

MPLS

Multi-protocol label switching

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The idea



**Forwarding packets
according to a label**

**Instead of the IP
destination address**

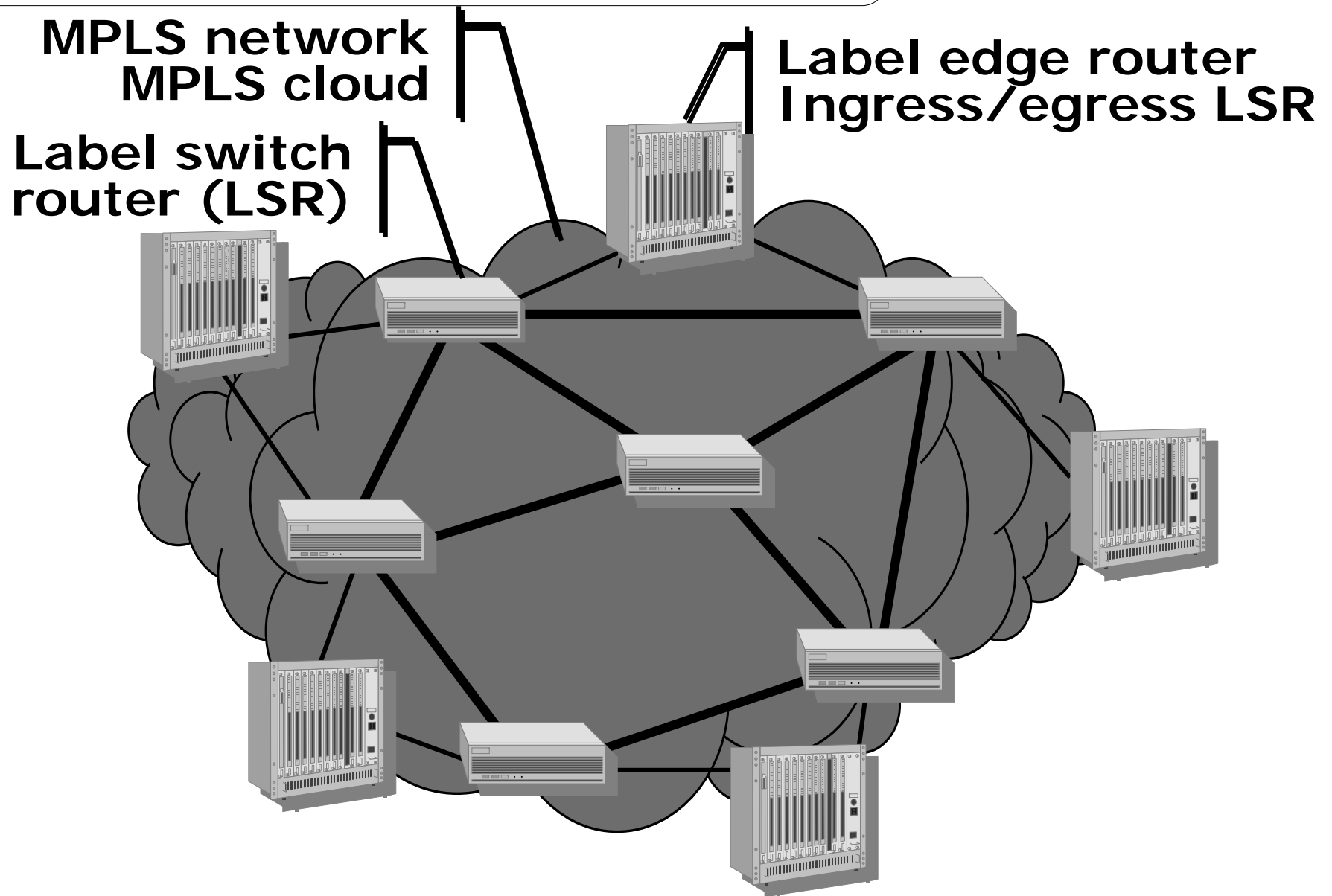
Why?

Faster lookup

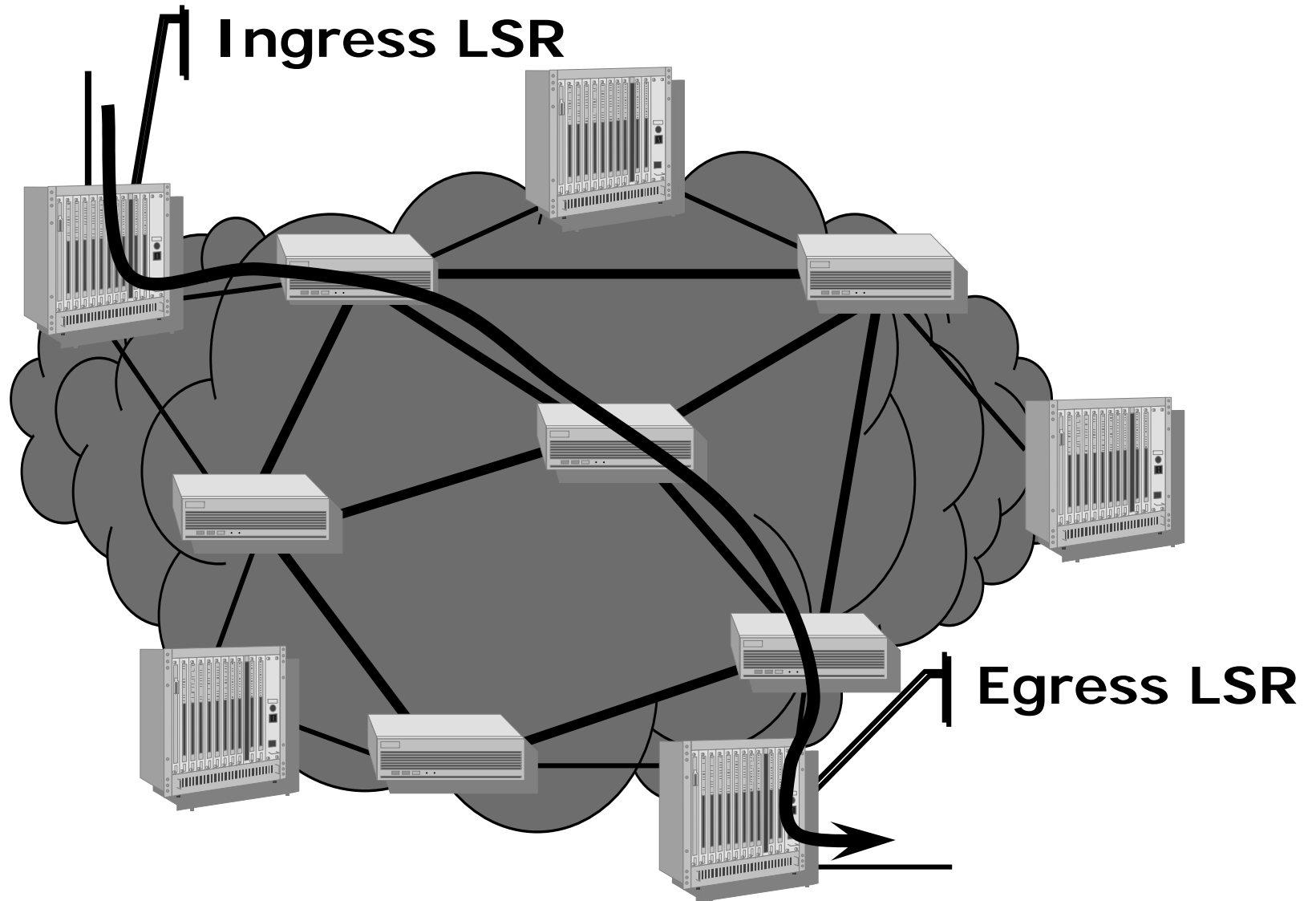
- The label may be used as an index
 - Instead of longest prefix matching

Traffic engineering

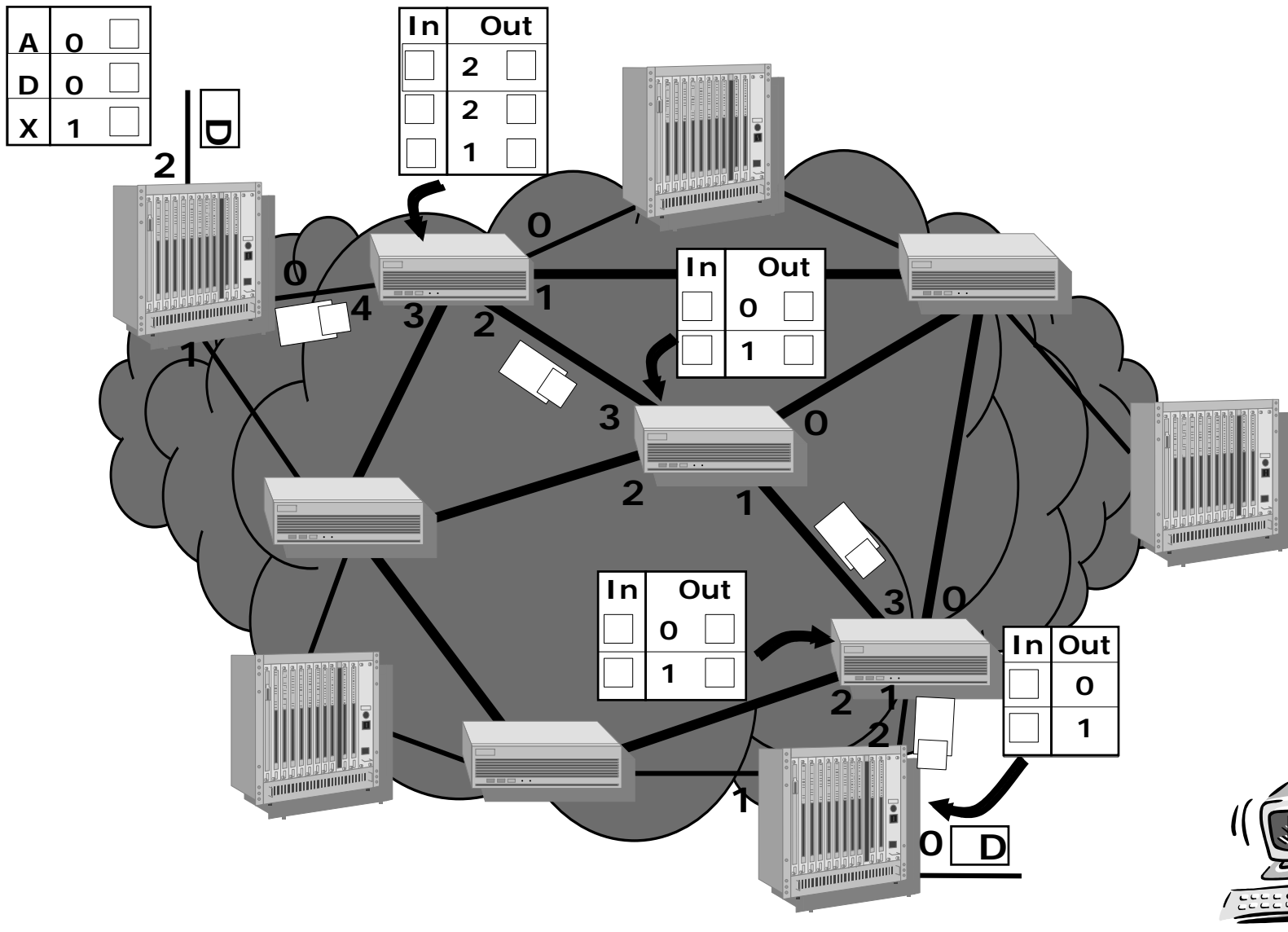
Network architecture



Label Switched Path (LSP)



Label switching



MPLS key elements

→ MPLS "header"

→ Contains the label

→ Upgraded routing protocols

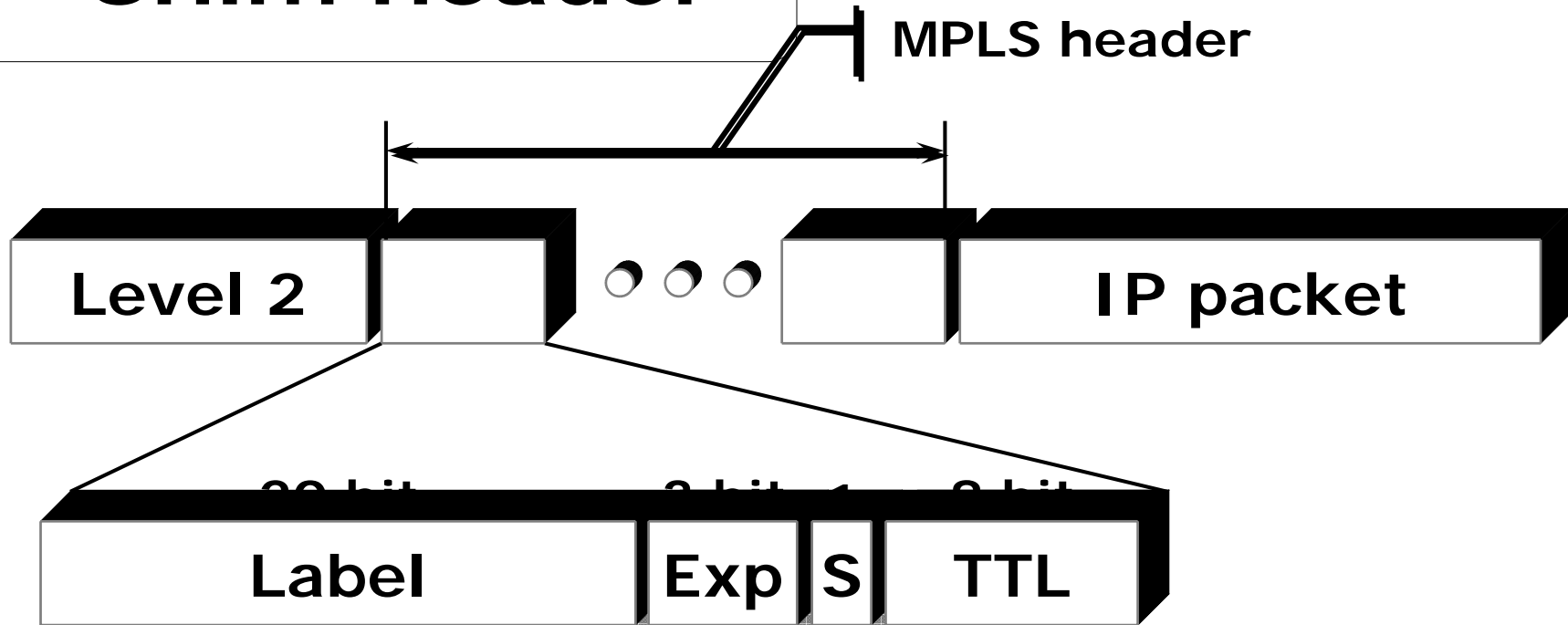
→ Constraints in choosing paths

→ Protocols for label distribution

→ Signaling

**MPLS introduces a
connection-oriented
paradigm in IP networks**

Shim header



Exp: Experimental bits (CoS)

S: Bottom of stack

TTL: Time to live

ATM and frame relay

Connection oriented layer 2 protocols

MPLS labels in layer 2 header

- **VCI / VPI (ATM)**
- **DLCI (Frame relay)**

Forwarding equivalence class (FEC)

Packets that

**Follow the same path
in MPLS network**

**Are treated the same way
by each LSR**

Receive the same label

Label Mapping

The label used by the downstream switch of a link for packets belonging to a FEC is associated to

Input label

Output port

LSP Creation

Static label binding (and mapping)

- **Through management**
- **Equivalent to PVC ATM**
- **Non-scalable**
- **No interoperability
among managing systems**
- **Impossible to have LSPs
through different networks**

Dynamic label binding

→ Protocol (IP) driven

→ The creation of LSPs is linked to the discovery of routes towards destinations

→ Explicit creation of LSP

→ Explicit signaling

→ Initiated by label edge routers

Label distribution protocols

Three alternatives (incompatible)

→ **Routing protocol: BGP**

→ Only protocol driven

→ **Label distribution protocol (LDP)**

→ Designed for the purpose

→ **Resource reservation protocol (RSVP)**

→ Designed for allocation in integrated service networks

Routing protocols

Used to determine LSP routing

- ▶ **Guide label binding procedures**
- ▶ **They indirectly determine packet routing**

Routing protocols

Existing protocols

OSPF

IS-IS

BGP-4

carry topology information

**In MPLS context
they are enhanced d to...**

New possibilities

→ Traffic engineering

→ Guaranteed quality of service

→ Not yet supported

→ Per-class traffic engineering

→ Synergy with DiffServ

→ Fast fault recovery

→ In less than 50 ms

Standardization

→ **IETF –
Internet Engineering Task Force**

→ **MPLS working group**

→ **FR/MPLS Alliance**

→ **Consortium of producers**

→ **Speed up spreading**

→ **Aspects omitted by IETF**

→ **VoMPLS, ADSL**

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