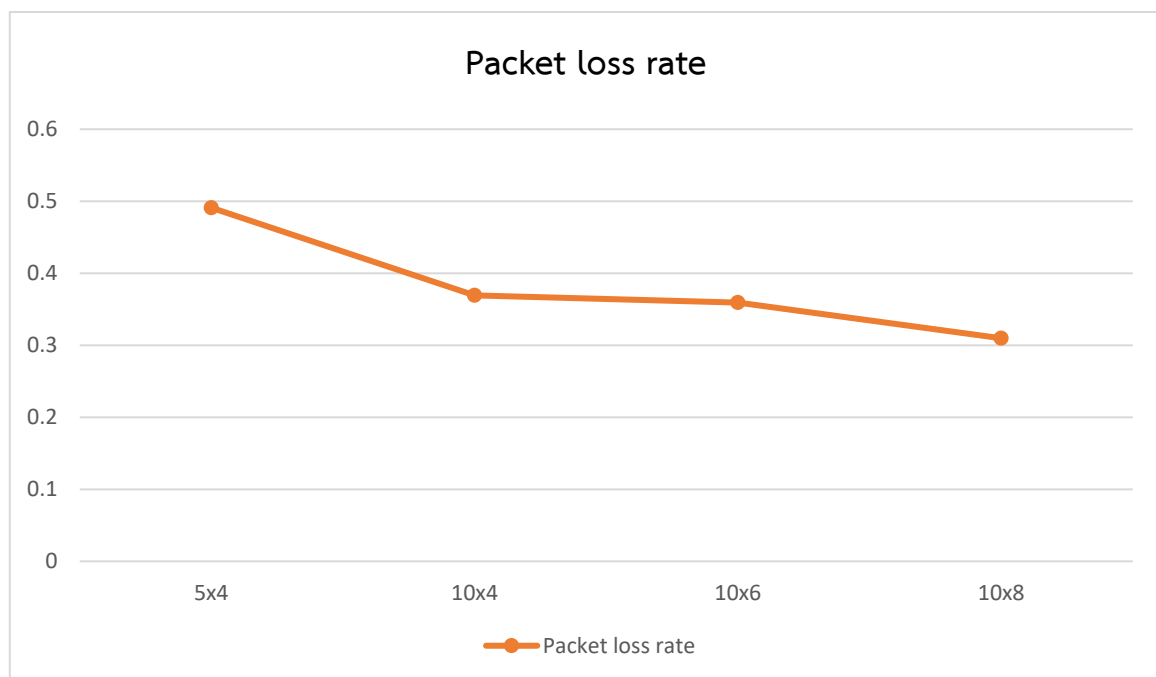


การบ้าน

ให้นิสิตกำหนดสถานการณ์การจำลอง การสื่อสารของเครือข่ายเซนเซอร์ไร้สาย โดยทำการกำหนดจำนวน โหนดและเปลี่ยนแปลงจำนวนโหนดเพื่อให้ประสิทธิภาพการสื่อสารดีขึ้น โดยกำหนดการจัดวางแบบ grid หรือ สุ่ม uniform พร้อมอภิปรายผล

Grid	20 โหนด	40 โหนด	60 โหนด	80 โหนด
Packet loss rate	0.49096	0.36928	0.35933	0.30977
Packet Reception Rate (PRR)	0.50904	0.63072	0.64067	0.68449
Packet Received Per Node	111	114.625	117.39583	124.03077



จากกราฟแสดงประสิทธิภาพการสื่อสารของเครือข่ายเซนเซอร์ไร้สายของ Smart Living ด้วยค่า packet loss rate จากการจัดวางโหนดแบบ grid พบว่า

- จำนวนโหนด 20 โหนด ประสิทธิภาพการสื่อสารด้วยค่า packet loss rate เท่ากับ 0.49096
- จำนวนโหนด 40 โหนด ประสิทธิภาพการสื่อสารด้วยค่า packet loss rate เท่ากับ 0.36928
- จำนวนโหนด 60 โหนด ประสิทธิภาพการสื่อสารด้วยค่า packet loss rate เท่ากับ 0.35933
- จำนวนโหนด 80 โหนด ประสิทธิภาพการสื่อสารด้วยค่า packet loss rate เท่ากับ 0.31551

สรุปจากจำนวนโหนด 20, 40, 60, 80 โหนด พบว่า จำนวนโหนด 80 โหนด ประสิทธิภาพการสื่อสารด้วยค่า packet loss rate เท่ากับ 0.31551 มีจำนวนโหนดน้อยหรือมีความหนาแน่นน้อยกว่าโหนดอื่นๆ และมีประสิทธิภาพมากกว่าจำนวนโหนดอื่นๆ ที่มีความหนาแน่นมากกว่า

แบบ 10x2 จำนวน 20 โหนด

```
mbs@ubuntu: ~/Castalia-3.3/Simulations/radioTest
mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/Castalia -c General
Running Castalia: Configuration 1/1 Run 1/1 Complete 100% Time taken 0:00:01.586000
mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/CastaliaResults -i 231002-193330.txt -s packets

Application:Packets loss rate - total
+-----+
| 0.49096 |
+-----+

Application:Packets received per node
+-----+
| 111 |
+-----+

Application:Packets reception rate - total
+-----+
| 0.50904 |
+-----+

Communication.MAC:Sent packets breakdown
+-----+
| ACK | CTS | DATA | RTS | SYNC |
+-----+
| 1453 | 2402 | 124.1875 | 236.78947 | 50 |
+-----+
```

```
omnetpp.ini (~:/Castalia-3.3/Simulations/radioTest) - gedit
Open [ ]

# *****/

[General]

# =====
# Always include the main Castalia.ini file
# =====

include ../Parameters/Castalia.ini

sim-time-limit = 300s

# These tests include 3 nodes each, coordinates will be specified manually
SN.numNodes = 20

SN.field_x = 50 # meters
SN.field_y = 40 # meters

SN.deployment = "10x2"
SN.node[0].xCoor = 50
SN.node[0].yCoor = 15
SN.deployment = "[1..19]->10x2"

#SN.deployment = "uniform"
#SN.node[0].xCoor = 1000
#SN.node[0].yCoor = 50
#SN.deployment = "[1..79]->uniform"

SN.node[0].Application.isSink = true

SN.wirelessChannel.collectTraceInfo = true

SN.node[*].ResourceManager.initialEnergy = 50

SN.node[*].MobilityManager.collectTraceInfo = true

# important wireless channel switch to allow mobility
SN.wirelessChannel.onlyStaticNodes = true
SN.wirelessChannel.sigma = 4
```

แบบ 8x5 จำนวน 40 โหนด

```

omnetpp.ini (~/.Castalia-3.3/Simulations/radioTest) - gedit
# *****/

[General]

# *****/
# Always include the main Castalia.ini file
# *****/

include ../Parameters/Castalia.ini

sim-time-limit = 300s

# These tests include 3 nodes each, coordinates will be specified manually
SN.numNodes = 40

SN.field_x = 50 # meters
SN.field_y = 40 # meters

SN.deployment = "8x5"|
SN.node[0].xCoord = 50
SN.node[0].yCoord = 15
SN.deployment = "[1..39]->8x5"

#SN.deployment = "uniform"
#SN.node[0].xCoord = 1000
#SN.node[0].yCoord = 50
#SN.deployment = "[1..79]->uniform"

SN.node[0].Application.isSink = true

SN.wirelessChannel.collectTraceInfo = true

SN.node[*].ResourceManager.initialEnergy = 50

SN.node[*].MobilityManager.collectTraceInfo = true

# important wireless channel switch to allow mobility
SN.wirelessChannel.onlyStaticNodes = true
SN.wirelessChannel.sigma = 4

```

```

mbs@ubuntu: ~/Castalia-3.3/Simulations/radioTest

mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/Castalia -c General
Running Castalia: Configuration 1/1 Run 1/1 Complete 100% Time taken 0:00:06.041000
mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/CastaliaResults -i 231002-192613.txt -s packets

Application:Packets loss rate - total
-----+
|
|
| 0.36928 |
|-----+

Application:Packets received per node
-----+
|
|
| 114.625 |
|-----+

Application:Packets reception rate - total
-----+
|
|
| 0.63072 |
|-----+

Communication.MAC:Sent packets breakdown
-----+-----+-----+-----+
| ACK | CTS | DATA | RTS | SYNC |
|-----+-----+-----+-----+
| 3680 | 5112 | 135.61765 | 218.94872 | 50 |
|-----+-----+-----+-----+

```

แบบ 10x6 จำนวน 60 โหนด

```

omnetpp.ini (~/.Castalia-3.3/Simulations/radioTest) - gedit
Open [ ] Save

# You do not need this file; copies can be found by setting the
# * NICTA, Locked Bag 9013, Alexandria, NSW 1435, Australia *
# * Attention: License Inquiry. *
# * =====/

[General]
# =====
# Always include the main Castalia.ini file
# =====

Include ../Parameters/Castalia.ini

sim-time-limit = 300s

# These tests include 3 nodes each, coordinates will be specified manually
SN.numNodes = 60

SN.field_x = 50 # Meters
SN.field_y = 40 # meters

SN.deployment = "10x6"
SN.node[0].xCoord = 50
SN.node[0].yCoord = 15
SN.deployment = "[1..59]->10x6"

#SN.deployment = "uniform"
#SN.node[0].xCoord = 1000
#SN.node[0].yCoord = 50
#SN.deployment = "[1..79]->uniform"

SN.node[0].Application.isSink = true

SN.wirelessChannel.collectTraceInfo = true

SN.node[*].ResourceManager.InitialEnergy = 50

SN.node[*].MobilityManager.collectTraceInfo = true

# Important wireless channel switch to allow mobility
SN.wirelessChannel.onlyStaticNodes = true
SN.wirelessChannel.sigma = 4
SN.wirelessChannel.bidirectionalSigma = 1
SN.wirelessChannel.pathLossExponent = 2.0 #freespace

# Throughput test application is used to send 2000-byte
# packets to node 0 (which by default is the receiving
# node for this app).5 packets per second will be send

mbs@ubuntu:~$ cd /home/mbs/Castalia-3.3/Simulations/radioTest/
mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/Castalia -c General
Running Castalia: Configuration 1/1 Run 1/1 Complete 100% Time taken 0:00:13.708000
mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/CastaliaResults -i 231002-114339.txt -s packets

Application:Packets loss rate - total
+-----+
| |
+-----+
| 0.35933 |
+-----+

Application:Packets received per node
+-----+
| |
+-----+
| 117.39583 |
+-----+

Application:Packets reception rate - total
+-----+
| |
+-----+
| 0.64067 |
+-----+

Communication.MAC:Sent packets breakdown
+-----+
| ACK | CTS | DATA | RTS | SYNC |
+-----+
| 5665 | 7782 | 135.05769 | 222.49153 | 50 |
+-----+

```

แบบ 10x8 จำนวน 80 โหนด

```

omnetpp.ini (~-/Castalia-3.3/Simulations/radioTest) - gedit
Open  [?]

# *****
# * Copyright: National ICT Australia, 2007 - 2010
# * Developed at the ATP Lab, Networked Systems research theme
# * Author(s): Athanassios Boulis, Yuriy Tselishchev
# * This file is distributed under the terms in the attached LICENSE file.
# * If you do not find this file, copies can be found by writing to:
# *
# * NICTA, Locked Bag 9013, Alexandria, NSW 1435, Australia
# * Attention: License Inquiry.
# *
# *****/

[General]

# =====
# Always include the main Castalia.ini file
# =====

include ../Parameters/Castalia.ini

sim-time-limit = 300s

# These tests include 3 nodes each, coordinates will be specified manually
SN.numNodes = 80

SN.field_x = 50 # meters
SN.field_y = 40 # meters

SN.deployment = "10x8"
SN.node[0].xCoord = 50
SN.node[0].yCoord = 15
SN.deployment = "[1..79]->10x8"

#SN.deployment = "uniform"
#SN.node[0].xCoord = 1000
#SN.node[0].yCoord = 50
#SN.deployment = "[1..79]->uniform"

SN.node[0].Application.isSink = true

SN.wirelessChannel.collectTraceInfo = true

SN.node[*].ResourceManager.initialEnergy = 50

SN.node[*].MobilityManager.collectTraceInfo = true

# important wireless channel switch to allow mobility
SN.wirelessChannel.onlyStaticNodes = true
SN.wirelessChannel.sigma = 4
SN.wirelessChannel.bidirectionalSigma = 1
SN.wirelessChannel.nathLossExponent = 2.0 #fresnare

```

```

mbs@ubuntu: ~/Castalia-3.3/Simulations/radioTest

Application:Packets reception rate - total
+-----+
|         |
| 0.62409 |
+-----+

Communication.MAC:Sent packets breakdown
+-----+
| ACK | CTS | DATA | RTS | SYNC |
+-----+
| 9259 | 12322 | 129.3988 | 224.71717 | 50 |
+-----+

mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/Castalia -c GeneralRunning Castalia: Configuration 1/1 Run 1/1
Complete 100% Time taken 0:00:22.469000
mbs@ubuntu:~/Castalia-3.3/Simulations/radioTest$ ../../bin/CastaliaResults -l 231002-191639.txt -s packets

Application:Packets loss rate - total
+-----+
|         |
| 0.31551 |
+-----+

Application:Packets received per node
+-----+
|         |
| 124.03077 |
+-----+

Application:Packets reception rate - total
+-----+
|         |
| 0.68449 |
+-----+

Communication.MAC:Sent packets breakdown
+-----+
| ACK | CTS | DATA | RTS | SYNC |
+-----+
| 8089 | 10467 | 132.86111 | 217.83544 | 50 |
+-----+

```