

Active Networking on the ENIAC 2000

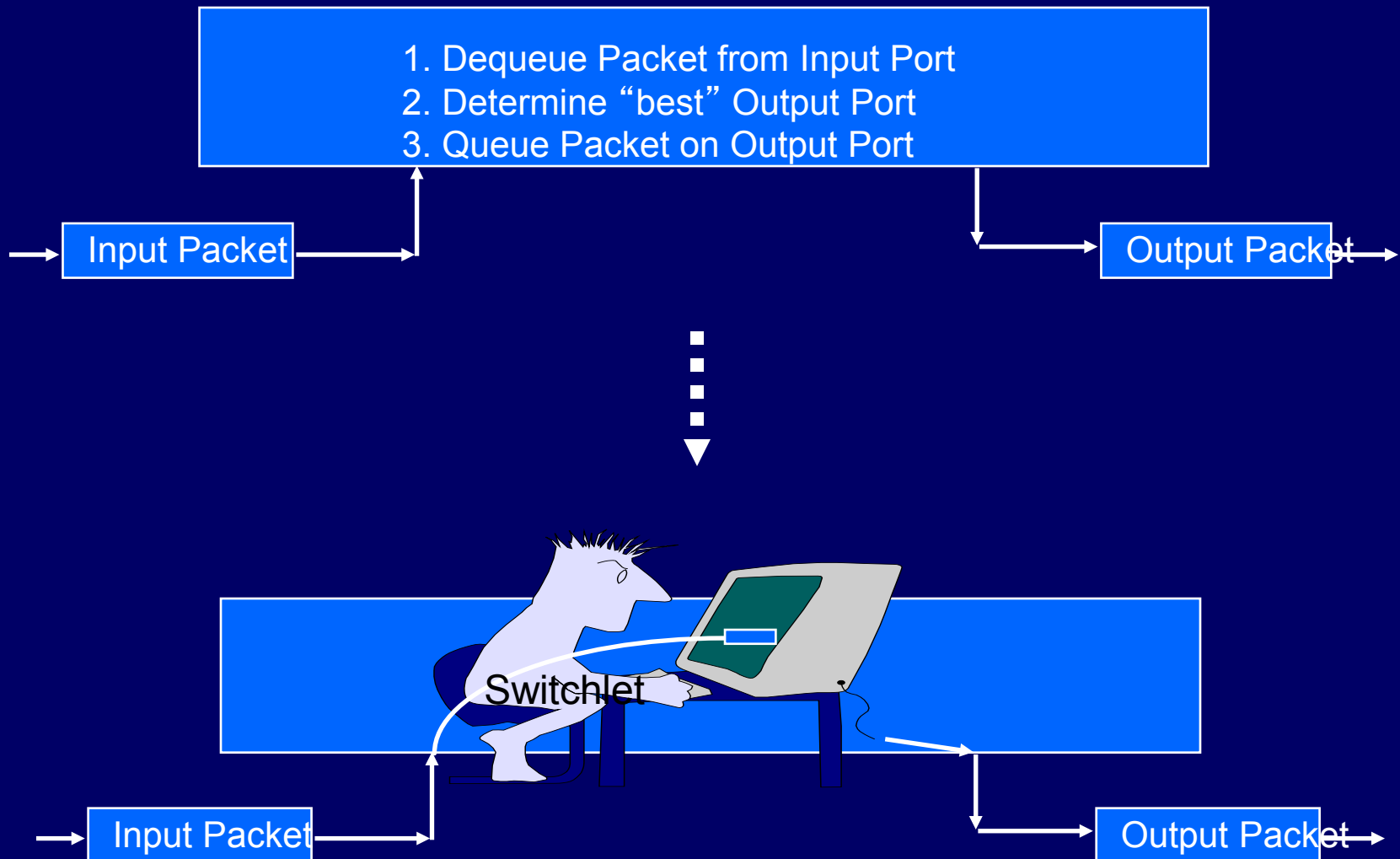
May 3rd, 1999

Jonathan M. Smith, <http://www.cis.upenn.edu/~jms>

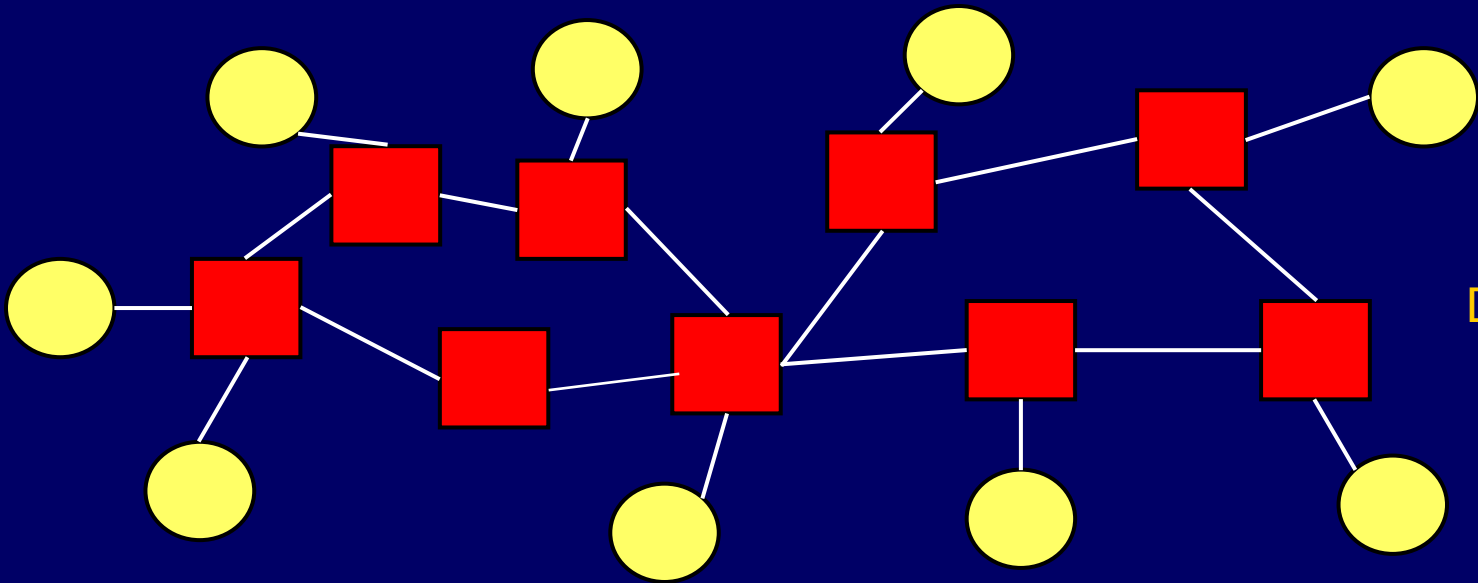
SwitchWare is joint work with Dave Farber, Carl Gunter and Scott Nettles of Penn, and Bill Marcus and Dave Sincoskie of Telcordia. See:

<http://www.cis.upenn.edu/~switchware>

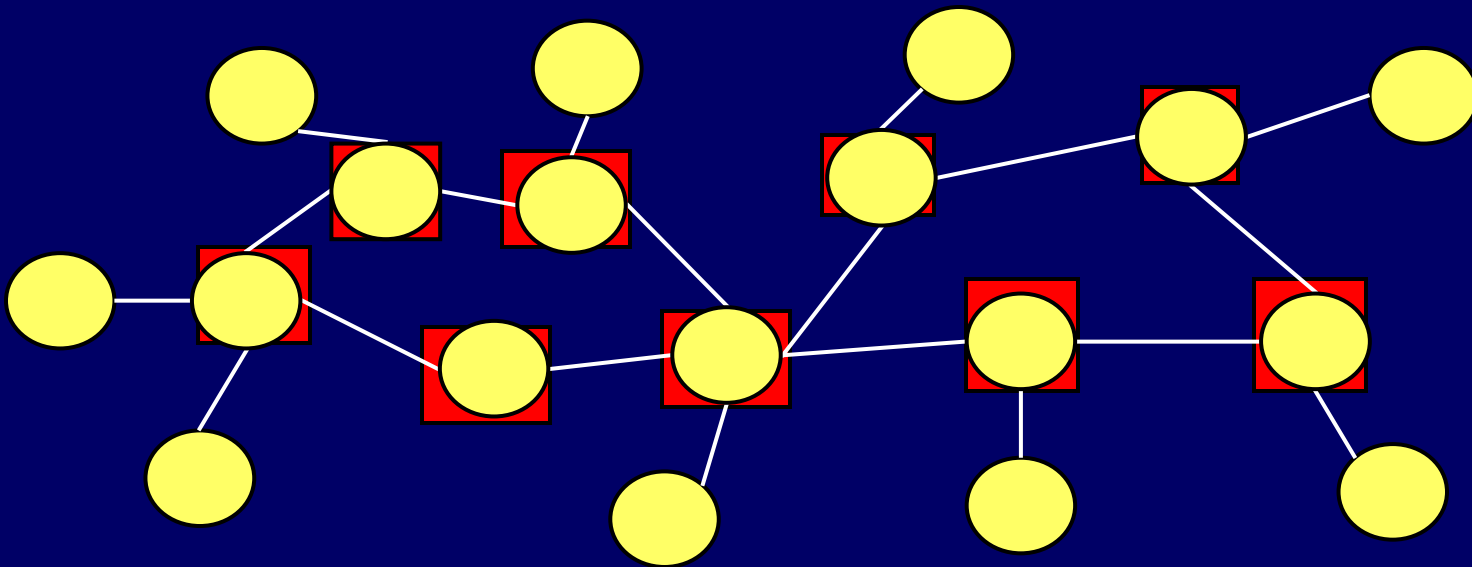
From Store-and-Forward



To Store-Compute-and-Forward!

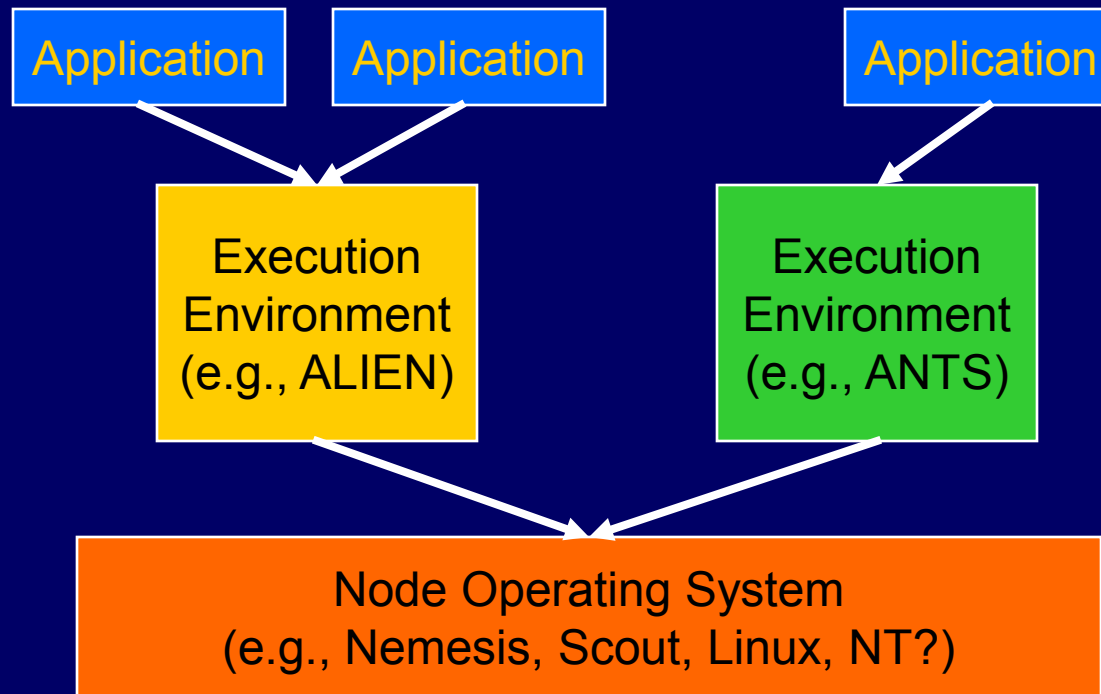


Smart Hosts
+
Dumb Switches
=
Passive Nets

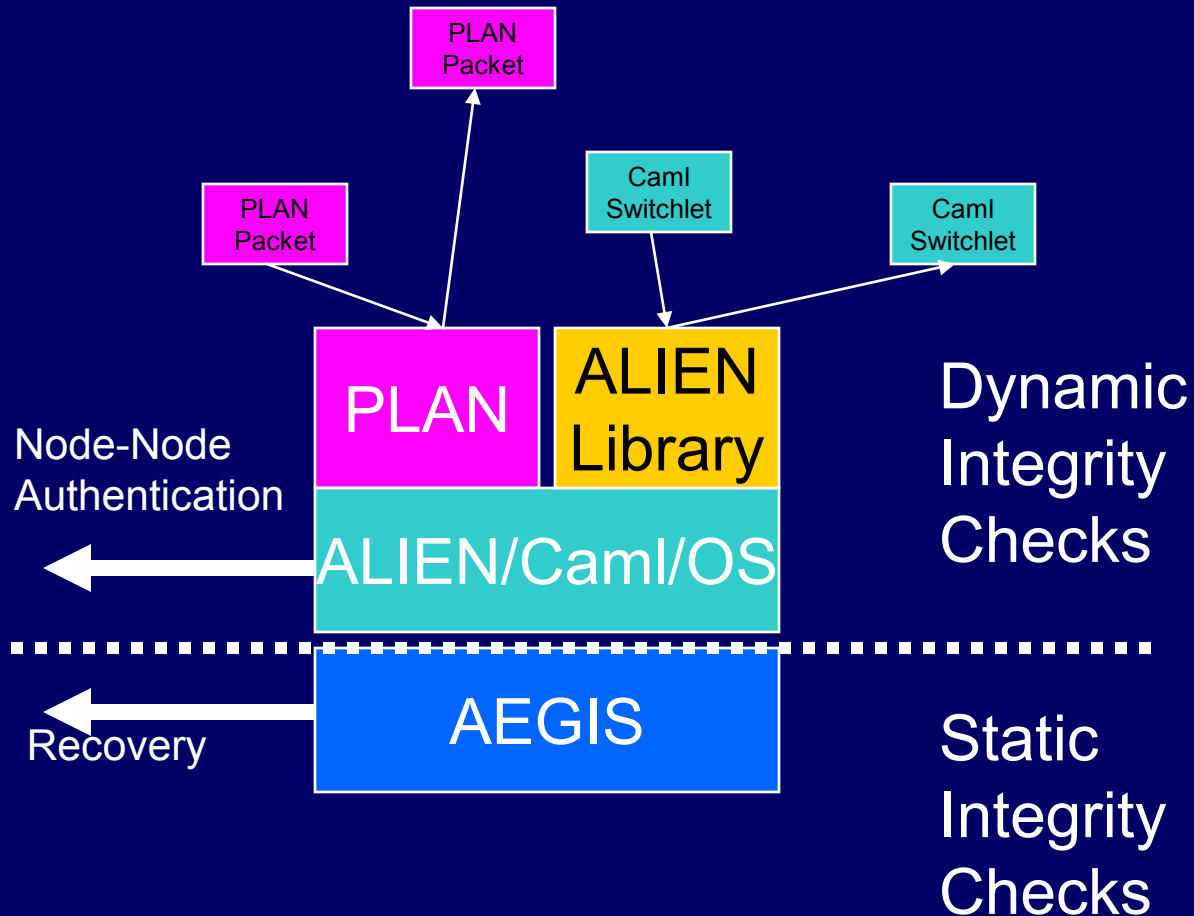


Smart Hosts
+
Smart Switches
=
Active Nets

Active Network Architecture



E.g., the SwitchWare A.N. Architecture



Packet Language for Active Networks (PLAN): Ideas

□ Domain-Specific Language for A.N.

- ▢ Active packets of ML-like code (but restricted for security & performance)

- ▢ Active extensions for restricted tasks (such as link-layer access)

- ▢ “Glue language” to build *active applications* (think of a UNIX shell for A.N.)

□ PLAN internetwork demonstrated

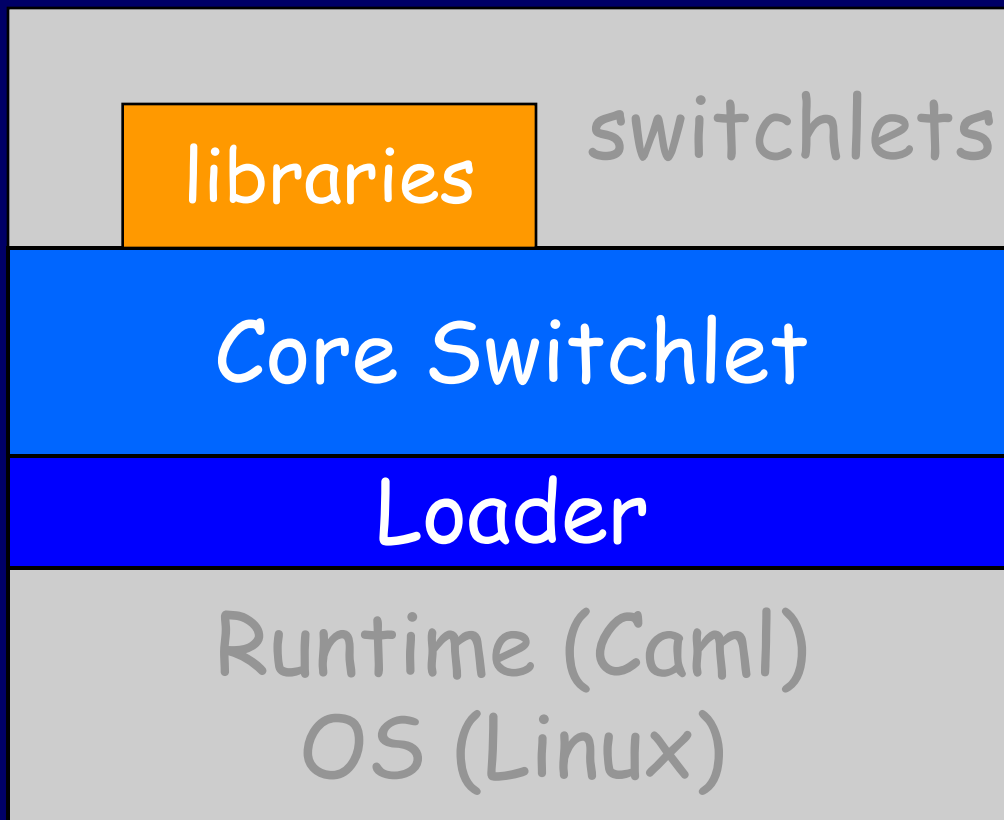
- ▢ Reported in IEEE INFOCOM '99

The ALIEN Active Loader

- Focus on generality and security
 - ▢ module thinning for locally enforced “views”
 - ▢ crypto. Credentials extend to remote case
 - ▢ *active packets* and *active extensions*
 - ▢ all written in Caml with restricted runtime
- Applications to LAN bridging (SIGCOMM '97), secure active ping, ...
- Performance in Alexander Ph.D. (1998)

ALIEN in an Active Element

- Three layer architecture



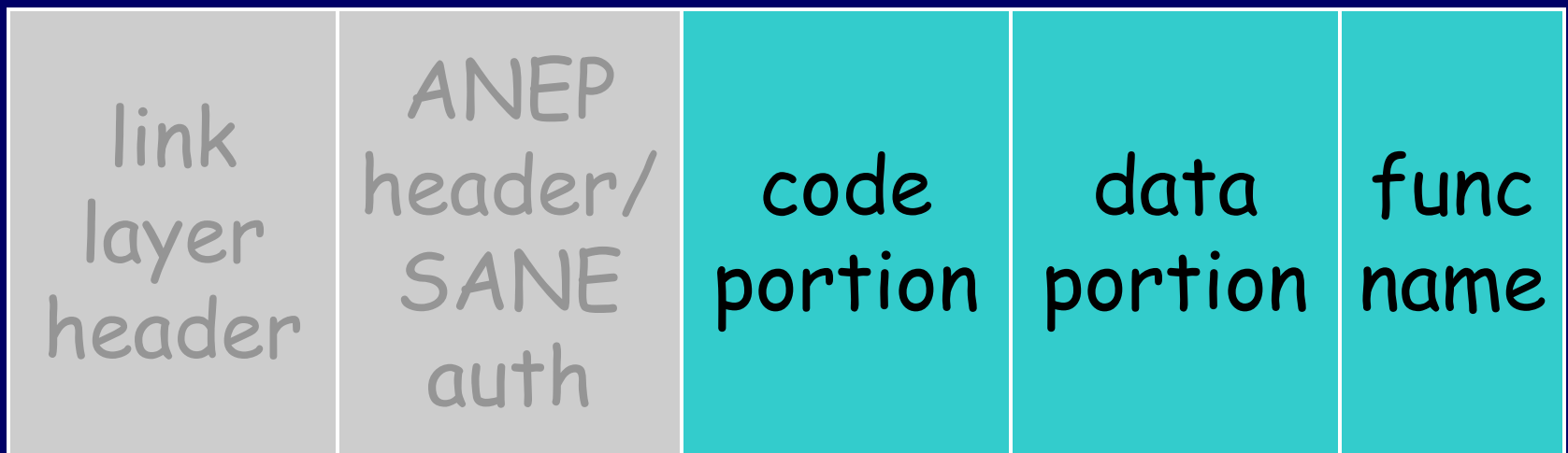
Active Packets in ALIEN

□ If ANEP header indicates ALIEN

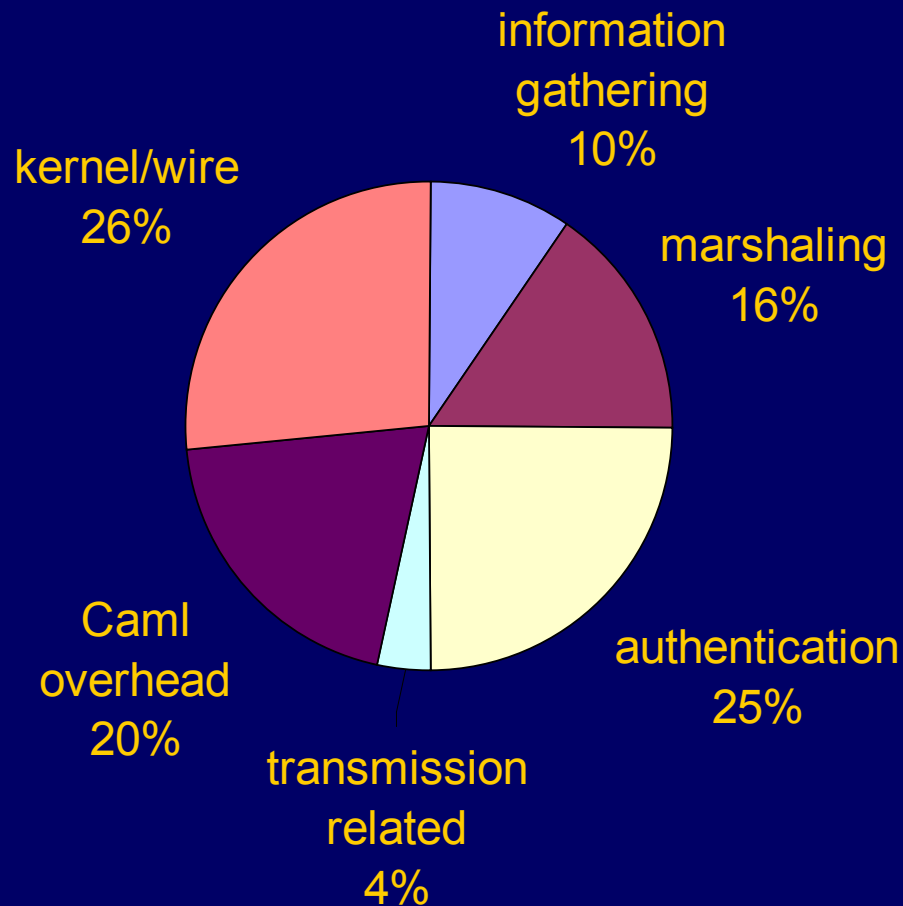
☞ SANE processing as part of ANEP

☞ Code portion is loaded

☞ *func* is called with code, data, and func name as arguments

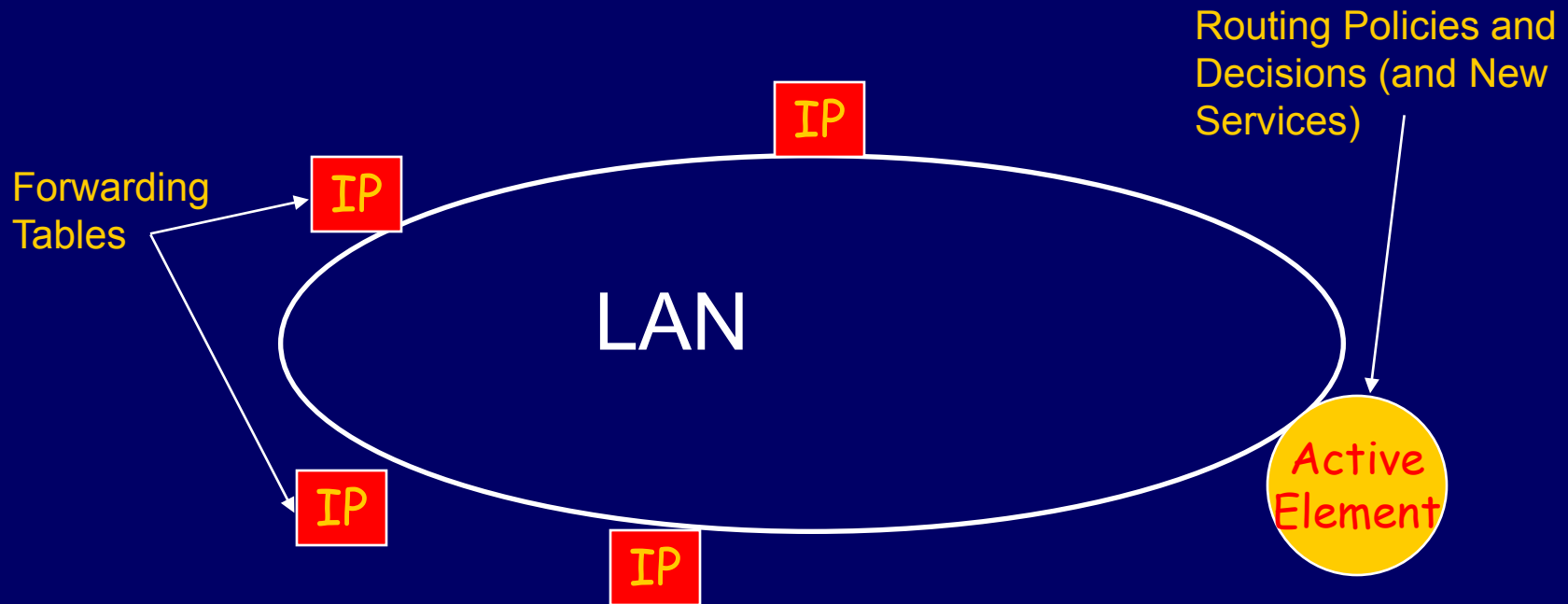


Breakdown of Costs in Alien

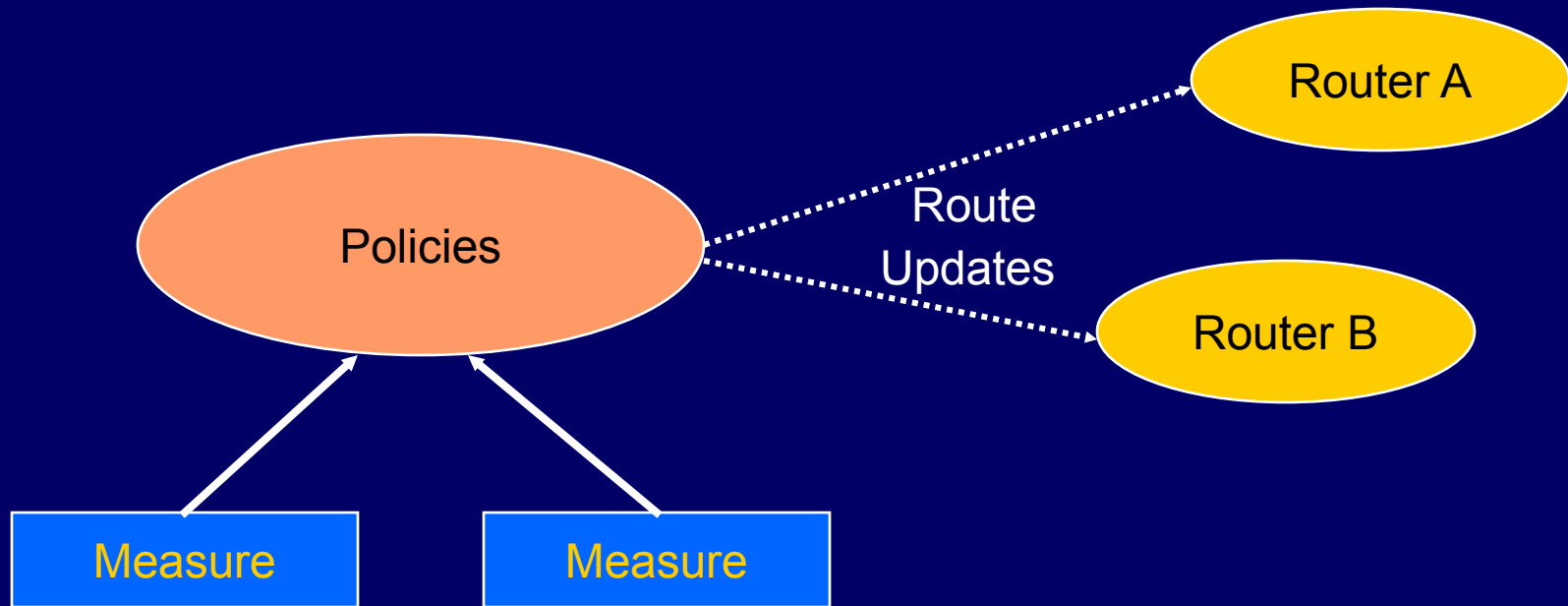


Active Router Control (Active Border Gateways?)

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

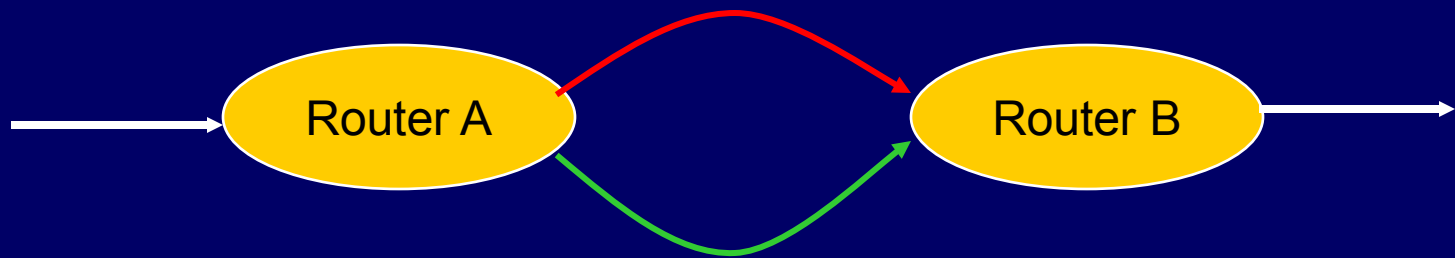


The basic architecture



The Basic Opportunity:

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



Goal: Resource Discovery and Exploitation!