

Islamic University of Technology

CSE 4840

Internetworking Protocols Lab

Lab 3

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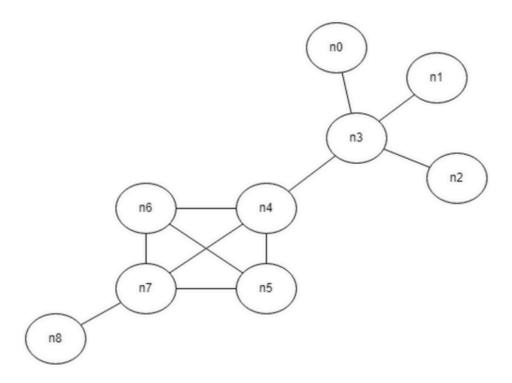
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CSE 1A

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Objective

Configure RIP routing protocols for a given network topology using ns-3. Monitor the routing tables at specified time intervals and observe the impact of link teardown events.



Code

```
if (printRoutingTables)
        RipHelper routingHelper;
                             Ptr<OutputStreamWrapper>
                                                         routingStream
Create<OutputStreamWrapper>(&std::cout);
        std::vector<uint32_t> intervals = {20, 40, 60, 80};
        for (uint32_t i : intervals)
            for (uint32_t j = 0; j < routers.GetN(); j++)
             routingHelper.PrintRoutingTableAt(Seconds(i), routers.Get(j),
routingStream);
    NS_LOG_INFO("Create Applications.");
    uint32_t packetSize = 1024;
    Time interPacketInterval = Seconds(1.0);
    V4PingHelper ping("10.0.10.2");
    ping.SetAttribute("Interval", TimeValue(interPacketInterval));
    ping.SetAttribute("Size", UintegerValue(packetSize));
    if (showPings)
        ping.SetAttribute("Verbose", BooleanValue(true));
    ApplicationContainer apps;
    apps.Add(ping.Install(n0));
    apps.Add(ping.Install(n1));
    apps.Add(ping.Install(n2));
    apps.Start(Seconds(1.0));
    apps.Stop(Seconds(150.0));
    Simulator::Schedule(Seconds(30), &TearDownLink, n4, n7, 4, 1);
    Simulator::Schedule(Seconds(50), &TearDownLink, n5, n6, 2, 2);
```

Result

At 20 seconds

Node: 4, Time:	+20s, Local ti	lme: +20s, Ipv4Lis	tRouti	ng tab	le	
Priority: 0	Protocol: ns3::	Rip				
		lme: +20s, IPv4 RI				
Destination	Gateway	Genmask	Fla	ags Me	tric Ref	Use
Iface						
10.0.7.0	10.0.3.2	255.255.255.0	UGS	3		4
10.0.8.0	10.0.3.2	255.255.255.0	UGS	3		4
10.0.10.0	10.0.3.2	255.255.255.0	UGS	3		4
10.0.9.0	10.0.3.2	255.255.255.0	UGS	3		4
10.0.6.0	10.0.3.2	255.255.255.0	UGS	2		4
10.0.5.0	10.0.3.2	255.255.255.0	UGS	2		4
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2		4
10.0.0.0	0.0.0.0	255.255.255.0	U	1		
10.0.1.0	0.0.0.0	255.255.255.0	U	1		_
10.0.2.0	0.0.0.0	255.255.255.0	U	1		_
10.0.3.0	0.0.0.0	255.255.255.0	U	1		4
Node E Tier	.20	30 T. 41 '-			1.	
		lme: +20s, Ipv4List	(Kouti	ng tab	te	
	Protocol: ns3::					
		lme: +20s, IPv4 RI				
Destination	Gateway	Genmask	Fla	ags Me	tric Ref	Use
Iface				_		
10.0.2.0	10.0.3.1	255.255.255.0	UGS	2		1
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2		_
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2		1
10.0.9.0	10.0.5.2	255.255.255.0	UGS	2		3
10.0.10.0	10.0.6.2	255.255.255.0	UGS	2		
10.0.8.0	10.0.4.2	255.255.255.0	UGS	2		_
10.0.7.0	10.0.4.2	255.255.255.0	UGS	2		2
10.0.3.0	0.0.0.0	255.255.255.0	U	1		1
10.0.4.0	0.0.0.0	255.255.255.0	U	1		2
10.0.5.0	0.0.0.0	255.255.255.0	U	1		3
10.0.6.0	0.0.0.0	255.255.255.0	U	1		4
		lme: +20s, Ipv4List	tRouti	ng tab	le	
	Protocol: ns3::					
		lme: +20s, IPv4 RI				
Destination	Gateway	Genmask	Fla	ags Me	tric Ref	Use
Iface						
10.0.0.0	10.0.4.1	255.255.255.0	UGS	3		1
10.0.1.0	10.0.4.1	255.255.255.0	UGS	3		1
10.0.2.0	10.0.4.1	255.255.255.0	UGS	3		1
	10.0.4.1	255.255.255.0	UGS	3		1
10.0.10.0						
10.0.9.0	10.0.7.2	255.255.255.0	UGS	2		2
			UGS UGS UGS	2 2 2		2 1

10.0.5.0	10.0.7.2	255.255.255.0	UGS	2		2
10.0.4.0	0.0.0.0	255.255.255.0	U	1		_
10.0.7.0	0.0.0.0	255.255.255.0	U	1		2
10.0.8.0	0.0.0.0	255.255.255.0	U	1		3
	e: +20s, Local t Protocol: ns3:	ime: +20s, Ipv4List	tRoutir	ng tab	le	
		ime: +20s, IPv4 RI	P tahle	2		
Destination	Gateway	Genmask			tric Ref	Use
Iface	dateway	Cermasic	1 24	95 110	CITC NOI	050
10.0.0.0	10.0.5.1	255.255.255.0	UGS	3		1
10.0.1.0	10.0.5.1	255.255.255.0	UGS	3		
10.0.2.0	10.0.5.1	255.255.255.0	UGS	3		
10.0.4.0	10.0.5.1	255.255.255.0	UGS	2		
10.0.3.0	10.0.5.1	255.255.255.0	UGS	2		1
10.0.10.0	10.0.5.1	255.255.255.0	UGS	3		
10.0.8.0	10.0.7.1	255.255.255.0	UGS	2		
10.0.6.0	10.0.5.1	255.255.255.0	UGS	2		
10.0.5.0	0.0.0.0	255.255.255.0	U	1		1
10.0.7.0	0.0.0.0	255.255.255.0	U	1		2
10.0.9.0	0.0.0.0	255.255.255.0	U	1		3
Node: 8, Time	e: +20s, Local t	ime: +20s, Ipv4Lis	tRoutir	ng tab	le	
	Protocol: ns3:					
		ime: +20s, IPv4 RI	P table	9		
Destination	Gateway	Genmask	Fla	gs Me	tric Ref	Use
Iface						
10.0.0.0	10.0.6.1	255.255.255.0	UGS	3		1
10.0.1.0	10.0.6.1	255.255.255.0	UGS	3		1
10.0.2.0	10.0.6.1	255.255.255.0	UGS	3		1
10 0 7 0	10001	255.255.255.0	UGS	2		3
10.0.7.0	10.0.9.1	233.233.233.0				1
10.0.7.0	10.0.9.1 10.0.6.1	255.255.255.0	UGS	2		Т
			UGS UGS	2 2		
10.0.5.0	10.0.6.1	255.255.255.0				1
10.0.5.0 10.0.4.0	10.0.6.1 10.0.6.1	255.255.255.0 255.255.255.0	UGS	2		1 1
10.0.5.0 10.0.4.0 10.0.3.0	10.0.6.1 10.0.6.1 10.0.6.1	255.255.255.0 255.255.255.0 255.255.255.0	UGS UGS	2 2		1 1 1
10.0.5.0 10.0.4.0 10.0.3.0 10.0.6.0	10.0.6.1 10.0.6.1 10.0.6.1 0.0.0.0	255.255.255.0 255.255.255.0 255.255.255.0 255.255.255.0	UGS UGS U	2 2 1		1 1 1 2 3

At 40 seconds

Node: 4, Time: +40s, Local time: +40s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 4, Time: +40s, Local time: +40s, IPv4 RIP table

Destination Gateway Genmask Flags Metric Ref Use

Iface

10.0.7.0	10.0.3.2	255.255.255.0	UGS	3		4
10.0.8.0	10.0.3.2	255.255.255.0	UGS	3		4
10.0.9.0	10.0.3.2	255.255.255.0	UGS	3		4
10.0.5.0	10.0.3.2	255.255.255.0	UGS	2		4
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2		4
10.0.0.0	0.0.0.0	255.255.255.0	U	1		1
10.0.1.0	0.0.0.0	255.255.255.0	U	1		2
10.0.2.0	0.0.0.0	255.255.255.0	U	1		3
10.0.3.0	0.0.0.0	255.255.255.0	U	1		4

Node: 5, Time: +40s, Local time: +40s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 5, Time: +40s, Local time: +40s, IPv4 RIP table

Destination	Gateway	Genmask	Flags Metric Ref			Į	Use
Iface							
10.0.2.0	10.0.3.1	255.255.255.0	UGS	2			1
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2			1
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2			1
10.0.9.0	10.0.5.2	255.255.255.0	UGS	2			3
10.0.8.0	10.0.4.2	255.255.255.0	UGS	2			2
10.0.7.0	10.0.4.2	255.255.255.0	UGS	2			2
10.0.3.0	0.0.0.0	255.255.255.0	U	1			1
10.0.4.0	0.0.0.0	255.255.255.0	U	1			2
10.0.5.0	0.0.0.0	255.255.255.0	U	1			3

Node: 6, Time: +40s, Local time: +40s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 6, Time: +40s, Local time: +40s, IPv4 RIP table

Destination	Gateway	Genmask	Fla	gs Me	tric Ref	ا	Jse
Iface							
10.0.0.0	10.0.4.1	255.255.255.0	UGS	3			1
10.0.1.0	10.0.4.1	255.255.255.0	UGS	3			1
10.0.2.0	10.0.4.1	255.255.255.0	UGS	3			1
10.0.9.0	10.0.7.2	255.255.255.0	UGS	2			2
10.0.3.0	10.0.4.1	255.255.255.0	UGS	2			1
10.0.5.0	10.0.7.2	255.255.255.0	UGS	2			2
10.0.4.0	0.0.0.0	255.255.255.0	U	1			1
10.0.7.0	0.0.0.0	255.255.255.0	U	1			2
10.0.8.0	0.0.0.0	255.255.255.0	U	1			3

Node: 7, Time: +40s, Local time: +40s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 7, Time: +40s, Local time: +40s, IPv4 RIP table

	,						
Destination	Gateway	Genmask	Fla	gs Met	ric Ref	ι	Jse
Iface							
10.0.0.0	10.0.5.1	255.255.255.0	UGS	3			1
10.0.1.0	10.0.5.1	255.255.255.0	UGS	3			1
10.0.2.0	10.0.5.1	255.255.255.0	UGS	3			1
10.0.4.0	10.0.5.1	255.255.255.0	UGS	2			1
10.0.3.0	10.0.5.1	255.255.255.0	UGS	2			1

10.0.8.0	10.0.7.1	255.255.255.0	UGS	2			2
10.0.5.0	0.0.0.0	255.255.255.0	U	1			1
10.0.7.0	0.0.0.0	255.255.255.0	U	1			2
10.0.9.0	0.0.0.0	255.255.255.0	U	1			3
	+40s, Local time rotocol: ns3::Ri		Routin	g table			
	+40s, Local time		tahla				
Destination		Genmask			ic Pof		se
Iface	dateway	Gennask	ιταί	js netr.	ic nei	U	30
10.0.0.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.1.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.2.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.7.0	10.0.9.1	255.255.255.0	UGS	2			3
10.0.5.0	10.0.9.1	255.255.255.0	UGS	2			3
10.0.4.0	10.0.9.1	255.255.255.0	UGS	3			3
10.0.3.0	10.0.9.1	255.255.255.0	UGS	3			3
10.0.8.0	0.0.0.0	255.255.255.0	U	1			2
10.0.9.0	0.0.0.0	255.255.255.0	U	1			3
10.0.10.0	0.0.0.0	255.255.255.0	U	1			4

At 60 seconds

	: +60s, Local to Protocol: ns3:	ime: +60s, Ipv4Lis† :Rip	tRoutin	g tabl	.e	
Node: 4, Time	: +60s, Local t	ime: +60s, IPv4 RIF	o table			
Destination Iface	Gateway	Genmask	Flaç	gs Met	ric Ref	Us
10.0.8.0	10.0.3.2	255.255.255.0	UGS	3		
10.0.9.0	10.0.3.2	255.255.255.0	UGS	3		
10.0.5.0	10.0.3.2	255.255.255.0	UGS	2		
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2		
10.0.0.0	0.0.0.0	255.255.255.0	U	1		
10.0.1.0	0.0.0.0	255.255.255.0	U	1		
10.0.2.0	0.0.0.0	255.255.255.0	U	1		
10.0.3.0	0.0.0.0	255.255.255.0	U	1		
	: +60s, Local to Protocol: ns3:	ime: +60s, Ipv4Lis† :Rip	tRoutin	g tabl	.e	
Node: 5, Time	: +60s, Local t	ime: +60s, IPv4 RIF	o table			
Destination	Gateway	Genmask	Flag	gs Met	ric Ref	Us
Iface						
10.0.2.0	10.0.3.1	255.255.255.0	UGS	2		
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2		
10 0 0 0	10.0.3.1	255.255.255.0	UGS	2		
10.0.0.0	10.0.5.1					

10.0.8.0	10.0.4.2	255.255.255.0	UGS	2		2
10.0.3.0	0.0.0.0	255.255.255.0	U	1		1
10.0.4.0	0.0.0.0	255.255.255.0	U	1		2
10.0.5.0	0.0.0.0	255.255.255.0	U	1		3

Node: 6, Time: +60s, Local time: +60s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 6, Time: +60s, Local time: +60s, IPv4 RIP table

Destination Iface	Gateway	Genmask	Fla	gs Me	tric Ref	l	Jse
10.0.0.0	10.0.4.1	255.255.255.0	UGS	3			1
10.0.1.0	10.0.4.1	255.255.255.0	UGS	3			1
10.0.2.0	10.0.4.1	255.255.255.0	UGS	3			1
10.0.3.0	10.0.4.1	255.255.255.0	UGS	2			1
10.0.4.0	0.0.0.0	255.255.255.0	U	1			1
10.0.8.0	0.0.0.0	255.255.255.0	U	1			3

Node: 7, Time: +60s, Local time: +60s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 7, Time: +60s, Local time: +60s, IPv4 RIP table

Houer // IIIIci	.005, 2004			_			
Destination	Gateway	Genmask	Fla	ıgs Me	tric Ref	l	Jse
Iface							
10.0.0.0	10.0.5.1	255.255.255.0	UGS	3			1
10.0.1.0	10.0.5.1	255.255.255.0	UGS	3			1
10.0.2.0	10.0.5.1	255.255.255.0	UGS	3			1
10.0.4.0	10.0.5.1	255.255.255.0	UGS	2			1
10.0.3.0	10.0.5.1	255.255.255.0	UGS	2			1
10.0.5.0	0.0.0.0	255.255.255.0	U	1			1
10.0.9.0	0.0.0.0	255.255.255.0	U	1			3

Node: 8, Time: +60s, Local time: +60s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 8, Time: +60s, Local time: +60s, IPv4 RIP table

Destination Iface	Gateway	Genmask	Flaç	gs Metr	ic Ref	U	lse
Trace							
10.0.0.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.1.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.2.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.5.0	10.0.9.1	255.255.255.0	UGS	2			3
10.0.4.0	10.0.8.1	255.255.255.0	UGS	2			2
10.0.3.0	10.0.9.1	255.255.255.0	UGS	3			3
10.0.8.0	0.0.0.0	255.255.255.0	U	1			2
10.0.9.0	0.0.0.0	255.255.255.0	U	1			3
10.0.10.0	0.0.0.0	255.255.255.0	U	1			4

At 80 seconds

	Protocol: ns3:	ime: +80s, IPv4 RI	P tahl	ے		
Destination	Gateway	Genmask			tric Ref	Use
Iface	dateway	Germask	1 00	igs ric	CITC NCI	030
10.0.8.0	10.0.3.2	255.255.255.0	UGS	3		- 4
10.0.10.0	10.0.3.2	255.255.255.0	UGS	8		
10.0.9.0	10.0.3.2	255.255.255.0	UGS	3		- 4
10.0.5.0	10.0.3.2	255.255.255.0	UGS	2		- 4
10.0.4.0	10.0.3.2	255.255.255.0	UGS	2		- 4
10.0.0.0	0.0.0.0	255.255.255.0	U	1		
10.0.1.0	0.0.0.0	255.255.255.0	U	1		
10.0.2.0	0.0.0.0	255.255.255.0		1		- 3
10.0.3.0	0.0.0.0	255.255.255.0	U	1		- 4
10.0.5.0	0.0.0.0	233.233.233.0	J			
Priority: 0	Protocol: ns3:	ime: +80s, Ipv4Lis :Rip ime: +80s, IPv4 RI			le	
Destination	Gateway	Genmask			tric Ref	Use
Iface				. j		
10.0.2.0	10.0.3.1	255.255.255.0	UGS	2		- 1
10.0.1.0	10.0.3.1	255.255.255.0	UGS	2		- 1
10.0.0.0	10.0.3.1	255.255.255.0	UGS	2		- 1
10.0.9.0	10.0.5.2	255.255.255.0	UGS	2		- 3
10.0.10.0	10.0.4.2	255.255.255.0	UGS	7		
10.0.8.0	10.0.4.2	255.255.255.0	UGS	2		- 2
10.0.3.0	0.0.0.0	255.255.255.0	U	1		- 1
10.0.4.0	0.0.0.0	255.255.255.0	Ü	1		- 2
10.0.5.0	0.0.0.0	255.255.255.0	U	1		- 3
10.0.6.0	10.0.3.1	255.255.255.0	UGS	- 16		- 1
						_
Priority: 0	Protocol: ns3:	ime: +80s, Ipv4Lis :Rip ime: +80s, IPv4 RI			le	
Node: 6, Time: Destination	Gateway	Genmask			tric Ref	Use
Iface	Gateway	Germask	- FLa	igs ne	CLIC VEL	USE
10.0.0.0	10.0.4.1	255.255.255.0	UGS	3		- 1
10.0.1.0	10.0.4.1	255.255.255.0	UGS	3		- 1
10.0.2.0	10.0.4.1	255.255.255.0	UGS	3		- 1 - 1
10.0.2.0	10.0.8.2	255.255.255.0	UGS	э 6		- 3
10.0.9.0	10.0.4.1	255.255.255.0	UGS	3		- 3 - 1
10.0.3.0	10.0.4.1	255.255.255.0	UGS	2		- 1 - 1
10.0.5.0	10.0.4.1	255.255.255.0	UGS	2		- 1 - 1
10.0.3.0	0.0.0.0	255.255.255.0		1		- 1 - 1
10.0.4.0						

Node: 7, Time:	+80s, Local ti	me: +80s, IPv4 RIP	table			
Destination	Gateway	Genmask	Flags Me	etric Ref	Į	Jse
Iface						
10.0.0.0	10.0.5.1	255.255.255.0	UGS 3			1
10.0.1.0	10.0.5.1	255.255.255.0	UGS 3			1
10.0.2.0	10.0.5.1	255.255.255.0	UGS 3			1
10.0.4.0	10.0.5.1	255.255.255.0	UGS 2			1
10.0.3.0	10.0.5.1	255.255.255.0	UGS 2			1
10.0.10.0	10.0.5.1	255.255.255.0	UGS 8			1
10.0.8.0	10.0.5.1	255.255.255.0	UGS 3			1
10.0.6.0	10.0.9.2	255.255.255.0	UGS 16			3
10.0.5.0	0.0.0.0	255.255.255.0	U 1			1
10.0.9.0	0.0.0.0	255.255.255.0	U 1			3

Node: 8, Time: +80s, Local time: +80s, Ipv4ListRouting table

Priority: 0 Protocol: ns3::Rip

Node: 8, Time: +80s, Local time: +80s, IPv4 RIP table

Destination	Gateway	Genmask	Flags Metric Ref			Use	
Iface							
10.0.0.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.1.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.2.0	10.0.9.1	255.255.255.0	UGS	4			3
10.0.5.0	10.0.9.1	255.255.255.0	UGS	2			3
10.0.4.0	10.0.8.1	255.255.255.0	UGS	2			2
10.0.3.0	10.0.9.1	255.255.255.0	UGS	3			3
10.0.8.0	0.0.0.0	255.255.255.0	U	1			2
10.0.9.0	0.0.0.0	255.255.255.0	U	1			3
10.0.10.0	0.0.0.0	255.255.255.0	U	1			4