Unicast Routing

ICNE532C - Computer Networks

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Introduction

- Least-Cost Routing
- Least-Cost Trees

Routing Algorithms

- Distance-Vector Routing
- Link-State Routing
- Path-Vector Routing

Distance Vector Routing

- Bellman-Ford Equation
- Distance Vector [one-dimensional array]
- Problems - Count to Infinity, Two-node loop
- Solutions - Split Horizon, Poison Reverse
- Three-node Instability

Link State Routing

- Link-State Database (LSDB)
- Link-State packet (LSP) - Identity of the node and cost of the link.
- Dijkstra's algorithm

Path Vector Routing

- Policy based routing
- Spanning tree.

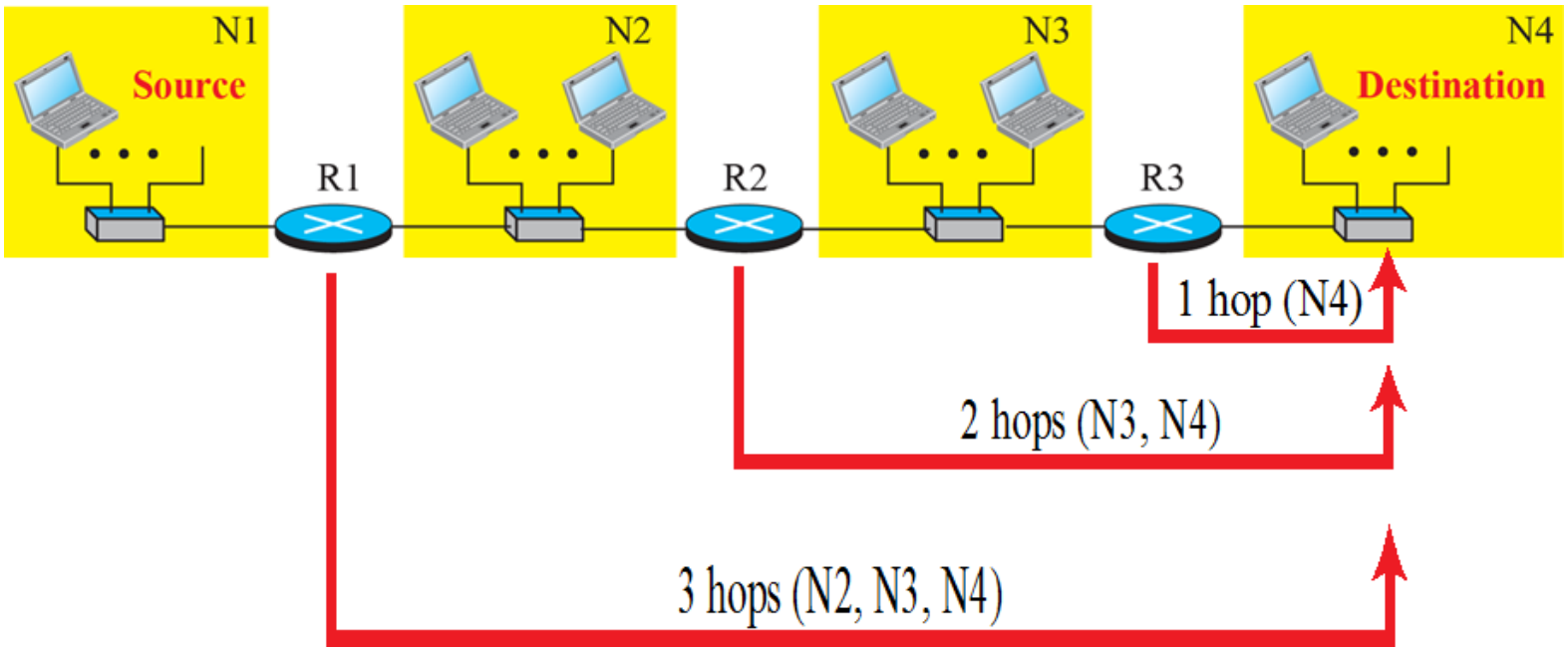
Unicast Routing Protocols

- Internet Structure
- Hierarchical Routing.
- Autonomous Systems (Stub, Multihomed and Transient)
- Routing Information Protocol (RIP)
- Open shortest path first (OSPF)

Routing Information Protocol (RIP)

- Intradomain routing protocol
- Distance Vector routing algorithm
- Hop Count
- Forwarding Table (Destination Network, Next router and cost in hops)
- RIP implementation - Uses UDP port number 520
- RIP Messages
- RIP algorithm
- Timers in RIP (Periodic Timer, Expiration times and garbage collection timer)
- Performance (Update Messages, Convergence of Forwarding Tables and Robustness)

Hop Count


N1
Source
N2
N3
N4
Destination
R1
R2
R3
1 hop (N4)
2 hops (N3, N4)
3 hops (N2, N3, N4)

Forwarding Tables

Forwarding table for R1

Destination network	Next router	Cost in hops
N1	——	1
N2	——	1
N3	R2	2
N4	R2	3

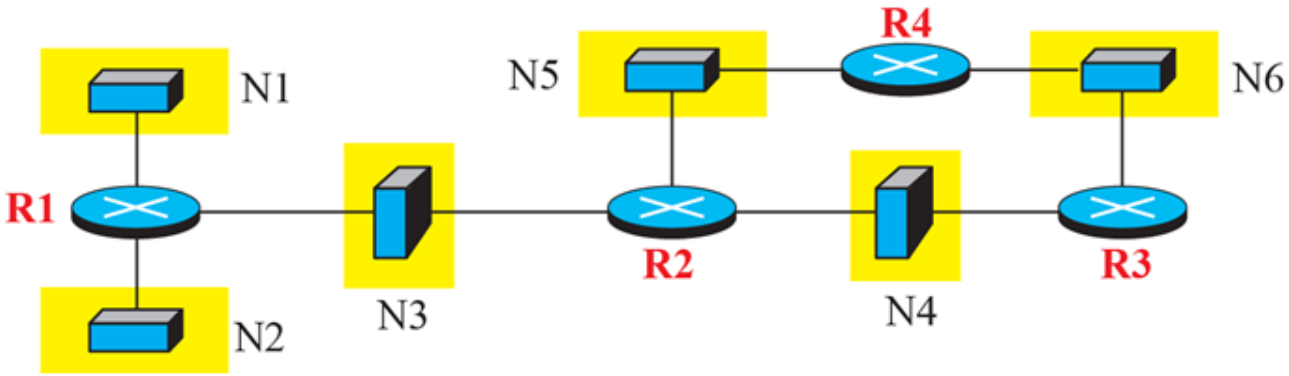
Forwarding table for R2

Destination network	Next router	Cost in hops
N1	R1	2
N2	——	1
N3	——	1
N4	R3	2

Forwarding table for R3

Destination network	Next router	Cost in hops
N1	R2	3
N2	R2	2
N3	——	1
N4	——	1

Forwarding Tables - final



New R1

Des.	N. R.	Cost
N1	—	1
N2	—	1
N3	—	1
N4	R2	2
N5	R2	2

Old R1

Des.	N. R.	Cost
N1	—	1
N2	—	1
N3	—	1

R2 Seen by R1

Des.	N. R.	Cost
N3	R2	2
N4	R2	2
N5	R2	2

New R3

Des.	N. R.	Cost
N3	R2	2
N4	—	1
N5	R2	2
N6	—	1

Old R3

Des.	N. R.	Cost
N4	—	1
N6	—	1

R2 Seen by R3

Des.	N. R.	Cost
N3	R2	2
N4	R2	2
N5	R2	2

New R4

Des.	N. R.	Cost
N3	R2	2
N4	R2	2
N5	—	1
N6	—	1

Old R4

Des.	N. R.	Cost
N5	—	1
N6	—	1

R2 Seen by R4

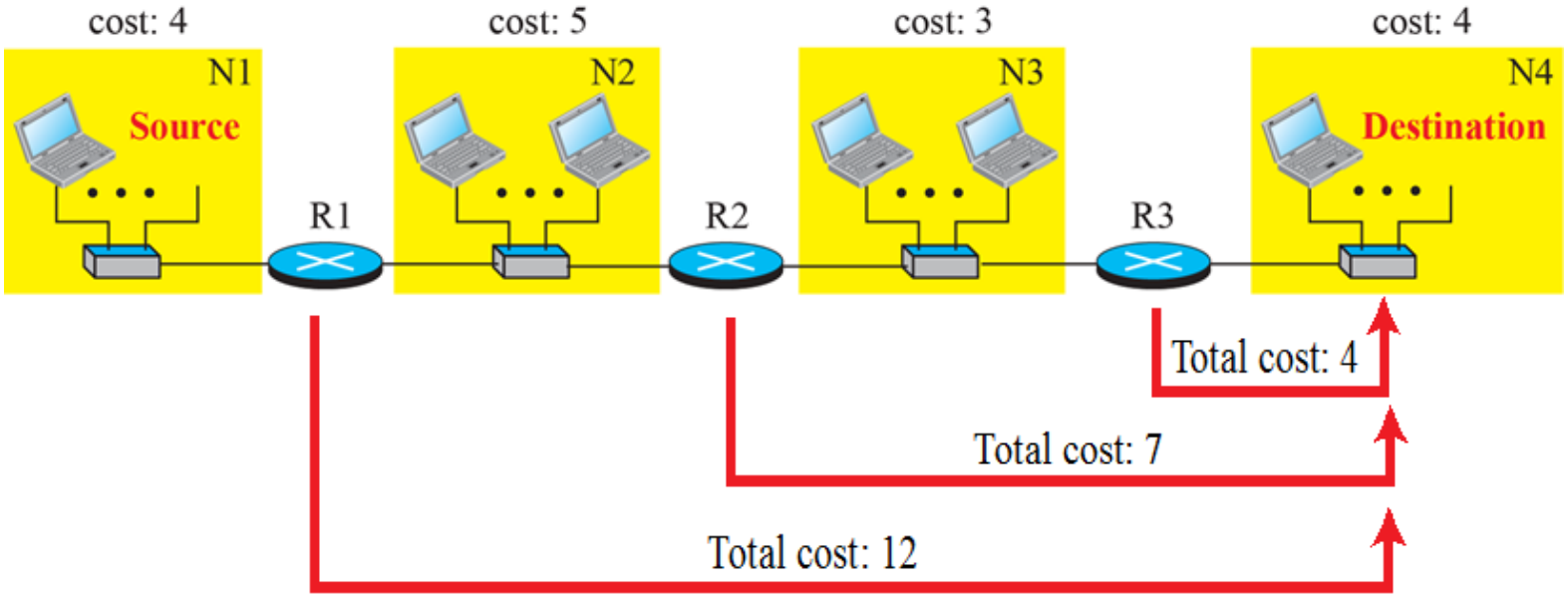
Des.	N. R.	Cost
N3	R2	2
N4	R2	2
N5	R2	2

Changes in the forwarding tables of R1, R3, and R4 after they receive a copy of R2's table

Open shortest path first (OSPF)

- Intra-domain routing protocol
- Link-state routing protocol
- Metric (can be Hop count)
- Forwarding Tables
- Link State Advertisements (router link, network link, summary link to network, summary link to AS border router, and external link)
- OSPF Implementation
- Performance (Update Messages, Convergence of Forwarding Tables and Robustness)

Metrics


cost: 4
cost: 5
cost: 3
cost: 4
N1
Source
N2
N3
N4
Destination
R1
R2
R3
Total cost: 4
Total cost: 7
Total cost: 12

Forwarding Tables

Forwarding table for R1

Destination network	Next router	Cost
N1	——	
N2	——	
N3	R2	
N4	R2	12

Forwarding table for R3

Destination network	Next router	Cost
N1	R2	12
N2	R2	8
N3	——	3
N4	——	4

Forwarding table for R2

Destination network	Next router	Cost
N1	R1	9
N2	——	5
N3	——	3
N4	R3	7

References

[1] Behrouz A. Forouzan *Data Communications and Networking*. McGraw-Hill fifth edition.

[2] *http://www.slideshare.net/hemangkothari/flowcontrol-error-control-at-data-link-layer*.