TOSSIM

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What is TOSSIM?

Discrete event simulator

ns2

Alternatives

Cycle-accurate simulators

Avrora, MSPSim

Two directions

Port

make PC a supported platform

TOSSIM
in tinyos-1.x

Virtualize

simulate one of the supported platforms

TOSSIM
in tinyos-2.x

Features

- Simulates a MicaZ mote
  - ATmega128L (128KB ROM, 4KB RAM)
  - CC2420
- Uses CPM to model the radio noise
- Supports two programming interfaces:
  - Python
  - C++

Anatomy

TOSSIM

```
tos/lib/tossim
tos/chips/atm128/sim
tos/chips/atm128/pins/sim
tos/chips/atm128/timer/sim
tos/chips/atm128/spi/sim
tos/platforms/mica/sim
tos/platforms/micaz/sim
tos/platforms/micaz/chips/cc2420/sim
```

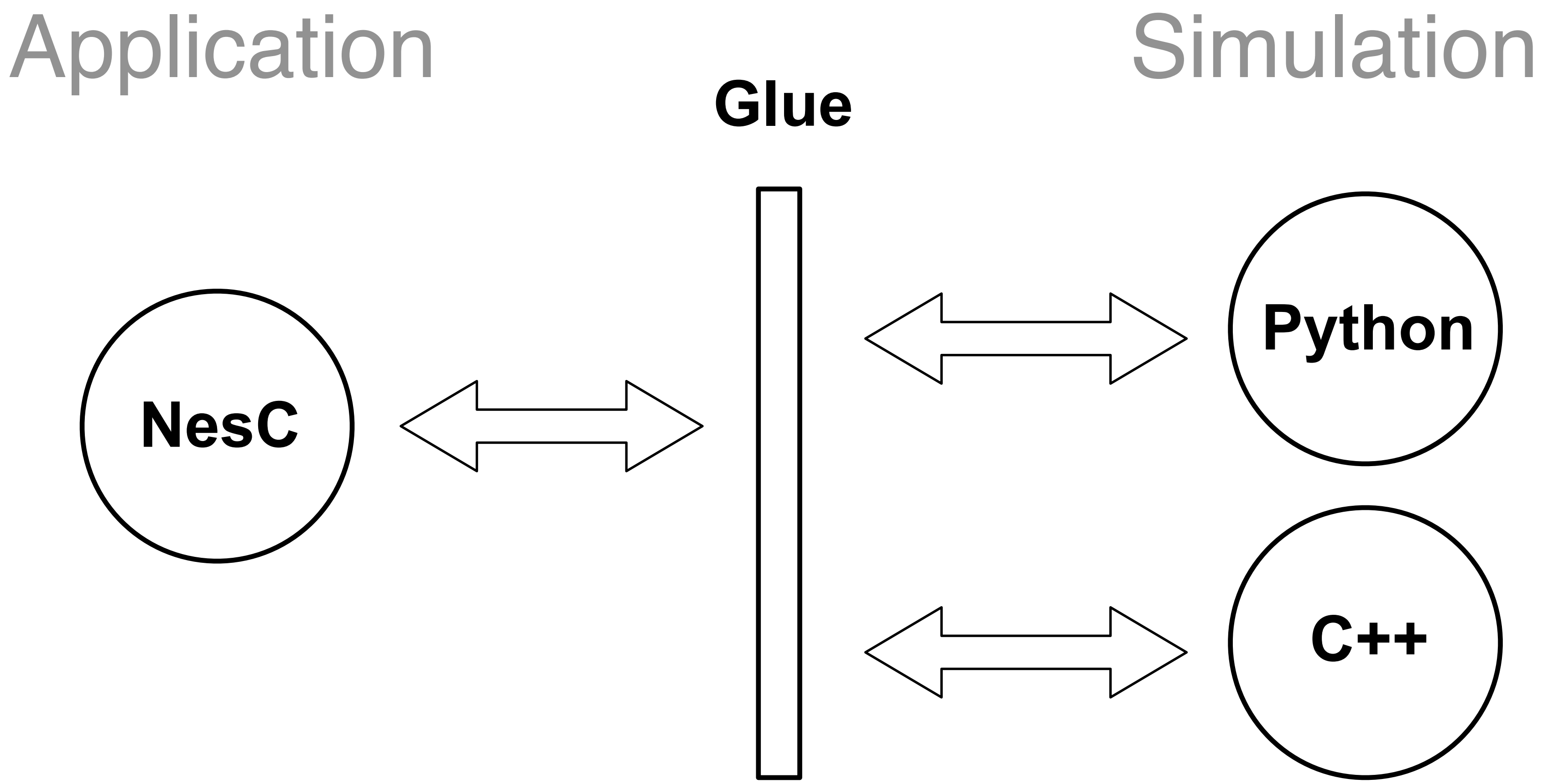
Application

```
Makefile
*.nc
*.h
```

Simulation Driver

```
*.py | *.cc
```

Quick Overview



The Building Process

```
$ make micaz sim
```

1. Generate an XML schema	*app.xml*
2. Compile the application	*sim.o*
3. Compile the Python support	*pytossim.o* *tossim.o* *c-support.o*
4. Build a share object	*_TOSSIMmodule.o*
5. Copying the Python support	*TOSSIM.py*

```
$ ./sim.py
```

TOSSIM.py

Tossim

Radio

Mote

Packet

Mac

TOSSIM.Tossim

.getNode() → TOSSIM.Mote

.radio() → TOSSIM.Radio

.newPacket() → TOSSIM.Packet

.mac() → TOSSIM.Mac

.runNextEvent()

.ticksPerSecond()

.time()

10 seconds

```
from TOSSIM import *
t = Tossim([])
  ...
while t.time() < 10*t.ticksPerSecond():
    t.runNextEvent()
```

dbg

Syntax

dbg(*tag, format, arg1, arg2, ...*);

Example

```
dbg("Trickle", "Starting time with time %u.\n", timerVal);
```

Python

```
t = Tossim([])
t.addChannel("Trickle", sys.stdout)
```

Useful Functions

*char**	sim_time_string()
sim_time_t	sim_time()
int	sim_random()
sim_time_t	sim_ticks_per_sec()

typedef *long long int sim_time_t*;

Radio Model

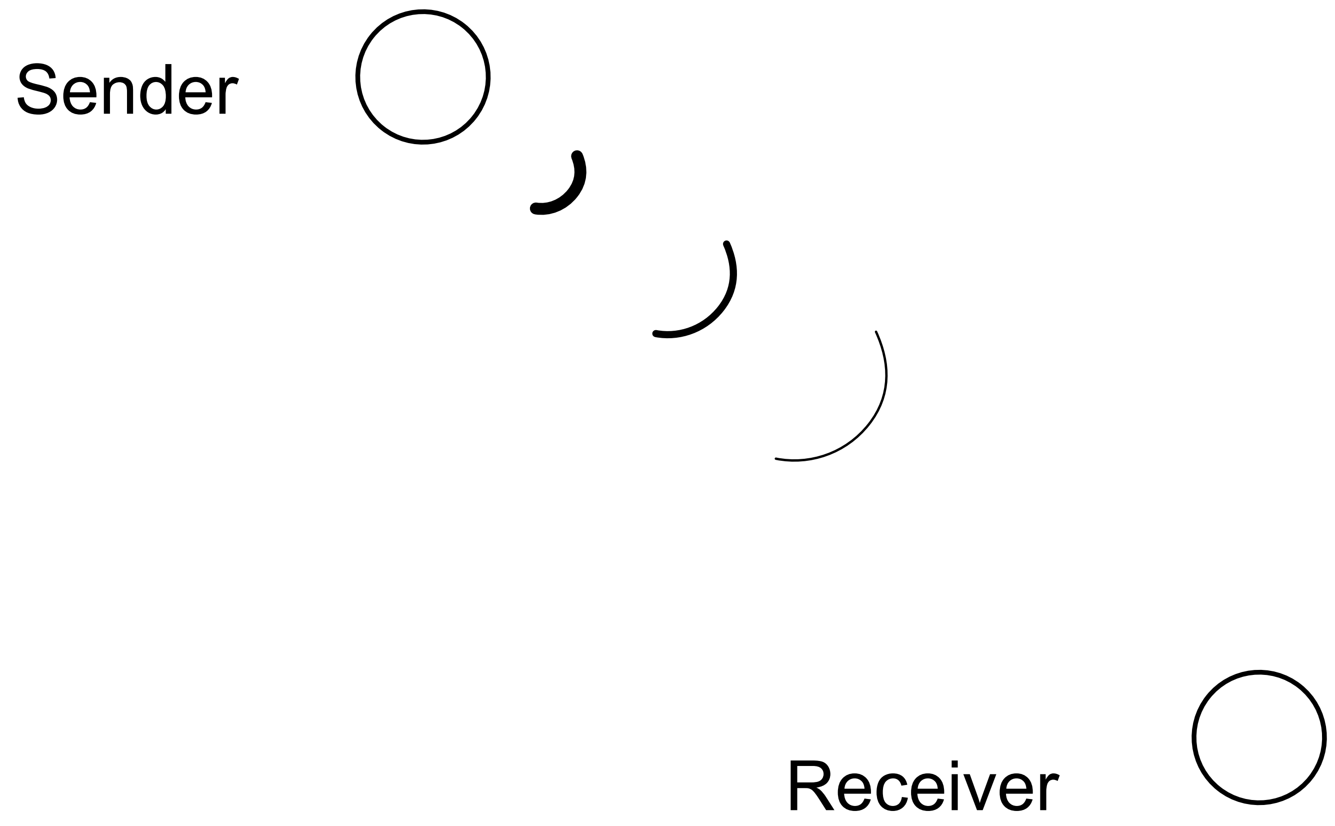
Closest-fit Pattern Matching (CPM)

Improving Wireless Simulation Through Noise Modeling

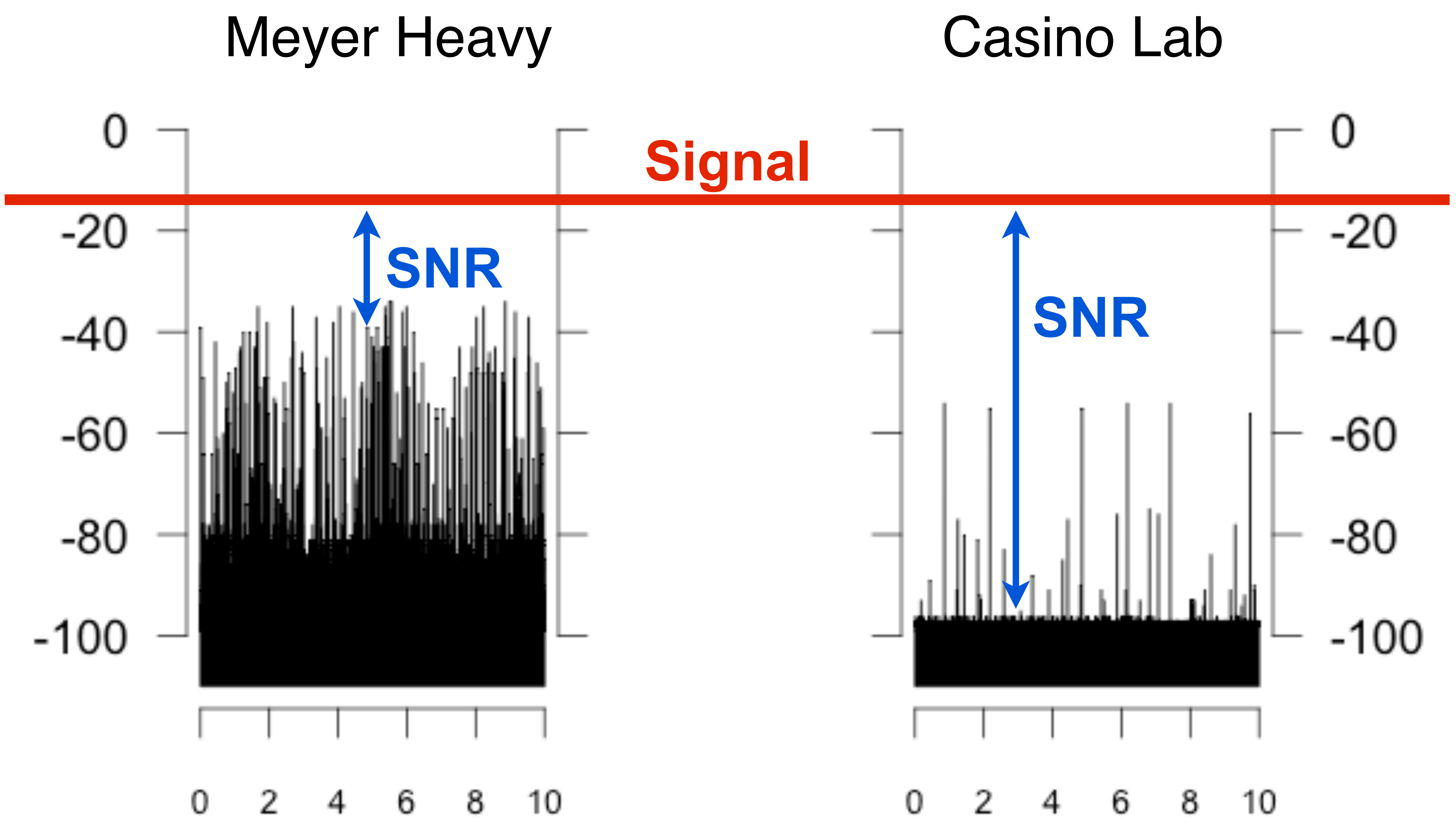
HyungJune Lee, Alberto Cerpa, and Philip Levis

IPSN 2007

Radio Model

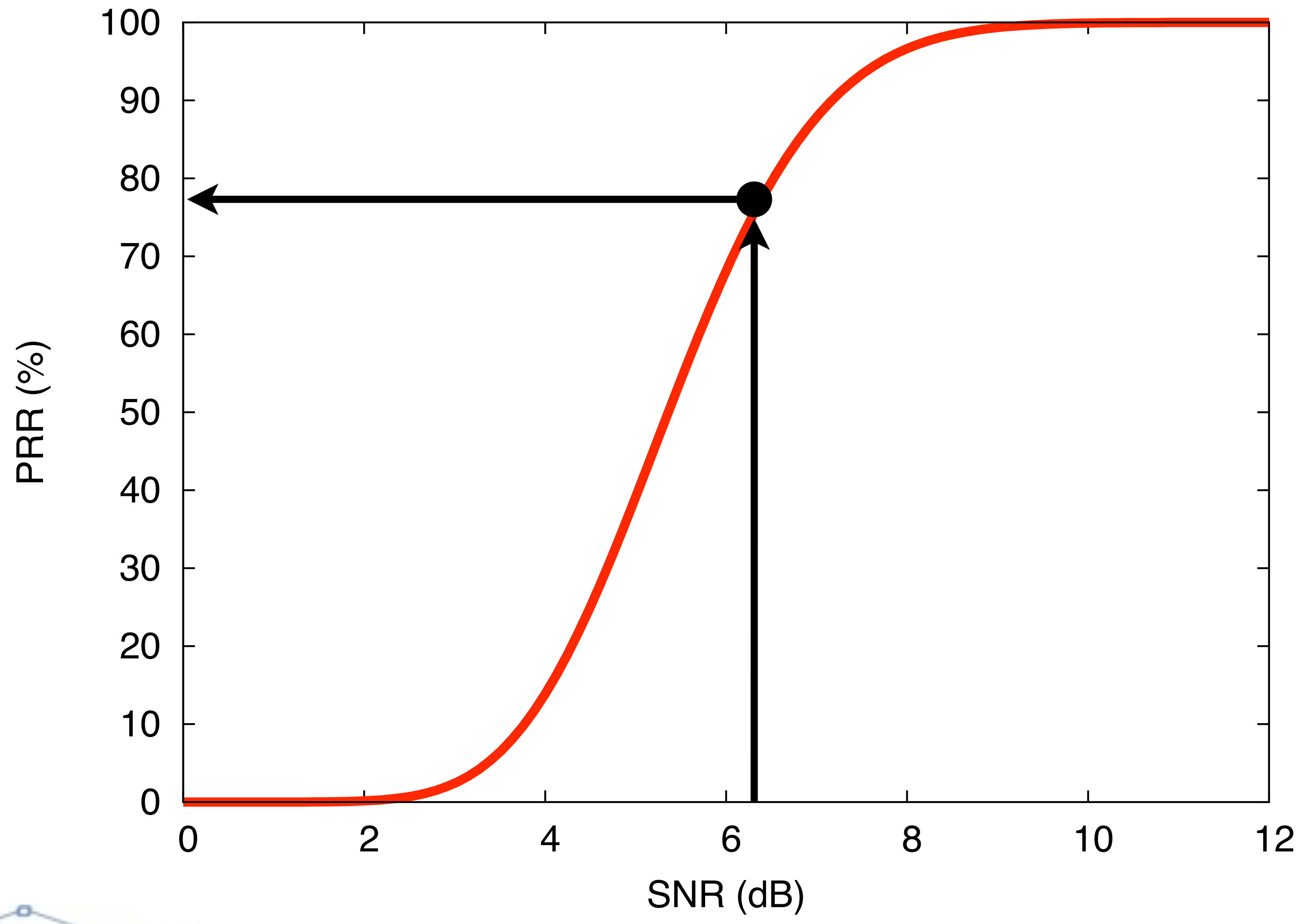


Noise Level



TinyOS

CC2420 SNR/PRR



TOSSIM.Radio

.add(*source, destination, gain*)

.connected(*source, destination*) → True/False

.gain(*source, destination*)

TOSSIM.Mote

.bootAtTime(*time*)

.addNoiseTraceReading(*noise*)

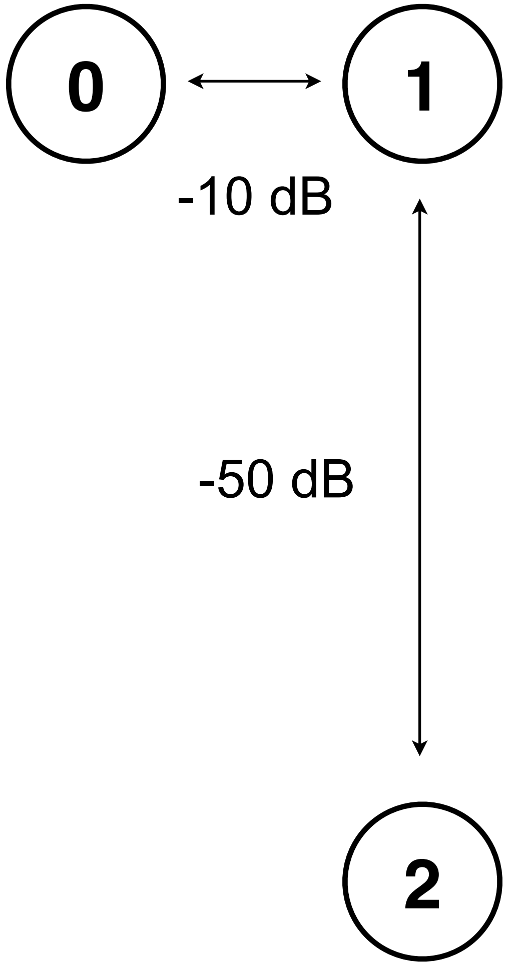
.createNoiseModel()

.isOn() → True/False

.turnOn()/.turnOff()

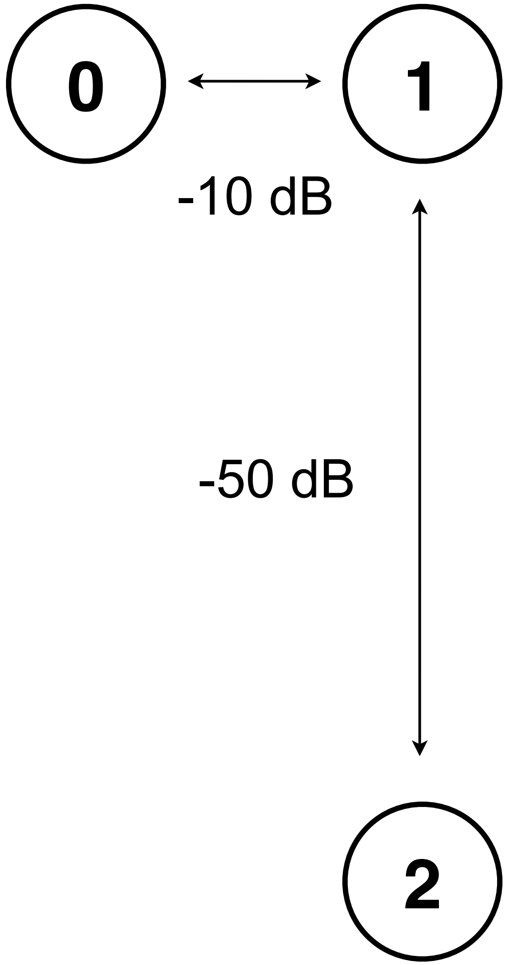
Example

```
from TOSSIM import *
t = Tossim([])
r = t.Radio()

mote0 = t.getNode(0)
mote1 = t.getNode(1)
mote2 = t.getNode(2)

r.add(0, 1, -10)
r.add(1, 0, -10)
r.add(1, 2, -50)
r.add(2, 1, -50)
```



Example (cont)

```
noise = file("meyer-short.txt")
lines = noise.readlines()
for line in lines:
  str = line.strip()
  if (str != ""):
    val = int(str)
    for m in [mote0, mote1, mote2]:
      m.addNoiseTraceReading(val)

for m in [mote0, mote1, mote2]:
    m.createNoiseModel()
```



Other Features

- Injecting packets
- Inspecting internal variables
- C++ interface
- Debuging using gdb

TinyOS

Improvements

- **TossimLive**
  - SerialActiveMessageC
- **CC2420sim**
  - Multiple channels
  - PacketLink
  - CC2420Packet: .getRSSI(), .getLQI()
  - ReadRssi()
  - Flash support

Future

Parametrized the PRR/SNR curve based on packet size *(in progress)*

Support for multiple binary images *(harder)*

Next

Safe TinyOS