

Routing Solution for Congested Networks with Emphasis on Reducing Packet Loss

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Protocol

Our code simulates a network of interconnected routers. The routers each contain a buffer queue that can hold up to 10 packets, a numeric ID, and a buffer flag that signals when the router is getting congested, which in our case is when the buffer queue contains at least seven packets.

The protocol written for this project is meant to address congestion in a network, on the level of each router. Because each router contains a flag that signals its congestion, traffic is throttled at the router - router level. Preemptively throttling the network when a router signals congestion helps to prevent packet loss at the expense of sacrificing throughput.

The protocol is implemented primarily in the `packet_path()` function, as well as the auxiliary functions `send_packet()` and `add_packet()`. The `packet_path()` function contains the protocol for sending packets from the source router in the network to the destination router. The `send_packet()` function is used by `packet_path()` and simulates sending packets from two routers in the network that are directly connected, or only have one link between them. The `add_packet()` function is used by `send_packet()` and actually adds the packet passed to the function into the routers buffer queue. Packets are successfully added to a routers buffer queue as long as the buffer queue isn't full. If the routers buffer queue contains at least seven packets, the `add_packet()` function sets the routers buffer flag to true, signalling that the router is getting congested.

In order to send packets from one router to another, a path must be determined. The edges that connect the routers in the graph are unweighted, so the path is found using a minimum distance breadth first search algorithm.

In `packet_path()`, packets are sent from one router to another in the network until the router signals that it is getting congested, and until there are no more packets left to send to the destination router. To prevent packet loss, once a router signals that it is congested, it stops receiving packets, acknowledges the packets it has received, and then begins sending the packets it has received to the next router in the path. This process repeats itself until the packets arrive at their intended destination. Once at the destination router, the packets are acknowledged, and for each packet acknowledged by the destination router, the total number of packets left to be sent from source to destination is decremented. Once there are no longer any packets to be sent to the destination, the protocol terminates.

This protocol is designed to prevent any packets lost, and for all the scenarios explained in the Results section, there were no packets that were dropped. However, the protocol is coded to keep track of any packets that are not successfully sent, detected using booleans. If `add_packet()` or `send_packet()` returns false at any point, then `packet_path()` increments a counter. If 3 packets in a row fail to send, then the `packet_path()` function returns false and prints a message to the user stating where in the path the packets failed to send.

Novel Contribution

The novelty of the simulation is explored from the solution derived from the original problem. Overall, the solution is as follows, to traverse, simulate, and reduce packet loss in a congested, mesh network. The way the team approached this was to throttle the amount of packets sent from individual routers, through a set of buffer flags in the receiving router. Effectively, the network is throttled in a micro, by-router basis, differing from other networking protocols that addresses this in a more macro scale, as is the case for TCP Reno or TCP Tahoe. In addition to this, other networking protocols, such as the two mentioned previously, throttles the transmission rate after detecting packet loss. Comparatively, this protocol preemptively detects and throttles a high amount of traffic prior to any packet loss. As such, this solution is not ideal for tasks that require a higher throughput, such as streaming; however, it is well-suited for tasks that require very few packet loss, such as file sharing. Fig. 1-5 describes the process visually.

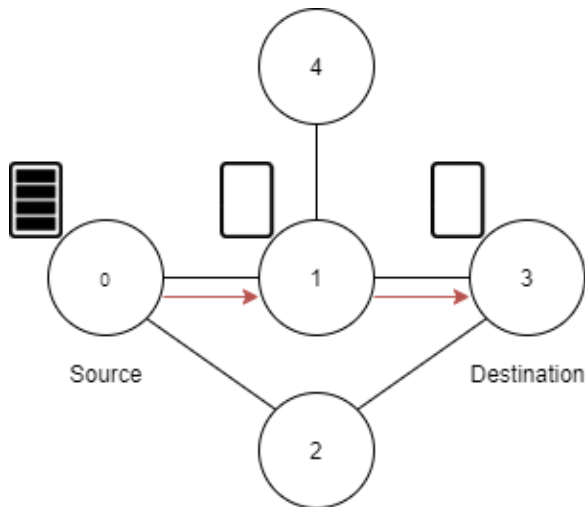


Figure 1: The initial state of the network. The total number of packets must be moved between source at Router 0 to destination at Router 3, whilst passing Router 1

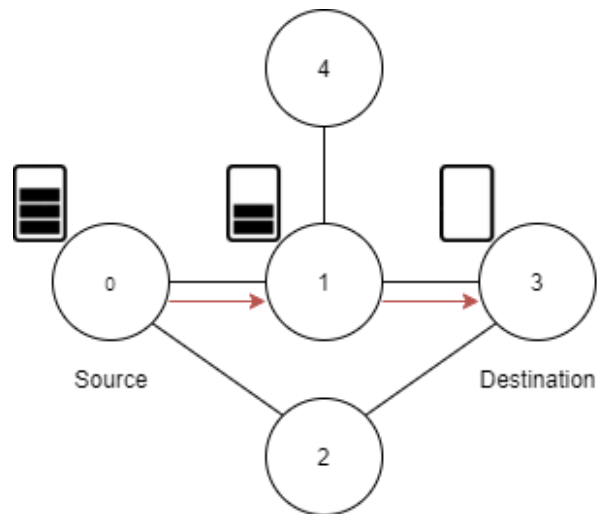


Figure 2: The buffer queue fills up at Router 1

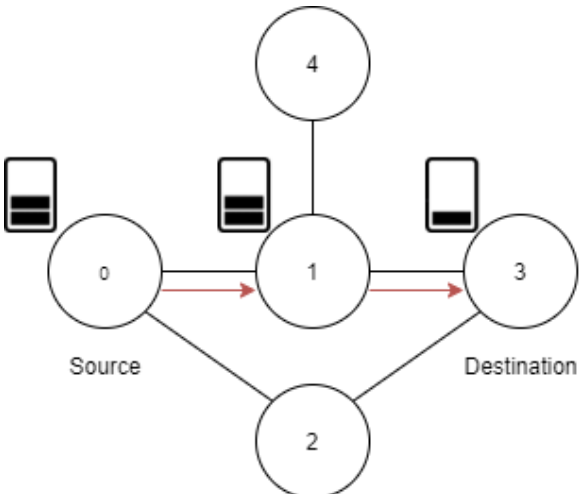
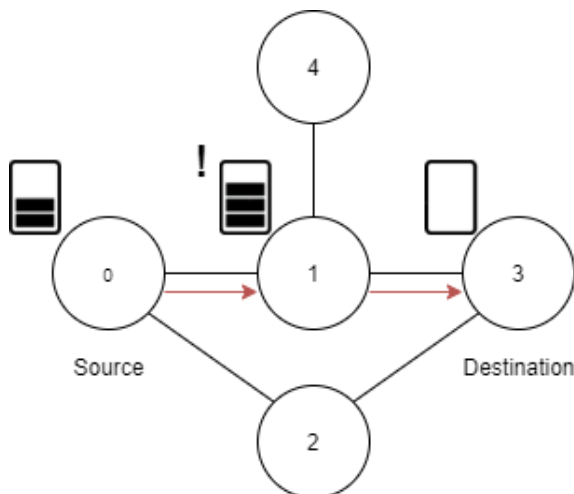


Figure 3: As soon as the buffer queue reaches a specified limit in Router 1, a flag is set to stop the flow of packets from the source router.

Figure 4: Router 1 will then clear its buffer queue by sending its packets to the destination before accepting any more

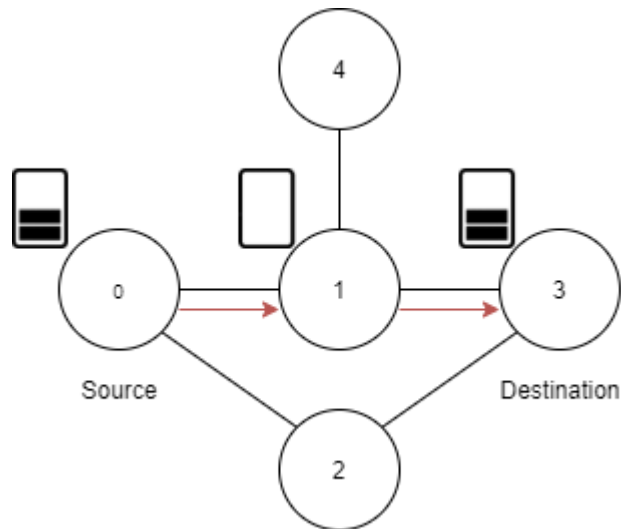


Figure 5: After Router 1 is empty, it will then continue sending packets from the source, to Router 1 and repeat the process above until the total number of packets is sent to the destination.

Results and Analysis

The following figures show the output for a graph containing 5 routers, and 5 edges. An explanation and analysis of the output follows the figures.

```

strangerdanger@ubuntu:~/CPE 400 Project/Pr
number of packets sent: 50
random src: 3 random dest: 2
The total packet is 50
new src: 3
new dest: 2
Packets left 49
new src: 3
new dest: 2
Packets left 48
new src: 3
new dest: 2
Packets left 47
new src: 3
new dest: 2
Packets left 46
new src: 3
new dest: 2
Packets left 45
new src: 3
new dest: 2
Packets left 44
new src: 3
new dest: 2
Packets left 43
new src: 3
new dest: 2
router flag value after set flag: 1
Packets left 42
The total packet is 42
new src: 3
new dest: 2
Packets left 41
new src: 3
new dest: 2
Packets left 40
new src: 3
new dest: 2
Packets left 39
new src: 3
new dest: 2
Packets left 38
new src: 3
new dest: 2
Packets left 37
new src: 3
new dest: 2
Packets left 36
new src: 3
new dest: 2
Packets left 35
new src: 3
new dest: 2
router flag value after set flag: 1
Packets left 34
The total packet is 34
new src: 3
new dest: 2
Packets left 33
new src: 3
new dest: 2
Packets left 32
new src: 3
new dest: 2
Packets left 31
new src: 3
new dest: 2
Packets left 30
new src: 3
new dest: 2
Packets left 29
new src: 3
new dest: 2
Packets left 28
new src: 3
new dest: 2

```

Figure 6:

Beginning of the output for a graph containing 5 routers and 5 edges. The path selected is from router 3 to router 2.

Figure 7:

Continued output from Fig 6. Packets are sent from routers 3 to 2.

```

Packets left 27
new src: 3
new dest: 2
router flag value after set flag: 1
Packets left 26
The total packet is 26
new src: 3
new dest: 2
Packets left 25
new src: 3
new dest: 2
Packets left 24
new src: 3
new dest: 2
Packets left 23
new src: 3
new dest: 2
Packets left 22
new src: 3
new dest: 2
Packets left 21
new src: 3
new dest: 2
Packets left 20
new src: 3
new dest: 2
Packets left 19
new src: 3
new dest: 2
router flag value after set flag: 1
Packets left 18
The total packet is 18
new src: 3
new dest: 2
Packets left 17
new src: 3
new dest: 2
Packets left 16

```

Figure 8:

Continued output from Fig 7. Packets are sent from routers 3 to 2.

```

new src: 3
new dest: 2
Packets left 15
new src: 3
new dest: 2
Packets left 14
new src: 3
new dest: 2
Packets left 13
new src: 3
new dest: 2
Packets left 12
new src: 3
new dest: 2
Packets left 11
new src: 3
new dest: 2
router flag value after set flag: 1
Packets left 10
The total packet is 10
new src: 3
new dest: 2
Packets left 9
new src: 3
new dest: 2
Packets left 8
new src: 3
new dest: 2
Packets left 7
new src: 3
new dest: 2
Packets left 6
new src: 3
new dest: 2
Packets left 5
new src: 3
new dest: 2
Packets left 4

```

Figure 9:

Continued output from Fig 8. Packets are sent from routers 3 to 2.

```

new dest: 2
Packets left 3
new src: 3
new dest: 2
router flag value after set flag: 1
Packets left 2
The total packet is 2
new src: 3
new dest: 2
Packets left 1
new src: 3
new dest: 2
Packets left 0
0
random src: 3 random dest: 0
The total packet is 50
new src: 3
new dest: 1
Packets left 50
new src: 3
new dest: 1
Packets left 50
new src: 3
new dest: 1
Packets left 50
new src: 3
new dest: 1
Packets left 50
new src: 3
new dest: 1
Packets left 50
new src: 3
new dest: 1
Packets left 50

```

Figure 10:

Continued output from Fig 9. Packets are sent from routers 3 to 2. The path selected is from router 3 to router 0. Packets are sent from router 3 to 1.

```

new src: 3
new dest: 1
router flag value after set flag: 1
Packets left 50
new src: 1
new dest: 0
Packets left 49
new src: 1
new dest: 0
Packets left 48
new src: 1
new dest: 0
Packets left 47
new src: 1
new dest: 0
Packets left 46
new src: 1
new dest: 0
Packets left 45
new src: 1
new dest: 0
Packets left 44
new src: 1
new dest: 0
Packets left 43
new src: 1
new dest: 0
router flag value after set flag: 1
Packets left 42
The total packet is 42
new src: 3
new dest: 1
Packets left 42
new src: 3
new dest: 1
Packets left 42
new src: 3
new dest: 1
Packets left 42

```

Figure 11:

Continued output from Fig 10. Packets are sent from routers 3 to 1 and routers 1 to 0.

In Fig 6, we are sending 50 packets to the destination router, reflected by the “Total packet is 50” statement. The main file is choosing a random source and destination router (called random src and random dest) which are 3 and 2 respectively.

In this case, the main file has selected two routers that are directly connected to one another.

In Fig 6 - 10, after packets are sent to the destination router, we decrement the total number of packets needed to be sent, represented by the “Packets left” statement. The packets are decremented right away in this case because the src and dest routers are directly connected.

The statement “router flag value after set flag” is printed once the `add_packet()` function sets the value of the buffer flag to be true, signalling that the router is getting congested. Once a router is congested, the source router will stop sending packets to the congested router, and the congested router will send the packets to the next router in the path. Because the congested router is also at the end of the path, it simulates sending the packets up to the application layer, which in this case is simply clearing its buffer queue. The router resets its buffer flag to false, since its queue is now empty.

Since there are still more packets to send, the protocol starts at the beginning of the path. This is reflected by the “Total packet is 42” statement. The process repeats itself until there are 0 packets left to send to the destination router, shown in Fig. 10.

This example shows that for two routers that are directly connected, no packets are dropped using this protocol, because once a router is congested, it stops receiving packets, and sends the packets in its buffer queue to the next router. The router does not start to receive packets again until it's no longer congested and its buffer flag is set to false.

In Fig. 10, the file picks another random router for source and destination, which is 3 and 0 respectively. These routers are not directly connected and the packet must traverse through other routers before arriving at the destination. As such, the total number of packets does not decrement until the first packet is received by the final destination router. The intermediary router's buffer queue is filled until a flag is raised, as shown in Fig. 11. From here, the packets are then transferred from the intermediary router to the final destination router. As soon as the buffer queue is cleared from the second router, the protocol will continue sending packets from source, to the intermediary router, then the destination in the same process until all 50 packets have made their way from the source to the final destination.

Because 5 routers is the size of a rather small network, we have included the text output of our protocol with 50 routers sending 500 packets from a source and destination router in the Appendix. This output is for reference to show that despite larger networks and massive amounts of traffic, our protocol succeeds in delivering packets without loss, at the expense of throughput.

Packets left 452	new src: 0	new dest: 33
new src: 0	Packets left 440	Packets left 429
new dest: 33	new src: 0	new src: 0
Packets left 451	new dest: 33	new dest: 33
new src: 0	Packets left 439	router flag value after set flag: 1
new dest: 33	new src: 0	Packets left 428
Packets left 450	new dest: 33	The total packet is 428
new src: 0	Packets left 438	new src: 42
new dest: 33	new src: 0	new dest: 0
Packets left 449	new dest: 33	Packets left 428
new src: 0	Packets left 437	new src: 42
new dest: 33	new src: 0	new dest: 0
Packets left 448	new dest: 33	Packets left 428
new src: 0	router flag value after set flag: 1	new src: 42
new dest: 33	Packets left 436	new dest: 0
Packets left 447	The total packet is 436	Packets left 428
new src: 0	new src: 42	new src: 42
new dest: 33	new dest: 0	new dest: 0
Packets left 446	Packets left 436	Packets left 428
new src: 0	new src: 42	new src: 42
new dest: 33	new dest: 0	new dest: 0
Packets left 445	Packets left 436	new dest: 0
new src: 0	new src: 42	Packets left 428
new dest: 33	new dest: 0	new src: 42
router flag value after set flag: 1	Packets left 436	new dest: 0
Packets left 444	new src: 42	Packets left 428
The total packet is 444	new dest: 0	new src: 42
new src: 42	Packets left 436	new dest: 0
new dest: 0	new src: 42	new dest: 0
Packets left 444	new dest: 0	Packets left 428
new src: 42	Packets left 436	new src: 42
new dest: 0	new src: 42	new dest: 0
Packets left 444	new dest: 0	router flag value after set flag: 1
new src: 42	Packets left 436	Packets left 428
new dest: 0	new src: 42	new src: 0
Packets left 444	new dest: 0	new dest: 33
new src: 42	new src: 42	Packets left 427
new dest: 0	new dest: 0	new src: 0
Packets left 444	Packets left 436	new dest: 33
new src: 42	new src: 42	Packets left 426
new dest: 0	new dest: 0	new src: 0
Packets left 444	router flag value after set flag: 1	new dest: 33
new src: 42	Packets left 436	Packets left 425
new dest: 0	new src: 0	new src: 0
Packets left 444	new dest: 33	new dest: 33
new src: 42	Packets left 435	Packets left 424
new dest: 0	new src: 0	new src: 0
Packets left 444	new dest: 33	new dest: 33
new src: 42	Packets left 434	Packets left 423
new dest: 0	new src: 0	new src: 0
Packets left 444	new dest: 33	new dest: 33
new src: 42	Packets left 433	Packets left 422
new dest: 0	new src: 0	new src: 0
router flag value after set flag: 1	new dest: 33	new dest: 33
Packets left 444	Packets left 432	router flag value after set flag: 1
new src: 0	new src: 0	Packets left 421
new dest: 33	new dest: 33	new src: 0
Packets left 443	Packets left 431	new dest: 33
new src: 0	new src: 0	The total packet is 420
new dest: 33	new dest: 33	new src: 42
Packets left 442	Packets left 430	new dest: 0
new src: 0	new src: 0	Packets left 420
new dest: 33		
Packets left 441		

new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 412	Packets left 404
Packets left 420	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 412	Packets left 403
Packets left 420	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 412	Packets left 402
Packets left 420	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 401
Packets left 420	Packets left 412	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 400
Packets left 420	Packets left 411	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 399
Packets left 420	Packets left 410	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 398
router flag value after set flag: 1	Packets left 409	new src: 0
Packets left 420	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 397
new dest: 33	Packets left 408	new src: 0
Packets left 419	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 407	Packets left 396
Packets left 418	new src: 0	The total packet is 396
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 406	new dest: 0
Packets left 417	new src: 0	Packets left 396
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 405	new dest: 0
Packets left 416	new src: 0	Packets left 396
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 415	Packets left 404	Packets left 396
new src: 0	The total packet is 404	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 414	new dest: 0	Packets left 396
new src: 0	Packets left 404	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 413	new dest: 0	Packets left 396
new src: 0	Packets left 404	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 396
Packets left 412	Packets left 404	new src: 42
The total packet is 412	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 396
new dest: 0	Packets left 404	new src: 42
Packets left 412	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 404	Packets left 396
Packets left 412	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 404	Packets left 395
Packets left 412	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 404	Packets left 394
Packets left 412	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33

Packets left 334	new dest: 0	Packets left 316
new src: 0	Packets left 324	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 333	new dest: 0	Packets left 316
new src: 0	Packets left 324	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 316
Packets left 332	Packets left 324	new src: 42
The total packet is 332	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 316
new dest: 0	Packets left 324	new src: 42
Packets left 332	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 324	Packets left 316
Packets left 332	new src: 42	new src: 0
new src: 0	new dest: 0	new dest: 33
Packets left 332	new dest: 0	Packets left 315
new src: 42	Packets left 324	new src: 0
new dest: 0	new src: 42	new dest: 33
Packets left 332	new dest: 0	Packets left 314
new src: 42	Packets left 324	new src: 0
new dest: 0	new src: 42	new dest: 33
Packets left 332	new dest: 0	Packets left 312
new src: 42	router flag value after set flag: 1	new src: 0
new dest: 0	Packets left 324	new dest: 33
Packets left 332	new src: 0	Packets left 311
new src: 42	new dest: 33	new src: 0
new dest: 0	Packets left 323	new dest: 33
Packets left 332	new src: 0	Packets left 310
new src: 42	new dest: 33	new src: 0
new dest: 0	Packets left 322	new dest: 33
Packets left 332	new src: 0	Packets left 309
new src: 42	new dest: 33	new src: 0
new dest: 0	Packets left 321	new dest: 33
router flag value after set flag: 1	new src: 0	router flag value after set flag: 1
Packets left 332	new dest: 33	Packets left 308
new src: 0	Packets left 320	The total packet is 308
new dest: 33	new src: 0	new src: 42
Packets left 331	new dest: 33	new dest: 0
new src: 0	Packets left 319	Packets left 308
new dest: 33	new src: 0	new src: 42
Packets left 330	new dest: 33	new dest: 0
new src: 0	Packets left 318	Packets left 308
new dest: 33	new src: 0	new src: 42
Packets left 329	new dest: 33	new dest: 0
new src: 0	Packets left 317	Packets left 308
new dest: 33	new src: 0	new src: 42
Packets left 328	new dest: 33	new dest: 0
new src: 0	router flag value after set flag: 1	Packets left 308
new dest: 33	Packets left 316	new src: 42
Packets left 327	The total packet is 316	new dest: 0
new src: 0	new src: 42	Packets left 308
new dest: 33	new dest: 0	new src: 42
Packets left 326	Packets left 316	new dest: 0
new src: 0	new src: 42	Packets left 308
new dest: 33	new dest: 0	new src: 42
Packets left 325	Packets left 316	new dest: 0
new src: 0	new src: 42	Packets left 308
new dest: 33	new dest: 0	new src: 42
router flag value after set flag: 1	Packets left 316	new dest: 0
Packets left 324	new src: 42	Packets left 308
The total packet is 324	new dest: 0	new src: 42
new src: 42	new dest: 0	new dest: 0

new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 286
router flag value after set flag: 1	Packets left 297	new src: 0
Packets left 308	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 285
new dest: 33	Packets left 296	new src: 0
Packets left 307	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 295	Packets left 284
Packets left 306	new src: 0	The total packet is 284
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 294	new dest: 0
Packets left 305	new src: 0	Packets left 284
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 293	new dest: 0
Packets left 304	new src: 0	Packets left 284
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 303	Packets left 292	Packets left 284
new src: 0	The total packet is 292	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 302	new dest: 0	Packets left 284
new src: 0	Packets left 292	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 301	new dest: 0	Packets left 284
new src: 0	Packets left 292	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 284
Packets left 300	Packets left 292	new src: 42
The total packet is 300	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 284
new dest: 0	Packets left 292	new src: 42
Packets left 300	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 292	Packets left 284
Packets left 300	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 292	Packets left 283
Packets left 300	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 282
Packets left 300	Packets left 292	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 281
Packets left 300	Packets left 291	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 279
Packets left 300	Packets left 290	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 278
router flag value after set flag: 1	Packets left 289	new src: 0
Packets left 300	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 277
new dest: 33	Packets left 288	new src: 0
Packets left 299	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 287	Packets left 276
Packets left 298	new src: 0	The total packet is 276

new src: 42	new dest: 0	Packets left 260
new dest: 0	Packets left 268	new src: 42
Packets left 276	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 268	Packets left 260
Packets left 276	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 268	Packets left 259
Packets left 276	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 268	Packets left 258
Packets left 276	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 257
Packets left 276	Packets left 268	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 256
Packets left 276	Packets left 267	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 255
Packets left 276	Packets left 266	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 254
router flag value after set flag: 1	Packets left 265	new src: 0
Packets left 276	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 253
new dest: 33	Packets left 264	new src: 0
Packets left 275	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 263	Packets left 252
Packets left 274	new src: 0	The total packet is 252
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 262	new dest: 0
Packets left 273	new src: 0	Packets left 252
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 261	new dest: 0
Packets left 272	new src: 0	Packets left 252
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 271	Packets left 260	Packets left 252
new src: 0	The total packet is 260	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 270	new dest: 0	Packets left 252
new src: 0	Packets left 260	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 269	new dest: 0	Packets left 252
new src: 0	Packets left 260	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 252
Packets left 268	Packets left 260	new src: 42
The total packet is 268	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 252
new dest: 0	Packets left 260	new src: 42
Packets left 268	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 260	Packets left 252
Packets left 268	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 260	Packets left 251
Packets left 268	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33

Packets left 250	new src: 0	The total packet is 228
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 238	new dest: 0
Packets left 249	new src: 0	Packets left 228
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 237	new dest: 0
Packets left 248	new src: 0	Packets left 228
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 247	Packets left 236	Packets left 228
new src: 0	The total packet is 236	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 246	new dest: 0	Packets left 228
new src: 0	Packets left 236	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 245	new dest: 0	Packets left 228
new src: 0	Packets left 236	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 228
Packets left 244	Packets left 236	new src: 42
The total packet is 244	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 228
new dest: 0	Packets left 236	new src: 42
Packets left 244	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 236	Packets left 228
Packets left 244	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 236	Packets left 227
Packets left 244	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 236	Packets left 226
Packets left 244	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 225
Packets left 244	Packets left 236	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 224
Packets left 244	Packets left 235	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 223
Packets left 244	Packets left 234	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 222
router flag value after set flag: 1	Packets left 233	new src: 0
Packets left 244	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 221
new dest: 33	Packets left 232	new src: 0
Packets left 243	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 231	Packets left 220
Packets left 242	new src: 0	The total packet is 220
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 230	new dest: 0
Packets left 241	new src: 0	Packets left 220
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 229	new dest: 0
Packets left 240	new src: 0	Packets left 220
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 239	Packets left 228	Packets left 220

new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 212	Packets left 202
Packets left 220	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 201
Packets left 220	Packets left 212	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 200
Packets left 220	Packets left 211	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 199
Packets left 220	Packets left 210	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 198
router flag value after set flag: 1	Packets left 209	new src: 0
Packets left 220	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 197
new dest: 33	Packets left 208	new src: 0
Packets left 219	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 207	Packets left 196
Packets left 218	new src: 0	The total packet is 196
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 206	new dest: 0
Packets left 217	new src: 0	Packets left 196
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 205	new dest: 0
Packets left 216	new src: 0	Packets left 196
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 215	Packets left 204	Packets left 196
new src: 0	The total packet is 204	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 214	new dest: 0	Packets left 196
new src: 0	Packets left 204	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 213	new dest: 0	Packets left 196
new src: 0	Packets left 204	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 196
Packets left 212	Packets left 204	new src: 42
The total packet is 212	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 196
new dest: 0	Packets left 204	new src: 42
Packets left 212	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 204	Packets left 196
Packets left 212	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 204	Packets left 195
Packets left 212	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 204	Packets left 194
Packets left 212	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 193
Packets left 212	Packets left 204	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 192
Packets left 212	Packets left 203	new src: 0
new src: 42	new src: 0	new dest: 33

new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 143
Packets left 164	Packets left 154	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 142
router flag value after set flag: 1	Packets left 153	new src: 0
Packets left 164	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 141
new dest: 33	Packets left 152	new src: 0
Packets left 163	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 151	Packets left 140
Packets left 162	new src: 0	The total packet is 140
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 150	new dest: 0
Packets left 161	new src: 0	Packets left 140
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 149	new dest: 0
Packets left 160	new src: 0	Packets left 140
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 159	Packets left 148	Packets left 140
new src: 0	The total packet is 148	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 158	new dest: 0	Packets left 140
new src: 0	Packets left 148	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 157	new dest: 0	Packets left 140
new src: 0	Packets left 148	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 140
Packets left 156	Packets left 148	new src: 42
The total packet is 156	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 140
new dest: 0	Packets left 148	new src: 42
Packets left 156	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 148	Packets left 140
Packets left 156	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 148	Packets left 139
Packets left 156	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 148	Packets left 138
Packets left 156	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 137
Packets left 156	Packets left 148	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 136
Packets left 156	Packets left 147	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 135
Packets left 156	Packets left 146	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 134
router flag value after set flag: 1	Packets left 145	new src: 0
Packets left 156	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 133
new dest: 33	Packets left 144	new src: 0
Packets left 155	new src: 0	new dest: 33

router flag value after set flag: 1	new dest: 0	Packets left 116
Packets left 132	Packets left 124	new src: 42
The total packet is 132	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 116
Packets left 132	Packets left 124	new src: 42
new src: 42	new src: 42	new dest: 0
new dest: 0	new dest: 0	router flag value after set flag: 1
Packets left 132	Packets left 124	Packets left 116
new src: 42	new src: 42	new src: 0
new dest: 0	new dest: 0	new dest: 33
Packets left 132	Packets left 124	Packets left 115
new src: 42	new src: 42	new src: 0
new dest: 0	new dest: 0	new dest: 33
Packets left 132	Packets left 124	Packets left 114
new src: 42	new src: 42	new src: 0
new dest: 0	new dest: 0	new dest: 33
Packets left 132	router flag value after set flag: 1	Packets left 113
new src: 42	Packets left 124	new src: 0
new dest: 0	new src: 0	new dest: 33
Packets left 132	new dest: 33	Packets left 112
new src: 42	Packets left 123	new src: 0
new dest: 0	new src: 0	new dest: 33
Packets left 132	new dest: 33	Packets left 111
new src: 42	Packets left 122	new src: 0
new dest: 0	new src: 0	new dest: 33
router flag value after set flag: 1	new dest: 33	Packets left 110
Packets left 132	Packets left 121	new src: 0
new src: 0	new src: 0	new dest: 33
new dest: 33	new dest: 33	Packets left 109
Packets left 131	Packets left 120	new src: 0
new src: 0	new src: 0	new dest: 33
new dest: 33	new dest: 33	router flag value after set flag: 1
Packets left 130	Packets left 119	Packets left 108
new src: 0	new src: 0	The total packet is 108
new dest: 33	new dest: 33	new src: 42
Packets left 129	Packets left 118	new dest: 0
new src: 0	new src: 0	Packets left 108
new dest: 33	new dest: 33	new src: 42
Packets left 128	Packets left 117	new dest: 0
new src: 0	new src: 0	Packets left 108
new dest: 33	new dest: 33	new src: 42
Packets left 127	router flag value after set flag: 1	new dest: 0
new src: 0	Packets left 116	Packets left 108
new dest: 33	The total packet is 116	new src: 42
Packets left 126	new src: 42	new dest: 0
new src: 0	new dest: 0	Packets left 108
new dest: 33	Packets left 116	new src: 42
Packets left 125	new src: 42	new dest: 0
new src: 0	new dest: 0	Packets left 108
new dest: 33	Packets left 116	new src: 42
router flag value after set flag: 1	new src: 42	new dest: 0
Packets left 124	new dest: 0	Packets left 108
The total packet is 124	Packets left 116	new src: 42
new src: 42	new src: 42	new dest: 0
new dest: 0	new dest: 0	Packets left 108
Packets left 124	Packets left 116	new src: 42
new src: 42	new src: 42	new dest: 0
new dest: 0	new dest: 0	router flag value after set flag: 1
Packets left 124	Packets left 116	Packets left 108
new src: 42	new src: 42	new src: 0
new dest: 0	new dest: 0	new dest: 33

Packets left 107	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 106	Packets left 84
Packets left 106	new src: 0	The total packet is 84
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 105	new dest: 0
Packets left 105	new src: 0	Packets left 84
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 104	new dest: 0
Packets left 104	new src: 0	Packets left 84
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 103	Packets left 92	Packets left 84
new src: 0	The total packet is 92	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 102	new dest: 0	Packets left 84
new src: 0	Packets left 92	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 101	new dest: 0	Packets left 84
new src: 0	Packets left 92	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 84
Packets left 100	Packets left 92	new src: 42
The total packet is 100	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 84
new dest: 0	Packets left 92	new src: 42
Packets left 100	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 92	Packets left 84
Packets left 100	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 92	Packets left 83
Packets left 100	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 92	Packets left 82
Packets left 100	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 81
Packets left 100	Packets left 92	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 80
Packets left 100	Packets left 91	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 79
Packets left 100	Packets left 90	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 78
router flag value after set flag: 1	Packets left 89	new src: 0
Packets left 100	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 77
new dest: 33	Packets left 88	new src: 0
Packets left 99	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 87	Packets left 76
Packets left 98	new src: 0	The total packet is 76
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 86	new dest: 0
Packets left 97	new src: 0	Packets left 76
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 85	new dest: 0
Packets left 96	new src: 0	Packets left 76

new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 68	Packets left 59
Packets left 76	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 68	Packets left 58
Packets left 76	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 57
Packets left 76	Packets left 68	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 56
Packets left 76	Packets left 67	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 55
Packets left 76	Packets left 66	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 54
router flag value after set flag: 1	Packets left 65	new src: 0
Packets left 76	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 53
new dest: 33	Packets left 64	new src: 0
Packets left 75	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 63	Packets left 52
Packets left 74	new src: 0	The total packet is 52
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 62	new dest: 0
Packets left 73	new src: 0	Packets left 52
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 61	new dest: 0
Packets left 72	new src: 0	Packets left 52
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 71	Packets left 60	Packets left 52
new src: 0	The total packet is 60	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 70	new dest: 0	Packets left 52
new src: 0	Packets left 60	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 69	new dest: 0	Packets left 52
new src: 0	Packets left 60	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 52
Packets left 68	Packets left 60	new src: 42
The total packet is 68	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 52
new dest: 0	Packets left 60	new src: 42
Packets left 68	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 60	Packets left 52
Packets left 68	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 60	Packets left 51
Packets left 68	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 60	Packets left 50
Packets left 68	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 49
Packets left 68	Packets left 60	new src: 0
new src: 42	new src: 0	new dest: 33

Packets left 48	new src: 0	Packets left 28
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 47	Packets left 36	Packets left 28
new src: 0	The total packet is 36	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 46	new dest: 0	Packets left 28
new src: 0	Packets left 36	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 45	new dest: 0	Packets left 28
new src: 0	Packets left 36	new src: 42
new dest: 33	new src: 42	new dest: 0
router flag value after set flag: 1	new dest: 0	Packets left 28
Packets left 44	Packets left 36	new src: 42
The total packet is 44	new src: 42	new dest: 0
new src: 42	new dest: 0	Packets left 28
new dest: 0	Packets left 36	new src: 42
Packets left 44	new src: 42	new dest: 0
new src: 42	new dest: 0	router flag value after set flag: 1
new dest: 0	Packets left 36	Packets left 28
Packets left 44	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 36	Packets left 27
Packets left 44	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	Packets left 36	Packets left 26
Packets left 44	new src: 42	new src: 0
new src: 42	new dest: 0	new dest: 33
new dest: 0	router flag value after set flag: 1	Packets left 25
Packets left 44	Packets left 36	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 24
Packets left 44	Packets left 35	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 23
Packets left 44	Packets left 34	new src: 0
new src: 42	new src: 0	new dest: 33
new dest: 0	new dest: 33	Packets left 22
router flag value after set flag: 1	Packets left 33	new src: 0
Packets left 44	new src: 0	new dest: 33
new src: 0	new dest: 33	Packets left 21
new dest: 33	Packets left 32	new src: 0
Packets left 43	new src: 0	new dest: 33
new src: 0	new dest: 33	router flag value after set flag: 1
new dest: 33	Packets left 31	Packets left 20
Packets left 42	new src: 0	The total packet is 20
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 30	new dest: 0
Packets left 41	new src: 0	Packets left 20
new src: 0	new dest: 33	new src: 42
new dest: 33	Packets left 29	new dest: 0
Packets left 40	new src: 0	Packets left 20
new src: 0	new dest: 33	new src: 42
new dest: 33	router flag value after set flag: 1	new dest: 0
Packets left 39	Packets left 28	Packets left 20
new src: 0	The total packet is 28	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 38	new dest: 0	Packets left 20
new src: 0	Packets left 28	new src: 42
new dest: 33	new src: 42	new dest: 0
Packets left 37	new dest: 0	Packets left 20

