Mobile Wireless Networking

The University of Kansas EECS 882
Ad Hoc Routing in ns-3

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http://www.ittc.ku.edu/~jpgs/courses/mwnets
Ad Hoc Routing in ns-3

Outline

SR.1  Overview of MANETs in ns-3
SR.2  Ad hoc routing examples
SR.3  Laboratory assignment
Ad Hoc Routing in ns-3

Overview of MANETs in ns-3

SR.1  Overview of MANETs in ns-3
SR.2  Ad hoc routing examples
SR.3  Laboratory assignment
Mobile Ad Hoc Networks

Overview

- MANETs are typically
  - wireless
  - mobile
  - little or no reliance on infrastructure
  - communication among peers
  - limited network resources
Network Layer
Services and Functions

• Network layer provides services to layer 4
• Link layer provides services to layer 3
• Network layer operates both HBH and E2E
• Network layer functions are:
  - forwarding
  - routing
  - signalling
  - addressing
  - traffic management
• In MANETs are all of these functions available?
Routing in ns-3

Routing Protocols for Wired Links

• Global centralized routing
  – based on shortest path first algorithm
  – only for wired links (PPP and CSMA)
    • wireless nodes can use, but does not consider medium effects
  – unicast
  – GlobalRouter interface in each node advertises LSA
  – each node has a routing table

• Nix-vector routing
  – intended for large topologies
  – targeted for simulations with wired links
Routing in ns-3
MANET Routing Protocols in ns-3

- **AODV**: ad-hoc on demand distance vector
  - based on RFC 3561
- **DSDV**: destination-sequenced distance vector
  - developed by Hemanth Narra and Yufei Cheng @ ResiliNets
- **DSR**: dynamic source routing
  - developed by Yufei Cheng @ ResiliNets
  - under review: http://codereview.appspot.com/4823051
- **OLSR**: optimised link state routing
  - mostly compliant with RFC 3626
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Ad Hoc Routing Examples

SR.1 Overview of MANETs in ns-3
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Ad Hoc Routing Examples

Global Routing in ns-3

• Global centralized routing
  – by default added to node by InternetStackHelper
  – Ipv4GlobalRoutingHelper::PopulateRoutingTables();
Ad Hoc Routing Examples

OLSR in ns-3

- OLSR routing
  
```cpp
  OlsrHelper olsr;
  Ipv4StaticRoutingHelper staticRouting;
  Ipv4ListRoutingHelper list;
  list.Add (staticRouting, 0);
  list.Add (olsr, 10);
  InternetStackHelper internet;
  internet.SetRoutingHelper (list);
  internet.Install (nodes);
```
AODV routing

```cpp
AodvHelper aodv;
InternetStackHelper stack;
stack.SetRoutingHelper (aodv);
stack.Install (nodes);
Ipv4AddressHelper address;
address.SetBase ("10.0.0.0", "255.0.0.0");
interfaces = address.Assign (devices);
```
Ad Hoc Routing in ns-3
Laboratory Assignment

SR.1  Overview of MANETs in ns-3
SR.2  Ad hoc routing examples
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Ad Hoc Routing in ns-3
Assignment Configuration

- Only 4 STA nodes
  - in ad-hoc mode
- Default physical and channel characteristics
  - optional: add propagation and loss model of your choice
- Non-QoS MAC with default configuration
- CBR traffic
- IP address block of your choice
- Enable ASCII tracing
  - for all IPv4 interfaces (EnableAsciiIpv4All) and mobility
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Assignment Configuration

- Mobility model to use GaussMarkovMobilityModel
  - with default values in 2D
  - only \( x \) and \( y \) coordinates
  - set initial positions randomly
- Routing: DSDV
  - with default values
- Submission deadline: 17 November 2011
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Extra Credit

• Using the same DSDV configuration, except:
  – use DSR routing protocol

• State steps on how to merge DSR from below page
  – http://codereview.appspot.com/4823051
  – into your local ns-3.12 directory

• Briefly contrast the two routing models…

• … from a simulation point of view
  – advantages/disadvantages?
  – easiness/difficulty?
  – briefly compare in few sentences (open question)
  – answer it only if you are sending the DSR simulation model
    • will not grade pure theoretical answers
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Assignment Submission Guidelines

• Write 1–2 page summary
• Report should include the following sections:
  – experiment setup and procedure (topology, issues, etc.)
  – conclusions (what you learned, etc.)
• You can discuss with other students but …
  … everyone must submit individual report
• Attach .cc file along with your submission
• Send report in PDF to: GTA and cc: Dr. Sterbenz
Ad Hoc Routing in ns-3
EECS 882 Assignment Submission Guidelines

• Send only source files (.cc, .pl, .pdf, etc.)
  - this means no .zip, zipped, .tar files
  - no reason to send trace files
• Always to: GTA and cc: Dr. Sterbenz
• Brownie points for identifying and fixing ns-3 bugs
• ns-3 scripts will be graded based on
  - functionality
    • major grade will be deducted for errors!!!
    • warnings will reduce your grade as well
  - documentation
    • use sensible file names: e.g. lab1_ikus.cc
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EECS 882 Commenting Guidelines

• Use comments as necessary:
  - Boilerplate... (optional)
  - //GNU release blah ...
  - /* File name: lab1_ikus.cc
  - Purpose: This is a sample script etc.
  - Author: Ima KU Student
  - Date: 24 October 2011
  - Version: 1 */
  - #include <iostream.h>

• Use comments for block of codes:
  - // This is an example comment for a block of code
Further Reading

- **Finish all tutorial chapters** *(if you haven’t yet)*
  

- **AODV API**
  
  http://www.nsnam.org/docs/release/3.12/doxygen/group__aodv.html

- **DSDV API**
  
  http://www.nsnam.org/docs/release/3.12/doxygen/group__dsdv.html

- **OLSR API**
  
  http://www.nsnam.org/docs/release/3.12/doxygen/group__olsr.html

- **DSR code**
  
  http://codereview.appspot.com/4823051
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Acknowledgements

Some material in these foils comes from the ns-3 tutorial presentations from conferences, workshops:

- Tom Henderson, *ns-3 tutorial*
  *SIMUTools 2009*
  [http://www.nsnam.org/tutorials.html](http://www.nsnam.org/tutorials.html)

- Gustavo Carneiro, *NS-3 Tutorial*
  *RTCM 2009*
  [http://telecom.inescporto.pt/~gjc/NS-3-RTCM.pdf](http://telecom.inescporto.pt/~gjc/NS-3-RTCM.pdf)

Ad Hoc Routing in ns-3

Other References

- C++ tutorials online
  - and many more links and books on the subject

- GDB
  - http://www.gnu.org/software/gdb/

- valgrind
  - http://valgrind.org/

- gnuplot
  - http://www.gnuplot.info/

- Python
  - http://www.python.org/