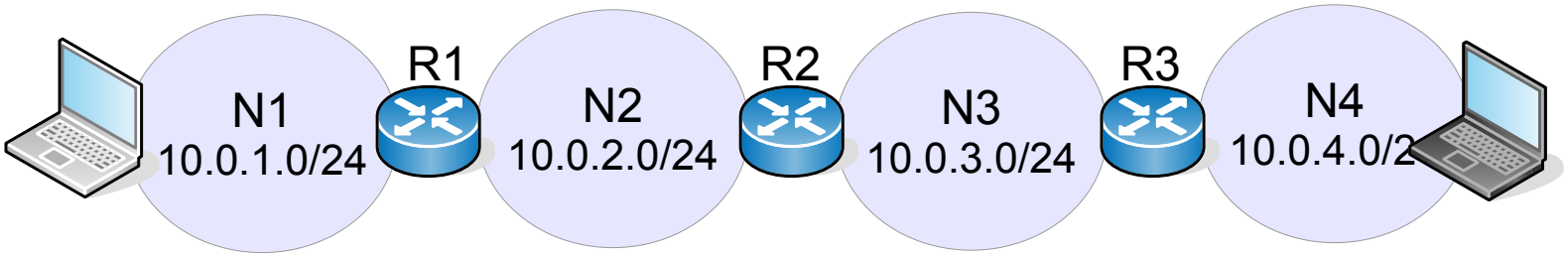
Routing Information Protocol (RIP)

- Distance Vector protocol
  - Number of hops, ∞ = 16
  - UDP, port 520
  - Routers send RIP updates every 30 secs
  - Per manufacturer variants (e.g. CISCO)
- RIP versions:
  - RIPv1 (1988) no subnet info, no auth, bcast table
  - RIPv2 (1993-1998), mcast table to 224.0.0.9
  - RIPng (1997), IPv6



Network

- RIPv2 uses mcast to 224.0.0.9
  (all nearby routers)
- IP address, subnet mask, next hop, metric
- Directly connected networks:

R1

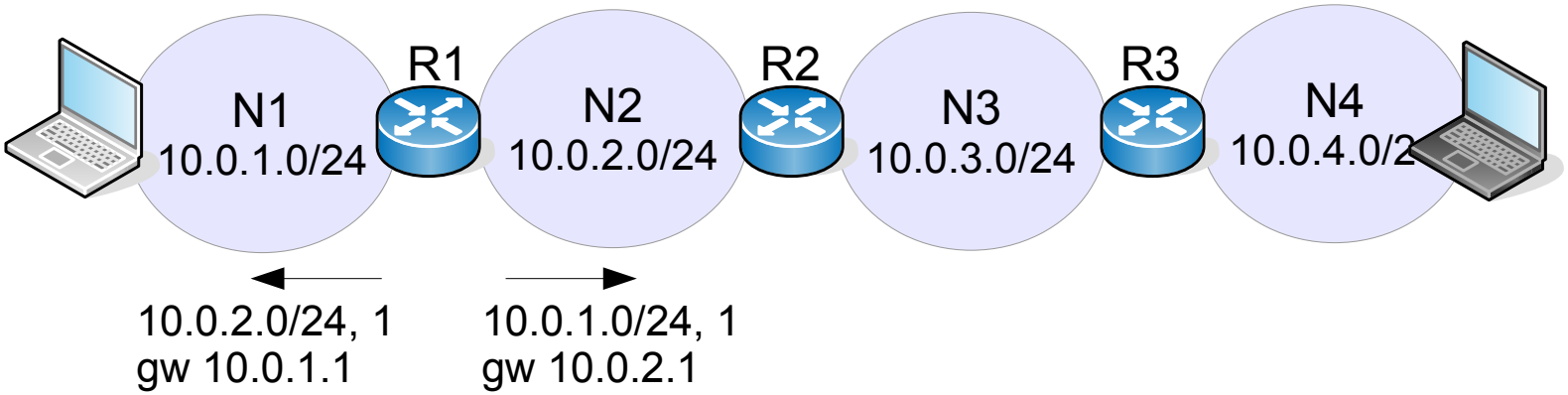
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1



- R1 sends message, when RIPv2 activated:
  - Entries that didn't come through that interface (split horizon)

R1

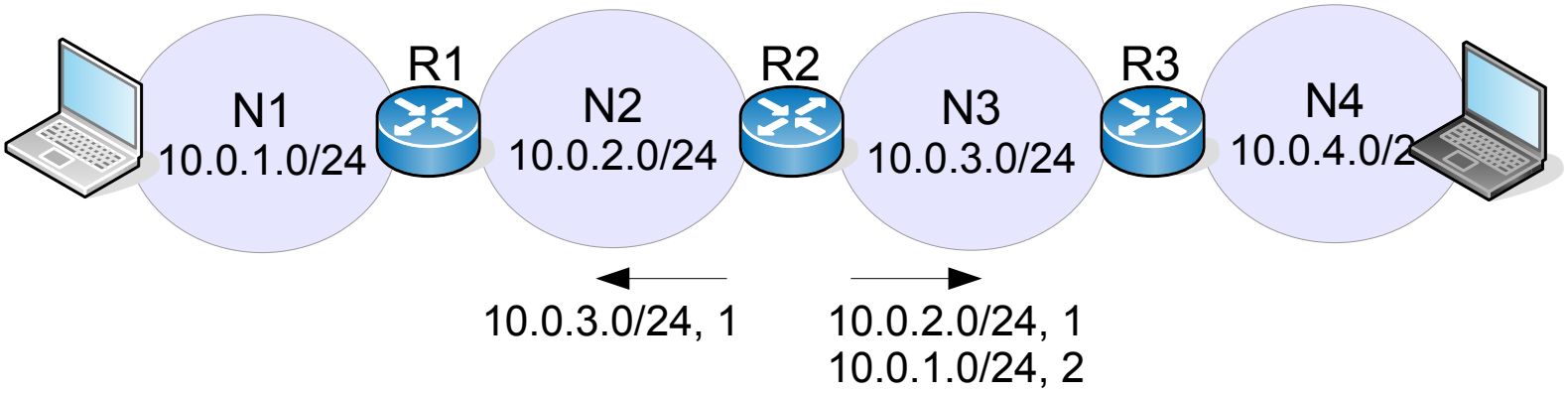
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1



- R2 sends message, when RIPv2 activated:

R1

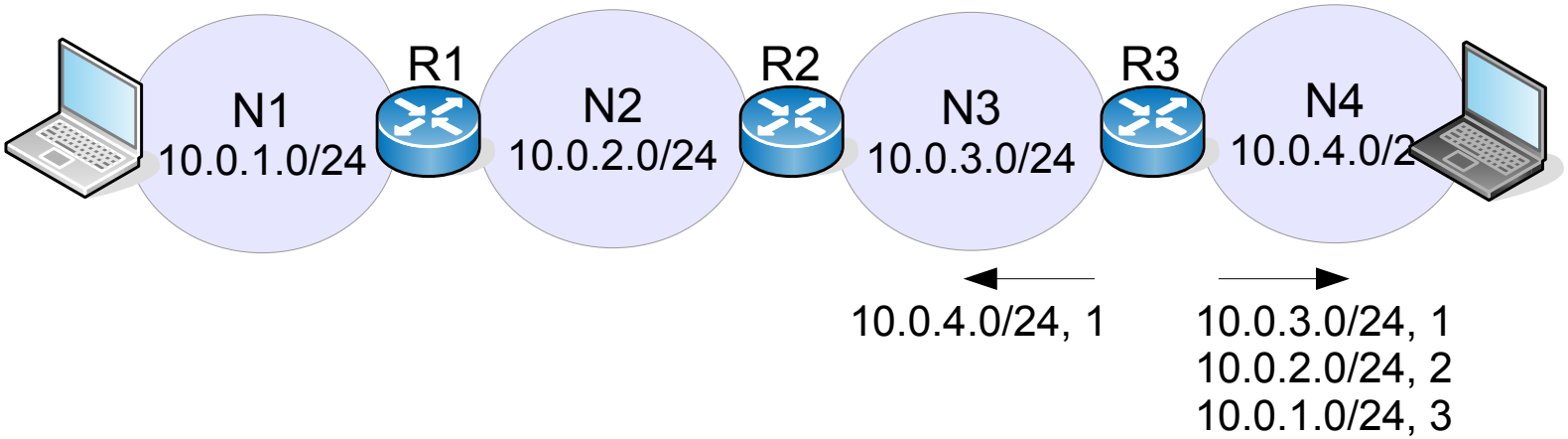
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- R3 sends message, when RIPv2 activated:

R1

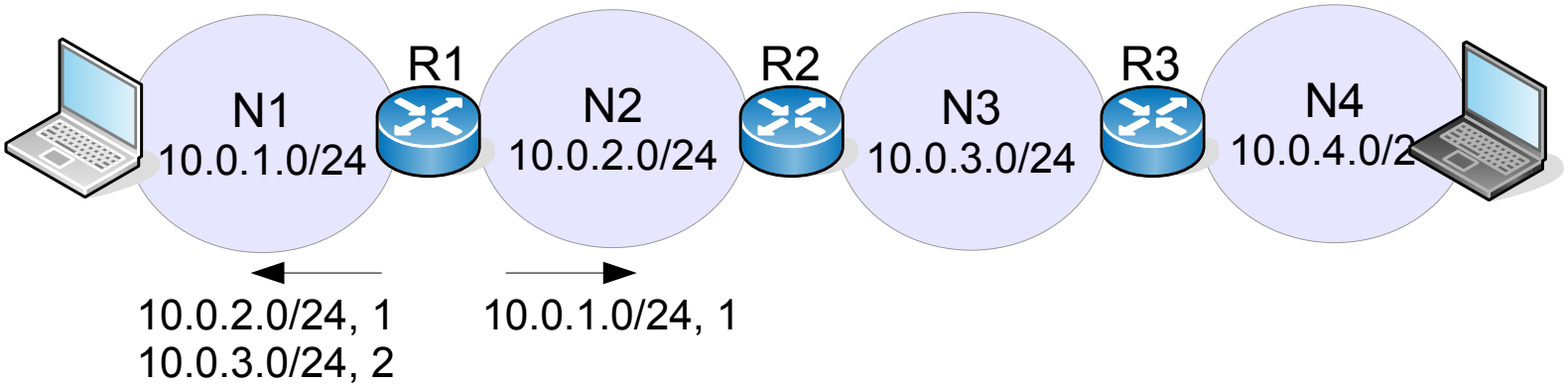
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- R1 sends message, 30 secs later:

R1

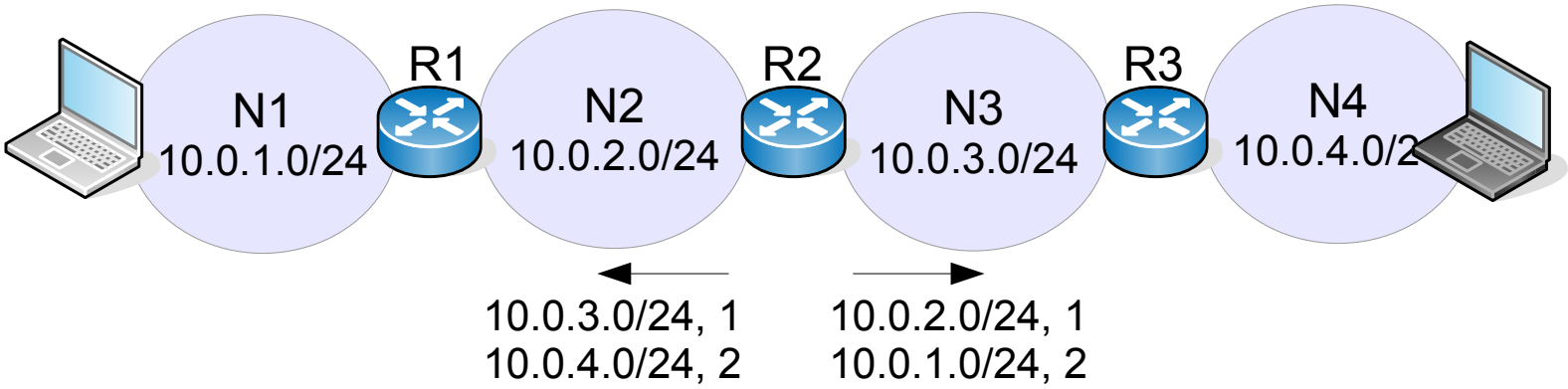
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- R2 sends message, 30 secs later:

R1

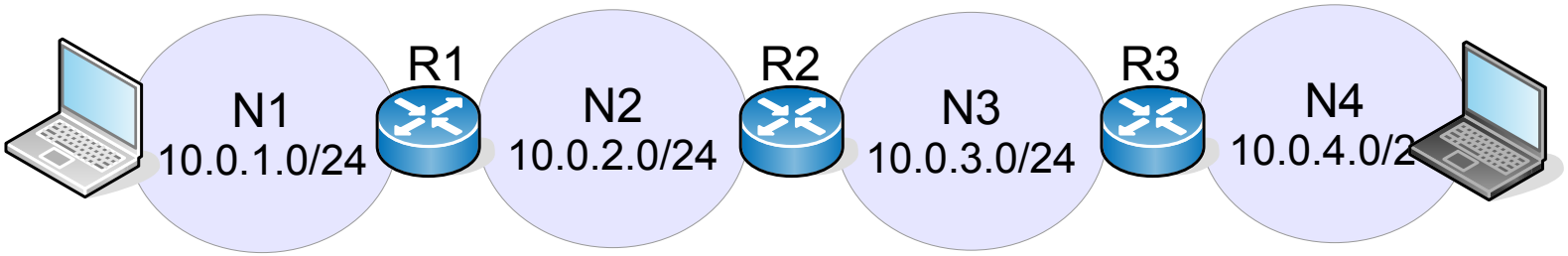
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2
10.0.4.0/24	10.0.2.2	3

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- Every 30 secs each router sends updates

R1

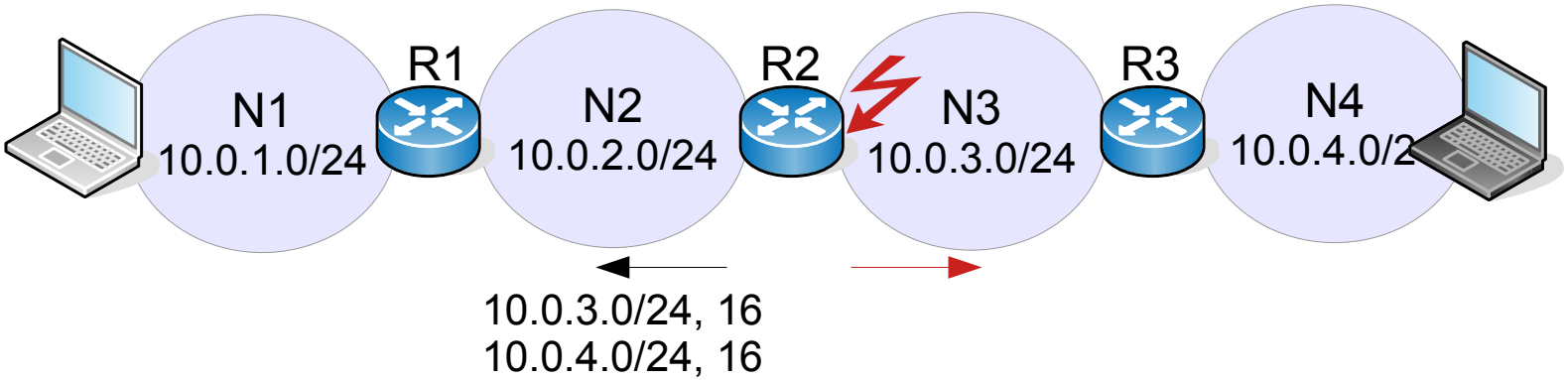
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2
10.0.4.0/24	10.0.2.2	3

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- R2 (10.0.3.1) fails!
  - Infinite metric (poison reverse)
  - Immediately sent (triggered update)

R1

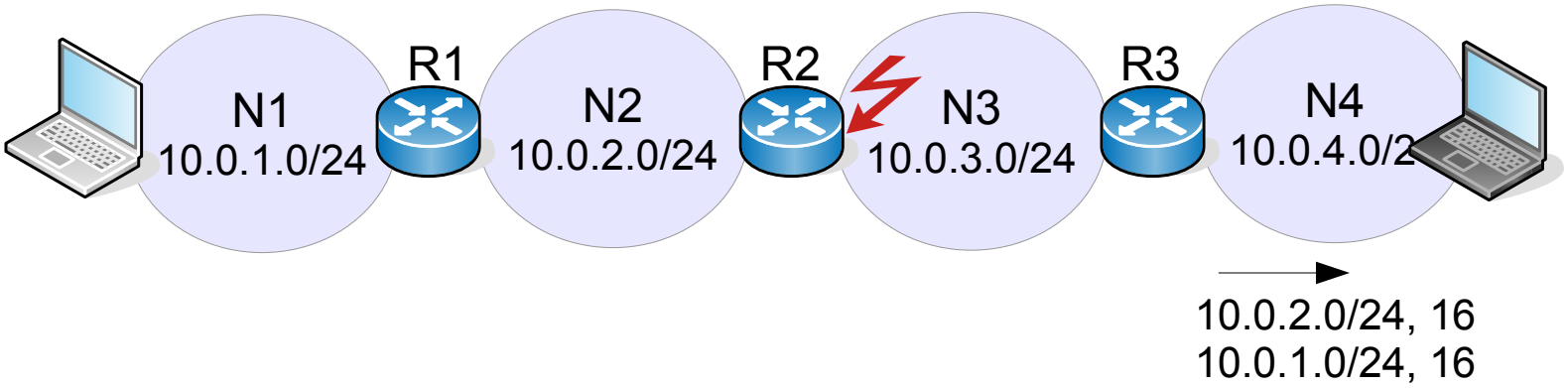
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	16
10.0.4.0/24	10.0.2.2	16

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	16
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	16

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- R3 misses an update from R2, 30 secs later after previous (timeout)
  - Detects fault
  - Immediately sends (triggered) update

R1

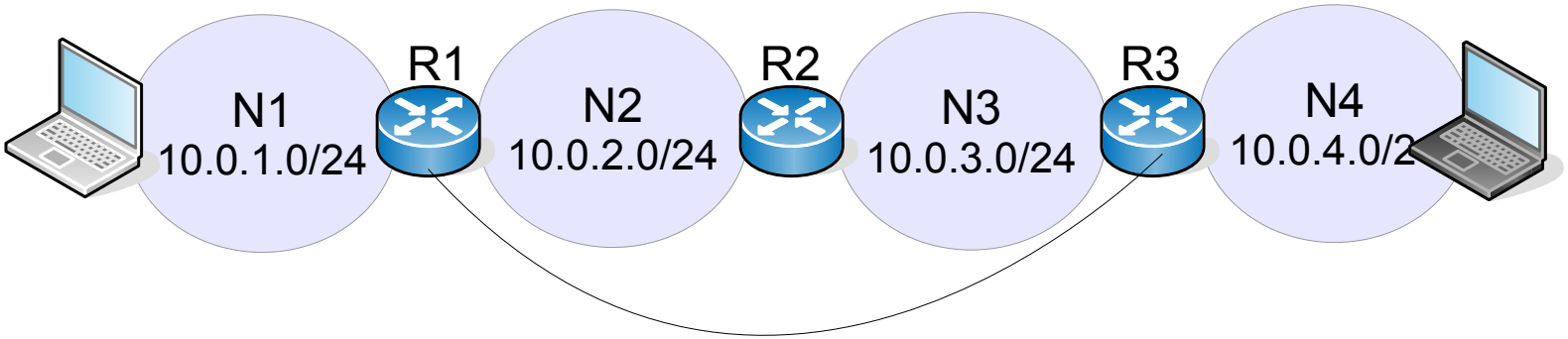
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	16
10.0.4.0/24	10.0.2.2	16

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	16
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	16

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	16
10.0.1.0/24,	10.0.3.1	16



- Suddenly a new PPP link R1-R3 is up

R1

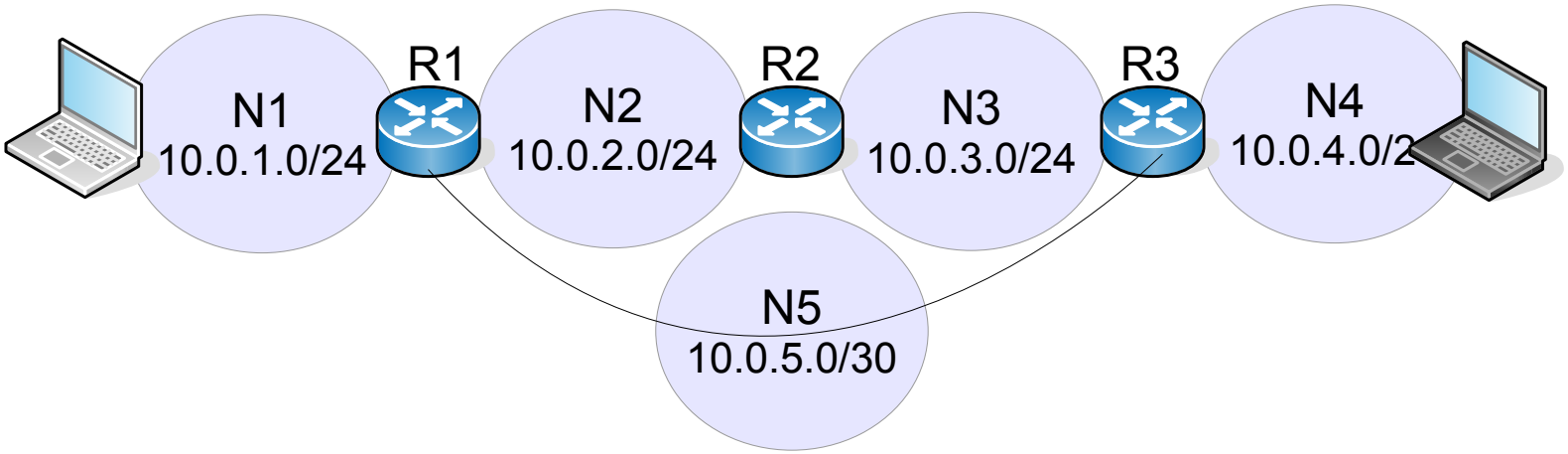
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2
10.0.4.0/24	10.0.2.2	3

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- Suddenly a new PPP link R1-R3 is up
  - N5 (10.0.5.0/30)

R1

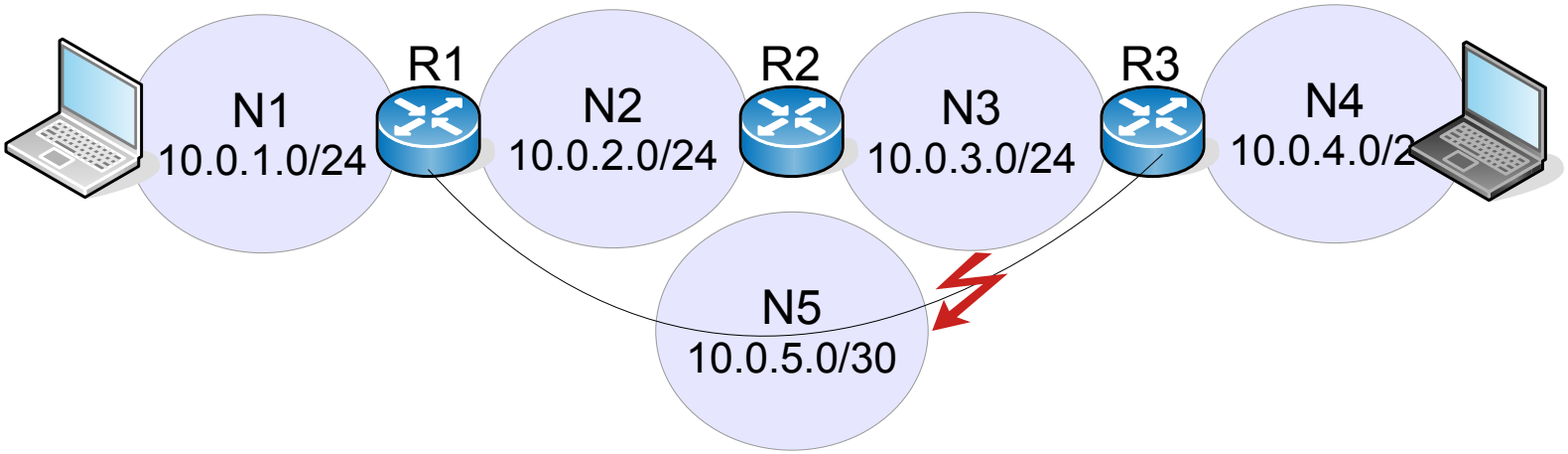
Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2
10.0.4.0/24	10.0.2.2	3

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3



- Suddenly the PPP link R1-R3 is down
  - N5 (10.0.5.0/30)

R1

Net/mask	gateway	metric
10.0.1.0/24	0.0.0.0	1
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	10.0.2.2	2
10.0.4.0/24	10.0.2.2	3

R2

Net/mask	gateway	metric
10.0.2.0/24	0.0.0.0	1
10.0.3.0/24	0.0.0.0	1
10.0.1.0/24	10.0.2.1	2
10.0.4.0/24	10.0.3.2	2

R3

Net/mask	gateway	metric
10.0.3.0/24	0.0.0.0	1
10.0.4.0/24	0.0.0.0	1
10.0.2.0/24,	10.0.3.1	2
10.0.1.0/24,	10.0.3.1	3

Security

- In general:
  - Confidentiality: who can access

    Protecting info from being accessed by unauthorized parties
  - Integrity: who can modify data

    Ensuring authenticity of info, not altered, source is genuine
  - Availability:

    Info accessible by authorized users (may be prevented by denial of service attacks)
  - *Authentication*: proving an assertion, such as user identity
- RIPv2:
  - Authentication: password, md5 hash

Timers (per entry)

- *Update:* controls interval between two gratuitous response messages, 30 sec default.
- *Invalid:* how long a routing entry can be in the routing table without being updated, also called expiration timer, 180 sec default.
- *Holddown:* (CISCO) when an update received indicates an unreachable route, info about better paths suppressed for 180 sec default.
- *Flush Timer:* time between the route is invalidated or marked as unreachable and removal of entry from the routing table, 240 sec default.