**18756 Project 7 – GMPLS REPORT**

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**Introduction**

In the example file, I create IP links between router A and B and between router F and G, and create optical links between router B, C, D, E and F. There are also IP links between router B, C, D, E and F, which are used for out-of-band control channel. The input is router A sends a packet to router G, after 30 tocks router G send a packet to router A. In this circumstance, a bidirectional LSP between router A and router G has been setup after 30 tocks, so the second packet sent from router G to router A will be sent directly without waiting.

Because there are IP links and optical links, so I create two graphs to compute routing table of two kinds of paths separately. When the router A sends the first packet to router G, a new LSP needs to be setup, so this packet will be saved in a buffer to wait to be sent. In the LSP setup process, firstly router A send a path message to router B with suggestion label. Then router B choose a color wavelength that has not been used and send a path message to router F with suggestion color label. When router F receives the packet with suggestion color label, the label-to-label table for downstream optical LSP setup has been saved in every LSROxc router. Then router F sends a resv message with another color label to router B. When router B receives the resv packet , both of the uptream and downtream optical LSP between B and F are setup. Router B sends a path message to router F with suggestion label, and router F forwards path message to destination router G. The label-to-label table for downtream LSP from G to A is saved in every LSRIP router when G receives the path message. G then sends a resv message to router A. When A receives resv message, it will send a ResvConf message to G. At this time, the whole bidirectional LSP between A and G is established.

All of the OAM messages are sent through IP links. When the LSP is established, the initial packet waited in the buffer is sent from A to G. This packet will go through optical links between B and F. After 30 tocks, the second packet is created in router G. Router G detects that there already exists a LSP between A and G, so the second packet can be sent to router A through downstream LSP directly.

**Experiment Results**

**Input:**

A.createPacket(7);

for(int i =0; i<30; i++)

tock();

G.createPacket(1);

for(int i =0; i<30; i++)

tock();

Router A sends a packet to router G, after 30 tocks router G send a packet to router A.

**Output:**

\*\* SYSTEM SETUP \*\*

PATH: Router 1 sent a PATH to Router 2

\*\* TIME = 0 \*\*

PATH: Router 2 received a PATH from Router 1

LSR: 2, ROUTE ADD, Input: LSI\3\green, Output: PSI\1\1

PATH: Router 2 sent a PATH to Router 3

\*\* TIME = 1 \*\*

PATH: Router 3 received a PATH from Router 2

LSR: 3, ROUTE ADD, Input: LSI\4\green, Output: LSI\2\green

PATH: Router 3 sent a PATH to Router 4

\*\* TIME = 2 \*\*

PATH: Router 4 received a PATH from Router 3

LSR: 4, ROUTE ADD, Input: LSI\5\green, Output: LSI\3\green

PATH: Router 4 sent a PATH to Router 5

\*\* TIME = 3 \*\*

PATH: Router 5 received a PATH from Router 4

LSR: 5, ROUTE ADD, Input: LSI\6\green, Output: LSI\4\green

PATH: Router 5 sent a PATH to Router 6

\*\* TIME = 4 \*\*

PATH: Router 6 received a PATH from Router 5

LSR: 6, ROUTE ADD, Input: PSI\7\PSC, Output: LSI\5\green

LSR: 6, ROUTE ADD, Input: LSI\5\yellow, Output: PSI\7\PSC

RESV: Router 6 sent a RESV to Router 5

\*\* TIME = 5 \*\*

RESV: Router 5 received a RESV from Router 6

LSR: 5, ROUTE ADD, Input: LSI\4\yellow, Output: LSI\6\yellow

RESV: Router 5 sent a RESV to Router 4

\*\* TIME = 6 \*\*

RESV: Router 4 received a RESV from Router 5

LSR: 4, ROUTE ADD, Input: LSI\3\yellow, Output: LSI\5\yellow

RESV: Router 4 sent a RESV to Router 3

\*\* TIME = 7 \*\*

RESV: Router 3 received a RESV from Router 4

LSR: 3, ROUTE ADD, Input: LSI\2\yellow, Output: LSI\4\yellow

RESV: Router 3 sent a RESV to Router 2

\*\* TIME = 8 \*\*

RESV: Router 2 received a RESV from Router 3

LSR: 2, ROUTE ADD, Input: PSI\3\PSC, Output: LSI\1\yellow

LSR: 2, ROUTE ADD, Input: PSI\1\1, Output: PSI\3\PSC

PATH: Router 2 sent a PATH to Router 3

\*\* TIME = 9 \*\*

PATH: Router 3 received a PATH from Router 2

PATH: Router 3 sent a PATH to Router 4

\*\* TIME = 10 \*\*

PATH: Router 4 received a PATH from Router 3

PATH: Router 4 sent a PATH to Router 5

\*\* TIME = 11 \*\*

PATH: Router 5 received a PATH from Router 4

PATH: Router 5 sent a PATH to Router 6

\*\* TIME = 12 \*\*

PATH: Router 6 received a PATH from Router 5

LSR: 6, ROUTE ADD, Input: PSI\7\1, Output: PSI\5\1

PATH: Router 6 sent a PATH to Router 7

\*\* TIME = 13 \*\*

PATH: Router 7 received a PATH from Router 6

LSR: 7, ROUTE ADD, Input: null\null\null, Output: PSI\6\1

RESV: Router 7 sent a RESV to Router 6

\*\* TIME = 14 \*\*

RESV: Router 6 received a RESV from Router 7

LSR: 6, ROUTE ADD, Input: PSI\5\2, Output: PSI\7\1

RESV: Router 6 sent a RESV to Router 5

\*\* TIME = 15 \*\*

RESV: Router 5 received a RESV from Router 6

RESV: Router 5 sent a RESV to Router 4

\*\* TIME = 16 \*\*

RESV: Router 4 received a RESV from Router 5

RESV: Router 4 sent a RESV to Router 3

\*\* TIME = 17 \*\*

RESV: Router 3 received a RESV from Router 4

RESV: Router 3 sent a RESV to Router 2

\*\* TIME = 18 \*\*

RESV: Router 2 received a RESV from Router 3

LSR: 2, ROUTE ADD, Input: PSI\1\2, Output: PSI\3\2

RESV: Router 2 sent a RESV to Router 1

\*\* TIME = 19 \*\*

RESV: Router 1 received a RESV from Router 2

LSR: 1, ROUTE ADD, Input: null\null\null, Output: PSI\2\2

RESVCONF: Router 1 sent a RESVCONF to Router 2

\*\* TIME = 20 \*\*

RESVCONF: Router 2 received a RESVCONF from Router 1

RESVCONF: Router 2 sent a RESVCONF to Router 3

DATA: Router 2 sent a DATA to Router 3

\*\* TIME = 21 \*\*

RESVCONF: Router 3 received a RESVCONF from Router 2

RESVCONF: Router 3 sent a RESVCONF to Router 4

DATA: Router 3 sent a DATA to Router 4

\*\* TIME = 22 \*\*

RESVCONF: Router 4 received a RESVCONF from Router 3

RESVCONF: Router 4 sent a RESVCONF to Router 5

DATA: Router 4 sent a DATA to Router 5

\*\* TIME = 23 \*\*

RESVCONF: Router 5 received a RESVCONF from Router 4

RESVCONF: Router 5 sent a RESVCONF to Router 6

DATA: Router 5 sent a DATA to Router 6

\*\* TIME = 24 \*\*

RESVCONF: Router 6 received a RESVCONF from Router 5

RESVCONF: Router 6 sent a RESVCONF to Router 7

DATA: Router 6 sent a DATA to Router 7

\*\* TIME = 25 \*\*

RESVCONF: Router 7 received a RESVCONF from Router 6

Trace (Router7): Received a packet

\*\* TIME = 26 \*\*

\*\* TIME = 27 \*\*

\*\* TIME = 28 \*\*

\*\* TIME = 29 \*\*

\*\* TIME = 30 \*\*

DATA: Router 6 sent a DATA to Router 5

\*\* TIME = 31 \*\*

DATA: Router 5 sent a DATA to Router 4

\*\* TIME = 32 \*\*

DATA: Router 4 sent a DATA to Router 3

\*\* TIME = 33 \*\*

DATA: Router 3 sent a DATA to Router 2

\*\* TIME = 34 \*\*

DATA: Router 2 sent a DATA to Router 1

\*\* TIME = 35 \*\*

Trace (Router1): Received a packet