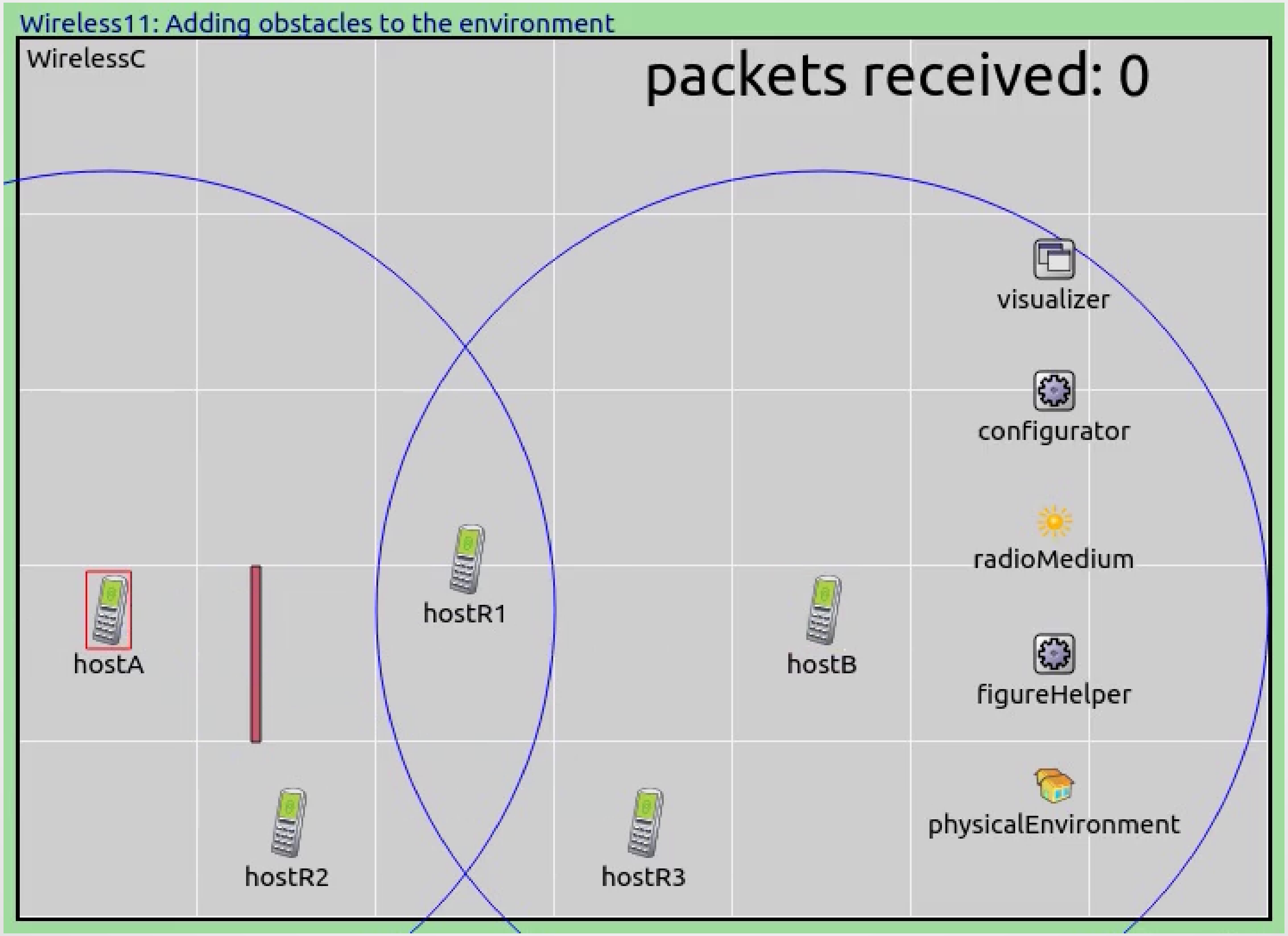
OMNeT++ Community Summit, 2016

Visualization in the INET Framework

Brno University of Technology – Czech Republic – September 15-16, 2016 Levente Mészáros

Motivation Example



Wireless11: Adding obstacles to the environment

WirelessC

packets received: 0

Implemented Visualizations for Communication

- Physical layer
  - Transmission & interference ranges, transmissions, propagating signals, receptions, and physical links
- Data link layer
  - Data links and link breaks
- Network layer
  - Routing tables and active network routes
- Transport layer
  - Transport connections and active transport routes
- Packet drops and numerical statistics

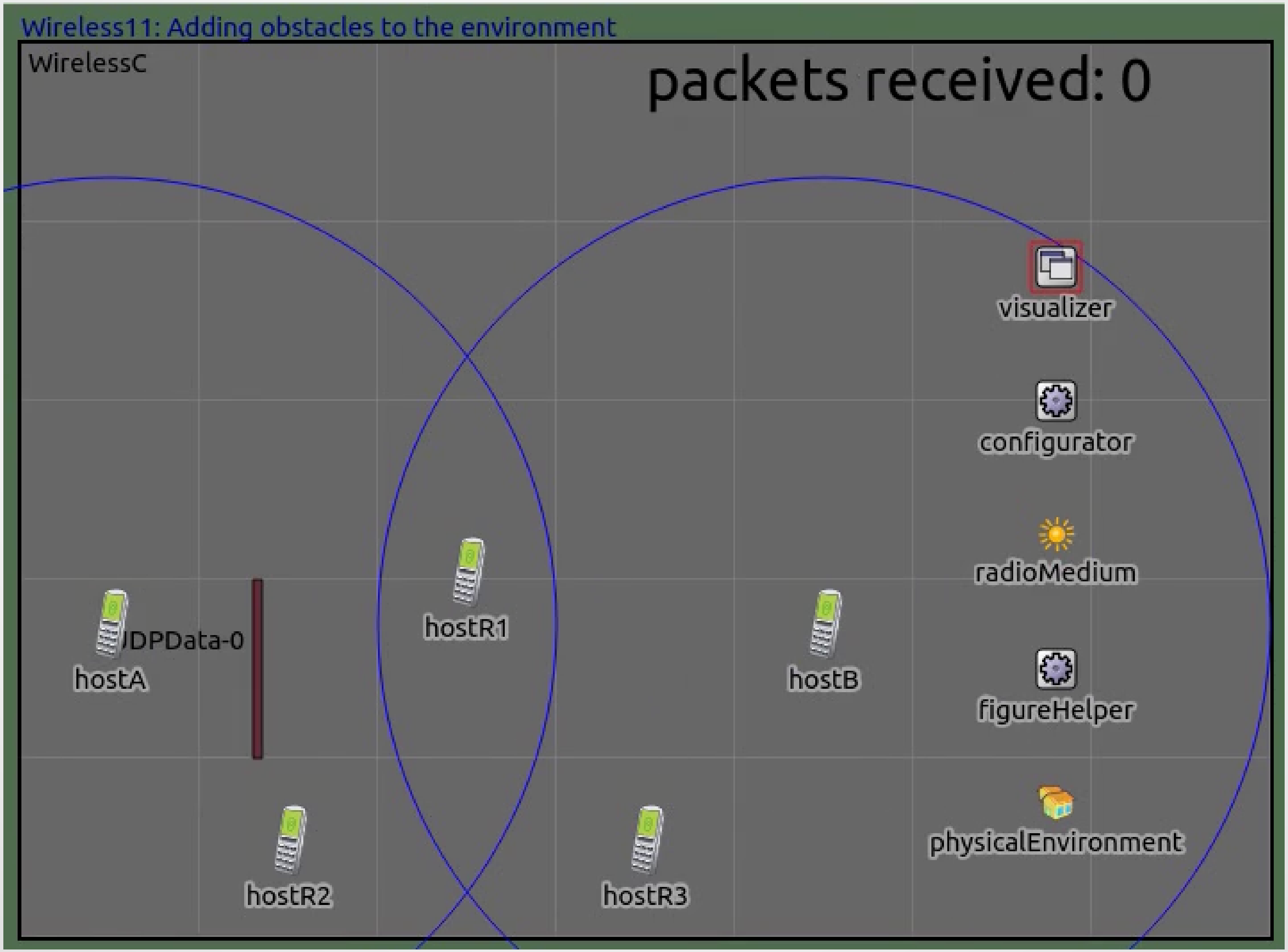
Other Implemented Visualizations

- Street maps and earth
- Playground with axis
- Physical objects and obstacle losses
- Network nodes and network connections
- Mobility and movement trajectory
- Module info strigns

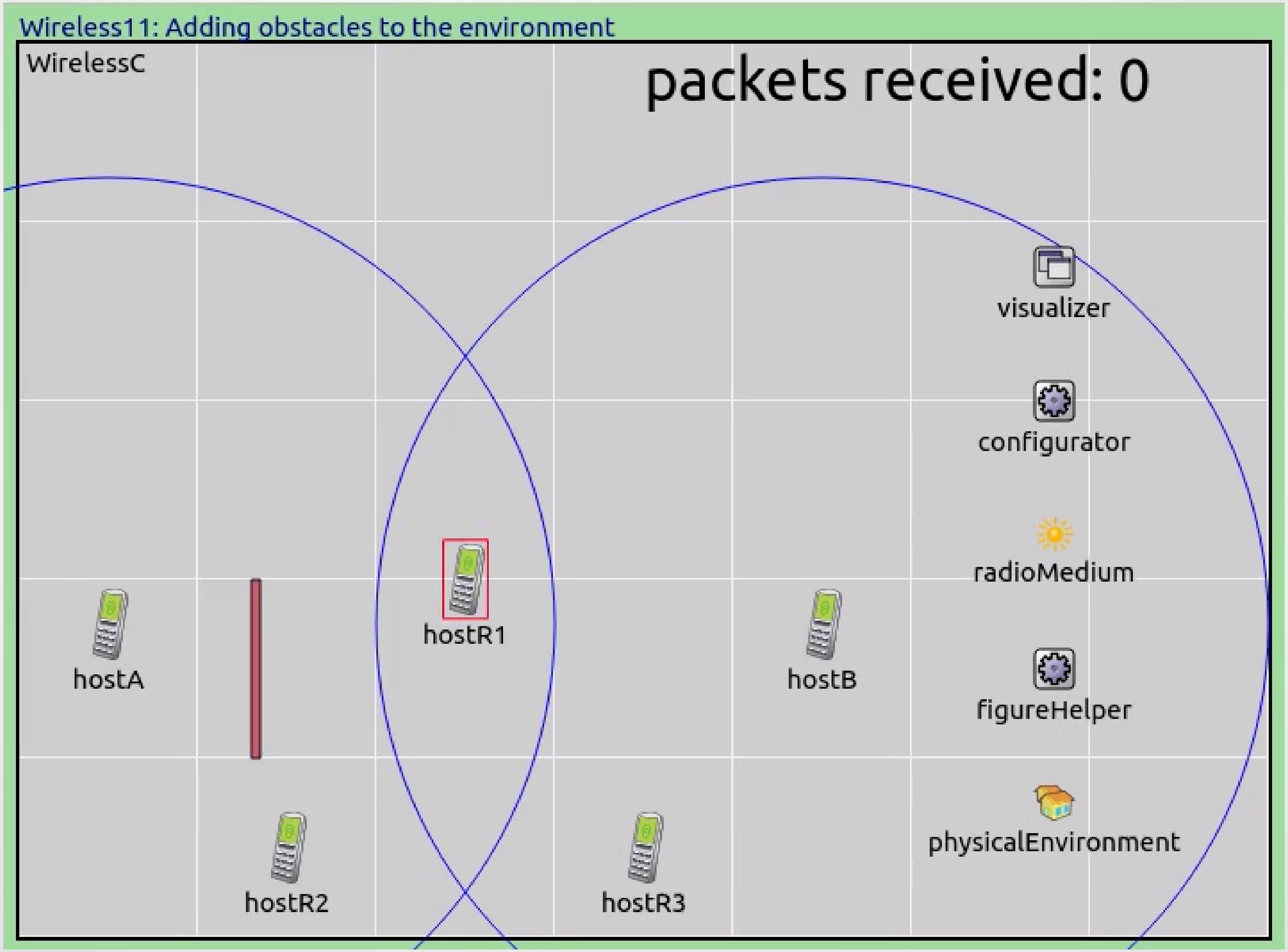
Visualization Goals

- De-couple visualization from simulation model
- Make it configurable in terms of *what* and *how*
- Support both 2D and 3D visualization
- Allow multiple different visualizations simultaneously
- First informative, then beautiful and interactive

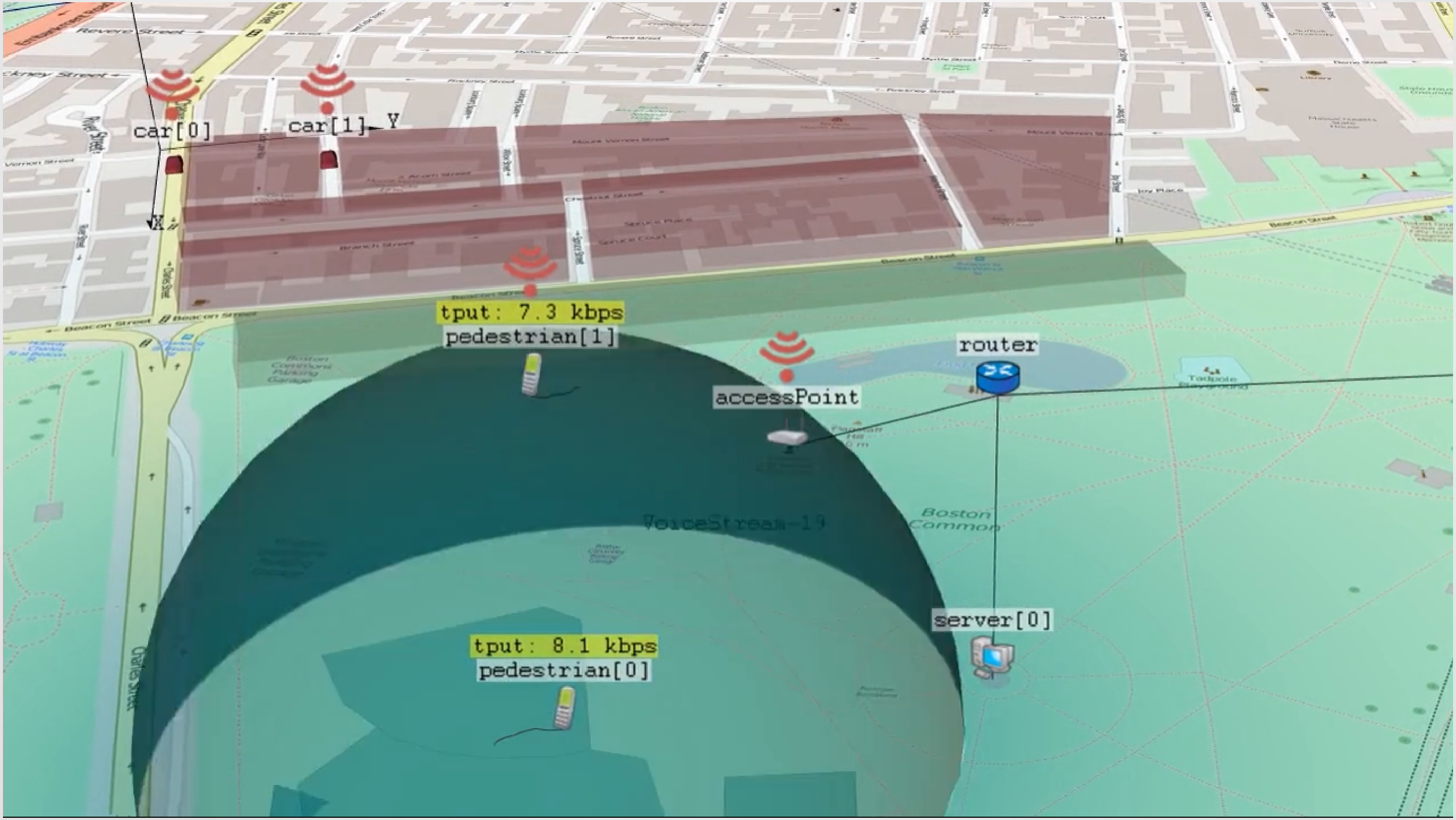
Motivation Example Solved



Motivation Example Extended

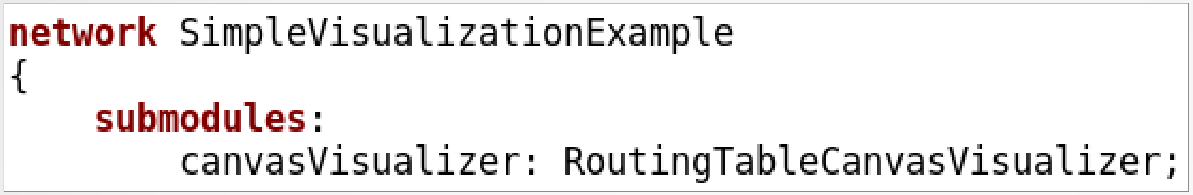


3D Example

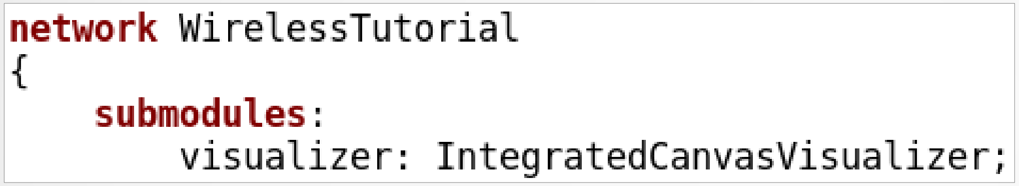

car[0]
car[1]
Y
X
tput: 7.3 kbps
pedestrian[1]
router
accessPoint
VoiceStream-19
Boston Common
server[0]
tput: 8.1 kbps
pedestrian[0]
Revere Street
Beacon Street
Charles Street

How to Use Visualizers?

- Add visualizer submodules in the NED file

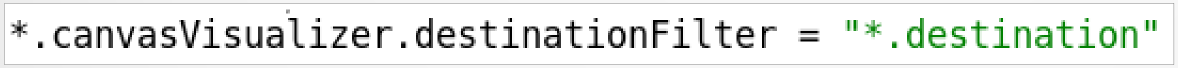


```
network SimpleVisualizationExample
{
    submodules:
        canvasVisualizer: RoutingTableCanvasVisualizer;
```

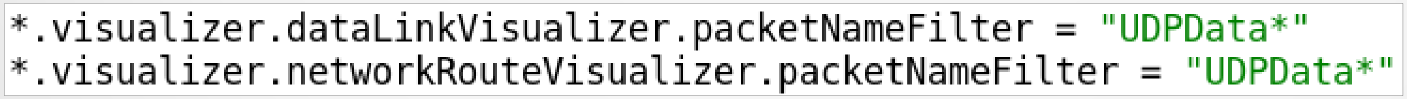


```
network WirelessTutorial
{
    submodules:
        visualizer: IntegratedCanvasVisualizer;
```

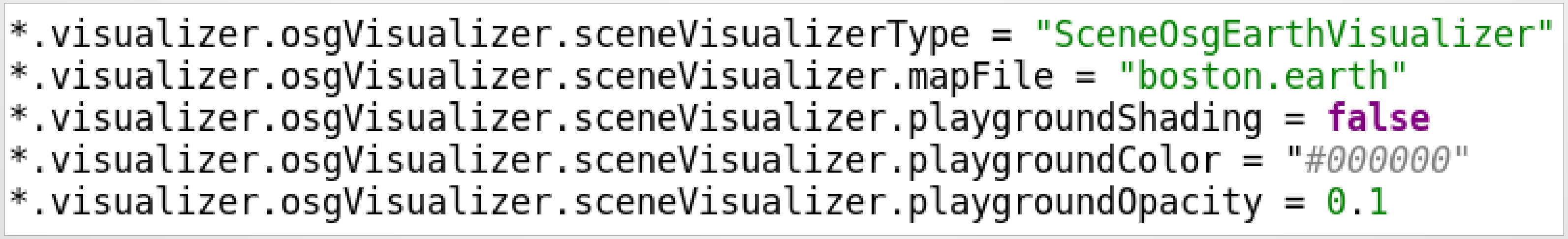
- Configure visualizers in the Ini file



```
*.canvasVisualizer.destinationFilter = "*.destination"
```



```
*.visualizer.dataLinkVisualizer.packetNameFilter = "UDPData*"
*.visualizer.networkRouteVisualizer.packetNameFilter = "UDPData*"
```



```
*.visualizer.osgVisualizer.sceneVisualizerType = "SceneOsgEarthVisualizer"
*.visualizer.osgVisualizer.sceneVisualizer.mapFile = "boston.earth"
*.visualizer.osgVisualizer.sceneVisualizer.playgroundShading = false
*.visualizer.osgVisualizer.sceneVisualizer.playgroundColor = "#000000"
*.visualizer.osgVisualizer.sceneVisualizer.playgroundOpacity = 0.1
```

What Parameters Visualizers have?

- Target canvas
- Turning various sub-visualizations on/off
- Filtering
  - Node filter, packet filter, etc.
- Styling
  - Colors, shapes, images, sizing, opacity, etc.

Where are the Visualizers?

- Visualizers can be found under ‘`INET/src/visualizer`’
- Simple visualizers are called something like
  - `DataLinkCanvasVisualizer` (2D)
  - `DataLinkOsgVisualizer` (3D)
- Combined visualizers exist for convenience
  - `IntegratedCanvasVisualizer` (2D)
  - `IntegratedOsgVisualizer` (3D)
  - `IntegratedVisualizer` (2D & 3D)

How do Visualizers Work?

- Visualizers are separate modules from network models
- They communicate with network models using
  - OMNeT++ signals (emit & subscribe)
  - C++ functions (lookup & call)
- Communication parameters
  - Subscription module paths for OMNeT++ signals
  - Module paths for C++ calls

Questions and Answers

Thank you for your kind attention!