

Network Simulation

Lecture 4: Design Simulation Scenario

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Lecture 4:

- Objects of the simulation
- Data to be collected
- Metrics to evaluate the network/protocol
- Scenario Design
- Examples
 - CSMA/CA
 - RTS/CTS

Simulated objects

Defining simulated objects

- Purpose of a simulation:
 - Performance Evaluation
 - Data Collection
 - Demonstration
 - Synthetic data

Defining objects

- Objects of the simulation:
 - What network technology is considered?
 - Protocol stack
 - Network entities
 - What tool should be used?
 - What models should be implemented?

Collected data

Data collection

- What data should be collected?
 - Network traffic
 - Errors
 - Medium sensing record
 - Queuing status
 - ...
- Data sources
 - Available (trace sources)
 - Available but not ready to collect

Data collection

- How many data should be collected?
 - Size of collecting window
 - Modify simulation time
- Applications:
 - Which applications will be run?
 - Set up correspondingly traffic generation in the simulation

Tracing

- Printing out
- NS-3 tracing system
 - Tracing sources and sinks
 - Connecting source and sink mechanism

Tracing

- Callback:
 - A piece of code to call a function without specific inter-module dependency
 - Pointer-to-function variable
 - Example: `/examples/tutorials/fourth.cc`

Tracing

- Tracing sink:
 - Using callback
- Tracing source:
 - Where data is stored
 - Available sources
- Connect:
 - Using Config path (for available sources)
 - Using function `ns3::MakeConnectWithoutContext`

Metrics

Metrics for evaluation

- What aspect of the technology is considered?
 - Overall network performance
 - A protocol
- Metrics:
 - Reflect and quantize how well the simulated objects works
 - Defining before computing
 - How to compute these metrics?
 - What data should be collected?
 - What tool helps to process the collected data?

Scenario Design

Network Topology

- Number of nodes
- Protocol stack
 - Select models in NS
 - Modify attributes
- Mobility model
 - Initial position
 - Moving trajectory

Application generation

- Define senders and receivers
- Generate traffic:
 - A protocol or a network performance varies according to different applications
 - Models of traffic generation must correspond to the aim of the simulation

Examples

CSMA/CA

- Evaluate performance of CSMA/CA without RTS/CTS scheme when there are $n=[2;20]$ nodes randomly distributed in a rectangle 5m x 250m.

RTS/CTS scheme

- Evaluate performance of CSMA/CA with and without RTS/CTS scheme