

# Active Network Commercialization

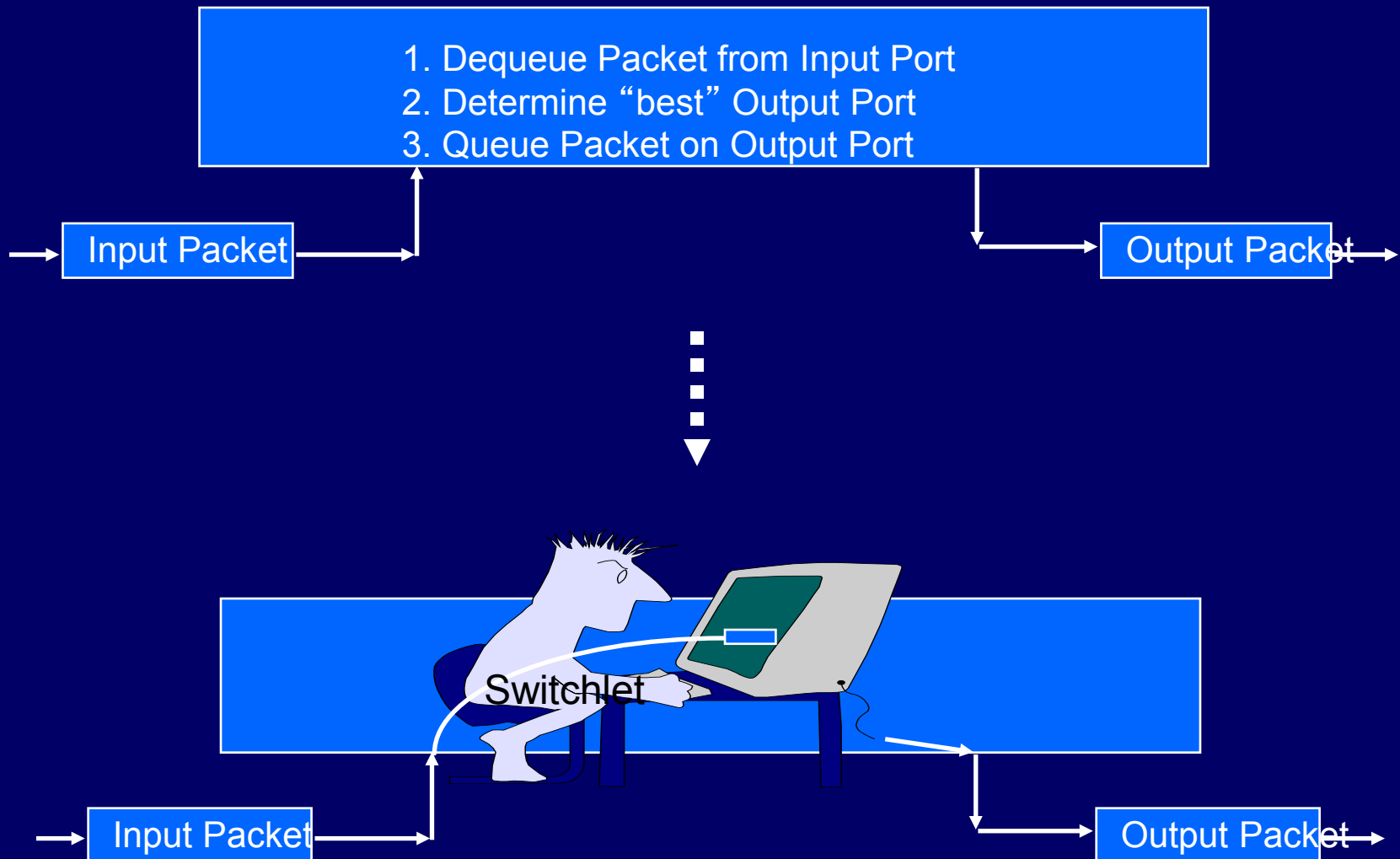
Oki Electric, Ltd.  
October 19th, 2000

**Jonathan M. Smith**

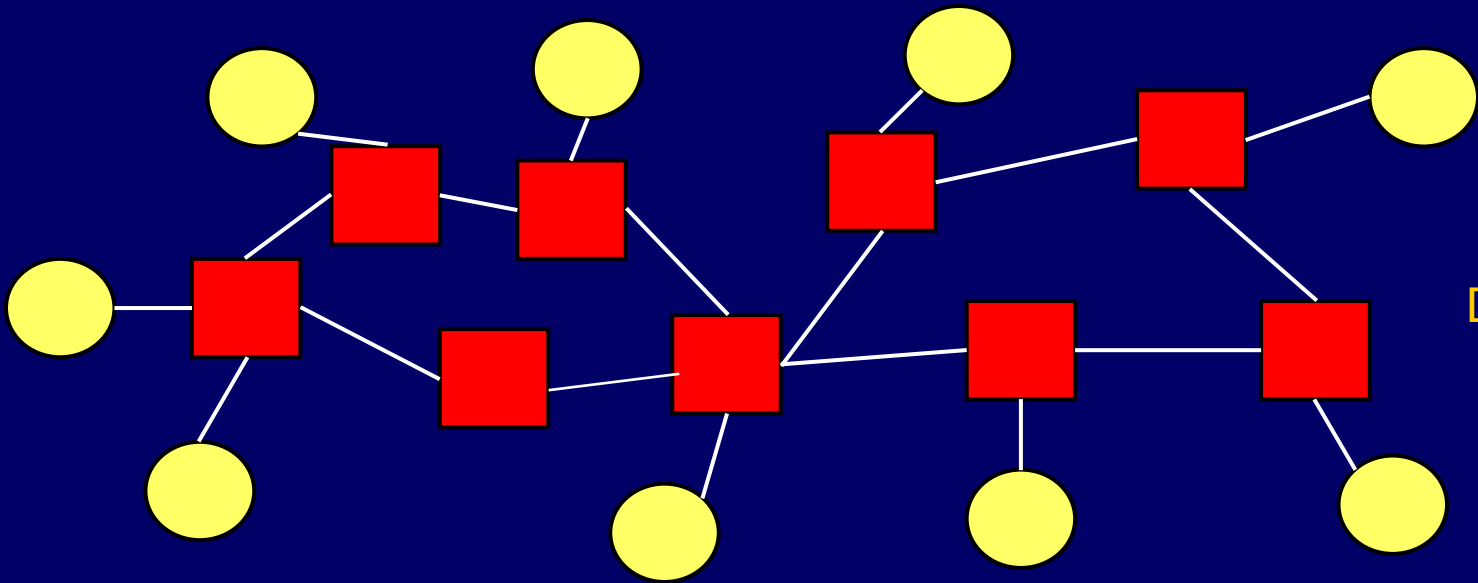
**University of Pennsylvania**

**<http://www.cis.upenn.edu/~jms>**

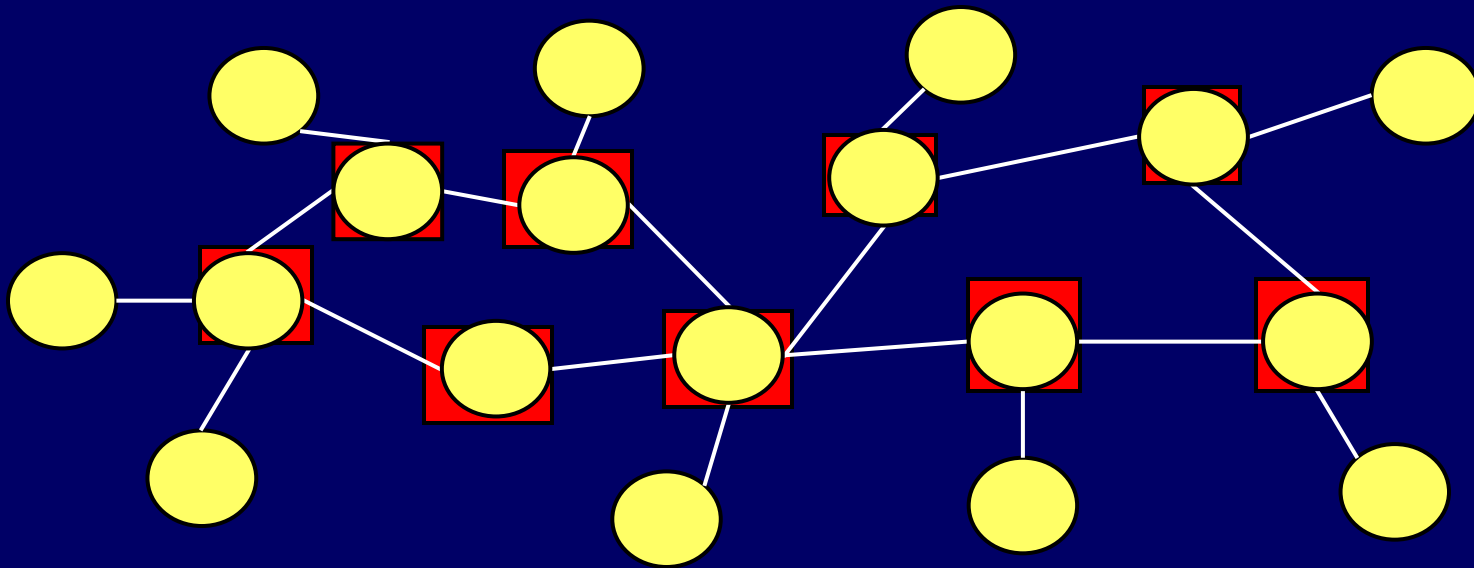
# From Store-and-Forward



To *Store-Compute-and-Forward!*

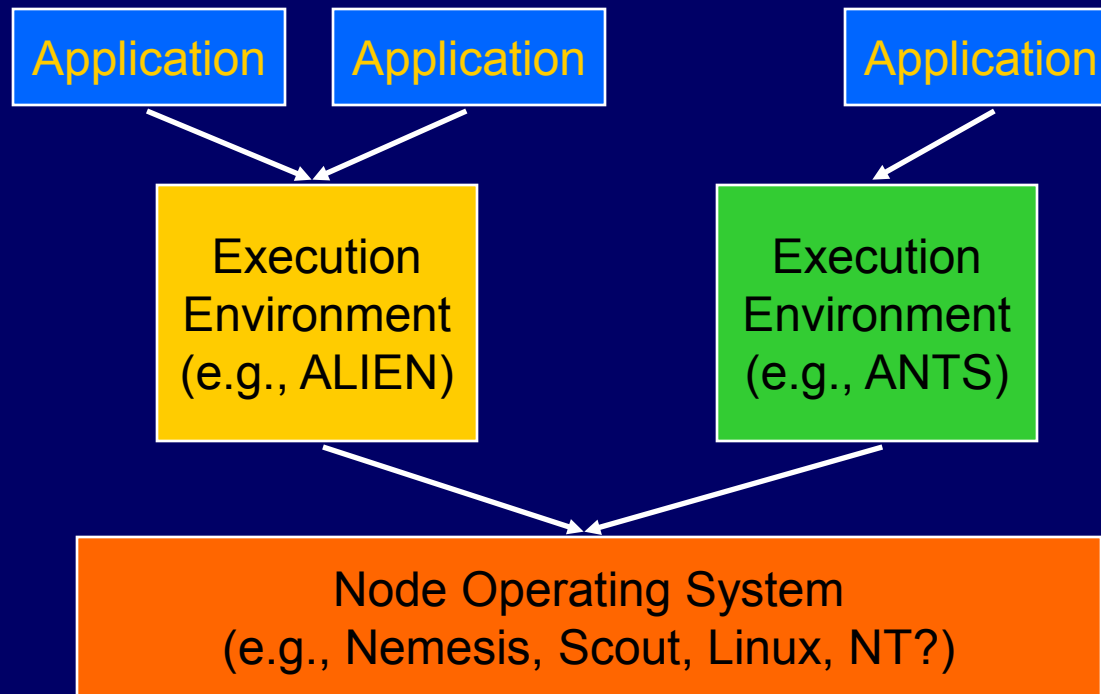


Smart Hosts  
+  
Dumb Switches  
=  
Passive Nets



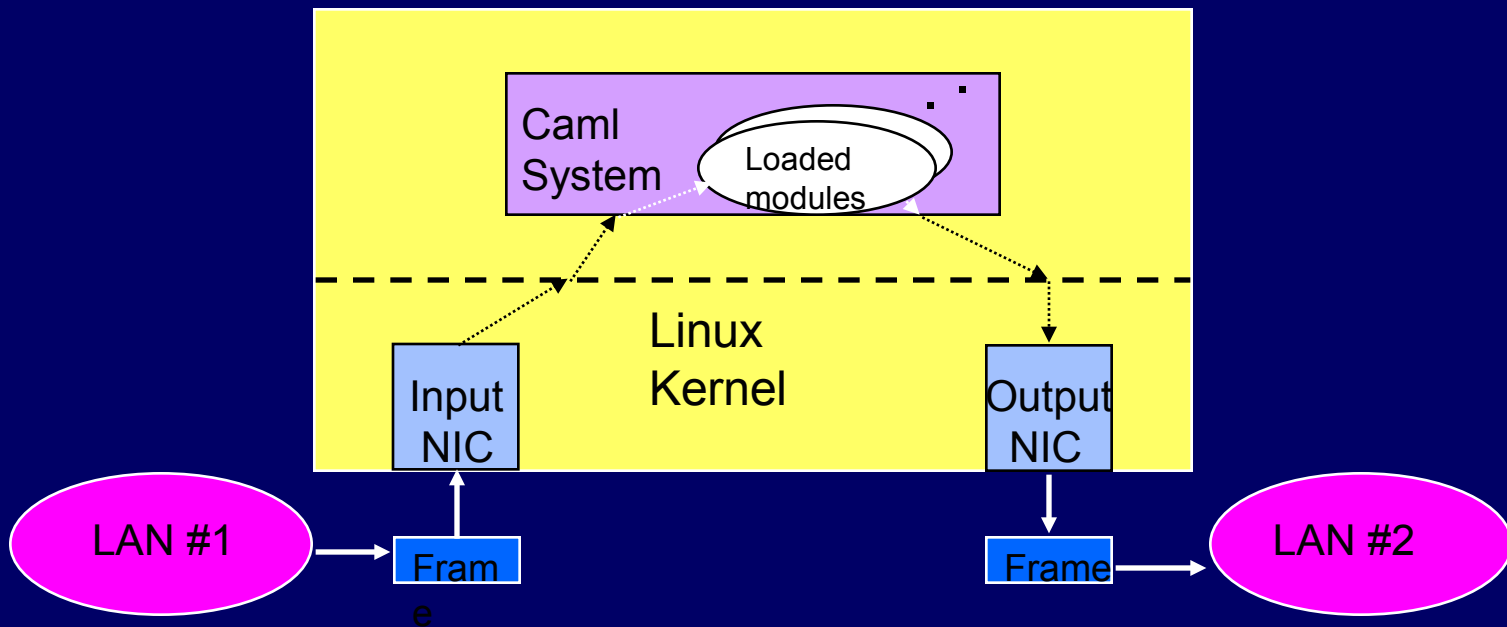
Smart Hosts  
+  
Smart Switches  
=  
Active Nets

# Active Network Architecture

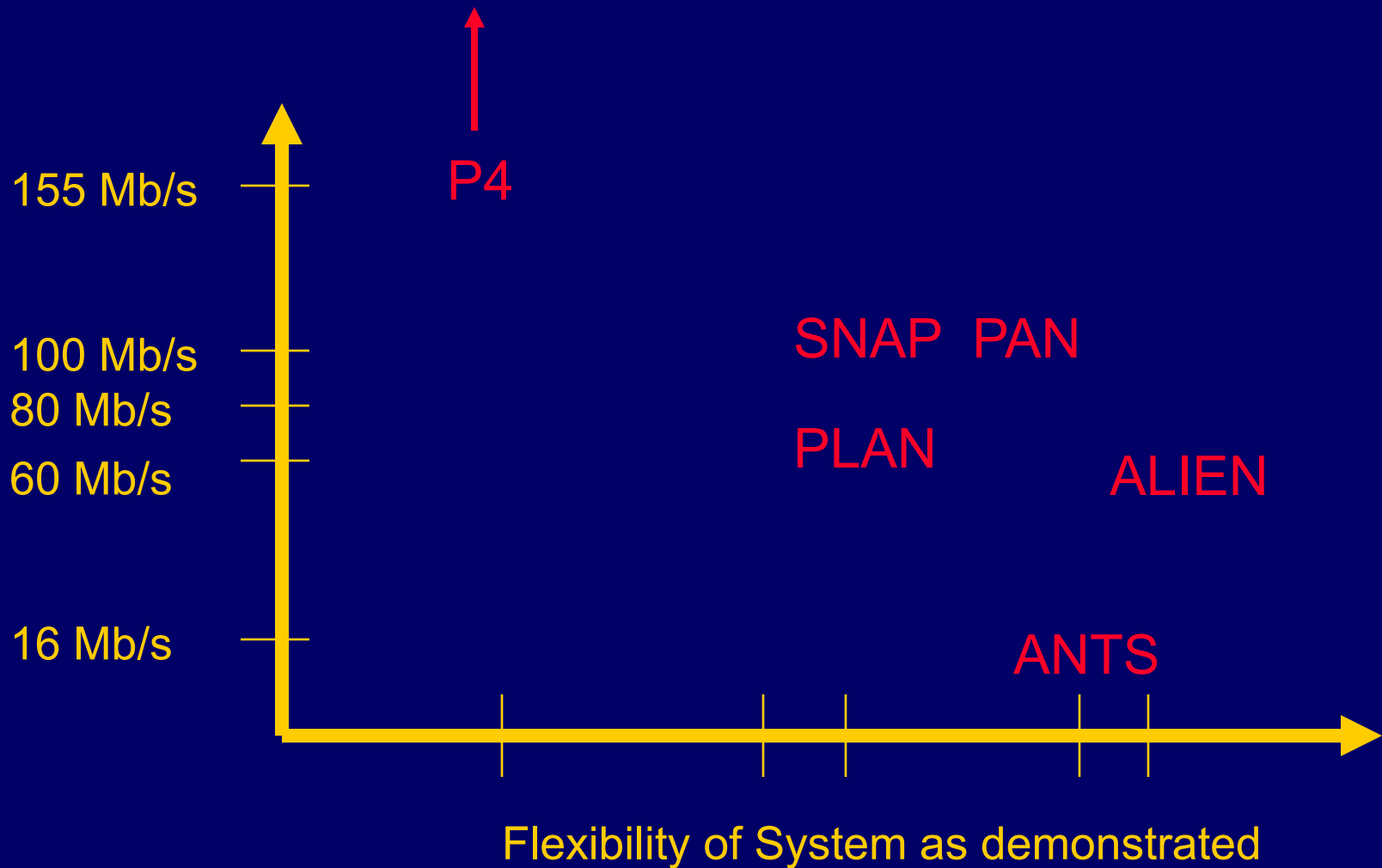


# Example Software:

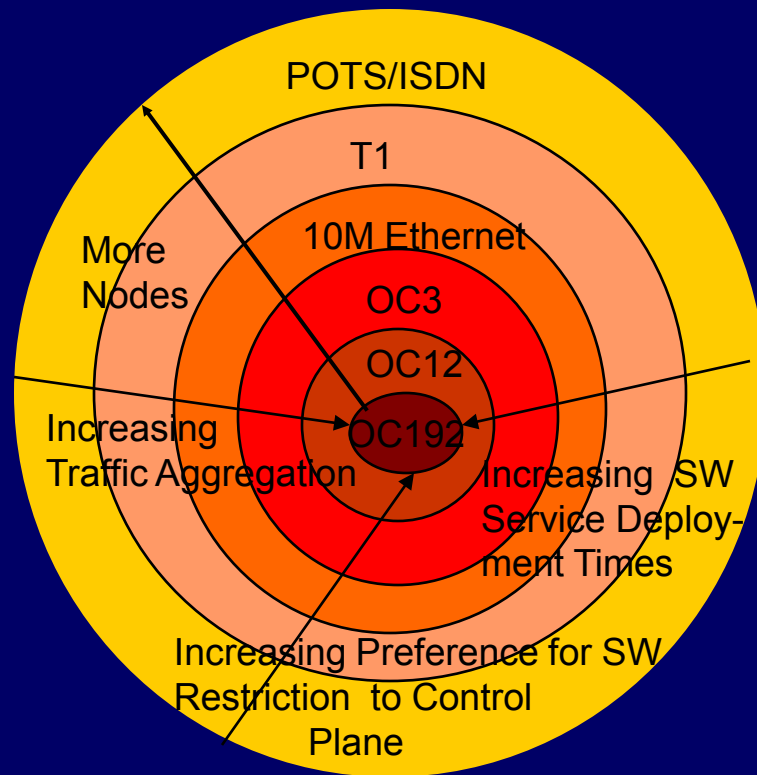
## □ Active Bridging



# Perf. Vs. Flexibility Tradeoffs



# Activation potential at various commercially deployed rates:



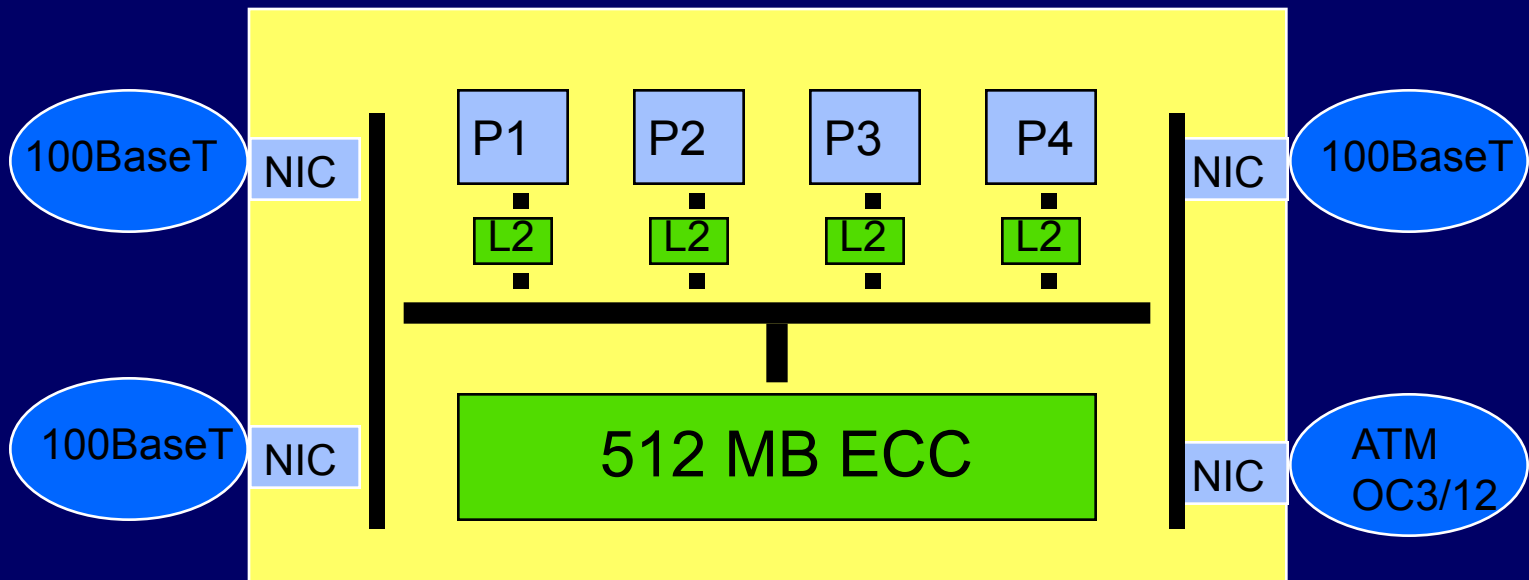
# Performance Options

- Special-purpose Node hardware + EE
- Optimized Execution Environments
- No activity in forwarding path :-)
- Not all nodes active (e.g., ARC)
- Architectural techniques such as code caching
- Hardware used as accelerator (e.g., P4)



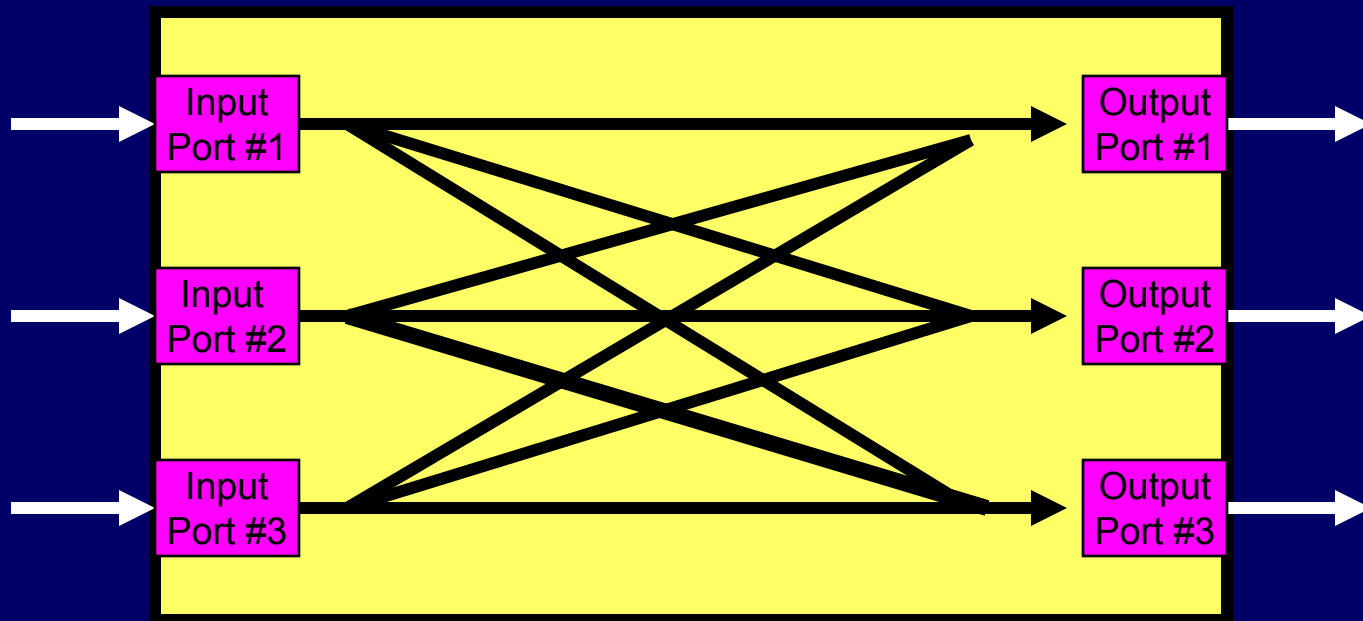
# AN node architecture: multi-NP

□ Control or forwarding. Bus unrealistic



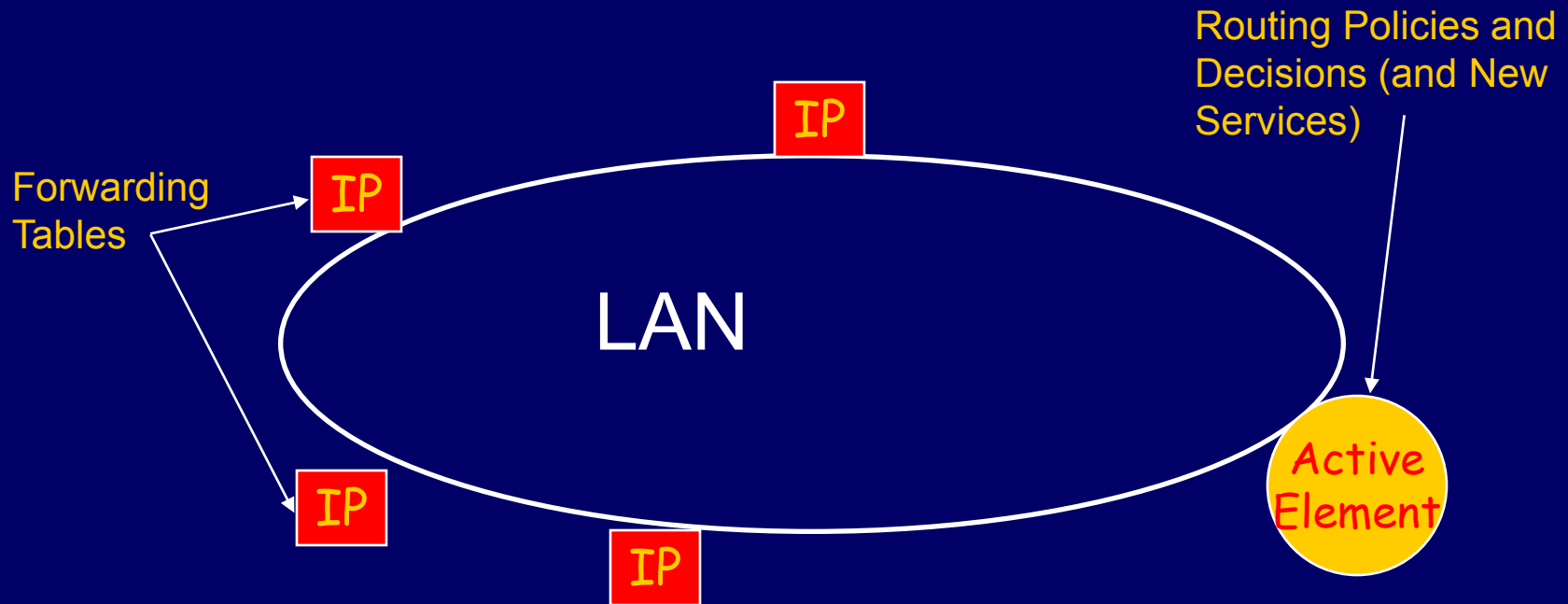
# A.N. Switch Architecture

□ Active Port Controllers, e.g., IXP1200

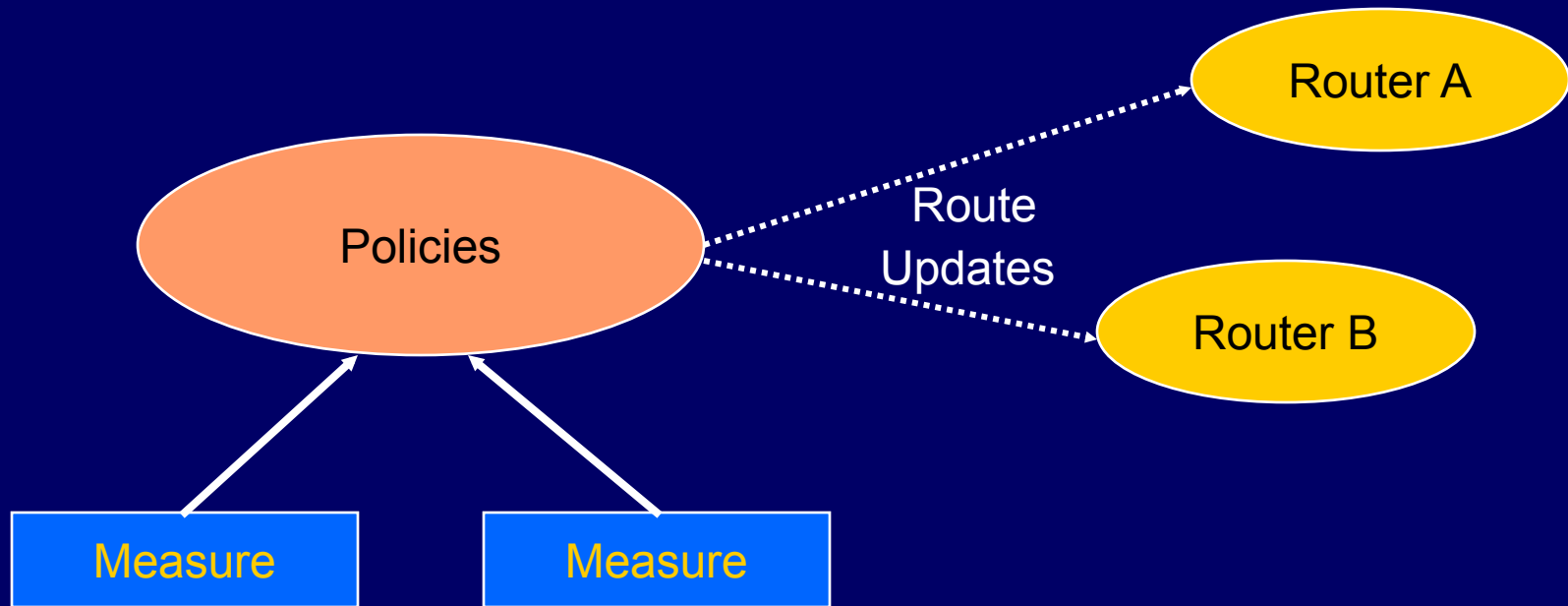


# Active Router Control: a hybrid

□ IP Router/Forwarders co-located with Active Elements:

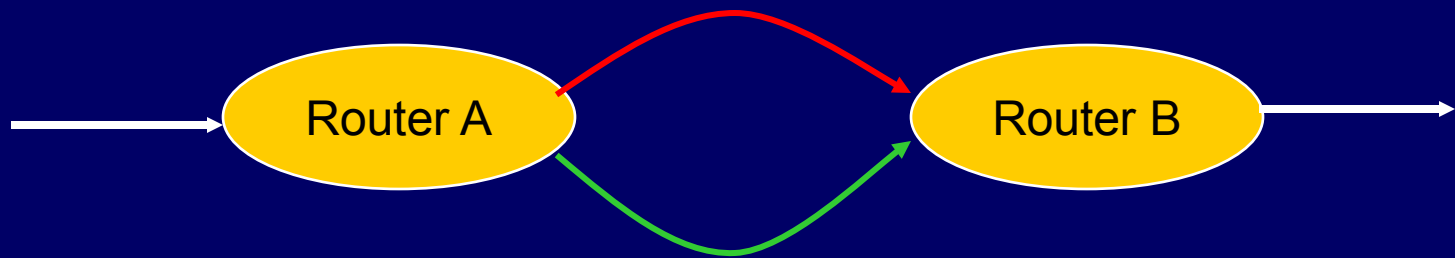


# ARC: Internet Control Plane



## The Basic Opportunity:

Internet routing does not utilize the available network topology unless manually configured:



Goal: Resource Discovery and Exploitation!

# The Commercial Landscape, I

## □ Control Plane Solutions

→ Cambridge switchlets: [www.cplane.com](http://www.cplane.com)

→ Columbia xbind: [www.xbind.com](http://www.xbind.com)

→ JVM on switch: several manufacturers

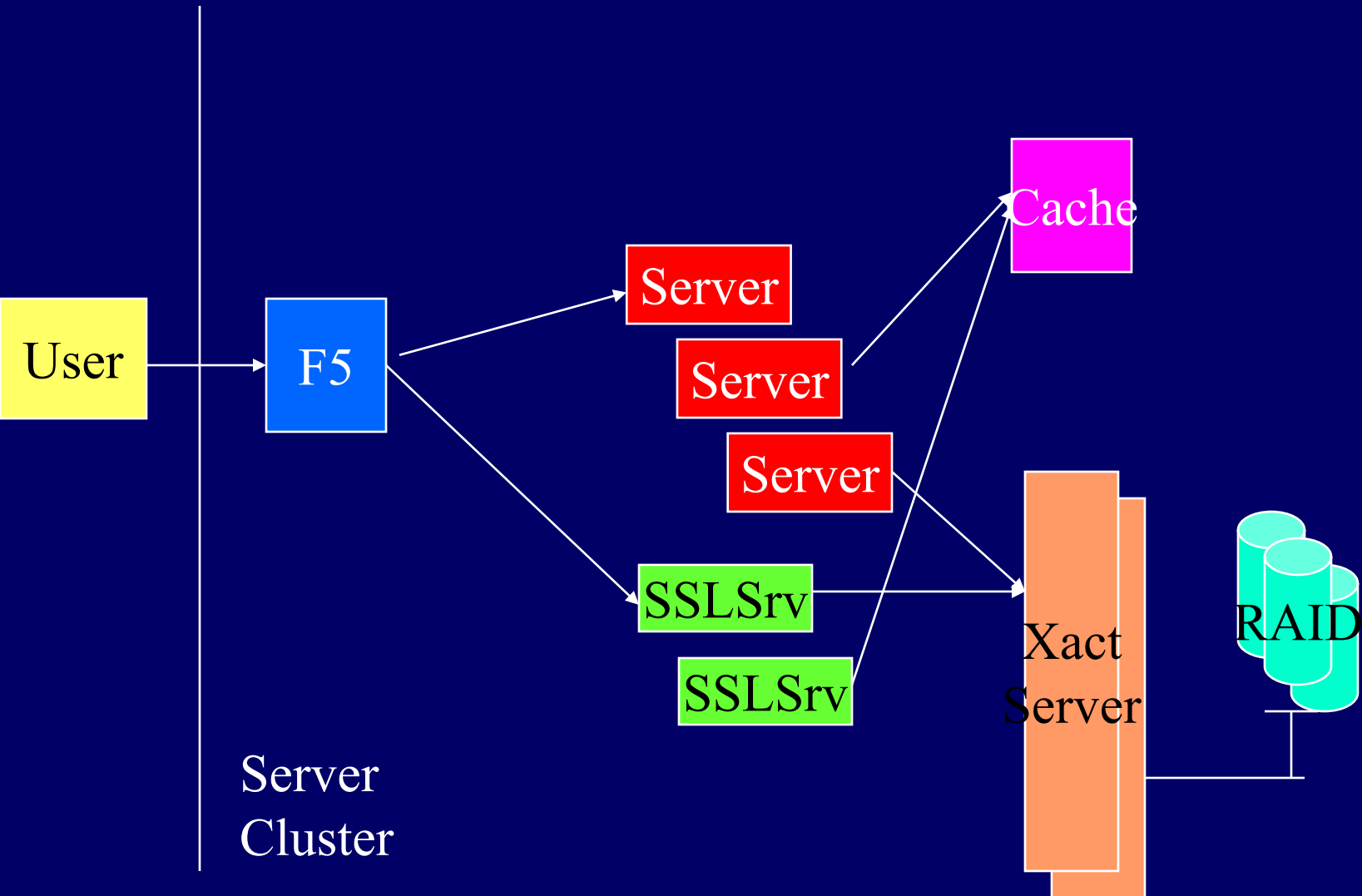
→ Linux available on (some) Cisco routers

## □ Active Functions

→ Packet Marking: [www.astanetworks.com](http://www.astanetworks.com)

→ Load balancing: F5 BIG IP, Cisco Distributed Director, etc. (deployed)

# Making a “router in a room”:



# The Commercial Landscape, II

## Active Router

→ Nortel Accelar 1100B

## Network Processors

→ Intel IXP1200 (netboost), IBM NP

→ Companies building nodes based on NPs

## Other possibilities

→ Dynamically programmable web services

→ E.g., Apache web interface to interpreter



# Future of AN: Human needs

- We can probably handle 50 Mbps input
- Is that all we need? No!
- Want to find best of 10,000,000 video streams occurring simultaneously
  - finding
  - selecting
  - focus
- Network as Information Appliance!

# Netwide Sense Data Selection

- Nets and computers improving exponentially. Humans not.
- Active nodes contain “delegates”
  - select information (watching a million cameras..... )
  - forward towards you for consumption
  - your senses extended into the network

