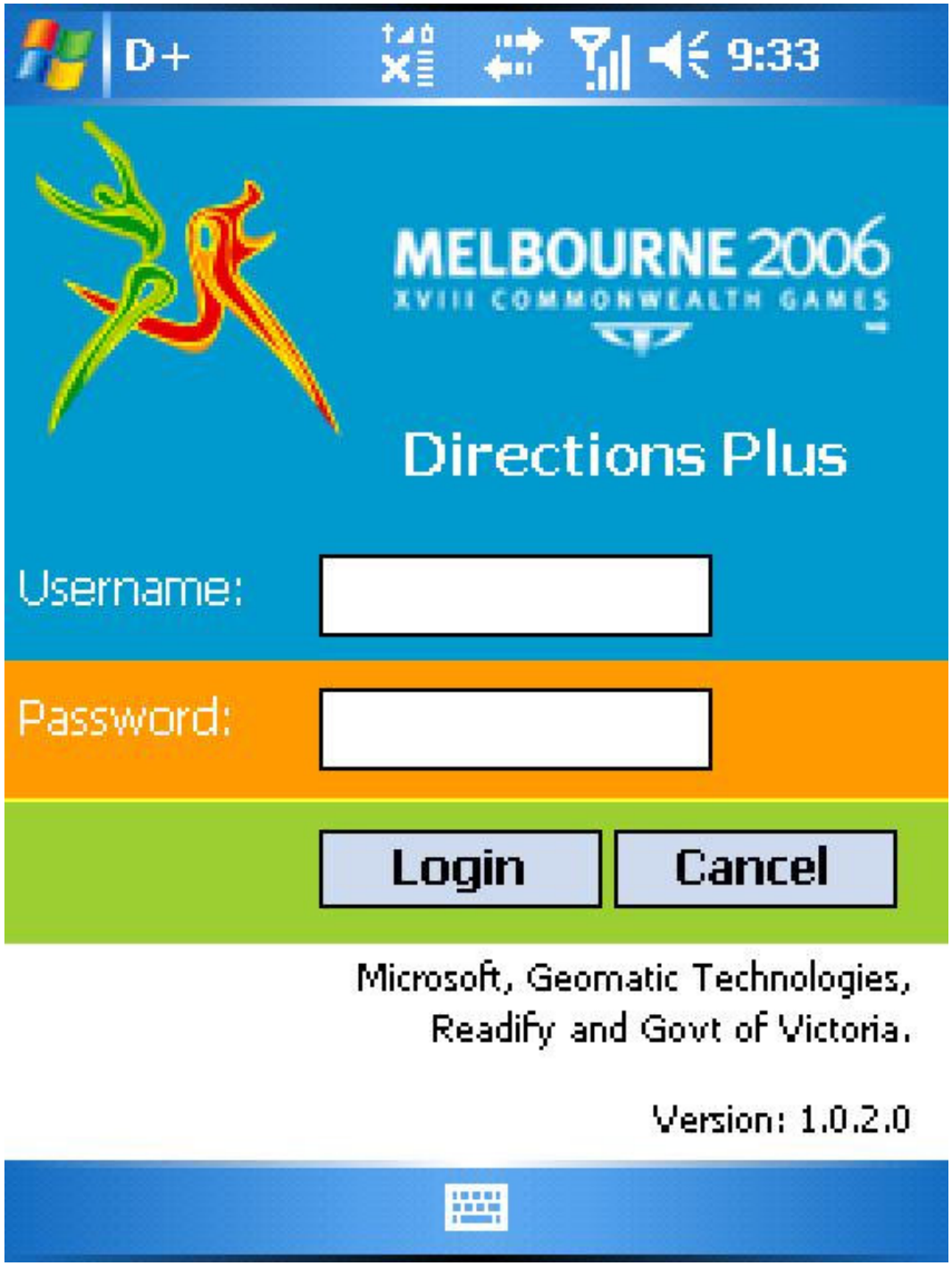

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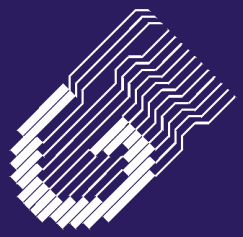
Conclusions

- Oracle Network Data Model can deliver multi-modal routing
- Oracle route server works for road networks only
- NDM must be extended with metadata for direction generation
- NDM API provides for route analysis
- Mapviewer is well suited to delivery of light-weight images via web services



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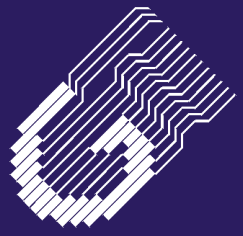
Questions?



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