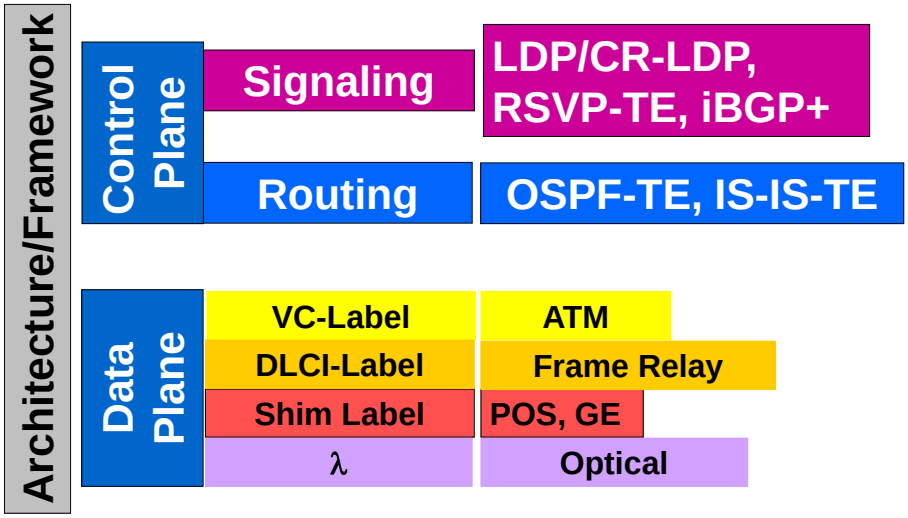
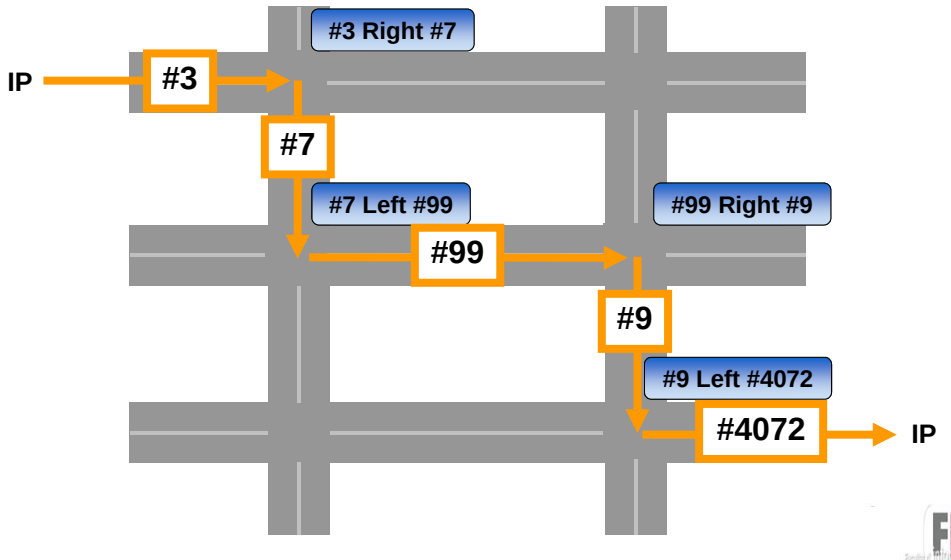
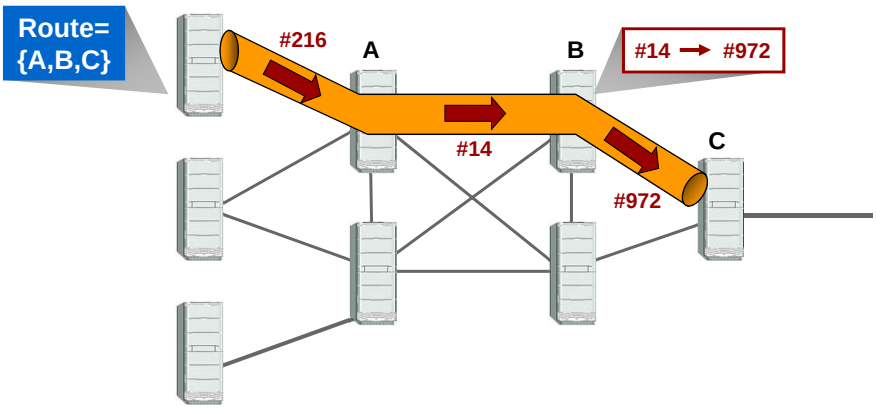
What is Standard MPLS?



Label Switched Path

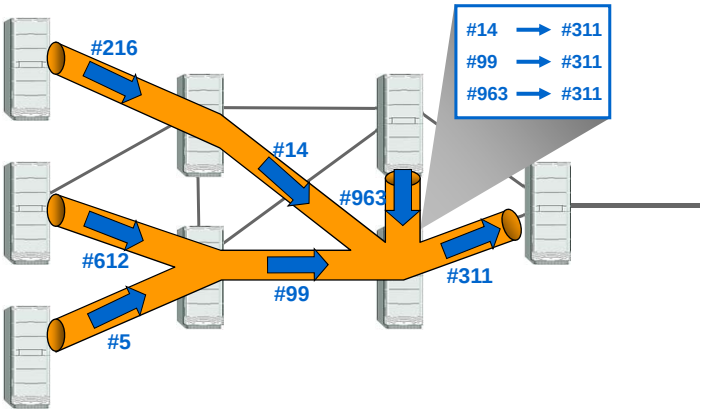


Point-to-point LSP



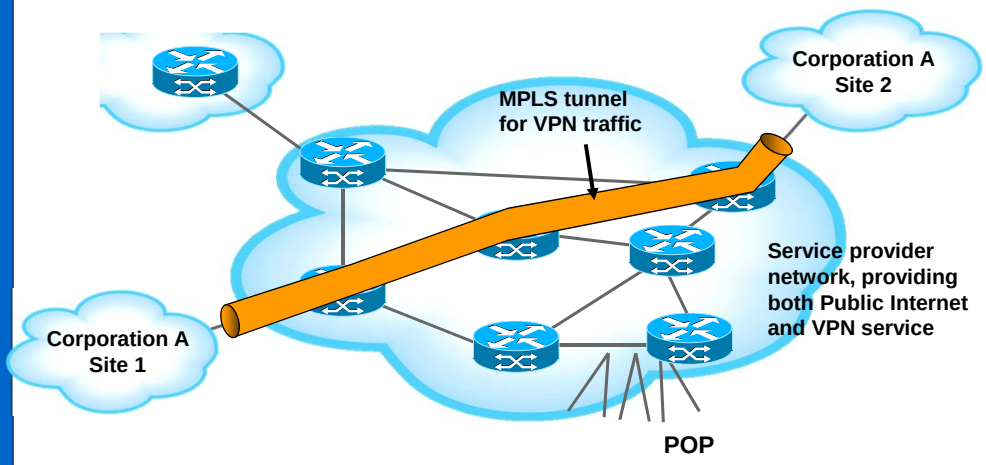
- LSP follows route that source chooses. In other words, the control message to establish the LSP (label request) is *source routed*.

Merging LSP

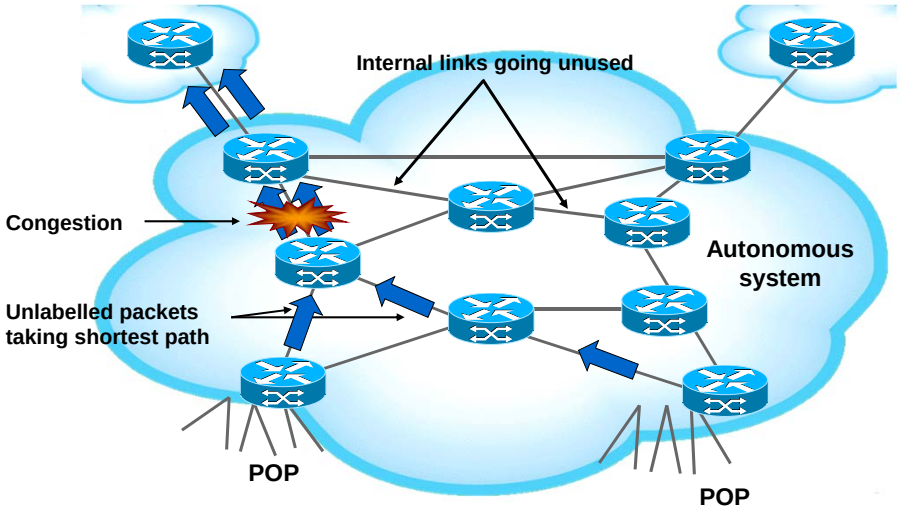


- LSP forms a "sink tree"
- The branches of the LSP always follows the same route as normal IP forwarding; that is, the *shortest path*

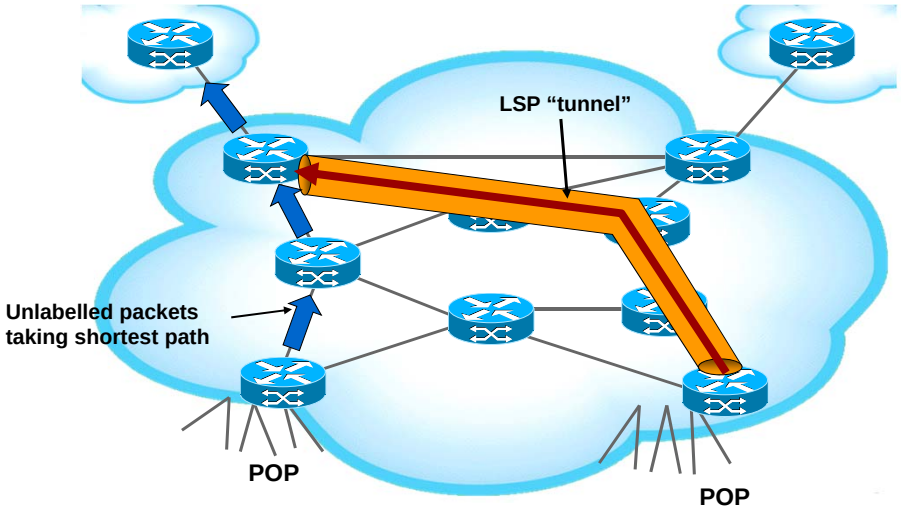
Network-Based Virtual Private Networks using MPLS



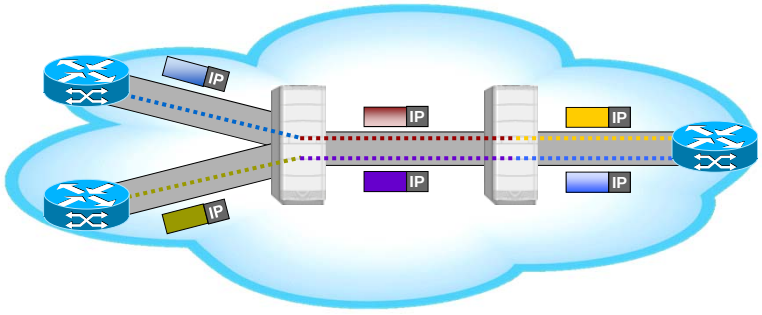
IP Traffic Engineering. Problem Definition



Traffic Engineering using MPLS

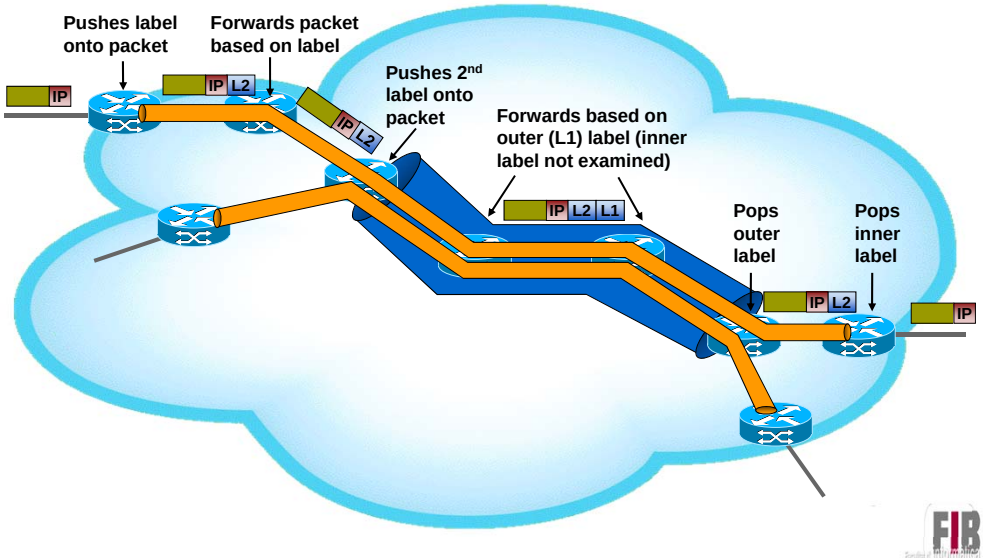


Optical

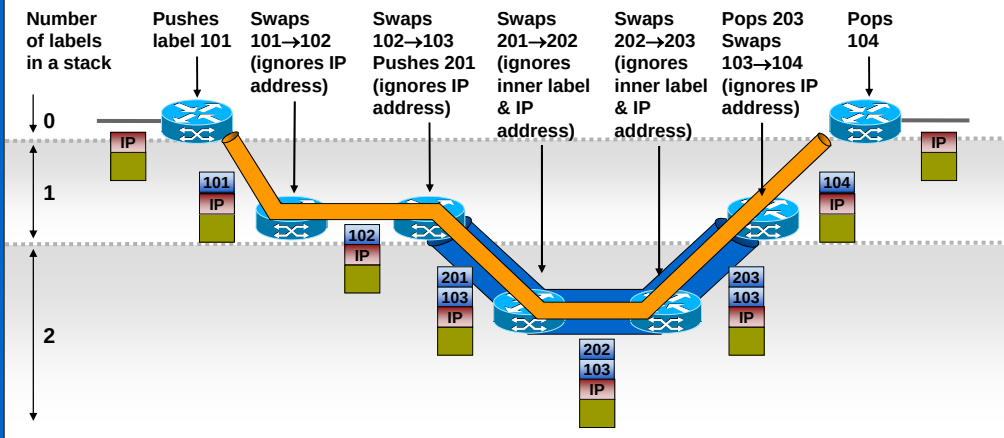


- Label not prepended to packet
- Instead is represented by a fiber number or a wavelength

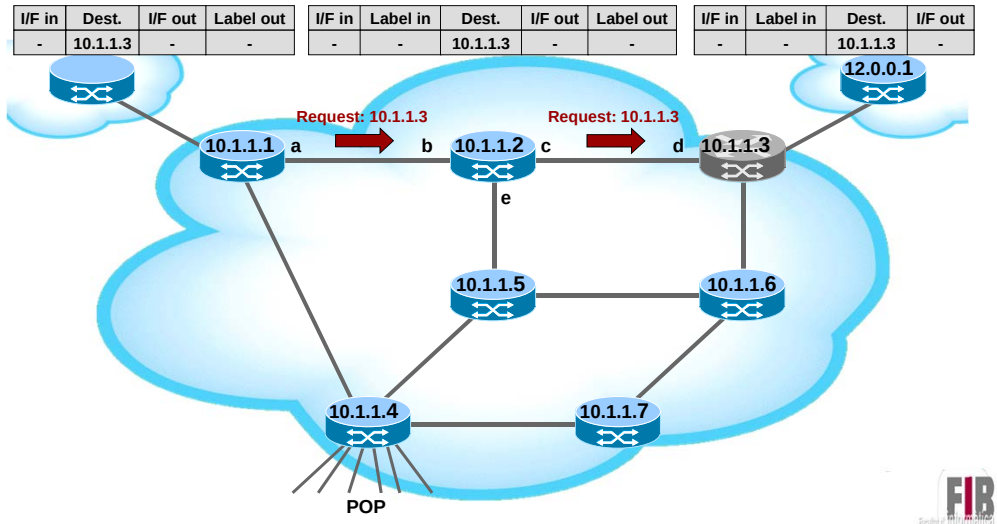
Label Stacking Example



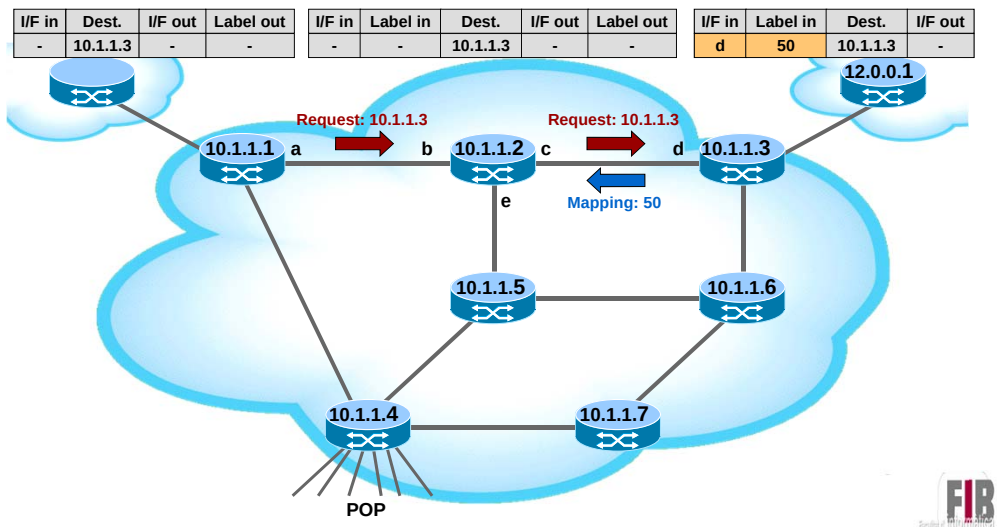
Label Stacking Details



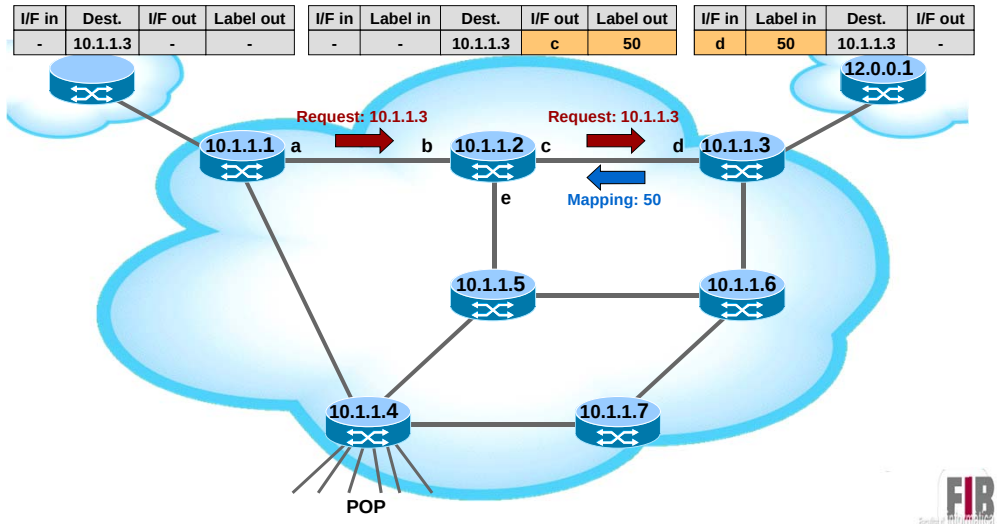
Example establishment LSP with LDP



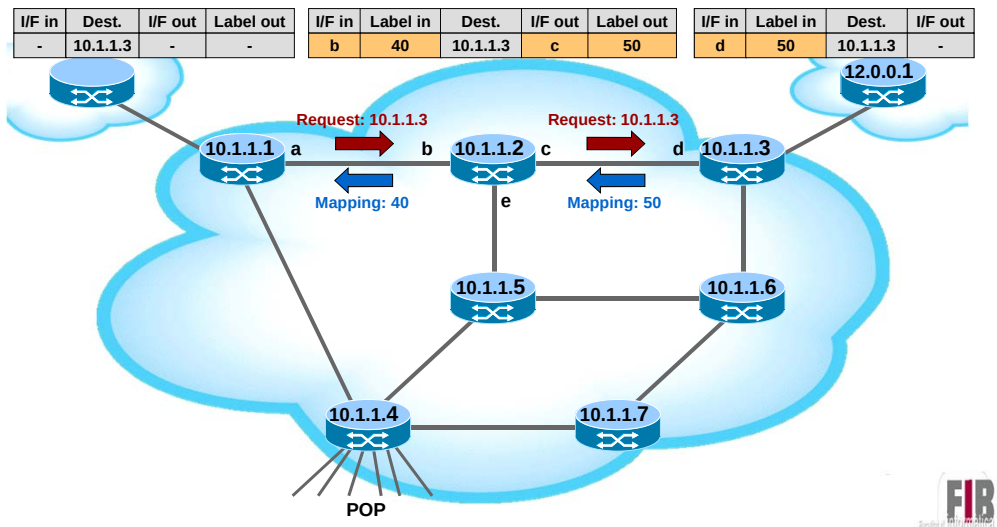
Example establishment LSP with LDP



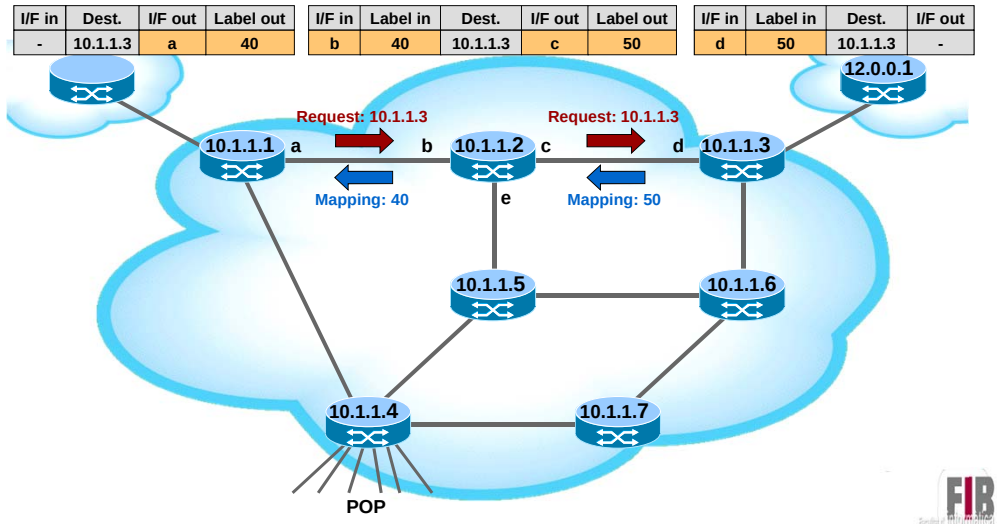
Example establishment LSP with LDP



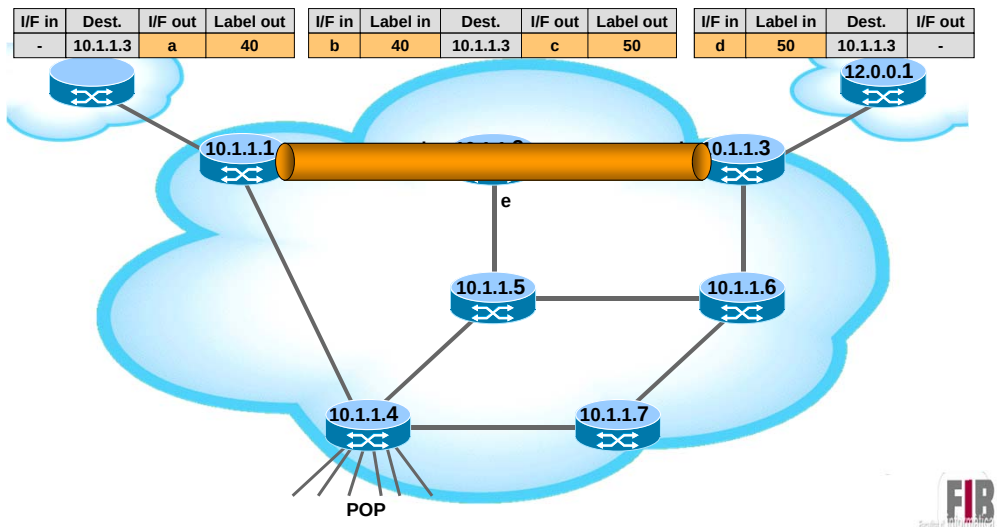
Example establishment LSP with LDP



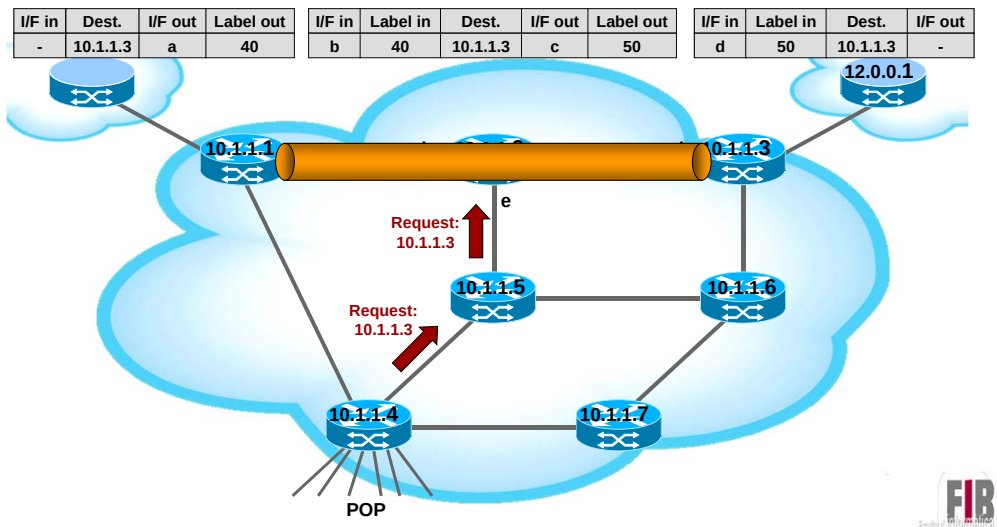
Example establishment LSP with LDP



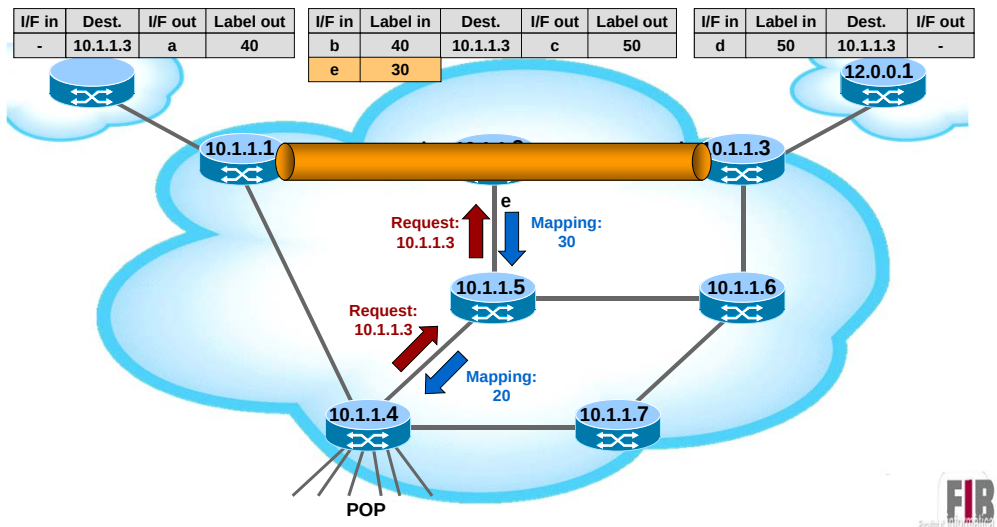
Example establishment LSP with LDP



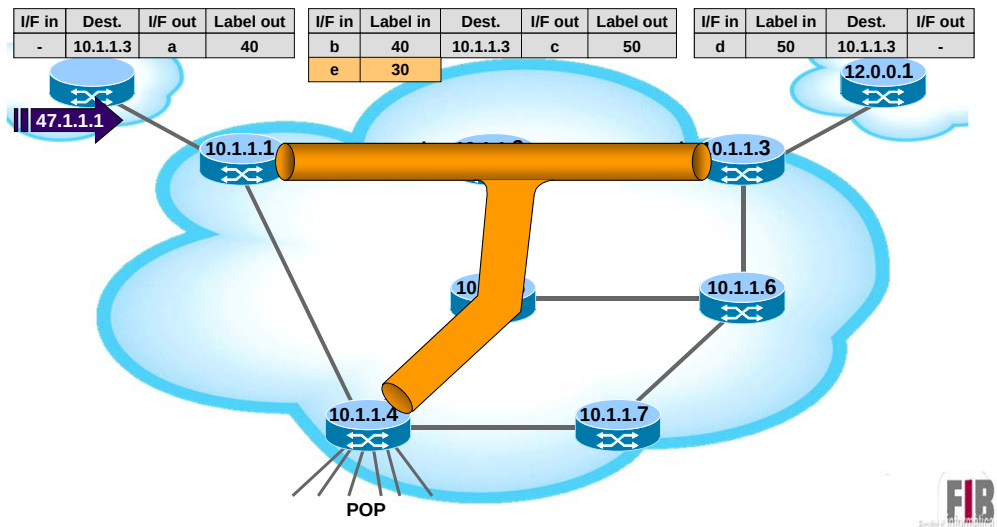
Example establishment LSP with LDP



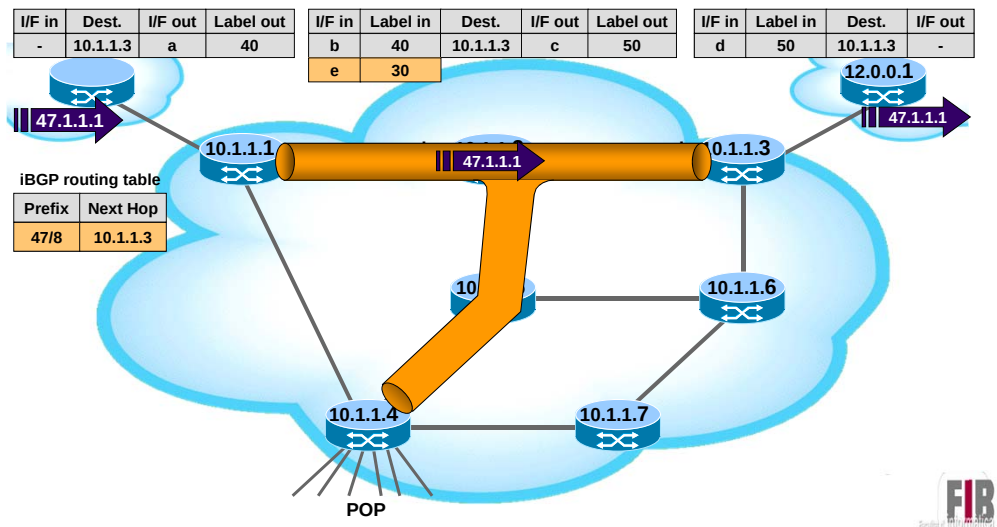
Example establishment LSP with LDP



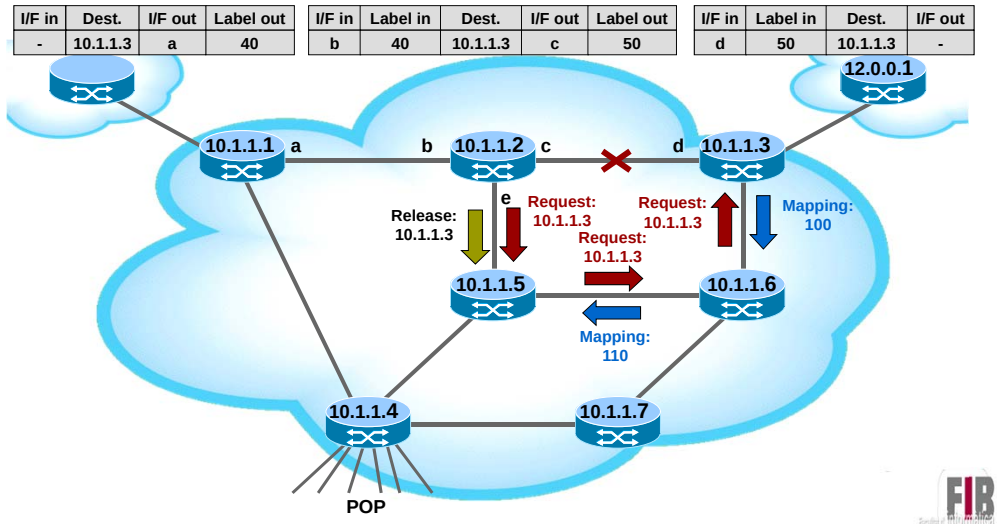
Example establishment LSP with LDP



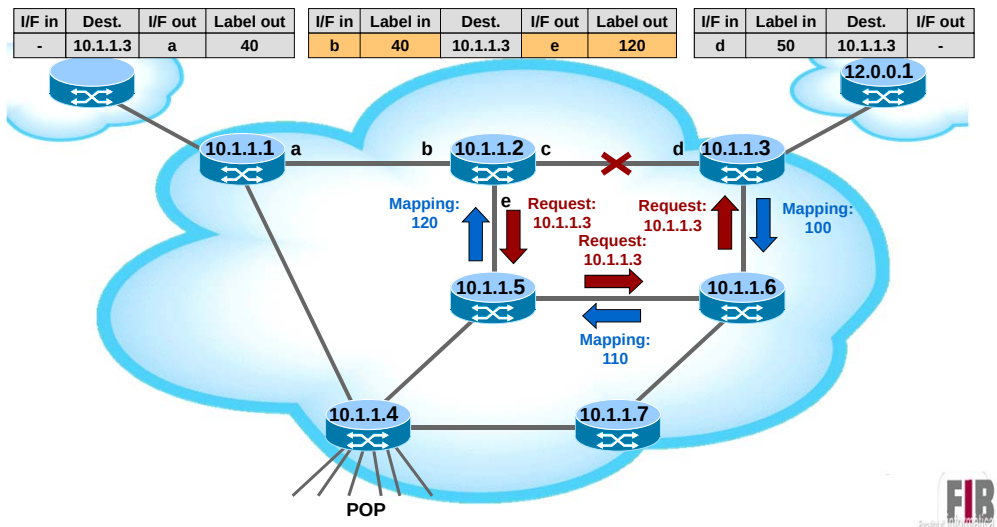
IP travel over LSP



LSP recovery in case of failure



LSP recovery in case of failure

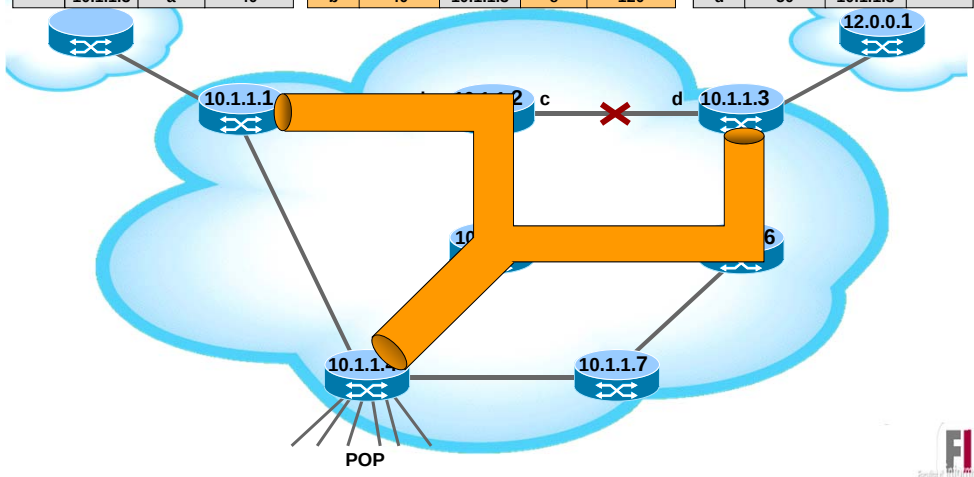


LSP recovery in case of failure

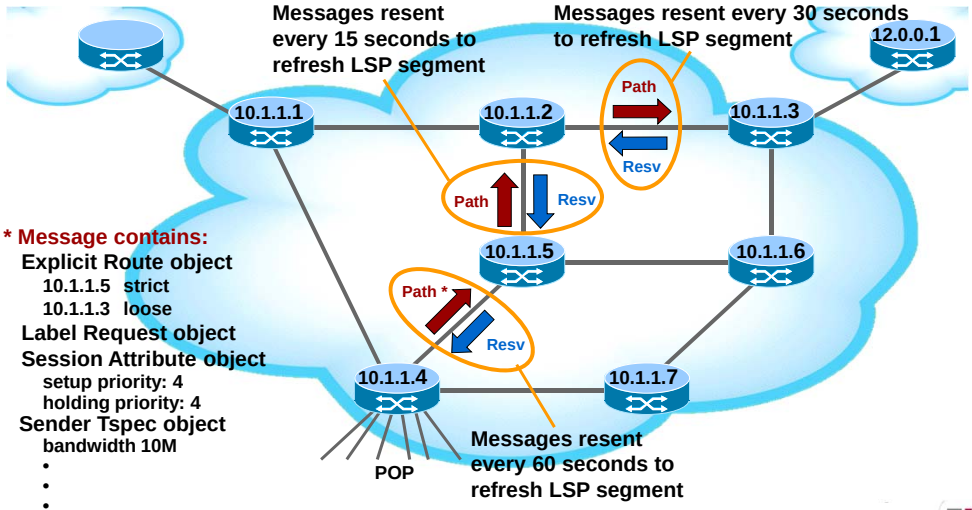
I/F in	Dest.	I/F out	Label out
-	10.1.1.3	a	40

I/F in	Label in	Dest.	I/F out	Label out
b	40	10.1.1.3	e	120

I/F in	Label in	Dest.	I/F out
d	50	10.1.1.3	-

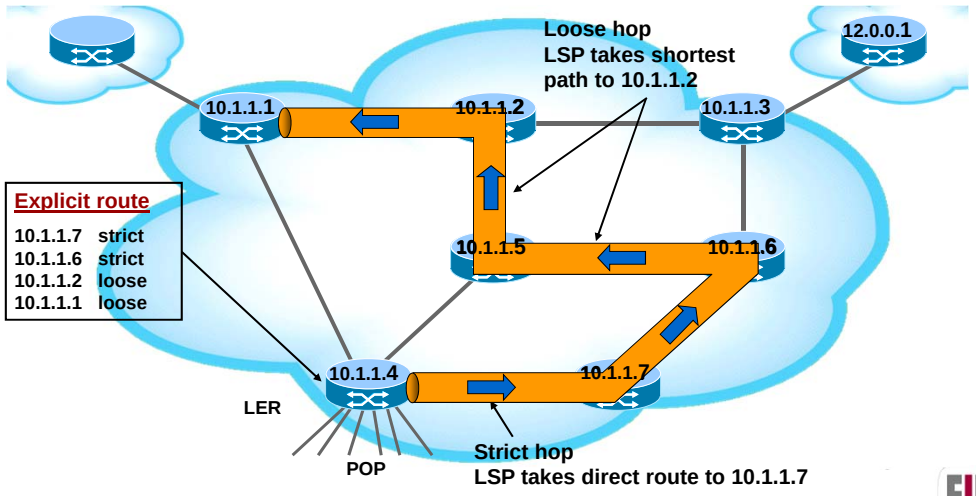


RSVP-TE details: Example

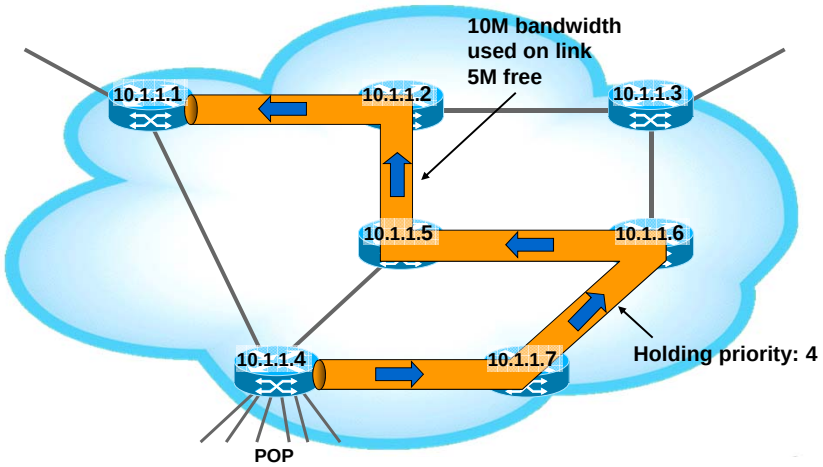


* Message contains:
- Explicit Route object
  - 10.1.1.5 strict
  - 10.1.1.3 loose
- Label Request object
- Session Attribute object
  - setup priority: 4
  - holding priority: 4
- Sender Tspec object
  - bandwidth 10M
  - •
  - •
  - •

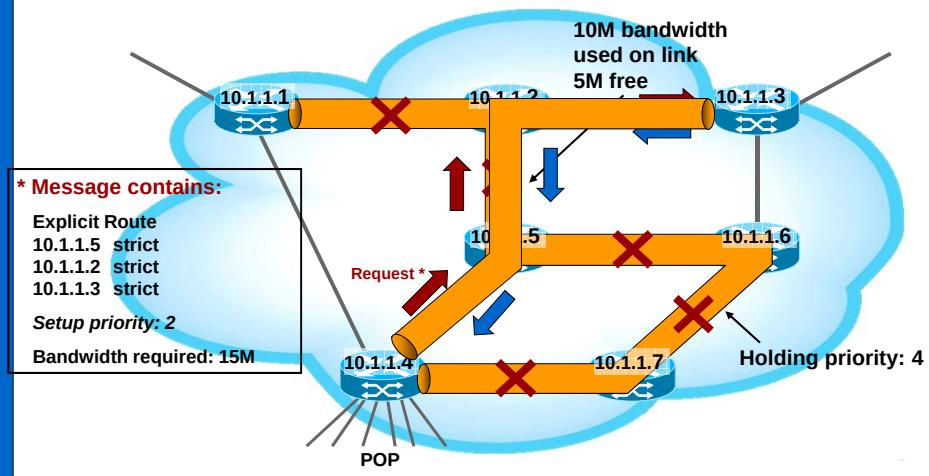
MPLS-TE Explicit Routing.



MPLS-TE: LSP preemption



MPLS-TE: LSP preemption



*** Message contains:**

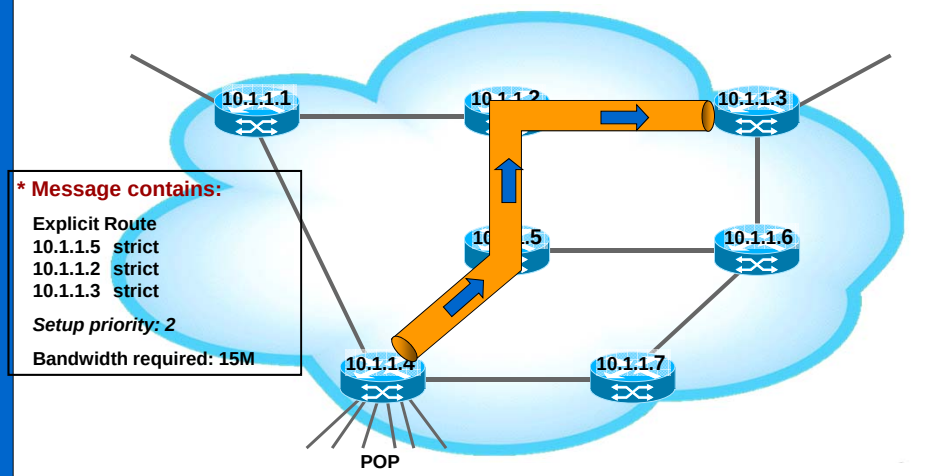
Explicit Route
10.1.1.5 strict
10.1.1.2 strict
10.1.1.3 strict

Setup priority: 2

Bandwidth required: 15M

Departament d'Arquitectura de Computadors

MPLS-TE: LSP preemption



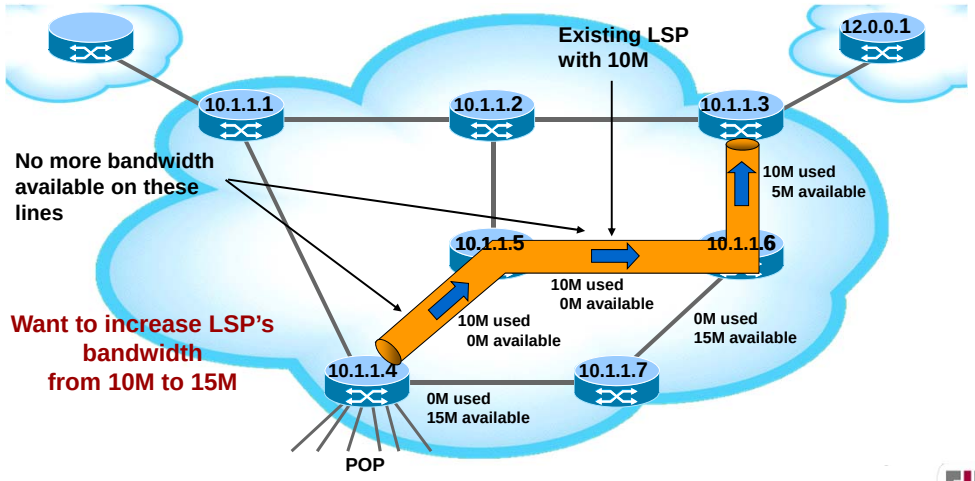
*** Message contains:**

Explicit Route
10.1.1.5 strict
10.1.1.2 strict
10.1.1.3 strict

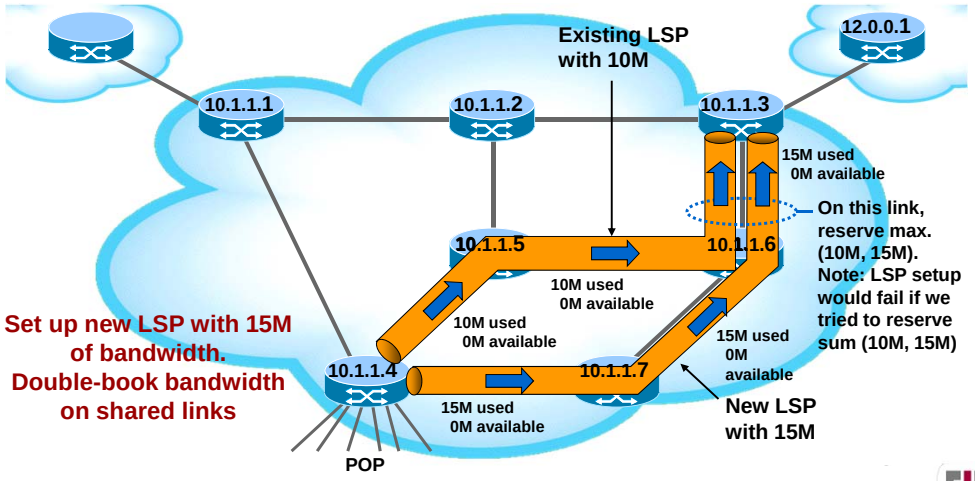
Setup priority: 2

Bandwidth required: 15M

MPLS-TE: LSP modification "make-before-break"



MPLS-TE: LSP modification "make-before-break"



MPLS-TE: LSP modification "make-before-break"