Routing spec

A(1,1)

B(2,1)

C(3,1)

Initialize

neighbor of A : B

A route table

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
|  |  |  |  |

neighbor of B: A and C

B route table

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (1,0) | (1,1) | 1 | neighbor |
| (3,0) | (3,1) | 1 | neighbor |

neighbor of C: B

C route table

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
|  |  |  |  |

and then A update from B

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (3,0) | (2,1) | 2 |  |
|  |  |  |  |

and then C update from B

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (1,0) | (2,1) | 2 |  |
|  |  |  |  |

New node D available

A(1,1)

B(2,1)

C(3,1)

D(4,1)

C add a new neighbor

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (1,0) | (2,1) | 2 |  |
| (4,0) | (4,1) | 1 | neighbor |
|  |  |  |  |

B update from C

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (1,0) | (1,1) | 1 | neighbor |
| (3,0) | (3,1) | 1 | neighbor |
| (4,0) | (3,1) | 2 |  |
|  |  |  |  |

A update from B

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (3,0) | (2,1) | 2 |  |
| (4,0) | (2,1) | 3 |  |
|  |  |  |  |

D update from C

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (3,0) | (3,1) | 1 | neighbor |
| (2,0) | (3,1) | 2 |  |
| (1,0) | (3,1) | 3 |  |
|  |  |  |  |

New link between A and C available

A(1,1)

B(2,1)

C(3,1)

D(4,1)

A add a new neighbor C

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (3,0) | (3,1) | 1 | neighbor |
| (4,0) | (2,1) | 3 |  |
|  |  |  |  |

C add a new neighbor A

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (1,0) | (1,1) | 1 | neighbor |
| (4,0) | (4,1) | 1 | neighbor |
|  |  |  |  |

affer exchange route informations

A

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (3,0) | (3,1) | 1 | neighbor |
| (4,0) | (2,1) | 2 |  |
|  |  |  |  |

B

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (1,0) | (1,1) | 1 | neighbor |
| (3,0) | (3,1) | 1 | neighbor |
| (4,0) | (3,1) | 2 |  |
|  |  |  |  |

C

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (1,0) | (1,1) | 1 | neighbor |
| (4,0) | (4,1) | 1 | neighbor |
|  |  |  |  |

D

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (3,0) | (3,1) | 1 | neighbor |
| (2,0) | (3,1) | 2 |  |
| (1,0) | (3,1) | 2 |  |
|  |  |  |  |

link between B and C is partition

A(1,1)

B(2,1)

C(3,1)

D(4,1)

B update route info

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (1,0) | (1,1) | 1 | neighbor |
| (3,0) | (3,1) | INFI |  |
| (4,0) | (3,1) | INFI |  |
|  |  |  |  |

C update route info

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | INFI |  |
| (1,0) | (1,1) | 1 | neighbor |
| (4,0) | (4,1) | 1 | neighbor |
|  |  |  |  |

affer exchange route informations

A

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (2,1) | 1 | neighbor |
| (3,0) | (3,1) | 1 | neighbor |
| (4,0) | (2,1) | 2 |  |
|  |  |  |  |

B

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (1,0) | (1,1) | 1 | neighbor |
| (3,0) | (1,1) | 2 |  |
| (4,0) | (1,1) | 3 |  |
|  |  |  |  |

C

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (2,0) | (1,1) | 2 |  |
| (1,0) | (1,1) | 1 | neighbor |
| (4,0) | (4,1) | 1 | neighbor |
|  |  |  |  |

D

|  |  |  |  |
| --- | --- | --- | --- |
| dst | next hop | metric |  |
| (3,0) | (3,1) | 1 | neighbor |
| (2,0) | (3,1) | 3 |  |
| (1,0) | (3,1) | 2 |  |
|  |  |  |  |

The rule

when startup, each snode initialize router table with its neignbors

dst = neighbor’s snode address

metric = 1

next\_hop = neighbor’s address

In every interval, snode receive route items updated from it’s neignbors.

For every items,

if it is new item or better item(metric is smaller) then accept it,

where,

dst = neighbor’s snode address

metric = item.mertic +1

next\_hop = neighbor’s address

Problems

Count to Infinity

good news propagates quickly, but bad news propagates slowly

Tow-Node Loop

A

X

B

To X m=2

To X m=1

before failure

A

X

B

To X m=2

To X m=Infinity

B to X failure

A

X

B

To X m=2

To X m=2

A update X to B

A

X

B

To X m=3

To X m=2

B update X to A

Loop ...

A

X

B

To X m=infinity

To X m=infinity

Finally stable

Three-Node Instability

A

X

B

To X m=2

To X m=1

before failure

C

To X m=2

A

X

B

To X m=infinity

To X m=infinity

B send update to   
B and C , but packets to C is lost

C

To X m=2

A

X

B

To X m=4

To X m=3

B send (X m=3) to A

C

To X m=2

A

X

B

To X m=4

To X m=3

A send (X m=4) to C

C

To X m=5

Loop...

A

X

B

C

To X m=infinity

To X m=infinity

To X m=infinity

Solutions

For Two-Node Loop

Do not send the item to the neighbor which is next hop adress

For Three-Node Instability

Max hop limit to 15, 16 means infinity.

Protocol Mesage format

struct message{

command:8;

version:8;

nfileds:16;

struct {

family:16;

address:64;

metric:32;

}fields[N];

};

Request message

when a Snode is aliviable/or some event rasied it can send a request to its neighbors

command field is 1.

When request 1 or n specific entries

for every field:

set field.family=family

set field.address = address

set others to 0

When request all entries

only 1 field and set field.family = family, set others to 0

Response message

A response can be sent in answer to a request or for update routing info to neighbors

command field is 2.

Three Timers

Periodic Timer

Controls the advertising of regular update messages, use a random number between 25 and 35 seconds.

when timeout snode sends update message to it’s neighbors

Expiration Timer

Snode initialize a timer for each neighbor.

When a snode receive update message from a neighbor, reset timer to 180s

If timeout the particular neighbor is considered unreachable.

Garbage Collection Timer

When a neighbor become unreachable, Snode set this timer to 120s, until timeout the route items relate to ths neighbor will be pure from the table.