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 snode 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 snode 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=2

To X m=1

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

C

To X m=2

A

X

B

To X m=2

To X m=3

C send (X m=2) B

C

To X m=2

A

X

B

To X m=2

To X m=1

send (X m=2) B

C

To X m=2

Solutions

For Two-Node Loop

Do not send the item which next hop is X to The Snode X

For Three-Node Instability

Max hop limit to 15, 16 means infinity.

Protocol Mesage format

struct message{

command:8;

version:8;

length:16;

struct {

family:16;

reserved: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 ofregular 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.