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INVESTIGATION ON THE INTERNET OF THINGS

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ABSTRACT

Do ＩＯＴ problem definition and research. Research on Internet of things, first research object, Re research alliance, Re study network. Objects are things in the Internet of things, Link is how objects connect to the network, Network is what this network is. Objective function is the key problem. Can start with simple and critical questions. Algorithm is the solution to the problem steps. What is the Internet of things, objects connected to the Internet is the Internet of things, cup networking, car networking. Things better than other networks, is composed of what objects, what composition, what nature, what innovation and superiority. Internet of things four key technologies are widely used, these four technologies are mainly RFID, WSN, M2M, as well as the integration of the two. RFID can be achieved using MATLAB, NS2, Android, WSN can use NS2, OMNET++ implementation, M2M can be developed using JAVA. Therefore, this paper focuses on the advantages of Internet of things than the internet.

KEYWORDS: ＩＯＴ, ＲＦＩＤ, ＷＳＮ

INTRODUCTION

The Internet of things has no unified definition. Some people believes that the interconnection of RFID is the Internet of things, some think that a sensor network is the Internet of things, some think that M2M (machine to machine) is the Internet of things. Some people think make the Internet stretched and extended to any goods and goods is the Internet of things.

The Internet of things not only meets the demands for information of goods' networking, but also the current technology development's push. And final the most important thing is the internet of things can boost the economy, so the investigation on the Internet of things is very important.

MATERIALS AND METHODS

Recently, more and more references talk about the Internet of things, we list some as follows. Reference[1] propose the Internet of things's definition is that is a network through radio frequency identification (RFID), infrared sensors, global positioning system, laser scanner, and so on, and other information sensing devices, according to contract agreement, connect any goods with the Internet, conducting information exchange and communication, aims to realize intelligent identification, location, tracking and monitoring and management. Reference[2] put foward the Internet of things's definition is that is a network based on standard and interaction communication protocols with the self-configuration of the ability of the dynamic global network infrastructure, within the Internet of things the physical and virtual objects has the characteristics such as identity, physical properties, personified, they can be connected by a comprehensive information network. Reference[3] put foward the Internet of things's definition is that through information sensing device, in accordance with the contract agreement, connect any goods with the Internet, conducting information exchange and communication, a network aims to realize intelligent identification, location, tracking and monitoring and management. Reference[4] propose the characteristics of the Internet of things is can be addressed for each object, each object networking can be controlled, every space networking can be communicated. Reference[5] propose the Internet of things is just the past a lot of regionalization of specific application of network and Internet further penetration, connected, is a lot of new generation of value-added services in the broader network platform's collection. In

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terms of technology, it make sensors, sensor networks and RFID and so on perception technology, communications network and Internet technology, Intelligent computing technology and so on integrated, achieve full perception, reliable transmission, and smart richard, is a network connecting the physical world, intelligent, HD, will become the keywords of Internet of things. Reference [6] put forward the Internet of things technology in recent years by people's widespread concern, China's "12th Five-Year" plan has clearly the Internet of things as a strategic emerging industries to cultivate development. As one of the core technologies of the Internet of things RFID technology, will determine the development of the Internet of things. Reference [7], wireless Ad Hoc network is unique in many wireless networks because of its characteristics of non center, self-organization and multi hop routing, and has been widely used in military and civil fields. However, things always have two sides. In the research of wireless Ad Hoc network, it faces many challenges such as the dynamic change of network topology, limited node energy and limited channel bandwidth. Reference [8] proposes that wireless sensor networks are essentially resource constrained networks. Usually, wireless sensor network nodes use battery power, limited energy limits the network lifetime. As an embedded system, the computing power and storage capacity of nodes are small, and the communication bandwidth between nodes is relatively low. I n r eference [9] w ireless sensor networks (Wireless Sensor Network, WSN) severely constrained energy. WSN for real-time monitoring of residual energy (Residual Energy Real-time Monitoring, RERM), is to understand the WSN life cycle of the fundamental way. RERM is important for designing and testing energy saving algorithms / protocols. In view of the common problems in RERM research, the RERM of opposite application is studied systematically and deeply. In the r eference [1 0], driven by mobile multimedia applications, with high speed wireless local area network as the background, from the media access control (MAC) layer protocol optimization, high-level communication protocol design and system level low-power design Methods, the multi domain multimedia on chip system (SoC) is deeply studied. Reference [1 1] puts forward that data transmission plays a more and more important role in wireless communication, especially in satellite communication and next generation mobile communication system (3G). Wireless channel, due to the atmospheric environment, terrain and mobile multiple effects, the state of the channel is extremely unstable, which brings great challenges to the reliability of data transmission. Automatic request retransmission (ARQ) technology, especially hybrid ARQ (HARQ), plays a huge role in improving the reliability of transmission. Reference [1 2] Study on fair scheduling problem in wireless networks, aiming at three typical network structures were studied in the wireless fading channel, how to ensure the limited system resources utilization efficiency under the precondition of fairness. Different fairness scheduling strategies are designed for different design objectives. Reference [1 3] proposes that wireless network coding is an important research direction of network coding technology, and the opportunistic network coding with localization characteristics is a simple and practical branch in the field of wireless network coding technology. For the basic problem of wireless network throughput optimization encoding opportunity, from the theoretical framework, scheduling algorithm and application of modified system of three levels of the theoretical and applied research, and puts forward a theoretical framework, put forward a constant approximation algorithm for community security, put forward a set of practical decoding caching mechanism. Reference [1 4] revolves around a key component of RFID reader -- the key technology and application of power amplifier (PA). Firstly, the CMOS power amplifier technology is summarized, and the key technologies of CMOS PA applied in RFID are analyzed emphatically. On this basis, taking a single chip CMOS power amplifier as the starting point, around the two commonly used RFID communication protocol, the corresponding reader in the transmitter front-end key circuit is studied. On the other hand, the RFID technology is further extended to the design of zero standby power wireless switch. Finally, the power control technology in portable reader is studied.

Cygwin＋NS2 environment

Use NS2 for network simulation of the basic operating process shown in figure 1, Users must first define the problem, Consider what you want to simulate, What about the topology, Need to modify or add source code. If you want to add or modify code, As shown in the box on the right, there is a modification of the NS2 source code, Recompile and debug process, If you do not need to modify the code, That is, NS2 existing components can be used to complete the simulation work, then the user's main task is to write Tcl/OTcl simulation code, Generate a.Tcl script file, and use NS2 to execute the script for simulation,After the simulation program will generate the corresponding Trace file,Simulation results file,Users use different tools to analyze the content of the script to get the results we want the chart. If the result is our expectations, then the entire simulation process can be successfully completed, Otherwise, Analyze the problem and reconsider the need for problem definition, source modification, and Tcl script modification.

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The whole simulation process are mainly modify the source code, written in Tcl simulation script, analysis results of the three parts of the workload, but the simulation should be considered to modify the source code to modify the source code, modify the source code is a more challenging work, which requires the user to have a certain level of programming and debugging, the need to pay attention to this this is the three step in the problem. In the modification of the source code need to remember to modify the corresponding OTcl code, this is because NS2 is written in C++ and OTcl two languages.

The most important NS2 in the simulation and the essential part is Tcl/ OTcl simulation code, the simulation work most of the NS2 is actually writing Tcl code to describe the network, network and control network scheduling simulation component event start stop process. Simulation results are an important part of the simulation work. Users familiar with the structure of the NS2 Trace file and then simulation results analysis, and can use some small tools to analyze the results of the file and draw some summary icon based on the results of the analysis data.

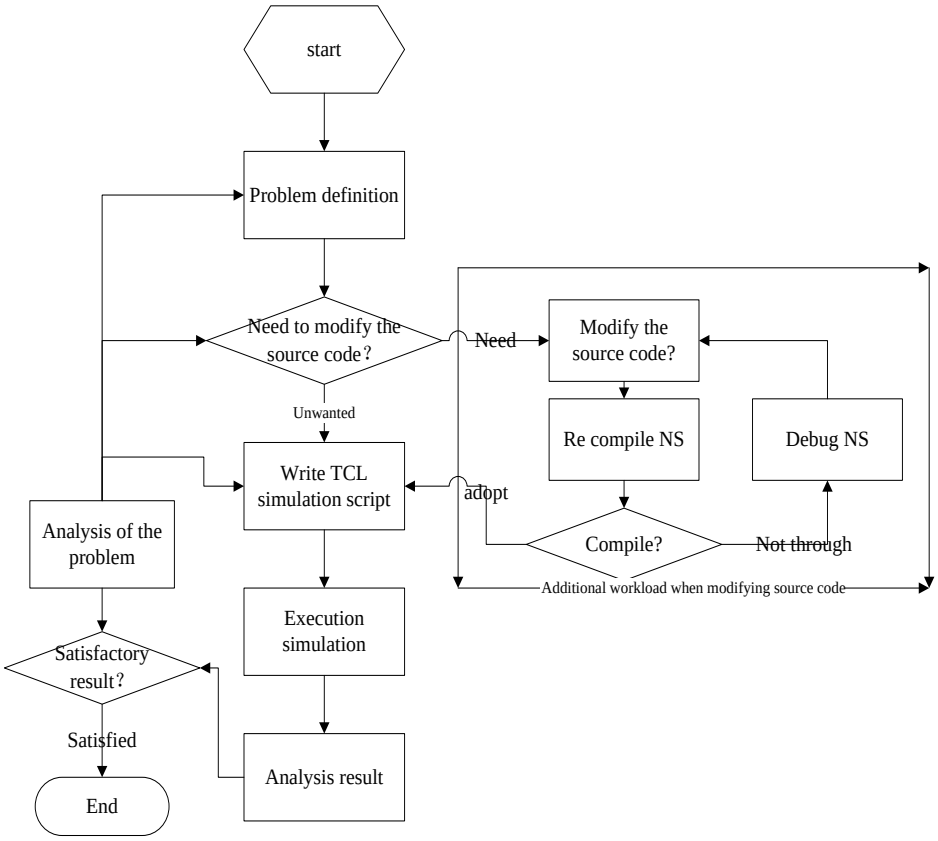

Figure 1 NS2 network simulation of the basic operating flow chart

METHODS

This paper analyzes the WSN network with 3 scenarios, as shown below.

(1)Code for the first scene:

Wireless topology code follows, 1 mobile nodes n0,8 fixed nodes n1-n8. There are 8 links are N0 to the 8 fixed nodes. The TCL script code is as follows:

```
set packetSize    1500
#=================================
#     Simulation parameters setup
#=================================
set val(chan)   Channel/WirelessChannel    ;# channel type
set val(prop)   Propagation/TwoRayGround   ;# radio-propagation model
set val(netif)  Phy/WirelessPhy            ;# network interface type
set val(mac)    Mac/802_11                 ;# MAC type
set val(ifq)    Queue/DropTail/PriQueue    ;# interface queue type
set val(ll)     LL                         ;# link layer type
```

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```
set val(ant)    Antenna/OmniAntenna        ;# antenna model
set val(ifqlen) 50                  ;# max packet in ifq
set val(nn)     4                   ;# number of mobilenodes
set val(rp)     DSDV                    ;# routing protocol
set val(x)      900                 ;# X dimension of topography
set val(y)      900                 ;# Y dimension of topography
set val(stop)   50.0                    ;# time of simulation end
#===================================
#       Initialization
#===================================
#Create a ns simulator
set ns [new Simulator]
set nf [open out.nam w]
$ns namtrace-all $nf
#Setup topography object
set topo       [new Topography]
$topo load_flatgrid $val(x) $val(y)
create-god $val(nn)
#Open the NS trace file
set tracefile [open out.tr w]
$ns trace-all $tracefile
#Open the NAM trace file
set namfile [open out.nam w]
$ns namtrace-all $namfile
$ns namtrace-all-wireless $namfile $val(x) $val(y)
set chan [new $val(chan)];#Create wireless channel
#===================================
#     Mobile node parameter setup
#===================================
$ns node-config -adhocRouting  $val(rp) \
             -llType        $val(ll) \
             -macType       $val(mac) \
             -ifqType       $val(ifq) \
             -ifqLen        $val(ifqlen) \
             -antType       $val(ant) \
             -propType      $val(prop) \
             -phyType       $val(netif) \
             -channel       $chan \
             -topoInstance  $topo \
             -agentTrace    ON \
             -routerTrace   ON \
                  -macTrace      ON \
                  -movementTrace ON
    #===================================
    #       Nodes Definition
    #===================================
    #Create 9 nodes
    set n0 [$ns node]
    $n0 set X_ 190
    $n0 set Y_ 590
    $n0 set Z_ 0.0
    $ns initial_node_pos $n0 20
    set n1 [$ns node]
    $n1 set X_ 551
    $n1 set Y_ 388
    $n1 set Z_ 0.0
```

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```
$ns initial_node_pos $n1 20
set n2 [$ns node]
$n1 set X_ 613
$n1 set Y_ 382
$n1 set Z_ 0.0
$ns initial_node_pos $n2 20
set n3 [$ns node]
$n1 set X_ 641
$n1 set Y_ 324
$n1 set Z_ 0.0
$ns initial_node_pos $n3 20
set n4 [$ns node]
$n1 set X_ 624
$n1 set Y_ 275
$n1 set Z_ 0.0
$ns initial_node_pos $n4 20
set n5 [$ns node]
$n1 set X_ 576
$n1 set Y_ 274
$n1 set Z_ 0.0
$ns initial_node_pos $n5 20
set n6 [$ns node]
$n1 set X_ 516
$n1 set Y_ 252
$n1 set Z_ 0.0
$ns initial_node_pos $n6 20
set n7 [$ns node]
$n1 set X_ 489
$n1 set Y_ 302
$n1 set Z_ 0.0
$ns initial_node_pos $n7 20
set n8 [$ns node]
$n1 set X_ 500
$n1 set Y_ 363
$n1 set Z_ 0.0
$ns initial_node_pos $n8 20
$ns at 1 " $n0 setdest 600 300 30 "
#==================================
#       Agents Definition
#==================================
set udp0 [new Agent/UDP]
$ns attach-agent $n0 $udp0
set null1 [new Agent/Null]
$ns attach-agent $n1 $null1
$ns connect $udp0 $null1
$udp0 set packetSize_ $packetSize
set udp1 [new Agent/UDP]
$ns attach-agent $n0 $udp1
set null2 [new Agent/Null]
$ns attach-agent $n2 $null2
$ns connect $udp1 $null2
$udp1 set packetSize_ $packetSize
set udp2 [new Agent/UDP]
$ns attach-agent $n0 $udp2
set null3 [new Agent/Null]
$ns attach-agent $n3 $null3
```

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```
$ns connect $udp2 $null3
$udp2 set packetSize_ $packetSize
set udp3 [new Agent/UDP]
$ns attach-agent $n0 $udp3
set null4 [new Agent/Null]
$ns attach-agent $n4 $null4
$ns connect $udp3 $null4
$udp3 set packetSize_ $packetSize
set udp4 [new Agent/UDP]
$ns attach-agent $n0 $udp4
set null5 [new Agent/Null]
$ns attach-agent $n5 $null5
$ns connect $udp4 $null5
$udp4 set packetSize_ $packetSize
set udp5 [new Agent/UDP]
$ns attach-agent $n0 $udp5
set null6 [new Agent/Null]
$ns attach-agent $n6 $null6
$ns connect $udp5 $null6
$udp5 set packetSize_ $packetSize
set udp6 [new Agent/UDP]
$ns attach-agent $n0 $udp6
set null7 [new Agent/Null]
$ns attach-agent $n7 $null7
$ns connect $udp6 $null7
$udp6 set packetSize_ $packetSize
set udp7 [new Agent/UDP]
$ns attach-agent $n0 $udp7
set null8 [new Agent/Null]
$ns attach-agent $n8 $null8
$ns connect $udp7 $null8
$udp7 set packetSize_ $packetSize
#=================================
#       Applications Definition
#=================================
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp0
$cbr set type_ CBR
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp1
$cbr set type_ CBR
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp2
$cbr set type_ CBR
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp3
$cbr set type_ CBR
```

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```
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp4
$cbr set type_ CBR
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp5
$cbr set type_ CBR
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp6
$cbr set type_ CBR
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp7
$cbr set type_ CBR
$cbr set packet_size_ $packetSize
$cbr set rate_ 1mb
$cbr set random_ false
$ns at 1.0 "$udp0 start"
$ns at 13.0 "$udp0 stop"
$ns at 1.0 "$udp1 start"
$ns at 13.0 "$udp1 stop"
$ns at 1.0 "$udp2 start"
$ns at 13.0 "$udp2 stop"
$ns at 1.0 "$udp3 start"
$ns at 13.0 "$udp3 stop"
$ns at 1.0 "$udp4 start"
$ns at 13.0 "$udp4 stop"
$ns at 1.0 "$udp5 start"
$ns at 13.0 "$udp5 stop"
$ns at 1.0 "$udp6 start"
$ns at 13.0 "$udp6 stop"
$ns at 1.0 "$udp7 start"
$ns at 13.0 "$udp7 stop"
#=================================
#       Termination
#=================================
#Define a 'finish' procedure
proc finish {} {
   global ns tracefile namfile
   $ns flush-trace
   close $tracefile
   close $namfile
   #exec nam out.nam &
   exit 0}
for {set i 0} {$i < $val(nn) } { incr i } {
   $ns at $val(stop) "\$n$i reset"}
```

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```
$ns at $val(stop) "$ns nam-end-wireless $val(stop)"
$ns at $val(stop) "finish"
$ns at $val(stop) "puts \"done\" ; $ns halt"
$ns run
```

(2)Second scenarios: different scenarios VAL (X), VAL (Y), and simulation time is not the same. The TCL code generated by plotting is as follows:

```
# This script is created by NSG2 beta1
# <http://wushoupong.googlepages.com/nsg>
#===================================
#     Simulation parameters setup
#===================================
set val(chan)   Channel/WirelessChannel    ;# channel type
set val(prop)   Propagation/TwoRayGround   ;# radio-propagation model
set val(netif)  Phy/WirelessPhy            ;# network interface type
set val(mac)    Mac/802_11                 ;# MAC type
set val(ifq)    Queue/DropTail/PriQueue    ;# interface queue type
set val(ll)     LL                         ;# link layer type
set val(ant)    Antenna/OmniAntenna        ;# antenna model
set val(ifqlen) 50                         ;# max packet in ifq
set val(nn)     9                          ;# number of mobilenodes
set val(rp)     DSDV                       ;# routing protocol
set val(x)      741                        ;# X dimension of topography
set val(y)      690                        ;# Y dimension of topography
set val(stop)   10.0                       ;# time of simulation end
#===================================
#        Initialization
#===================================
#Create a ns simulator
set ns [new Simulator]
#Setup topography object
set topo       [new Topography]
$topo load_flatgrid $val(x) $val(y)
create-god $val(nn)
#Open the NS trace file
set tracefile [open out.tr w]
$ns trace-all $tracefile
#Open the NAM trace file
set namfile [open out.nam w]
$ns namtrace-all $namfile
$ns namtrace-all-wireless $namfile $val(x) $val(y)
set chan [new $val(chan)];#Create wireless channel
#===================================
#     Mobile node parameter setup
#===================================
$ns node-config -adhocRouting  $val(rp) \
                -llType        $val(ll) \
                -macType       $val(mac) \
                -ifqType       $val(ifq) \
                -ifqLen        $val(ifqlen) \
                -antType       $val(ant) \
                -propType      $val(prop) \
                -phyType       $val(netif) \
                -channel       $chan \
                -topoInstance  $topo \
                -agentTrace    ON \
                -routerTrace   ON \
```

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```
            -macTrace      ON \
            -movementTrace ON
#=================================
#       Nodes Definition
#=================================
#Create 9 nodes
set n0 [$ns node]
$n0 set X_ 190
$n0 set Y_ 590
$n0 set Z_ 0.0
$ns initial_node_pos $n0 20
set n1 [$ns node]
$n1 set X_ 551
$n1 set Y_ 388
$n1 set Z_ 0.0
$ns initial_node_pos $n1 20
set n2 [$ns node]
$n2 set X_ 613
$n2 set Y_ 382
$n2 set Z_ 0.0
$ns initial_node_pos $n2 20
set n3 [$ns node]
$n3 set X_ 641
$n3 set Y_ 324
$n3 set Z_ 0.0
$ns initial_node_pos $n3 20
set n4 [$ns node]
$n4 set X_ 624
$n4 set Y_ 275
$n4 set Z_ 0.0
$ns initial_node_pos $n4 20
set n5 [$ns node]
$n5 set X_ 576
$n5 set Y_ 247
$n5 set Z_ 0.0
$ns initial_node_pos $n5 20
set n6 [$ns node]
$n6 set X_ 516
$n6 set Y_ 252
$n6 set Z_ 0.0
$ns initial_node_pos $n6 20
set n7 [$ns node]
$n7 set X_ 489
$n7 set Y_ 302
$n7 set Z_ 0.0
$ns initial_node_pos $n7 20
set n8 [$ns node]
$n8 set X_ 500
$n8 set Y_ 363
$n8 set Z_ 0.0
$ns initial_node_pos $n8 20
#=================================
#       Generate movement
#=================================
$ns at 1 " $n0 setdest 600 300 30 "
#=================================
```

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```
#       Agents Definition
#=====================================
#=====================================
#       Applications Definition
#=====================================
#=====================================
#       Termination
#=====================================
#Define a 'finish' procedure
proc finish {} {
   global ns tracefile namfile
   $ns flush-trace
   close $tracefile
   close $namfile
   exec nam out.nam &
   exit 0}
for {set i 0} {$i < $val(nn) } { incr i } {
   $ns at $val(stop) "\$n$i reset"}
$ns at $val(stop) "$ns nam-end-wireless $val(stop)"
$ns at $val(stop) "finish"
$ns at $val(stop) "puts \"done\" ; $ns halt"
$ns run
```

(3)Third scenes:

```
# This script is created by NSG2 beta1
# <http://wushoupong.googlepages.com/nsg>
#=====================================
#     Simulation parameters setup
#=====================================
set val(chan)   Channel/WirelessChannel    ;# channel type
set val(prop)   Propagation/TwoRayGround   ;# radio-propagation model
set val(netif)  Phy/WirelessPhy            ;# network interface type
set val(mac)    Mac/802_11                 ;# MAC type
set val(ifq)    Queue/DropTail/PriQueue    ;# interface queue type
set val(ll)     LL                         ;# link layer type
set val(ant)    Antenna/OmniAntenna        ;# antenna model
set val(ifqlen) 50                         ;# max packet in ifq
set val(nn)     9                          ;# number of mobilenodes
set val(rp)     DSDV                       ;# routing protocol
set val(x)      741                        ;# X dimension of topography
set val(y)      690                        ;# Y dimension of topography
set val(stop)   13.0                       ;# time of simulation end
#=====================================
#       Initialization
#=====================================
#Create a ns simulator
set ns [new Simulator]
#Setup topography object
set topo       [new Topography]
$topo load_flatgrid $val(x) $val(y)
create-god $val(nn)
#Open the NS trace file
set tracefile [open out.tr w]
$ns trace-all $tracefile
#Open the NAM trace file
set namfile [open out.nam w]
$ns namtrace-all $namfile
```

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```
$ns namtrace-all-wireless $namfile $val(x) $val(y)
set chan [new $val(chan)];#Create wireless channel
#===================================
#     Mobile node parameter setup
#===================================
$ns node-config -adhocRouting  $val(rp) \
                -llType        $val(ll) \
                -macType       $val(mac) \
                -ifqType       $val(ifq) \
                -ifqLen        $val(ifqlen) \
                -antType       $val(ant) \
                -propType      $val(prop) \
                -phyType       $val(netif) \
                -channel       $chan \
                -topoInstance  $topo \
                -agentTrace    ON \
                -routerTrace   ON \
                -macTrace      ON \
                -movementTrace ON
#===================================
#        Nodes Definition
#===================================
#Create 9 nodes
set n0 [$ns node]
$n0 set X_ 190
$n0 set Y_ 590
$n0 set Z_ 0.0
$ns initial_node_pos $n0 20
set n1 [$ns node]
$n1 set X_ 551
$n1 set Y_ 388
$n1 set Z_ 0.0
$ns initial_node_pos $n1 20
set n2 [$ns node]
$n2 set X_ 613
$n2 set Y_ 382
$n2 set Z_ 0.0
$ns initial_node_pos $n2 20
set n3 [$ns node]
$n3 set X_ 641
$n3 set Y_ 324
$n3 set Z_ 0.0
$ns initial_node_pos $n3 20
set n4 [$ns node]
$n4 set X_ 624
$n4 set Y_ 275
$n4 set Z_ 0.0
$ns initial_node_pos $n4 20
set n5 [$ns node]
$n5 set X_ 576
$n5 set Y_ 247
$n5 set Z_ 0.0
$ns initial_node_pos $n5 20
set n6 [$ns node]
$n6 set X_ 516
$n6 set Y_ 252
```

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```
$n6 set Z_ 0.0
$ns initial_node_pos $n6 20
set n7 [$ns node]
$n7 set X_ 489
$n7 set Y_ 302
$n7 set Z_ 0.0
$ns initial_node_pos $n7 20
set n8 [$ns node]
$n8 set X_ 500
$n8 set Y_ 363
$n8 set Z_ 0.0
$ns initial_node_pos $n8 20
#=================================
#       Agents Definition
#=================================
#Setup a UDP connection
set udp0 [new Agent/UDP]
$ns attach-agent $n0 $udp0
set null8 [new Agent/Null]
$ns attach-agent $n1 $null8
$ns connect $udp0 $null8
$udp0 set packetSize_ 1500
#Setup a UDP connection
set udp1 [new Agent/UDP]
$ns attach-agent $n0 $udp1
set null9 [new Agent/Null]
$ns attach-agent $n2 $null9
$ns connect $udp1 $null9
$udp1 set packetSize_ 1500
#Setup a UDP connection
set udp2 [new Agent/UDP]
$ns attach-agent $n0 $udp2
set null10 [new Agent/Null]
$ns attach-agent $n3 $null10
$ns connect $udp2 $null10
$udp2 set packetSize_ 1500
#Setup a UDP connection
set udp3 [new Agent/UDP]
$ns attach-agent $n0 $udp3
set null11 [new Agent/Null]
$ns attach-agent $n4 $null11
$ns connect $udp3 $null11
$udp3 set packetSize_ 1500
#Setup a UDP connection
set udp4 [new Agent/UDP]
$ns attach-agent $n0 $udp4
set null12 [new Agent/Null]
$ns attach-agent $n5 $null12
$ns connect $udp4 $null12
$udp4 set packetSize_ 1500
#Setup a UDP connection
set udp5 [new Agent/UDP]
$ns attach-agent $n0 $udp5
set null13 [new Agent/Null]
$ns attach-agent $n6 $null13
$ns connect $udp5 $null13
```

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```
$udp5 set packetSize_ 1500
#Setup a UDP connection
set udp6 [new Agent/UDP]
$ns attach-agent $n0 $udp6
set null14 [new Agent/Null]
$ns attach-agent $n7 $null14
$ns connect $udp6 $null14
$udp6 set packetSize_ 1500
#Setup a UDP connection
set udp7 [new Agent/UDP]
$ns attach-agent $n0 $udp7
set null15 [new Agent/Null]
$ns attach-agent $n8 $null15
$ns connect $udp7 $null15
$udp7 set packetSize_ 1500
#=================================
#       Applications Definition
#=================================
#Setup a CBR Application over UDP connection
set cbr0 [new Application/Traffic/CBR]
$cbr0 attach-agent $udp0
$cbr0 set packetSize_ 1500
$cbr0 set rate_ 1.0Mb
$cbr0 set random_ null
$ns at 1.0 "$cbr0 start"
$ns at 13.0 "$cbr0 stop"
#Setup a CBR Application over UDP connection
set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $udp1
$cbr1 set packetSize_ 1500
$cbr1 set rate_ 1.0Mb
$cbr1 set random_ null
$ns at 1.0 "$cbr1 start"
$ns at 13.0 "$cbr1 stop"
#Setup a CBR Application over UDP connection
set cbr2 [new Application/Traffic/CBR]
$cbr2 attach-agent $udp2
$cbr2 set packetSize_ 1500
$cbr2 set rate_ 1.0Mb
$cbr2 set random_ null
$ns at 1.0 "$cbr2 start"
$ns at 13.0 "$cbr2 stop"
#Setup a CBR Application over UDP connection
set cbr3 [new Application/Traffic/CBR]
$cbr3 attach-agent $udp3
$cbr3 set packetSize_ 1500
$cbr3 set rate_ 1.0Mb
$cbr3 set random_ null
$ns at 1.0 "$cbr3 start"
$ns at 13.0 "$cbr3 stop"
#Setup a CBR Application over UDP connection
set cbr4 [new Application/Traffic/CBR]
$cbr4 attach-agent $udp4
$cbr4 set packetSize_ 1500
$cbr4 set rate_ 1.0Mb
$cbr4 set random_ null
```

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```
$ns at 1.0 "$cbr4 start"
$ns at 13.0 "$cbr4 stop"
#Setup a CBR Application over UDP connection
set cbr5 [new Application/Traffic/CBR]
$cbr5 attach-agent $udp5
$cbr5 set packetSize_ 1500
$cbr5 set rate_ 1.0Mb
$cbr5 set random_ null
$ns at 1.0 "$cbr5 start"
$ns at 13.0 "$cbr5 stop"
#Setup a CBR Application over UDP connection
set cbr6 [new Application/Traffic/CBR]
$cbr6 attach-agent $udp6
$cbr6 set packetSize_ 1500
$cbr6 set rate_ 1.0Mb
$cbr6 set random_ null
$ns at 1.0 "$cbr6 start"
$ns at 13.0 "$cbr6 stop"
#Setup a CBR Application over UDP connection
set cbr7 [new Application/Traffic/CBR]
$cbr7 attach-agent $udp7
$cbr7 set packetSize_ 1500
$cbr7 set rate_ 1.0Mb
$cbr7 set random_ null
$ns at 1.0 "$cbr7 start"
$ns at 13.0 "$cbr7 stop"
#=================================
#       Termination
#=================================
#Define a 'finish' procedure
proc finish {} {
   global ns tracefile namfile
   $ns flush-trace
   close $tracefile
   close $namfile
   exec nam out.nam &
   exit 0}
for {set i 0} {$i < $val(nn) } { incr i } {
   $ns at $val(stop) "\$n$i reset"}
$ns at $val(stop) "$ns nam-end-wireless $val(stop)"
$ns at $val(stop) "finish"
$ns at $val(stop) "puts \"done\" ; $ns halt"
$ns run
```

RESULTS AND DISCUSSION

(1)Analysis of the first scene: OUT.TR file for the first scene.

Enter command ns WSN.tcl run results produced out.tr file, the contents of this file as follows:

```
s 0.007067806 _0_ RTR  --- 0 message 32 [0 0 0 0] ------- [0:255 -1:255 32 0]
s 0.007382806 _0_ MAC  --- 0 message 84 [0 ffffffff 0 800] ------- [0:255 -1:255 32 0]
s 0.028837267 _2_ RTR  --- 1 message 32 [0 0 0 0] ------- [2:255 -1:255 32 0]
s 0.029272267 _2_ MAC  --- 1 message 84 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944267 _3_ MAC  --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944267 _4_ MAC  --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944267 _5_ MAC  --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944267 _6_ MAC  --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944267 _7_ MAC  --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
```

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r 0.029944267 _8_ MAC --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]

.....

M 1.00000 0 (190.00, 590.00, 0.00), (600.00, 300.00), 30.00

Input command, Nam out.nam produces the following figure, as showen in figure 2:

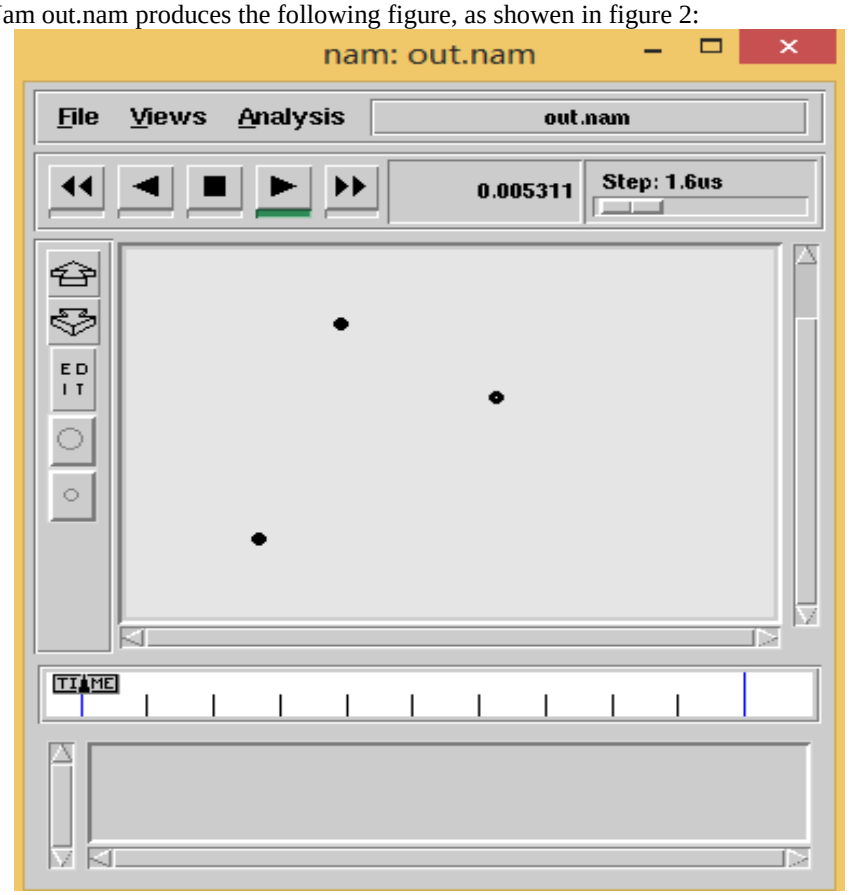

Figure 2 The first scene of the NAM display

Input awk -f measure-delay.awk out.tr>cbr_delay, the generated file is empty.

Input awk -f measure-jitter.awk out.tr>cbr_jitter, the generated file is empty.

Input awk -f measure-loss.awk out.tr>cbr_loss, the contents of the generated document are as follows：

number of packets sent:0 lost:0

Input awk -f measure-throughput.awk out.tr>cbr_throughput

The contents of the generated document are as follows：0.00 0.00 0.00 0.00

Draw topology, open the drawing software using the following code:

sh-4.1$ java -version

java version "1.6.0_18"

Java(TM) SE Runtime Environment (build 1.6.0_18-b07)

Java HotSpot(TM) Client VM (build 16.0-b13, mixed mode)

sh-4.1$ cd d:/cygwin/home/ns-allinone-2.28/ns-2.28/book/lab7

sh-4.1$ java -jar NSG2.jar

The first scene's topology diagram as showen in figure 3:

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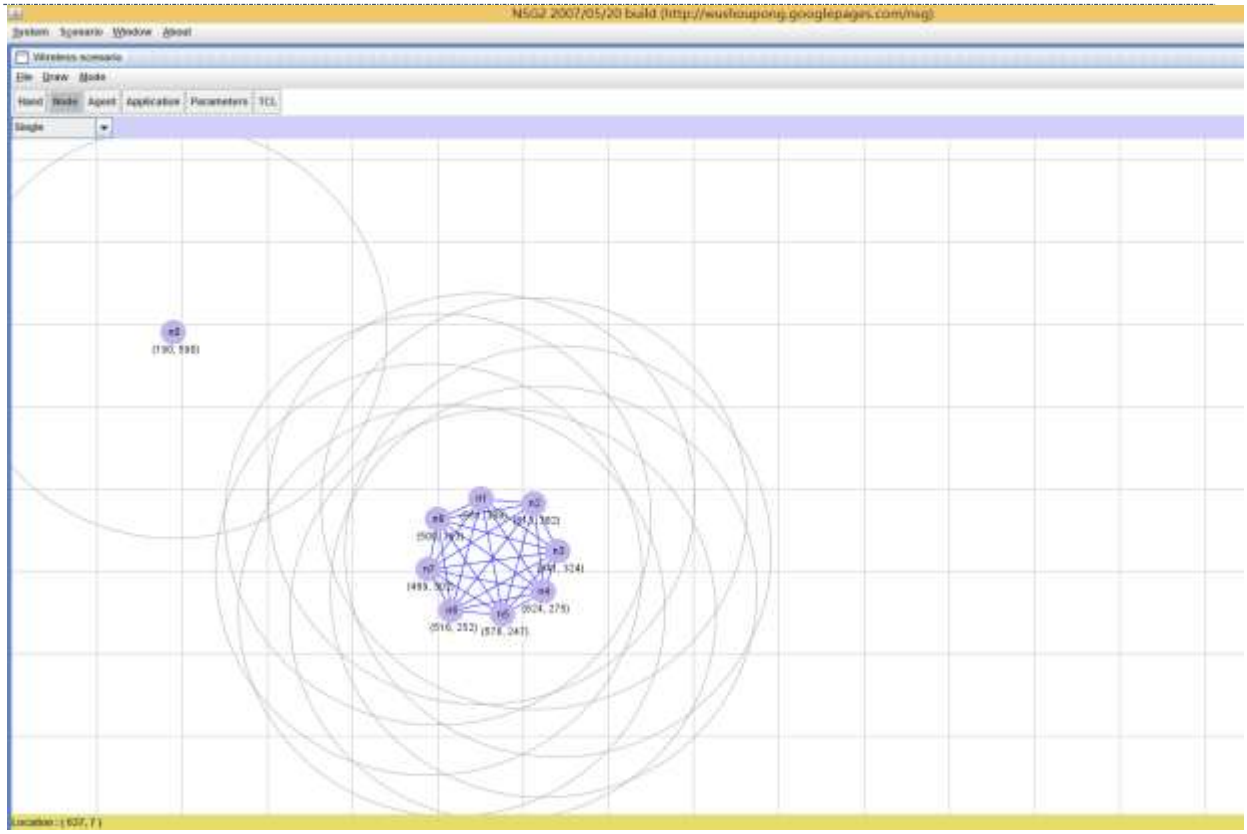

Figure 3 The first scene's topology diagram

(2)Analysis of second scenarios: The second scene's topology diagram as showen in figure 4.

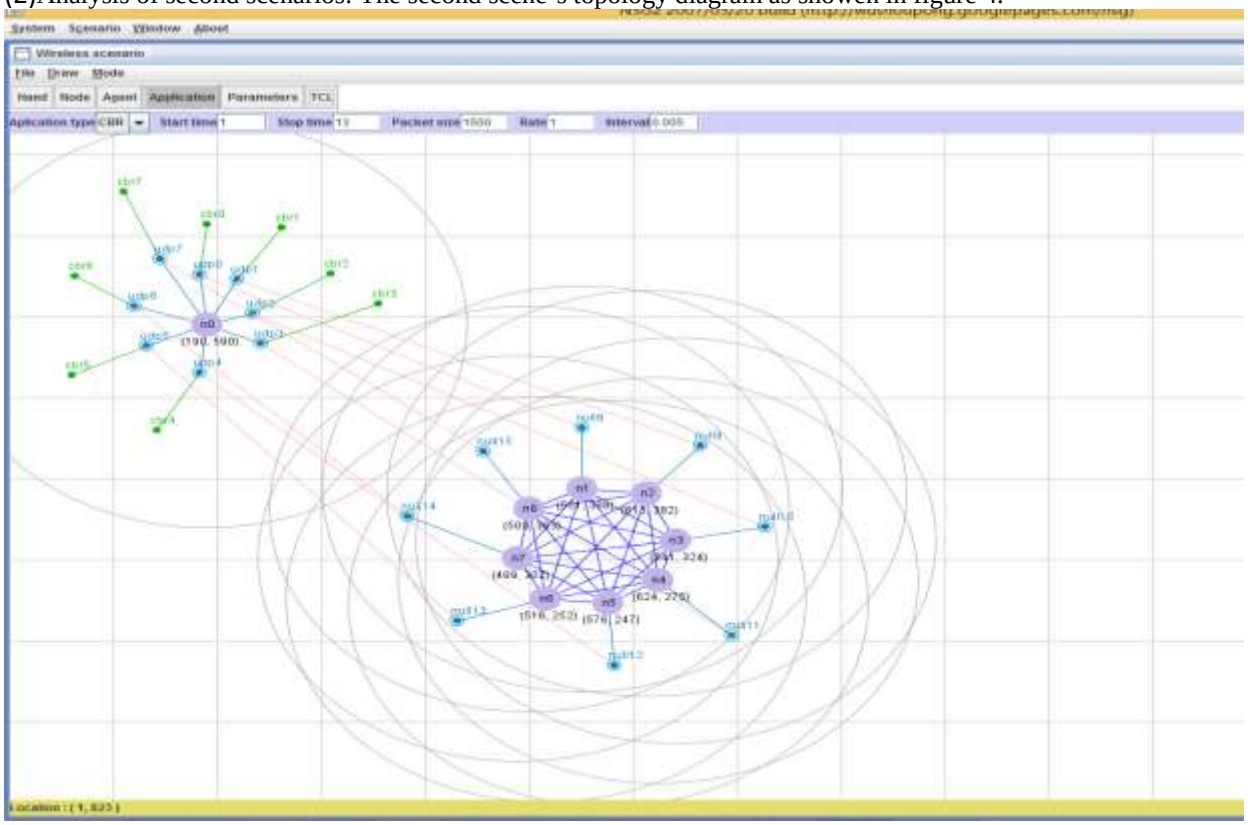

Figure 4 The second scene's topology diagram

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(3)Analysis of third scenarios: Run the third scene code as shown in figure 5: After run the results as shown in figure 6 and figure 7:

```
Main Options  VT Options  VT Fonts
sh-4.1$ cd d:/cygwin/home
sh-4.1$ ns WSNW.tcl
 When configured, ns found the right version of tclsh in /home/dukat/ns-allinone
-2.28/tcl8.4.5/unix/tclsh
but it doesn't seem to be there anymore, so ns will fall back on running the fir
st tclsh in your path. The wrong version of tclsh may break the test suites. Rec
onfigure and rebuild ns if this is a problem.
num_nodes is set 9
INITIALIZE THE LIST xListHead
channel.cc:sendUp - Calc highestAntennaZ_ and distCST_
highestAntennaZ_ = 1.5,  distCST_ = 550.0
SORTING LISTS ...DONE!
sh-4.1$ Cannot connect to existing nam instance. Starting a new one...
```

Figure 5 The code of run the third scene

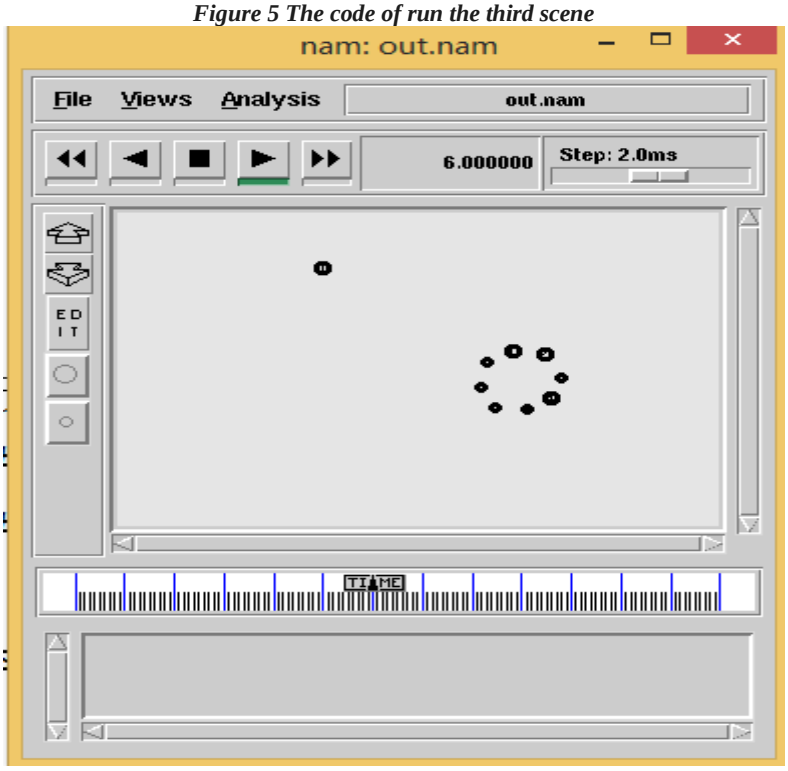

Figure 6 The third scene's nam display diagram(1)

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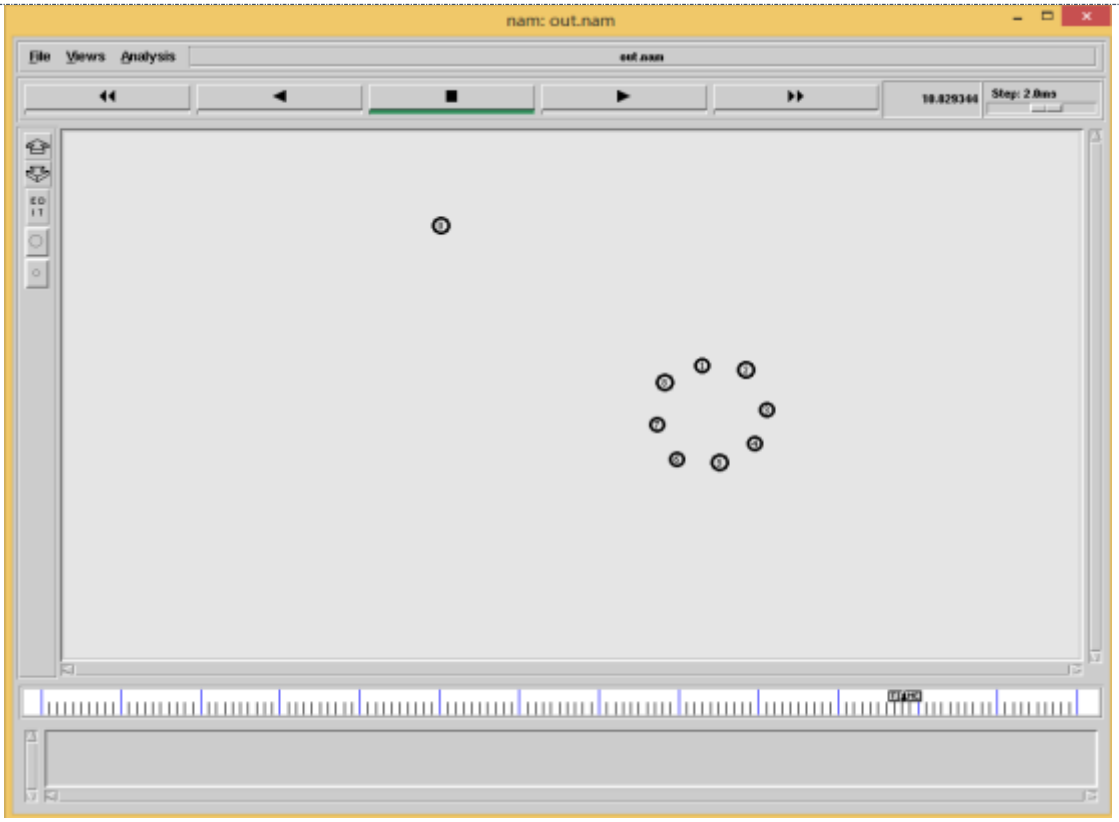

Figure 7 The third scene's nam display diagram(2)

Out.tr file part of the contents are as follows :

s 0.007067806 _0_ RTR --- 0 message 32 [0 0 0 0] ------- [0:255 -1:255 32 0]
s 0.007382806 _0_ MAC --- 0 message 84 [0 ffffffff 0 800] ------- [0:255 -1:255 32 0]
s 0.028837267 _2_ RTR --- 1 message 32 [0 0 0 0] ------- [2:255 -1:255 32 0]
s 0.029272267 _2_ MAC --- 1 message 84 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944475 _1_ MAC --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944482 _3_ MAC --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944625 _4_ MAC --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944649 _8_ MAC --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944733 _5_ MAC --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
r 0.029944759 _7_ MAC --- 1 message 32 [0 ffffffff 2 800] ------- [2:255 -1:255 32 0]
.....

Input awk -f measure-delay.awk out.tr>cbr_delay analysis delay, the generated file is empty.

Input awk -f measure-jitter.awk out.tr>cbr_jitter analysis jitter, the generated file is empty.

Input awk -f measure-loss.awk out.tr>cbr_loss analysis packet loss, the generated file is: number of packets sent:0 lost:0.

Input awk -f measure-throughput.awk out.tr>cbr_throughput analysis throughput,
Generate 0.00 0.00 0.00 0.00

CONCLUSION

While, the literatures have many shortcomings, so we conduct our research contents and research key points. Internet of things is still in the concept primary stage and the exploratory stage, not yet the persuasive complete large-scale application. The Internet of things is first put forward the noun concept, such as smart home, smart transportation, smart medical, but there intelligibility, communication is not high, lack of overarching, difficult to form a cluster effect and scale.

So, we put forward research content is the Internet of things, and research key points are RFID and WSN, RFID's wings are WSN.

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