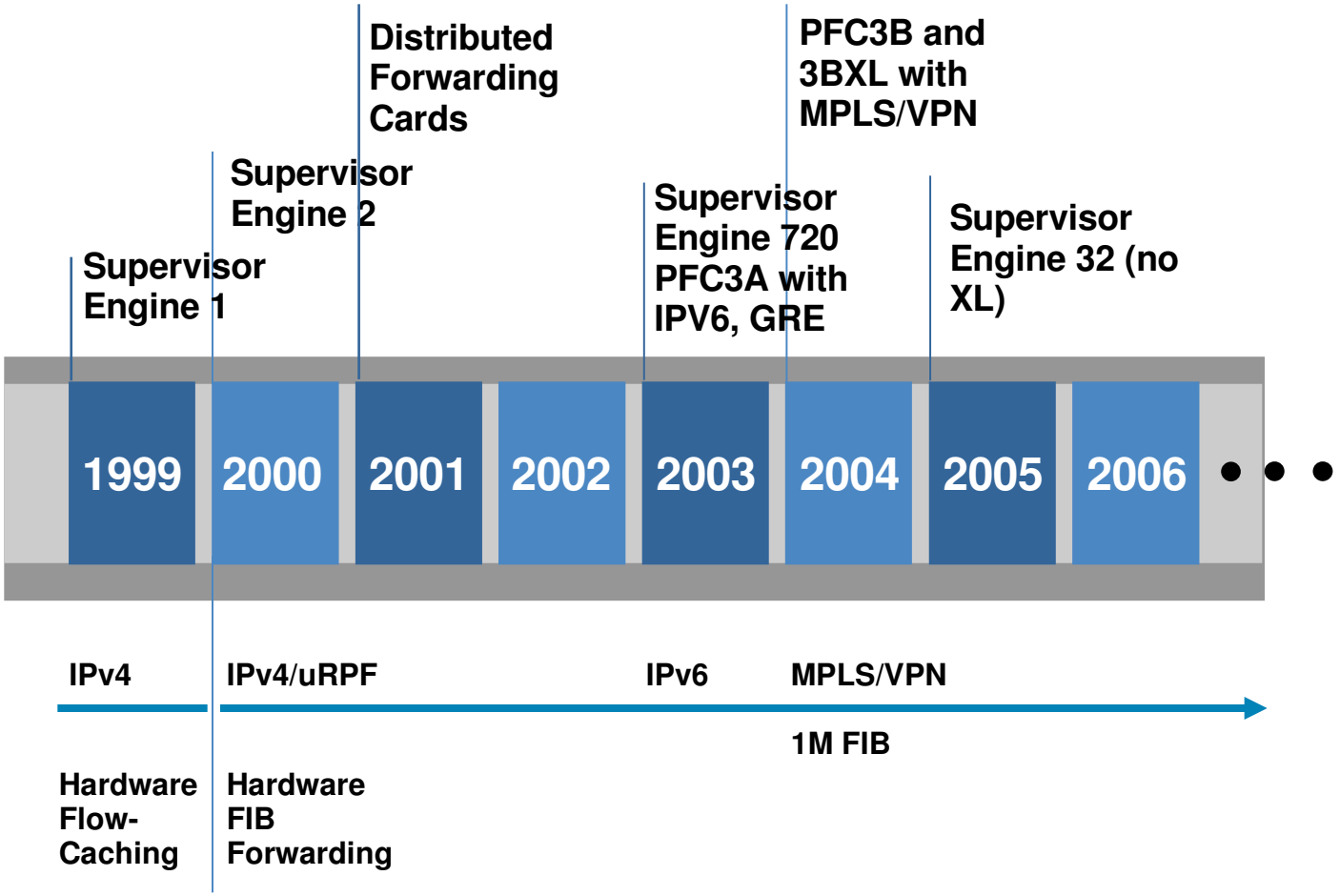
6500 FIB Forwarding Capacities

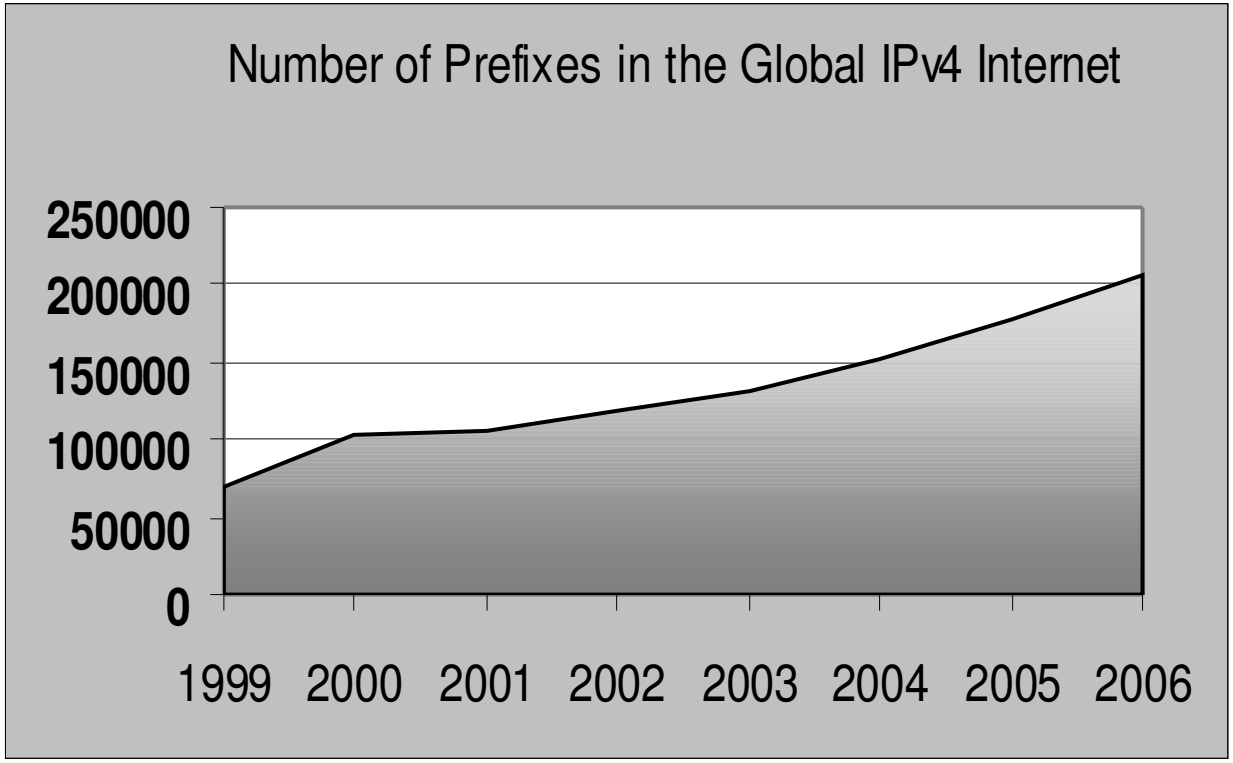
Presented by Suran de Silva, Engineering

Cisco Systems

Catalyst 6500 Hardware Forwarding Evolution



Global IPv4 Internet Routing Table Growth

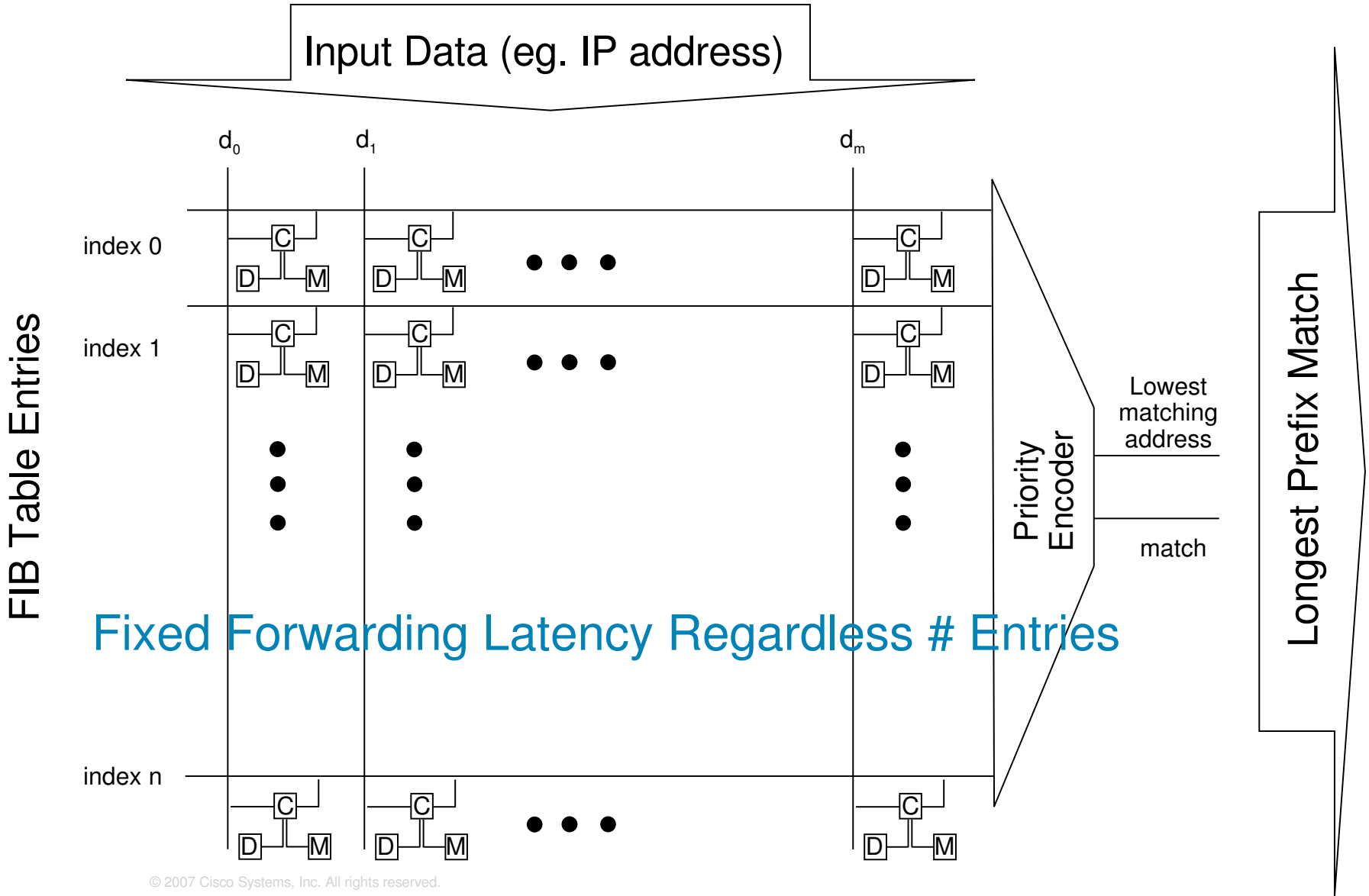


Year-End	# of Prefixes	% Growth
1999	70258	N/A
2000	103465	47%
2001	106659	3%
2002	118519	11%
2003	131483	11%
2004	153334	17%
2005	177399	16%
2006	206320	16%

[Source: http://www.apnic.net/mailing-lists/apops/]

Note: # of prefixes corresponds to the year end figures. i.e. 2006 figures are taken in Dec'06

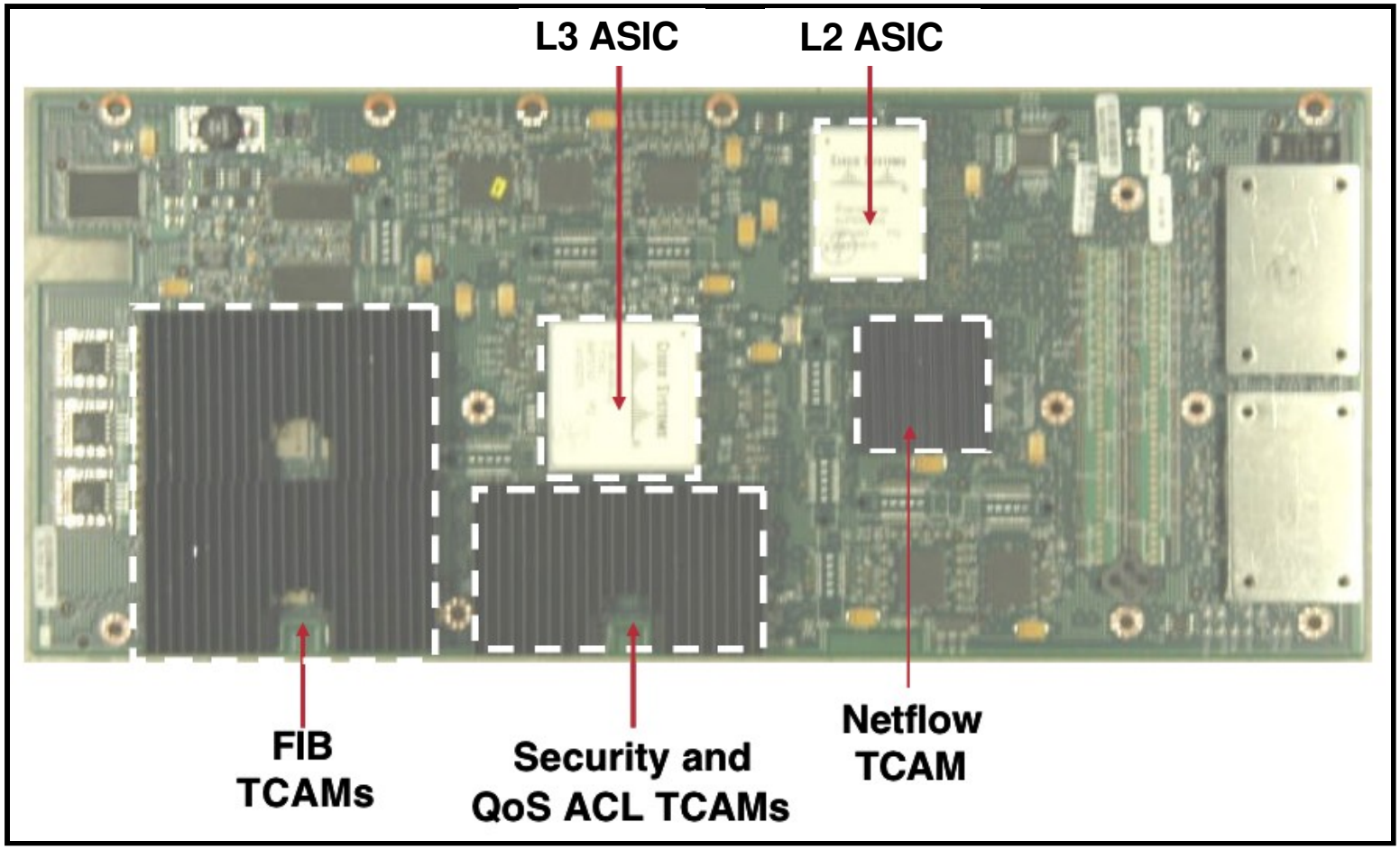
TCAM Architecture



Fixed Forwarding Latency Regardless # Entries

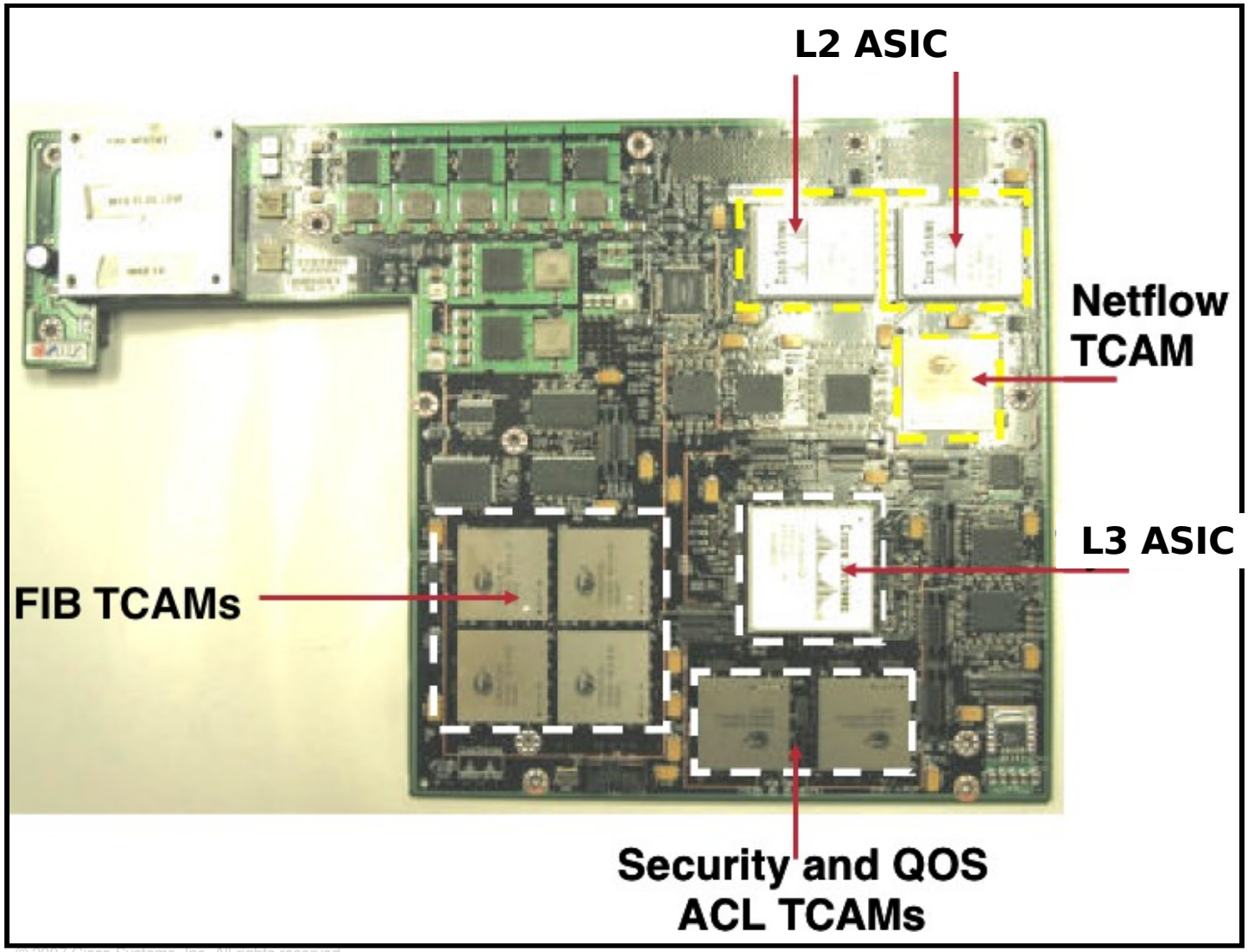
Cat6500 Sup Hardware L3 Tables

Separate Hardware Devices for L2, FIB, ACLs, Netflow Tables



Cat6500 DFC Hardware L3 Tables

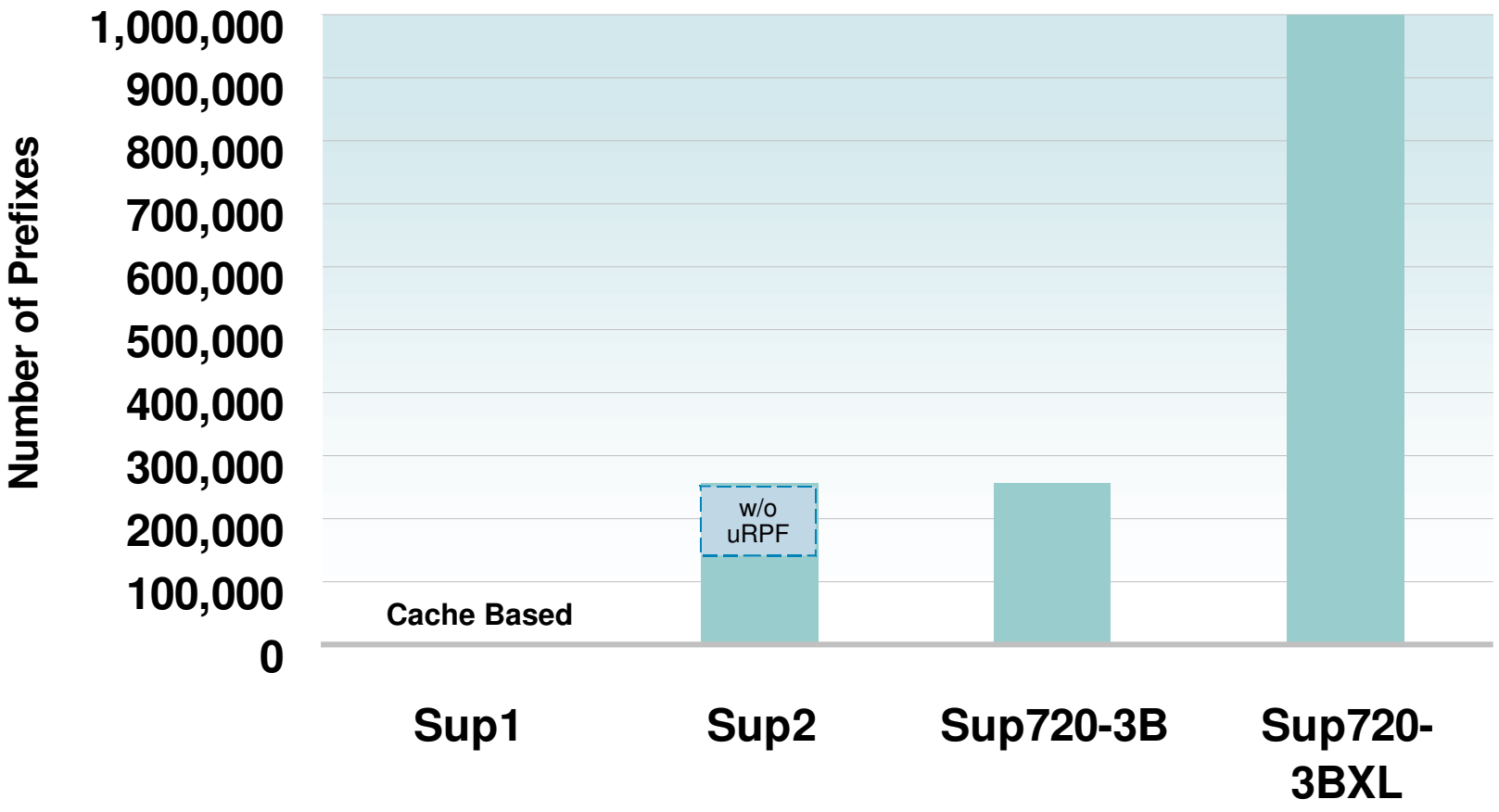
Separate Hardware Devices for L2, FIB, ACLs, Netflow Tables



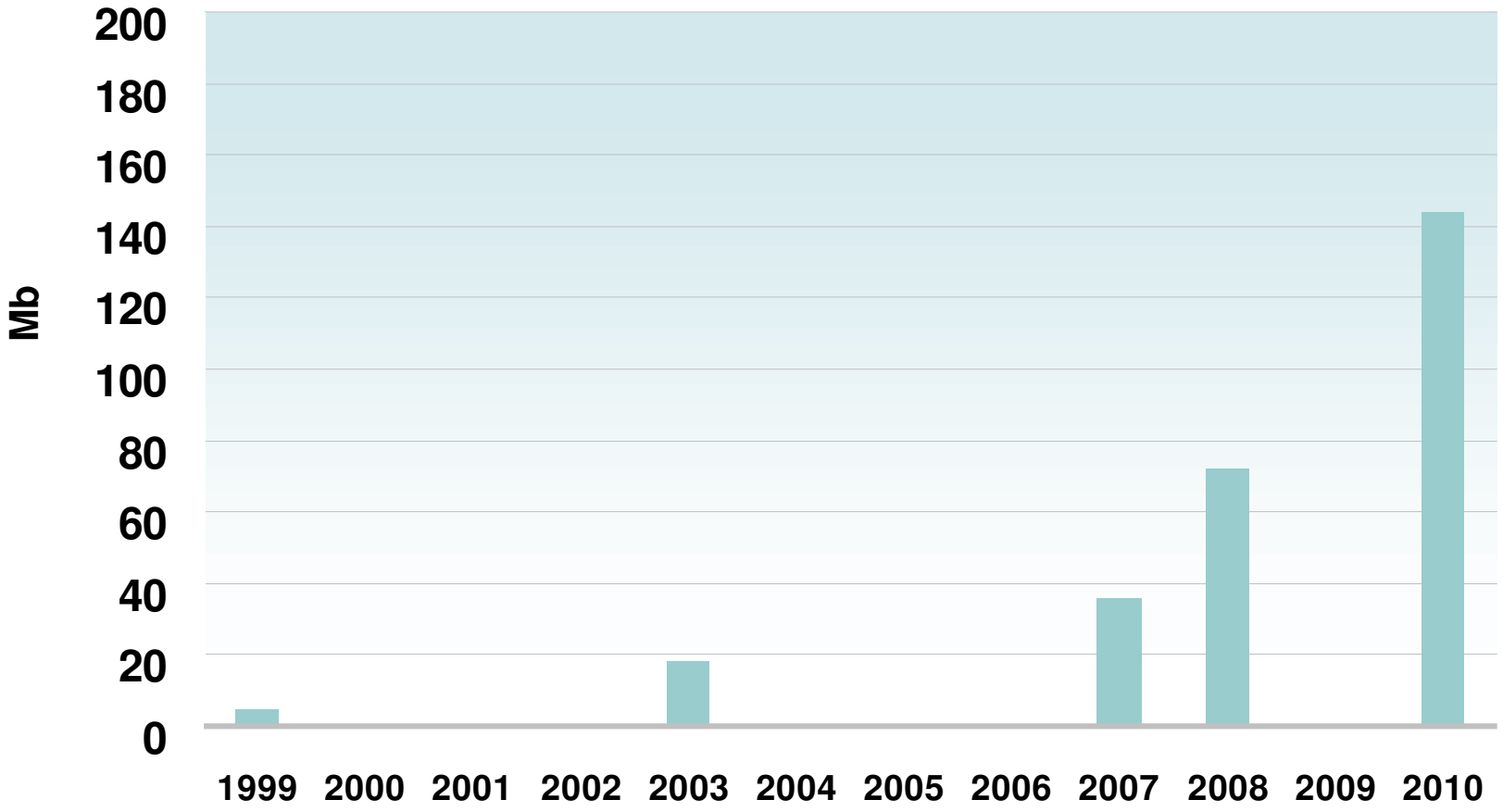
Protocol Entry Types in the FIB TCAM

	IPv4 DA	IPv4 SA	IPv4 mcast	IPv6	IPv6 mcast	VPN	MPLS	EoM
Sup2	Yes	Yes (Separate Entry)	Yes (Dual Entry)	No	No	No	No	No
Sup720-3B	Yes	Yes (Combined Entry)	Yes (Dual Entry)	Yes (Dual Entry)	Yes (Dual Entry)	Yes	Yes	Yes
Sup720-3BXL	Yes	Yes (Combined Entry)	Yes (Dual Entry)	Yes (Dual Entry)	Yes (Dual Entry)	Yes	Yes	Yes

Catalyst 6500 IPv4 Prefix Capacity in H/W



Industry TCAM Device Density Growth



Hardware FIB Maximum-routes Configuration

- **Sup720-3BXL Defaults (Configurable)**

```
sudesilv-c6k#sh mls cef maximum-routes
FIB TCAM maximum routes :
=======================
Current :-
-------
 IPv4 + MPLS         - 512k (default)
 IPv6 + IP Multicast - 256k (default)
```

- **Sup720-3B Defaults (Configurable – IPv4 up to 239K)**

```
sudesilv-c6k-lite#sh mls cef maximum-routes
FIB TCAM maximum routes :
=======================
Current :-
-------
 IPv4 + MPLS         - 192k (default)
 IPv6 + IP Multicast - 32k (default)
```

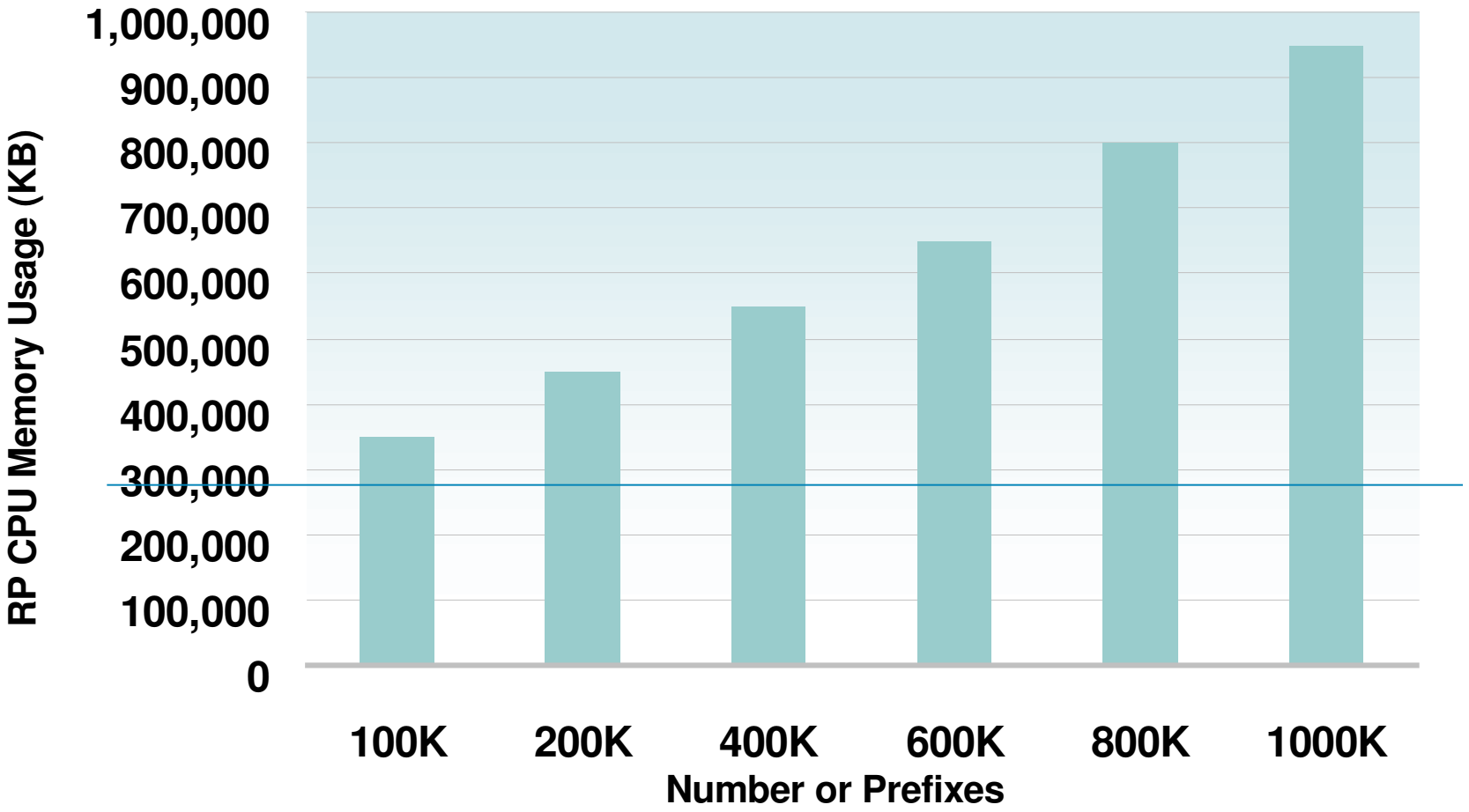
- **Considerations:**
  - **local routes, multicast routes, vpn routes are doubled**
  - **Increasing IPv4 allocation reduces IPv6/Multicast allocation**
  - **Requires reboot to enable re-configuration**

Hardware FIB Capacity Monitoring

- **Monitor Usage**

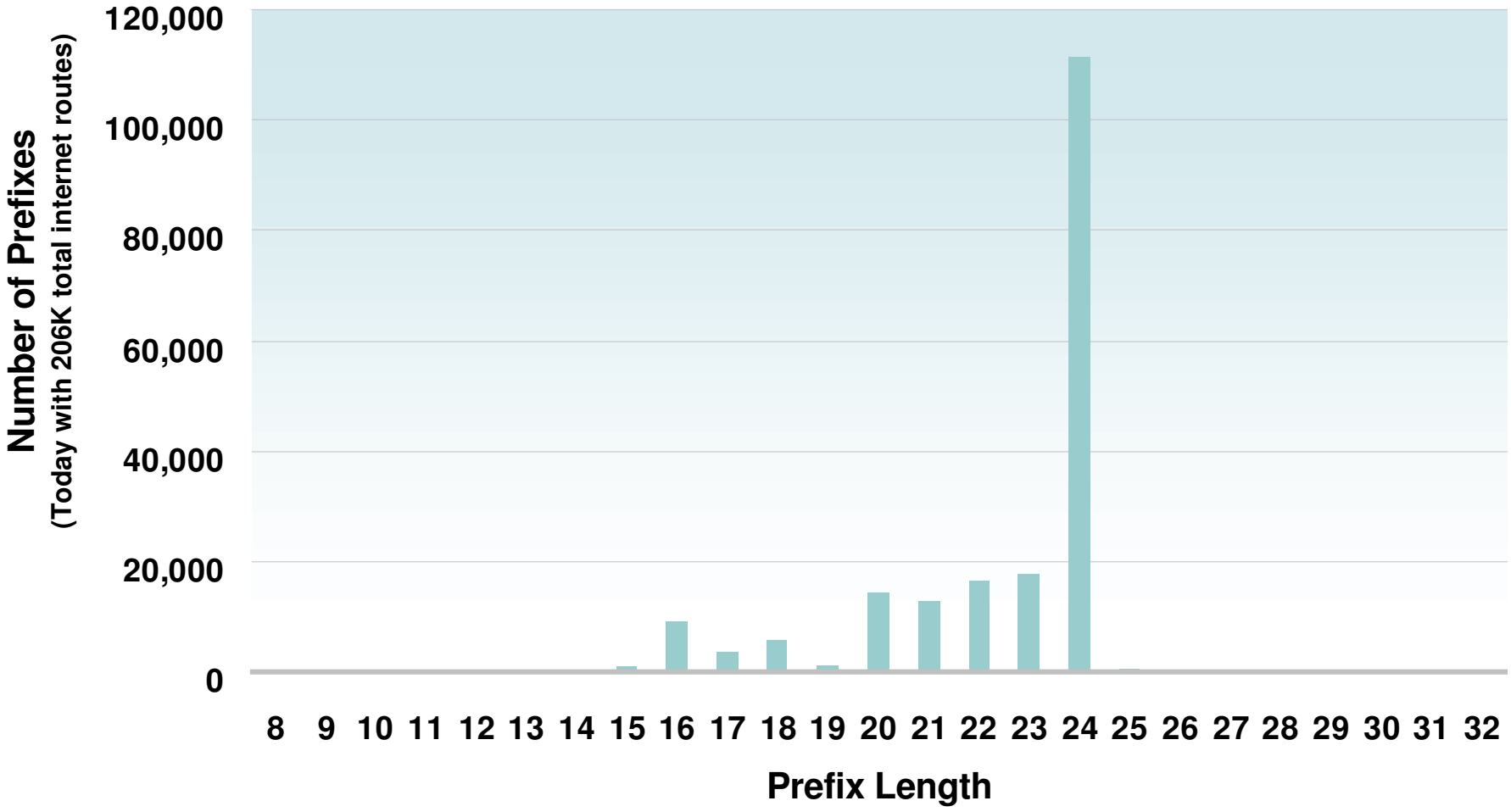
```
sudesilv-c6k-lite#sh platform hardware capacity | begin L3 Forwarding Resources
L3 Forwarding Resources
  FIB TCAM usage:                  Total       Used      %Used
    72 bits (IPv4, MPLS, EoM)     245760         35         1%
    144 bits (IP mcast, IPv6)       8192          6         1%

  detail:    Protocol                          Used      %Used
             IPv4                                35         1%
             MPLS                                 0         0%
             EoM                                  0         0%

             IPv6                                 0         0%
             IPv4 mcast                           3         1%
             IPv6 mcast                           3         1%

  Adjacency usage:                 Total       Used      %Used
                                1048576        172         1%

Forwarding engine load:
  Module   pps   peak-pps                        peak-time
  5         11         12   07:19:03 UTC Wed Jan 31 2007
```

RP CPU RAM Usage (w/ all /24 prefixes)



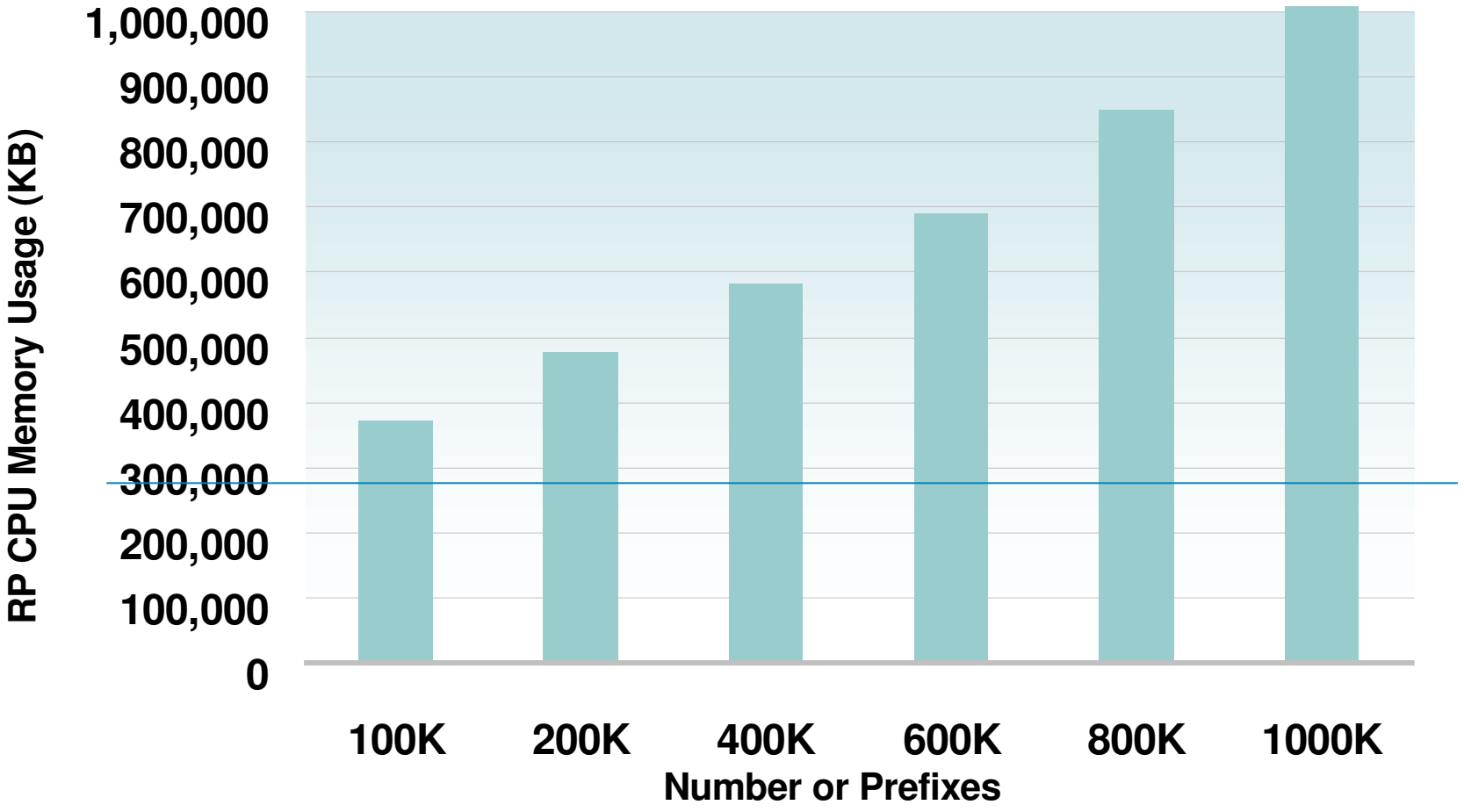
(Taken under a specific configuration, using 12.2.18-SXF images, for purposes of showing increasing memory usage)

Internet Route Prefix Length Distribution



[Source: http://bgp.potaroo.net/index-bgp.html]

RP CPU RAM Usage (w/ internet prefix distribution)



(Taken under a specific configuration, using 12.2.18-SXF images, for purposes of showing increasing memory usage)

Summary

- For catalyst 6500 switches running full Internet Routes, consider upgrading PFCs from sup720-3B to sup720-3BXL
  - extrapolation of current internet route growth trends suggest by mid-2007
- If running distributed forwarding, consider upgrading DFCs from DFC-3B to DFC-3BXL (same image)
- Sup720-3BXL and DFC-3BXL each come standard with 1GB CPU memory
- Use show ‘sh platform hardware capacity | begin L3 Forwarding Resources’ to monitor FIB capacity
- Use ‘mls cef maximum-routes …’ configuration to change defaults as required

What is the Catalyst 6500 FIB TCAM

- One hardware table accessed by the hardware forwarding engine ASIC
- Containing prefixes for hardware L3 multi-protocol forwarding
- Populated as entries with associated masks ordered as longest-prefix first
- Allowing fixed low-latency lookup independent of number of entries
- In a distributed forwarding (DFC-enabled) system, each hardware forwarding engine locally accesses it's own FIB TCAM
- L2, ACLs and Netflow have separate dedicated hardware tables. Catalyst 6500 does not combined all into one shared hardware table