# MPLS Based Web Switching

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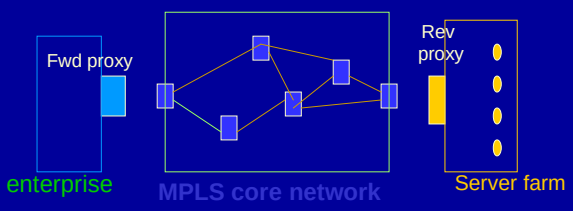
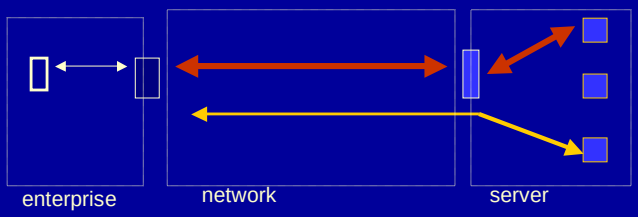
## Two Observations/ Trends

- Expected use of MPLS in core networks
  - Global Crossing, AT&T Canada have deployed MPLS
  - Use of MPLS as the control plane in optical networks
  - MPLS supported by most router vendors (Cisco, Juniper, Nortel,….)
  - MPLS switches (L2/ L3) will be “commodity” ?
  - MPLS/IP in storage area networks
- Specialised L4-L7 web switches in front of server farms for
  - Alteon(Nortel), F5, Arrowpoint (Cisco), Foundry
- Can we leverage MPLS for web switching?



## Different types of web switching

- Content routing: partitioned content, need to route request to the right server
- Load balancing : replicated content
- Affinity : direct http requests within a session to the same server
- Service differentiation : handle requests differently depending on point of origin/enterprise (e.g., predetermined SLAs)

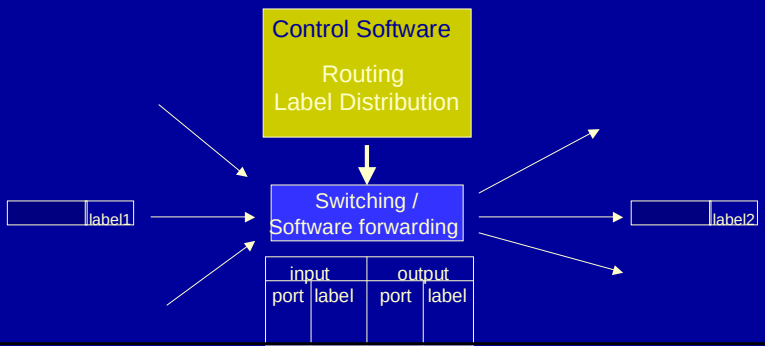



## WWW dispatchers : two basic approaches

- TCP/IP header for dispatch decisions (layer 4)
  - Limited functionality : load balancing, affinity (per src addr)
  - High performance (specialized hardware implementations)
    - IBM ND, Cisco LD
- Application-layer headers
  - Requires TCP termination/splicing (layer 7)
  - Content routing, affinity, load balancing …
  - Bottleneck : TCP connection termination
- Our goal : combine L7 flexibility with L4 performance
  - Eliminate TCP termination bottleneck
  - Use standard hardware instead of specialized switches
    - Leverage use of MPLS in core networks
    - Better price/performance ratio

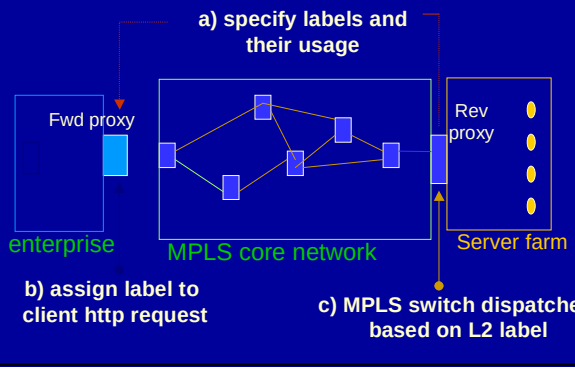
## MPLS basic operation

- Label placed between IP and MAC addresses
  - Labels defined for PPP, ethernet, ATM, Frame relay
  - Pkt forwarding based on label lookup, not IP address
- Signaling protocols to distribute labels, create a label-switched path
- *Switching hardware is agnostic of label semantics*



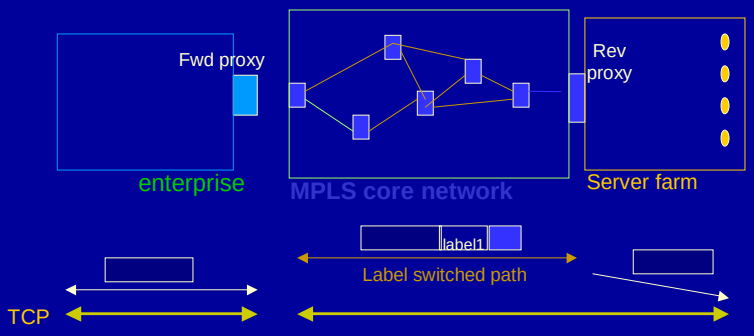

## Proposed Approach

- Map L4-L7 semantics onto MPLS labels and use commodity MPLS switches for web-switching (in MPLS, L3/routing semantics applied to L2 labels)
  - No TCP termination at reverse proxy and yet, achieve content routing, load balancing, affinity
  - Out of path return allowed
- Requires participation of client-side proxy in web-switching decisions



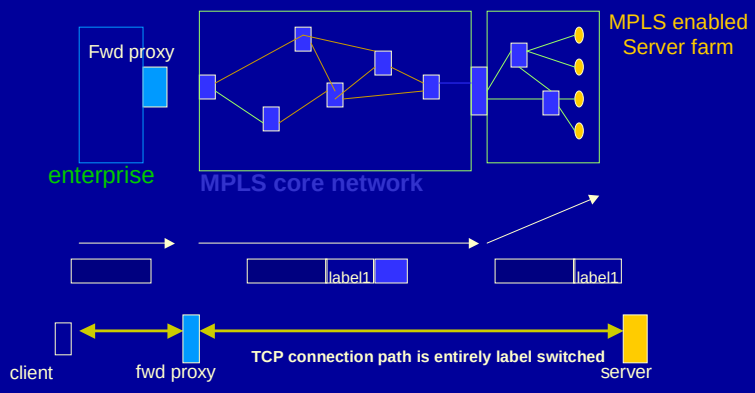
## MPLS label stacking

- Outer label used for routing in the core
- Inner label used for web switching
- Reverse proxy communicates semantics of (inner) label to fwd proxy
  - Example: content based routing
    - Forward proxy assigns inner label based on URL
    - Label1 → www.cnn.com/ headlinenews/
    - Label2 → www.cnn.com/ fn/
- Reverse proxy routes to the right server based on inner label




## Server farm supports MPLS

- If the server farm network is also MPLS enabled, then label switched path from forward proxy all the way to server
  - Dispatcher is a MPLS switch
  - Inner label allows desired L4-L7 functionality (content routing,…..,)

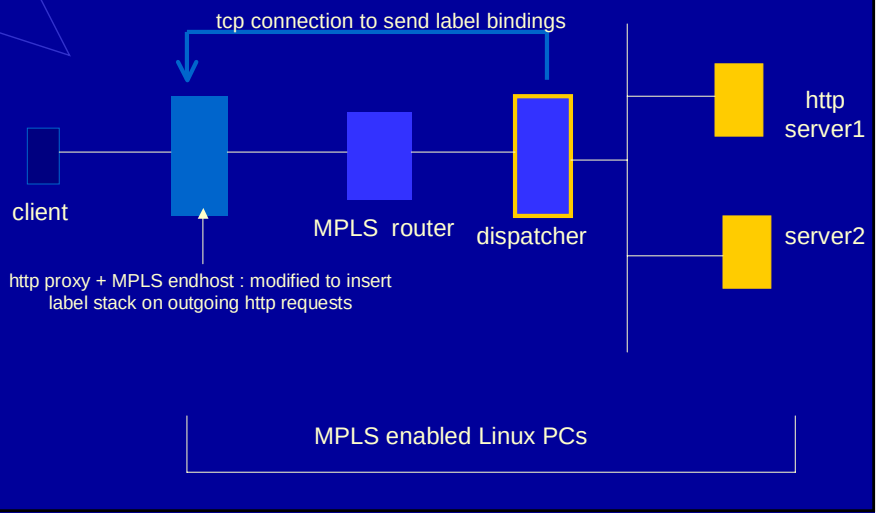


## Label Distribution

- Control connection between dispatcher and proxy
  - Content based routing : URL⇒label mappings
  - Load balancing : set of labels, proxy round-robins client requests across labels (could also send weights+labels)
  - Affinity : set of labels, proxy assigns same label to all client requests within a given time T
  - Service differentiation : proxy receives sets of labels, one set per class (gold/…/..), assumes pre-defined service agreement
- Dispatcher populates label table at layer2

## Prototype

- Objectives : # of simultaneous http requests scales linearly with #servers, (i.e. the dispatcher is not a bottleneck), and yet support content routing,…..,



## Deployment Scenarios

- ISP offering Web hosting service (proxies and server farms are controlled by a single entity)
- Web hosting provider has SLAs with particular clients

- If proxy and dispatcher are in different MPLS domains, the solution will depend on (yet undefined) inter-domain MPLS standards
- Alternative to MPLS labels : use IP addresses or port# ?
  - Conceptually yes, but does not leverage commodity layer2 switching hardware

## THANKS!

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