

1.Heterogeneous traffic

The image shows a VMware Workstation 17 Player window titled "InstantContiki3.0 - VMware Workstation 17 Player (Non-commercial use only)". The main window displays a C program named "udp-client.c" in a text editor. The code includes headers for "contiki.h", "lib/random.h", "sys/ctimer.h", "net/ulp.h", "net/ipv6/ulp-ds6.h", "net/ipv6/ulp-udp-packet.h", and "sys/ctimer.h". It defines constants for UDP_CLIENT_PORT (8765), UDP_SERVER_PORT (5678), and UDP_EXAMPLE_ID (190). The program uses a timer to send UDP packets at a specified interval. The code is as follows:

```

#include "contiki.h"
#include "lib/random.h"
#include "sys/ctimer.h"
#include "net/ulp.h"
#include "net/ipv6/ulp-ds6.h"
#include "net/ipv6/ulp-udp-packet.h"
#include "sys/ctimer.h"
#include "powertrace.h"
#include "stdio.h"
#include "string.h"

#define UDP_CLIENT_PORT 8765
#define UDP_SERVER_PORT 5678

#define UDP_EXAMPLE_ID 190

#define DEBUG DEBUG_PRINT
#include "net/ipv6/ulp-debug.h"

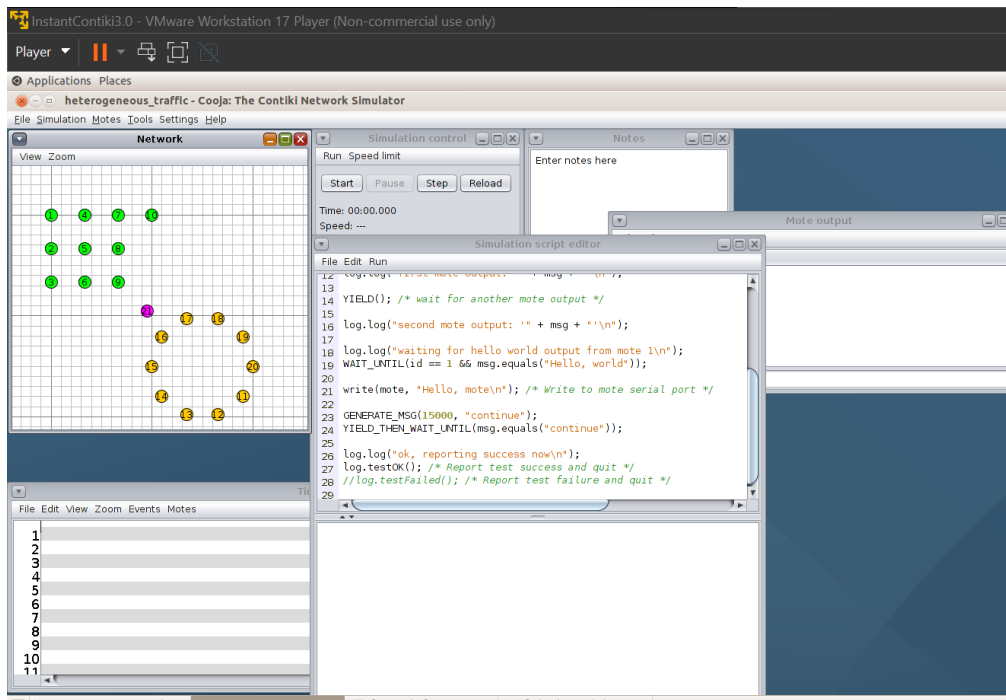
#ifndef PERIOD
#define PERIOD 15
#endif

#define START_INTERVAL (15 * CLOCK_SECOND)
#define SEND_INTERVAL (PERIOD * CLOCK_SECOND)
#define SEND_TIME (random_rand() % (SEND_INTERVAL))
#define MAX_PAYLOAD_LEN 10

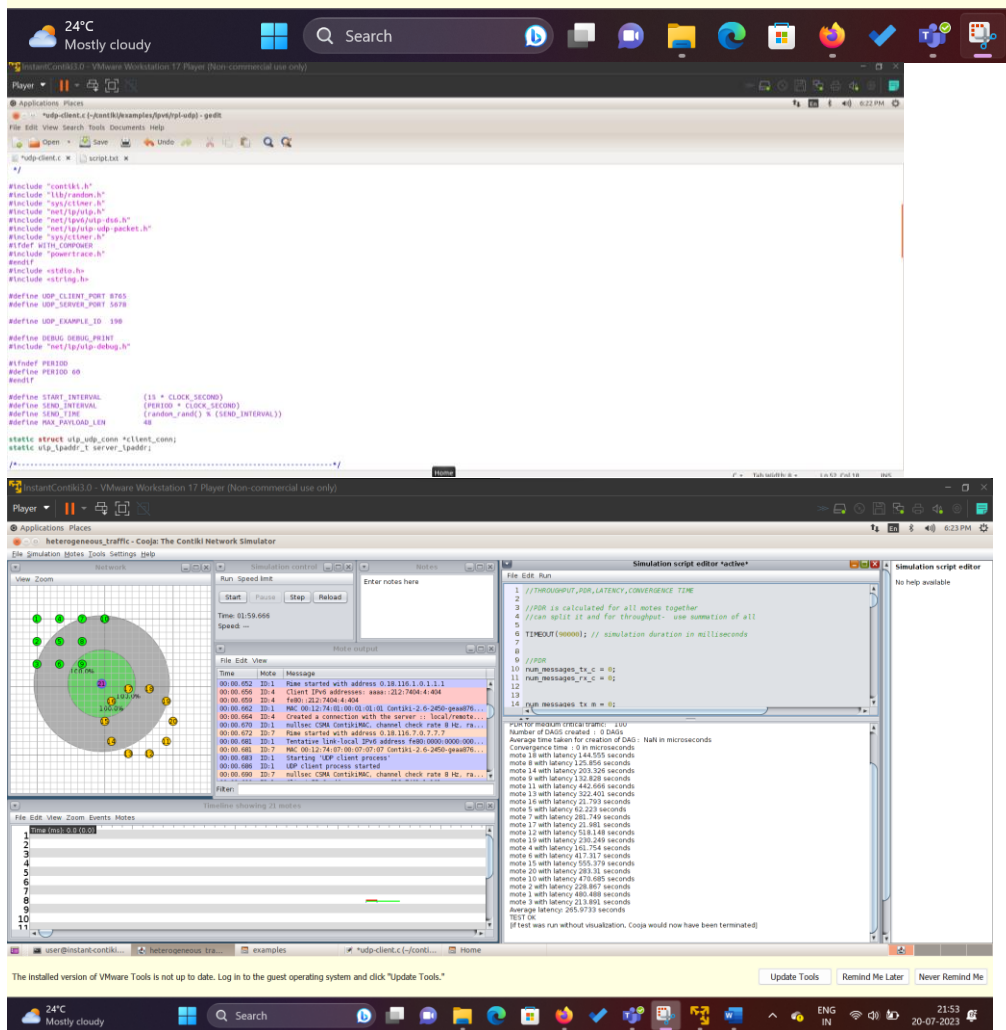
static struct udp_udp_conn *client_conn;
static ulp_ipaddr_t server_ipaddr;

```

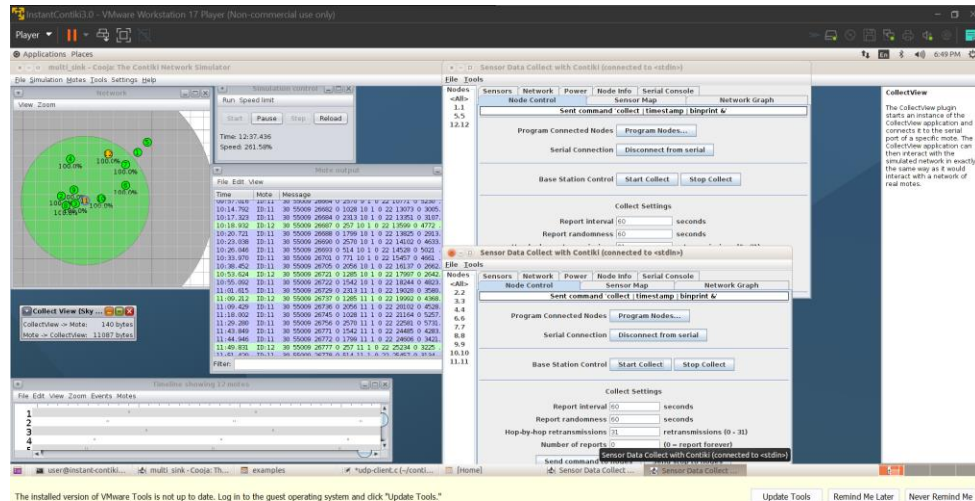
Below the code editor, there is a status bar indicating the installed version of VMware Tools is not up to date. The bottom of the window shows the VMware Workstation 17 Player interface with the "heterogeneous_traffic - Cooja: The Contiki Network Simulator" window open. The Cooja window displays a network diagram with 10 nodes (1-10) and a "Simulation control" panel with buttons for Start, Pause, Step, and Reload. The "Network" panel on the right provides instructions on how to use the network window, including zooming and panning. The timeline at the bottom shows 21 motes.



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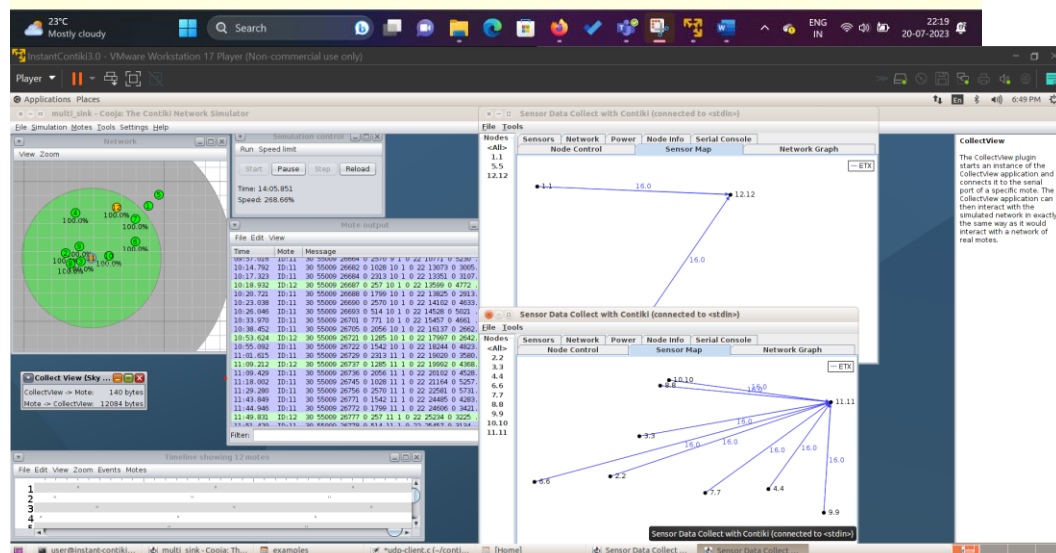


2.Multi Sink



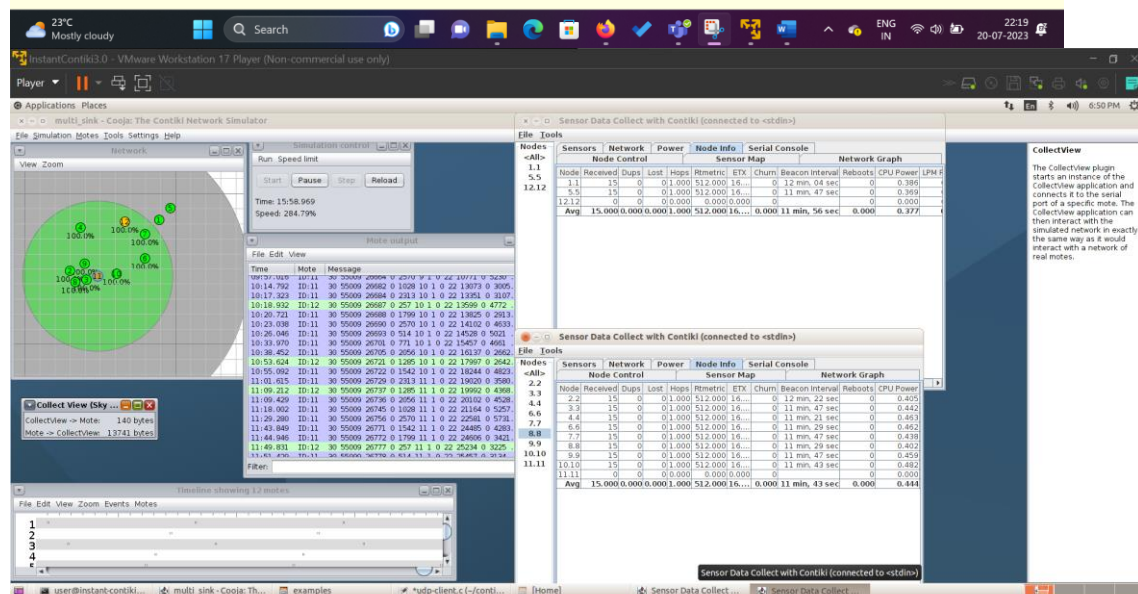
The screenshot shows the InstantContiki 3.0 VM interface. The main window displays a network graph with 12 nodes and a sink at node 1. The 'CollectView' plugin is active, showing a list of collected data points. The 'Sensor Data Collect with Contiki' window is open, displaying a table of sensor data for node 1. The table includes columns for Node, Received, Dups, Lost, Hops, Retrans, ETX, Churn, Beacon Interval, Reboots, CPU Power, and LPM. The data shows a high number of received packets and a low number of lost packets, indicating good network performance.

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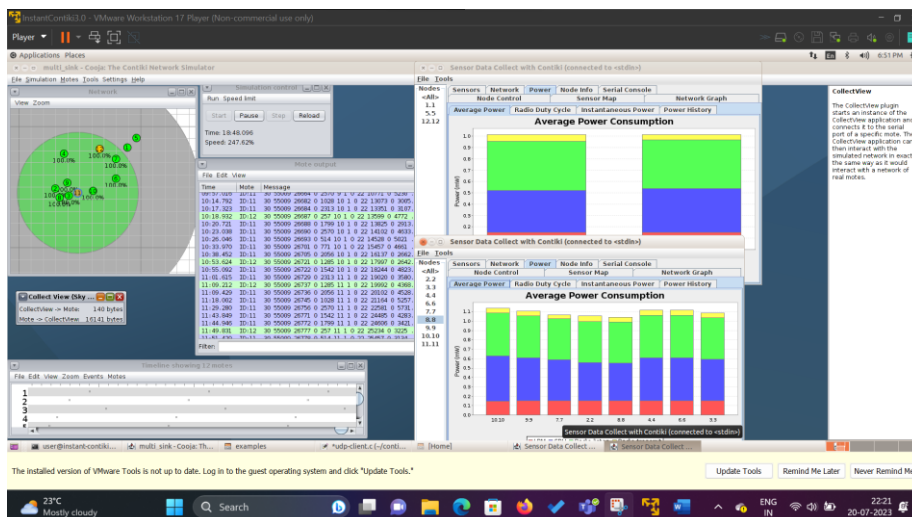


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The screenshot shows the Windows taskbar at the bottom of the screen. The system clock displays the time as 22:20 on 20-07-2023. The taskbar also shows various application icons and the Windows Start button.



3.Objective functions

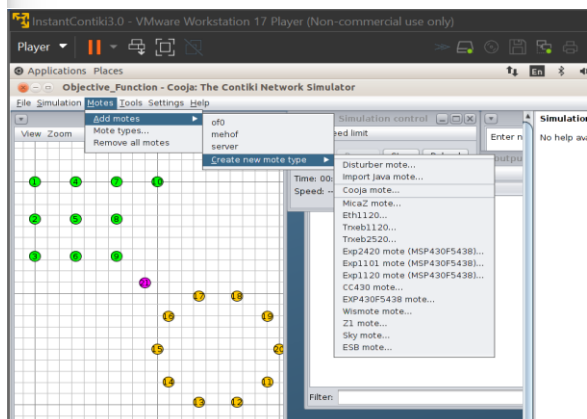
```
InstantContiki3.0 - VMware Workstation 17 Player (Non-commercial use only)
Player
Applications Places
rpl-conf.h (-/contiki/core/net/rpl) - gedit
File Edit View Search Tools Documents Help
rpl-conf.h x
/* be used; instead the rank carries ETX directly.
*/
#define RPL_CONF_DAG_MC
#define RPL_DAG_MC RPL_CONF_DAG_MC
#else
#define RPL_DAG_MC RPL_DAG_MC_NONE
#endif /* RPL_CONF_DAG_MC */

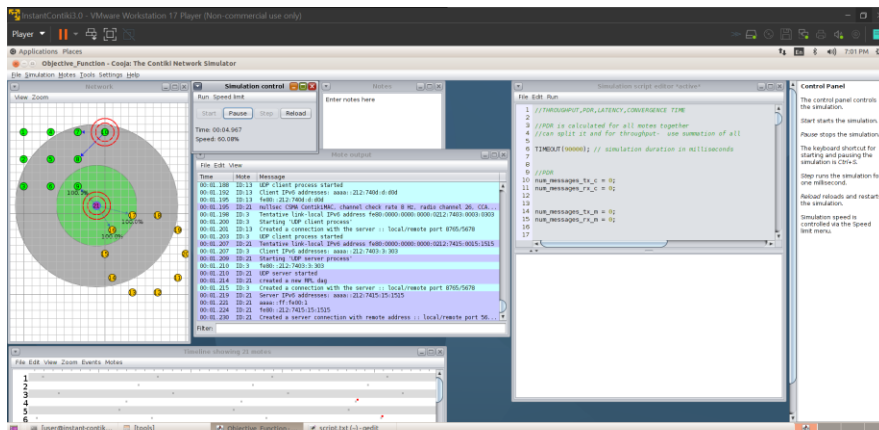
/*
 * The objective function used by RPL is configurable through the
 * RPL_CONF_OF parameter. This should be defined to be the name of an
 * rpl_of object linked into the system image, e.g., rpl_of0.
 */
#define RPL_CONF_OF
#define RPL_OF RPL_CONF_OF
#else
/* ETX is the default objective function. */
#define RPL_OF rpl_mrhof
#endif /* RPL_CONF_OF */

/* This value decides which DAG instance we should participate in by default. */
#define RPL_CONF_DEFAULT_INSTANCE
#define RPL_CONF_DEFAULT_INSTANCE 0

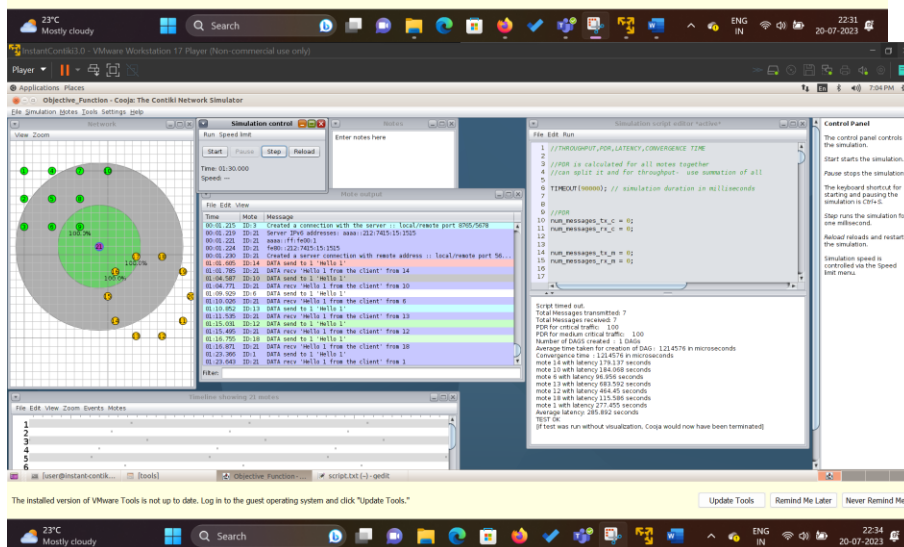
InstantContiki3.0 - VMware Workstation 17 Player (Non-commercial use only)
Player
Applications Places
*rpl-conf.h (-/contiki/core/net/rpl) - gedit
File Edit View Search Tools Documents Help
rpl-conf.h x
/* be used; instead the rank carries ETX directly.
*/
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#define RPL_DAG_MC RPL_CONF_DAG_MC
#else
#define RPL_DAG_MC RPL_DAG_MC_NONE
#endif /* RPL_CONF_DAG_MC */

/*
 * The objective function used by RPL is configurable through the
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 */
#define RPL_CONF_OF
#define RPL_OF RPL_CONF_OF
#else
/* ETX is the default objective function. */
#define RPL_OF rpl_of0
#endif /* RPL_CONF_OF */
```



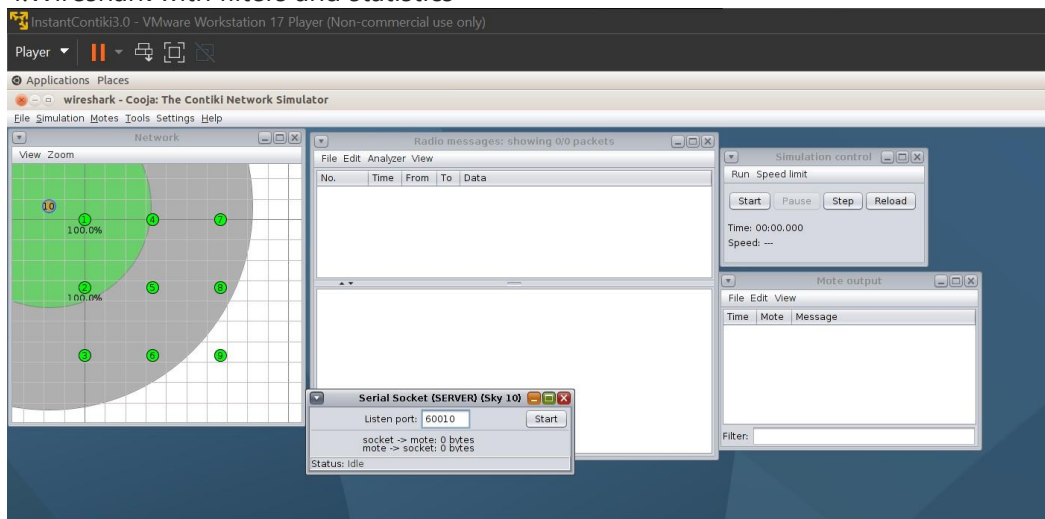


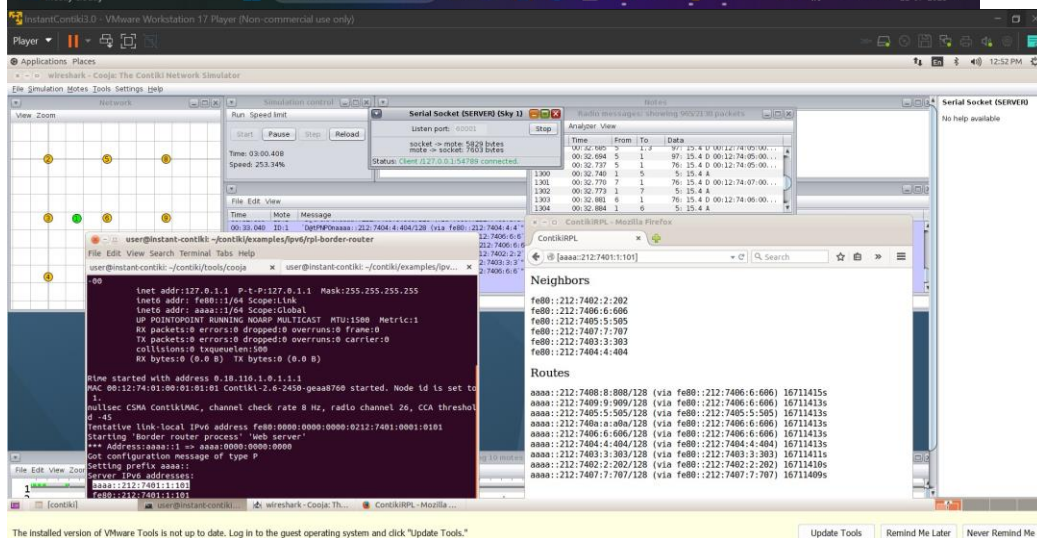
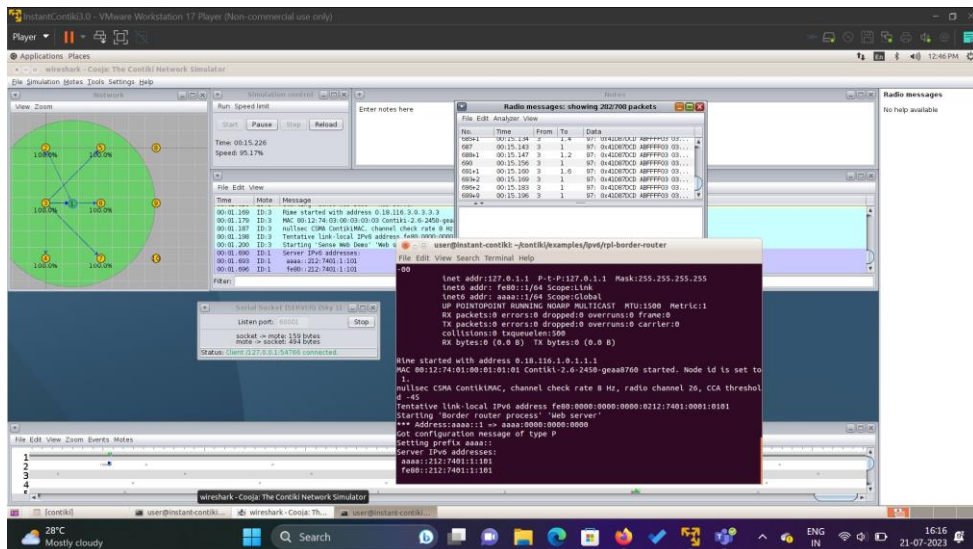
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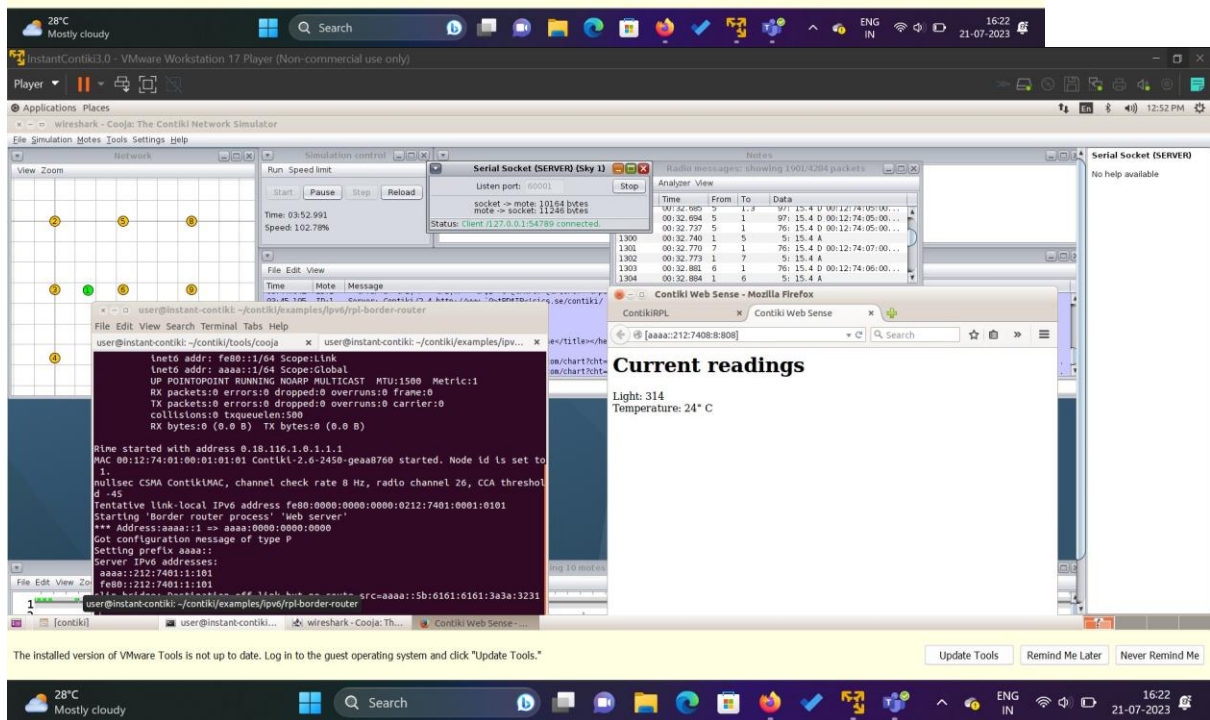
4. Wireshark with filters and statistics





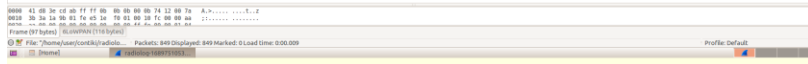
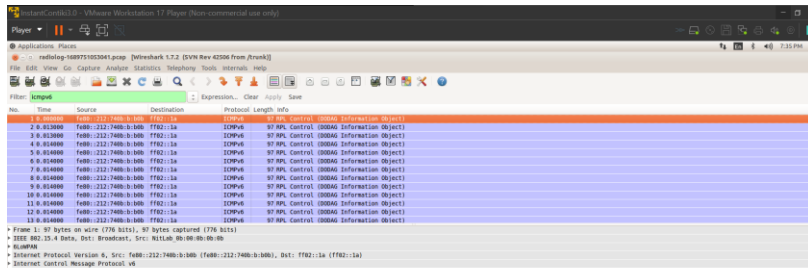
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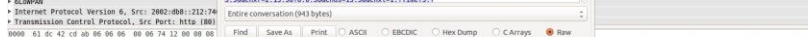
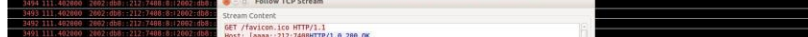
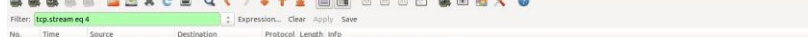
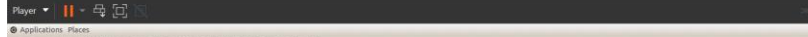
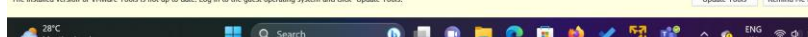
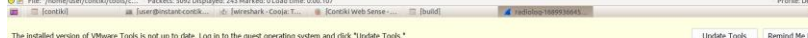
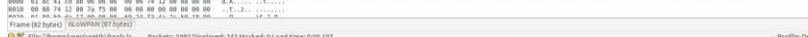
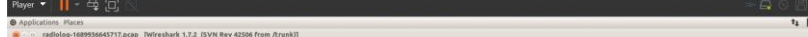
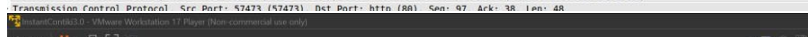
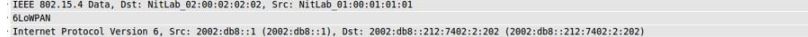
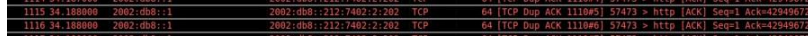
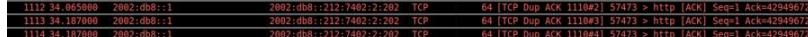
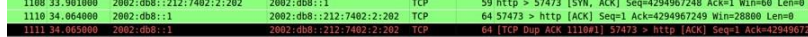
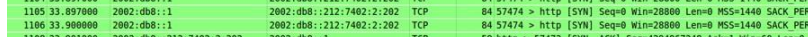
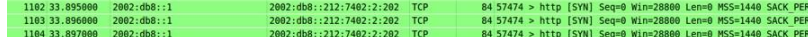
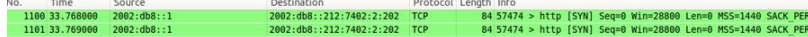
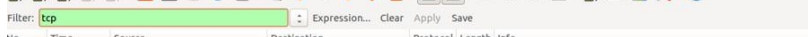


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The installed version of Wireshark is not up to date. Log in to the guest operating system and click "Update Tools."



InstantContiki3.0 - VMware Workstation 17 Player (Non-commercial use only)

Player

Applications Places

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No. Time Source Destination Protocol Length Info

Wireshark: Protocol Hierarchy Statistics

Display filter: none

Protocol	%Packets	Packets	%Bytes	Bytes	Mbit/s	End Packets	End Bytes	End Mbit/s
Frame	100.00%	5092	100.00%	422257	0.012	0	0	0.006
* IEEE 802.15.4 Low-Rate Wireless PAN	100.00%	5092	100.00%	422257	0.012	286	1430	0.006
* IPv6 over IEEE 802.15.4	94.38%	4806	89.60%	420827	0.012	0	0	0.006
* Internet Protocol Version 6	94.38%	4806	89.60%	420827	0.012	0	0	0.006
* Internet Control Message Protocol v6	58.37%	2972	64.94%	274226	0.008	2972	274226	0.008
* Transmission Control Protocol	36.02%	1834	34.72%	146601	0.004	1354	101090	0.003
* Hypertext Transfer Protocol	9.43%	480	10.78%	45511	0.001	480	45511	0.001

File: /home/user/contiki-3.0/examples/gw/p2p/border-router Load time: 0:00:00

contiki

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Player

Applications Places

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No. Time Source Destination Protocol Length Info

Wireshark IO Graphs: radiolog-1689936645717.pcap

Graphs

Graph 1 Color Filter: ip Style: Line Tick interval: 1 sec

Graph 2 Color Filter: ipv6 Style: Line Pixels per tick: 5

Graph 3 Color Filter: icmp Style: Line Views as time of day

Graph 4 Color Filter: icmpv6 Style: Line

Unit: Packets/Tick

Scale: Auto

Smooth: No Filter

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contiki

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Player

Applications Places

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No. Time Source Destination Protocol Length Info

IPv6 Conversations: radiolog-1689936645717.pcap

IPv6 Conversations: 21

Address A	Address B	Packets	Bytes	Packets A-B	Bytes A-B	Rel Start	Duration	bps A-B
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	241	22 123	241	22 123	0	0.000000000	199.6860
fe80::212:7406:6:606::1a	fe80::212:7402:2:202::1a	212	19 310	212	19 310	0	0.342000000	184.5290
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	241	22 123	241	22 123	0	0.748000000	194.0600
fe80::212:7406:6:606::1a	fe80::212:7402:2:202::1a	241	22 123	241	22 123	0	1.192000000	173.5650
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	160	15 520	160	15 520	0	2.428000000	52.4530
fe80::212:7406:6:606::1a	fe80::212:7402:2:202::1a	241	22 123	241	22 123	0	3.028000000	180.4220
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	23	1 904	0	0	23	5.512000000	272.1890
fe80::212:7406:6:606::1a	fe80::212:7402:2:202::1a	11	992	0	0	11	5.746000000	279.2020
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	11	992	0	0	11	5.851000000	277.9510
fe80::212:7406:6:606::1a	fe80::212:7402:2:202::1a	203	19 691	203	19 691	0	5.952000000	169.2460
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	203	19 691	203	19 691	0	6.534000000	179.5360
fe80::212:7406:6:606::1a	fe80::212:7402:2:202::1a	40	3 248	0	0	40	6.709000000	280.8670
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	203	19 691	203	19 691	0	7.023000000	167.4030
fe80::212:7406:6:606::1a	fe80::212:7402:2:202::1a	11	992	0	0	11	9.146000000	244.2780
fe80::212:7402:2:202::1a	fe80::212:7406:6:606::1a	204	18 364	0	0	204	8.406000000	280.0070

File: /home/user/contiki-3.0/examples/gw/p2p/border-router Load time: 0:00:00

contiki

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