



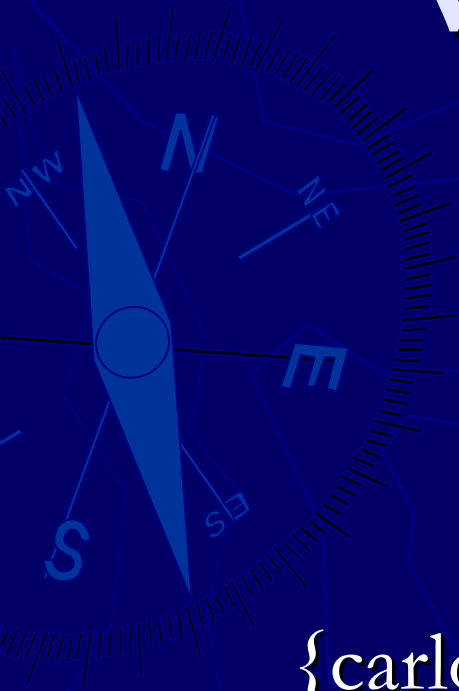
# GIS development for Web using MDA

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# Outline

- Introduction, Goal and Scope
- MapServer Overview
- Model Driven Architecture Overview
- UML Extension
- AndroMDA Cartridges
- Conclusion and ongoing work

# Introduction

- GIS development for Web
  - High cost and effort of development
  - Difficulties of integration between business and geographic models
  - Huge amount of configuration files
  - Complex data types
- Model Driven Architecture (MDA)
  - New technology for software development
  - Complete software development life-cycle
  - Increase of development productivity

# Goal

- This work aims at
  - improving the productivity in the development of GIS for Web through MDA
- How did we perform it?
  - Defining an UML extension for GIS
  - Developing automatic transformations in order to generate code in a MDA tool

# Scope

- Tools focused
  - MapServer
  - AndroMDA
- What code will we generate?
  - MapServer configuration files

# MapServer Overview

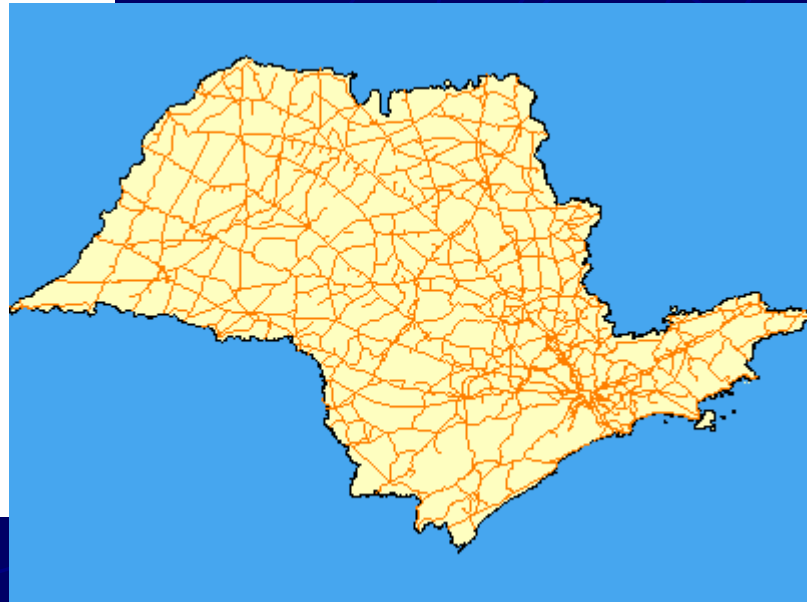
- Environment to support GIS development for Web
- Supports search, retrieval and visualization of maps
- Open-source technology
- Layer concept
- Based on configuration files and special tags in HTML-code
- Maps are described in a configuration file called *mapfile*

# GIS for Web using MapServer

```

1  MAP
2  EXTENT      -53.11 -25.312 -44.161 -19.779
3  SHAPEPATH  "../mapas/"
4  SIZE        400 300
5
6  LAYER
7  |  NAME      "uf"
8  |  TYPE      POLYGON
9  |  DATA     "sp_uf"
10 |  STATUS    DEFAULT
11 |  CLASS
12 | |  NAME      "São Paulo"
13 | |  OUTLINECOLOR 0 0 0
14 | |  COLOR     255 255 192
15 |  END
16 END
17
18 LAYER
19 |  NAME      "rvia"
20 |  TYPE      LINE
21 |  DATA     "sp_rvia"
22 |  CLASS
23 | |  NAME      "Rodovias"
24 | |  COLOR     255 128 0
25 |  END
26 END
27
28 END

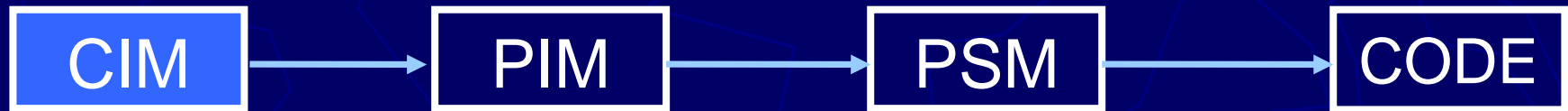
```



# Model Driven Architecture Overview

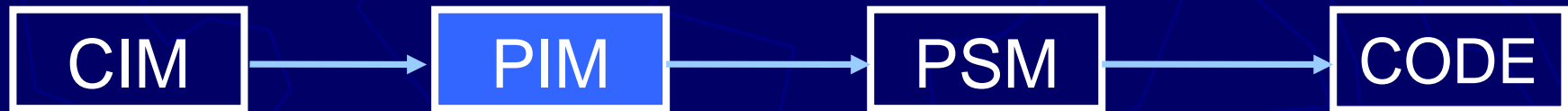
- The specification of system functionality is separated from the specification of implementation on a specific technology or platform
- Automatic transformations provide to generate code from models

# Model-Driven Architecture Overview



- CIM – Computation Independent Model

# Model-Driven Architecture Overview



- CIM – Computation Independent Model
- PIM - Platform Independent Model

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- PSM – Platform Specific Model

# Model-Driven Architecture Overview



- CIM – Computation Independent Model
- PIM - Platform Independent Model
- PSM – Platform Specific Model
- Code generated by previous steps

# UML Extension

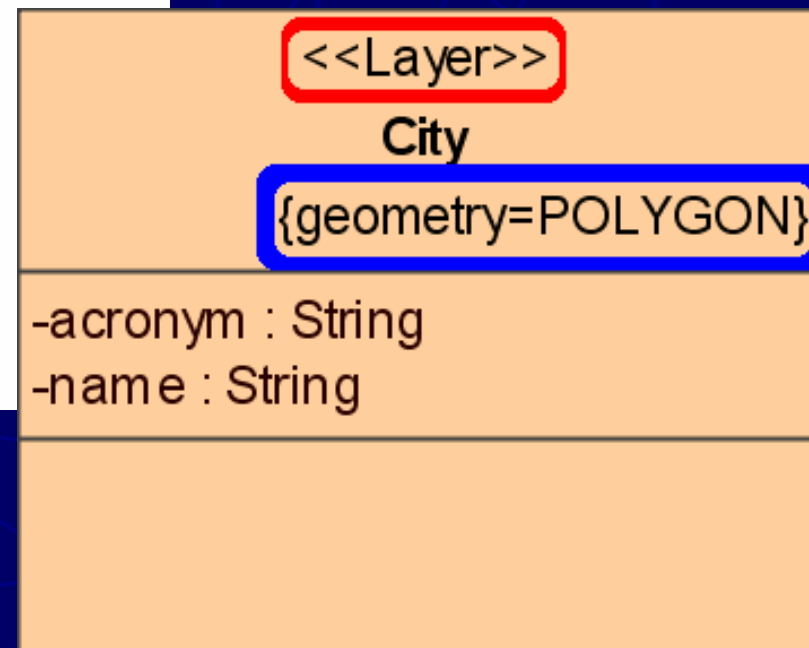
- Goals
  - Adding geographic information in UML Class Diagram
  - Providing information for MDA tool in order to generate *mapfiles*
- What's the news?
  - Two stereotypes
  - Two tagged-values

# UML Extension

```

1  MAP
2  EXTENT ..... -53.11 -25.312 -44.161 -19.779
3  IMAGECOLOR ..... 70 166 239
4
5  LAYER
6  NAME ..... "city"
7  TYPE ..... POLYGON
8  DATA → ..... "city"
9  CLASS
10 NAME ..... "city"
11 OUTLINECOLOR ..... 0 0 0
12 COLOR ..... 255 255 255
13 END
14 END
15
16 END
17

```



# UML Extension

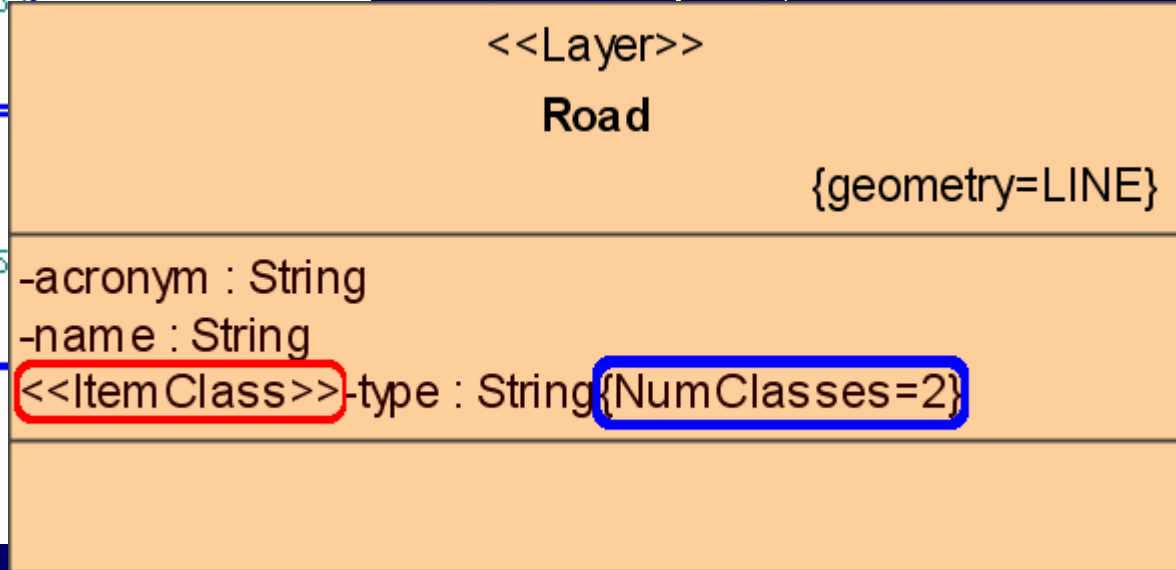
attribute in a map layer

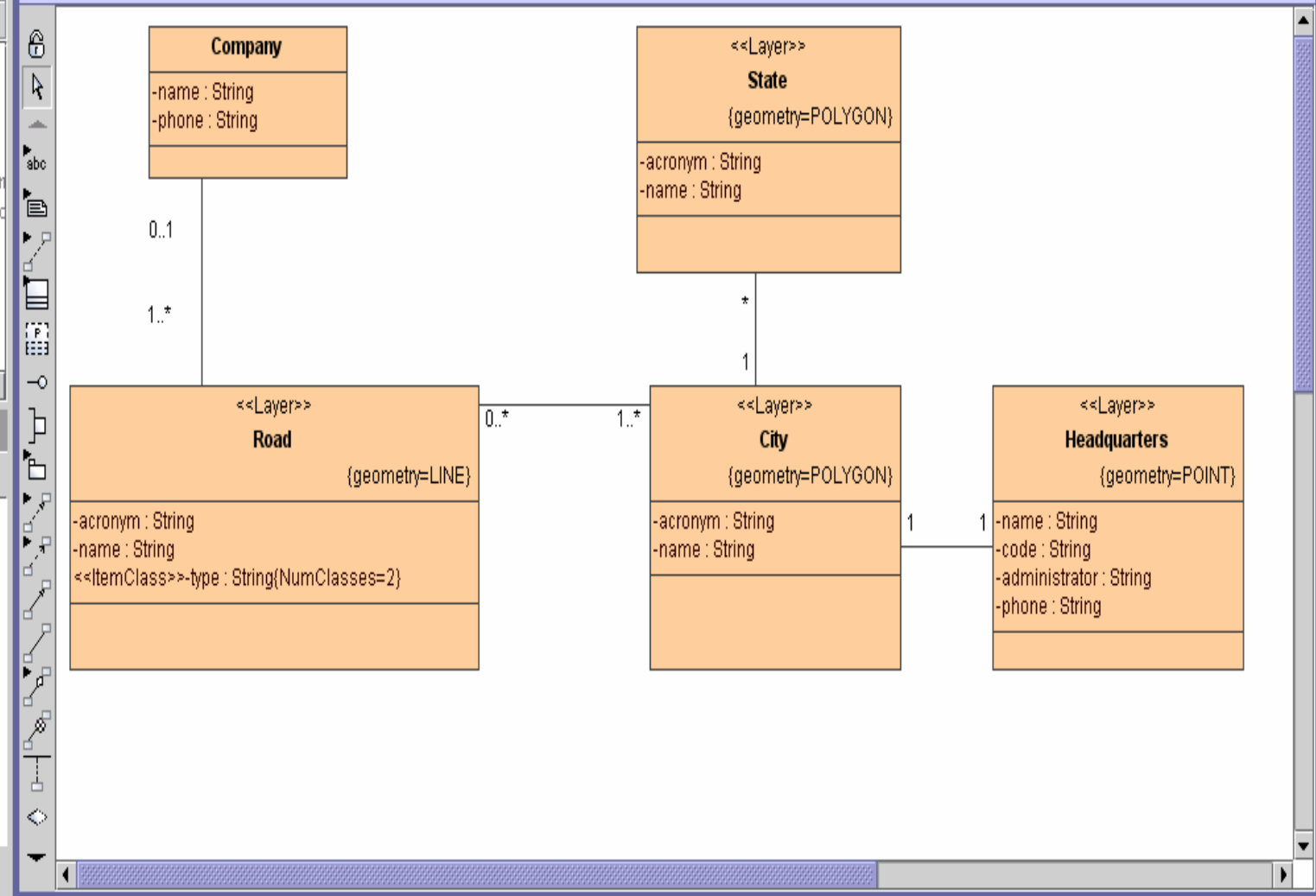
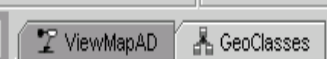
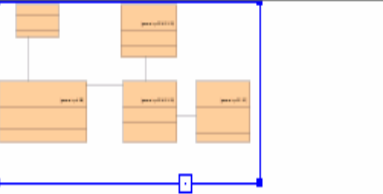
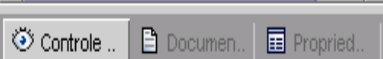
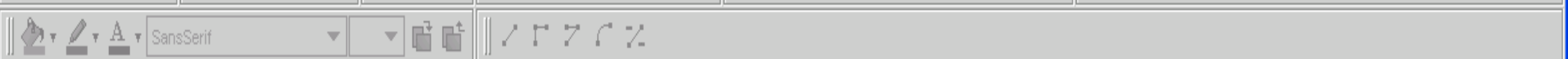
classes in a map layer

```

1 MAP
2   EXTENT ..... -53.11 -25.312 -44.161 -19.779
3   IMAGECOLOR ..... 70 166 239
4
5   | LAYER
6     NAME ..... "road"
7     TYPE ..... LINE
8     DATA ..... "road"
9     CLASSITEM ..... "type"
10    CLASS
11     NAME ..... "1"
12     → OUTLINECOLOR ..... 0 0 0
13     → COLOR ..... 255 255 255
14     EXPRESSION ..... ""
15    END
16    CLASS
17     NAME ..... "2"
18     → OUTLINECOLOR ..... 0 0 0
19     → COLOR ..... 255 255 255
20     EXPRESSION ..... ""
21    END
22  END
23
24 END
25

```





# AndroMDA Cartridges

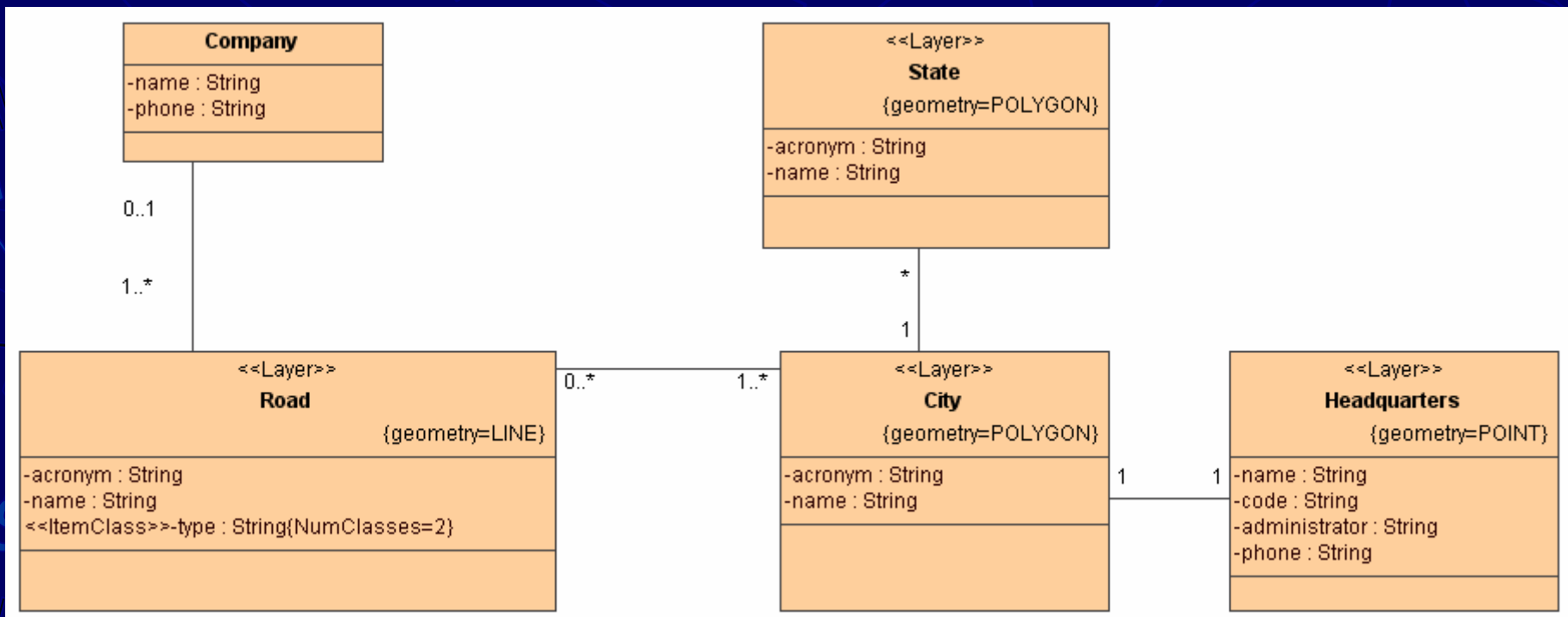
- AndroMDA
  - MDA tool
  - Open-source
  - Transforming models in other models or code
  - The transformations are made by cartridges
  - Cartridges can be developed or evolved
- GIS for Web cartridge
  - Using UML Extension for GIS
  - Generating the basic *mapfile* structure

# AndroMDA Cartridges

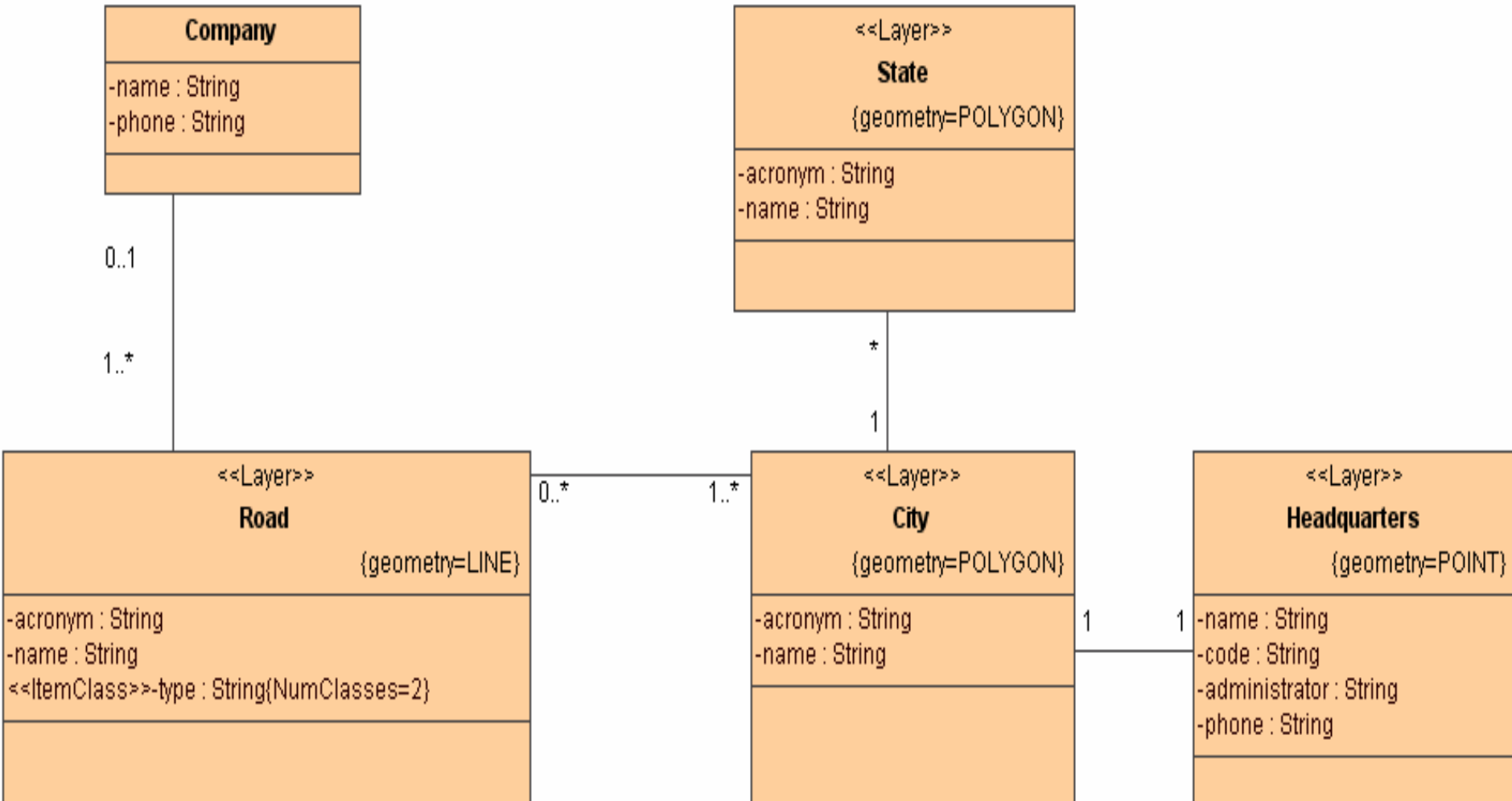
- Transformations performed by the GIS for Web cartridge:
  - Generation of the basic skeleton of *mapfile code*
  - Generation of layers
  - Generation of layer classes

# Example of application

## ■ Application model:



# Model



# Example of application

```

1  MAP
2  EXTENT ..... 0 0 0
3  IMAGECOLOR ..... 255 255 255
4  LAYER
5  NAME ..... "state"
6  TYPE ..... POLYGON
7  → DATA ..... "state"
8  CLASS
9  → NAME ..... "state"
10 → OUTLINECOLOR 0 0 0
11 → COLOR ..... 255 255 255
12 → END
13 END
14 LAYER
15 NAME ..... "city"
16 TYPE ..... POLYGON
17 → DATA ..... "city"
18 CLASS
19 → NAME ..... "city"
20 → OUTLINECOLOR 0 0 0
21 → COLOR ..... 255 255 255
22 → END
23 END
24 LAYER
25 NAME ..... "road"
26 TYPE ..... LINE
27 DATA ..... "road"
28 CLASSITEM ..... "type"
29 CLASS
30 NAME ..... "1"
31 → OUTLINECOLOR 0 0 0
32 → COLOR ..... 255 255 255
33 → EXPRESSION ..... ""
34 → END
35 CLASS
36 NAME ..... "2"
37 → OUTLINECOLOR 0 0 0
38 → COLOR ..... 255 255 255
39 → EXPRESSION ..... ""
40 → END
41 END
42 LAYER
43 NAME ..... "headquarters"
44 TYPE ..... POINT
45 DATA ..... "headquarters"
46 CLASS
47 NAME ..... "headquarters"
48 → COLOR ..... 255 255 255
49 SYMBOL ..... ""
50 SIZE ..... 1
51 LABEL
52 COLOR ..... 0 0 0
53 TYPE ..... TRUETYPE
54 SIZE ..... 1
55 POSITION ..... AUTO
56 → END
57 END
58 LABELITEM ..... ""
59 END
60 END

```

MAP

EXTENT 0 0 0 0  
IMAGECOLOR 255 255 255

LAYER  
NAME "state"  
TYPE POLYGON  
DATA "state"  
CLASS  
NAME "state"  
OUTLINECOLOR 0 0 0  
COLOR 255 255 255  
END

LAYER  
NAME "city"  
TYPE POLYGON  
DATA "city"  
CLASS  
NAME "city"  
OUTLINECOLOR 0 0 0  
COLOR 255 255 255  
END

LAYER  
NAME "road"  
TYPE LINE  
DATA "road"  
CLASSITEM "type"  
CLASS  
NAME "1"

OUTLINECOLOR 0 0 0  
COLOR 255 255 255  
EXPRESSION ""  
END

CLASS  
NAME "2"  
OUTLINECOLOR 0 0 0  
COLOR 255 255 255  
EXPRESSION ""  
END

END  
LAYER  
NAME "headquarters"  
TYPE POINT  
DATA "headquarters"  
CLASS  
NAME "headquarters"  
COLOR 255 255 255  
SYMBOL ""  
SIZE 1  
LABEL  
COLOR 0 0 0  
TYPE TRUETYPE  
SIZE 1  
POSITION AUTO  
END  
END  
LABELITEM ""  
END

END

Navegar  Consultar

Aproximar  Mover  Afastar

Sedes municipais  Rodovias

- Sedes municipais
- / Rodovia principal
- / Rodovia secundária
- Município



0 16 32 48 km

Escala = 1:873150.172665



# Conclusion and ongoing work

- Conclusion
  - Providing GIS development for Web using MDA
- Ongoing work
  - New stereotypes and tagged-values
  - New transformations in the cartridges in order to generate more complete *mapfiles*



# GIS Development for Web using MDA

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Thank you very much!!!

