Transparent Network Security Policy Enforcement

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Overview

□ OpenBSD bridge

□ Transparent firewall

□ Layer-2 filtering

□ LAN extension (IPsec bridge)

Other uses...

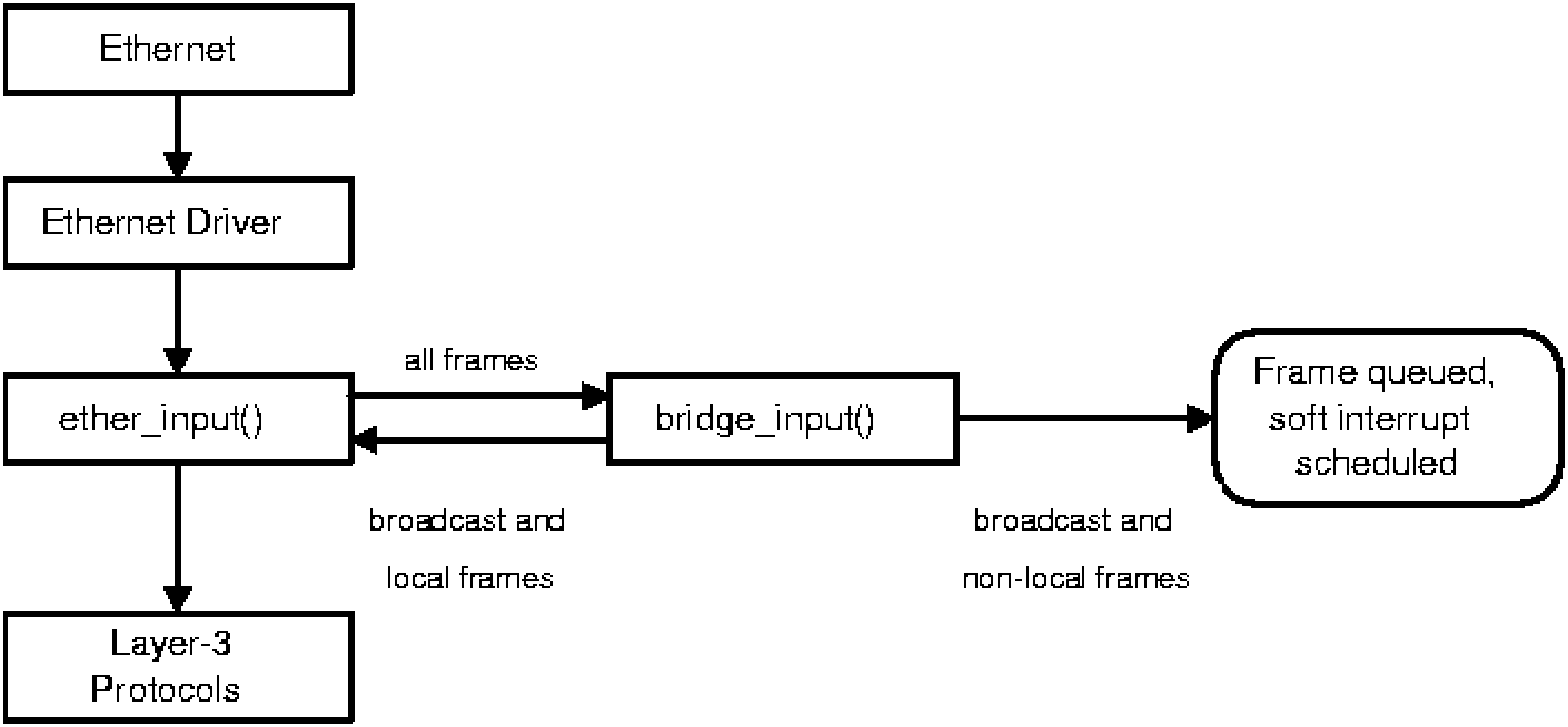
□ Bump-in-the-wire

□ Distributed firewalls

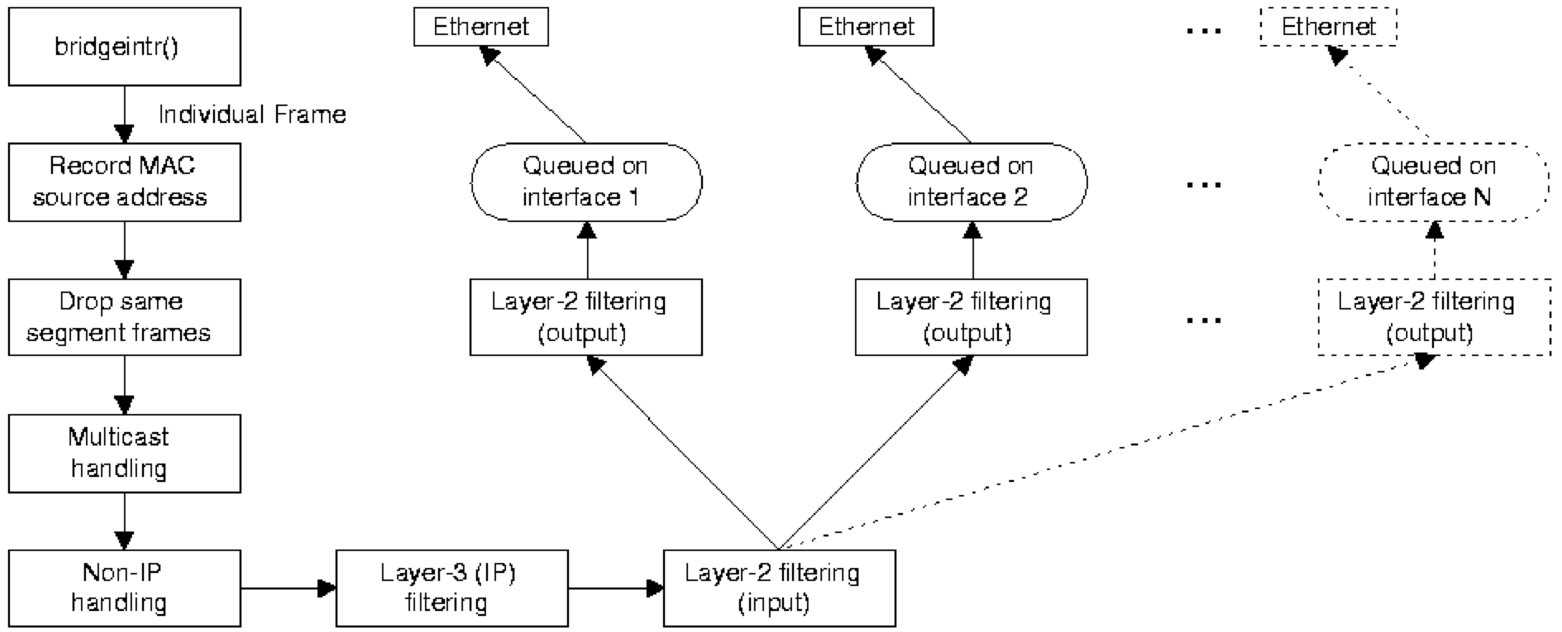
Bridge Implementation

- What is a bridge?
  - Address cache
  - Learning
  - Discovery
- OpenBSD bridge
  - Implemented as a virtual interface
  - Member interfaces as ports
  - Multiple independent bridged networks per host

Input Processing


Ethernet
Ethernet Driver
ether_input()
all frames
bridge_input()
Frame queued, soft interrupt scheduled
broadcast and local frames
broadcast and non-local frames
Layer-3 Protocols

Output Processing



Layer-2 Filtering

□ Prevent ethernet address spoofing

□ Static address cache entries

□ Tunable MAC discovery

□ Tunable MAC address learning

□ Tunable multicast/broadcast handling

□ IPF-like rules for Layer-2 MAC addresses

Layer-3 Filtering

- Uses standard packet filter mechanism (IPF) for Layer-3 filtering
  - Code and knowledge reuse
- Divert frames that pass Layer-2 filters to Layer-3
  - Some packet-cooking necessary
- Frames are forwarded iff they pass both filtering mechanisms

Result: Invisible firewall

Problems this solves

- □ Firewalls themselves can be subject to attack since they are exposed
- □ Sometimes at the wrong layer
- □ Minimizes topology changes
- □ No changes necessary to the protected hosts
- □ "Personal firewalls"
  - ○ Plug-n-play
  - ○ Useful in home-networking

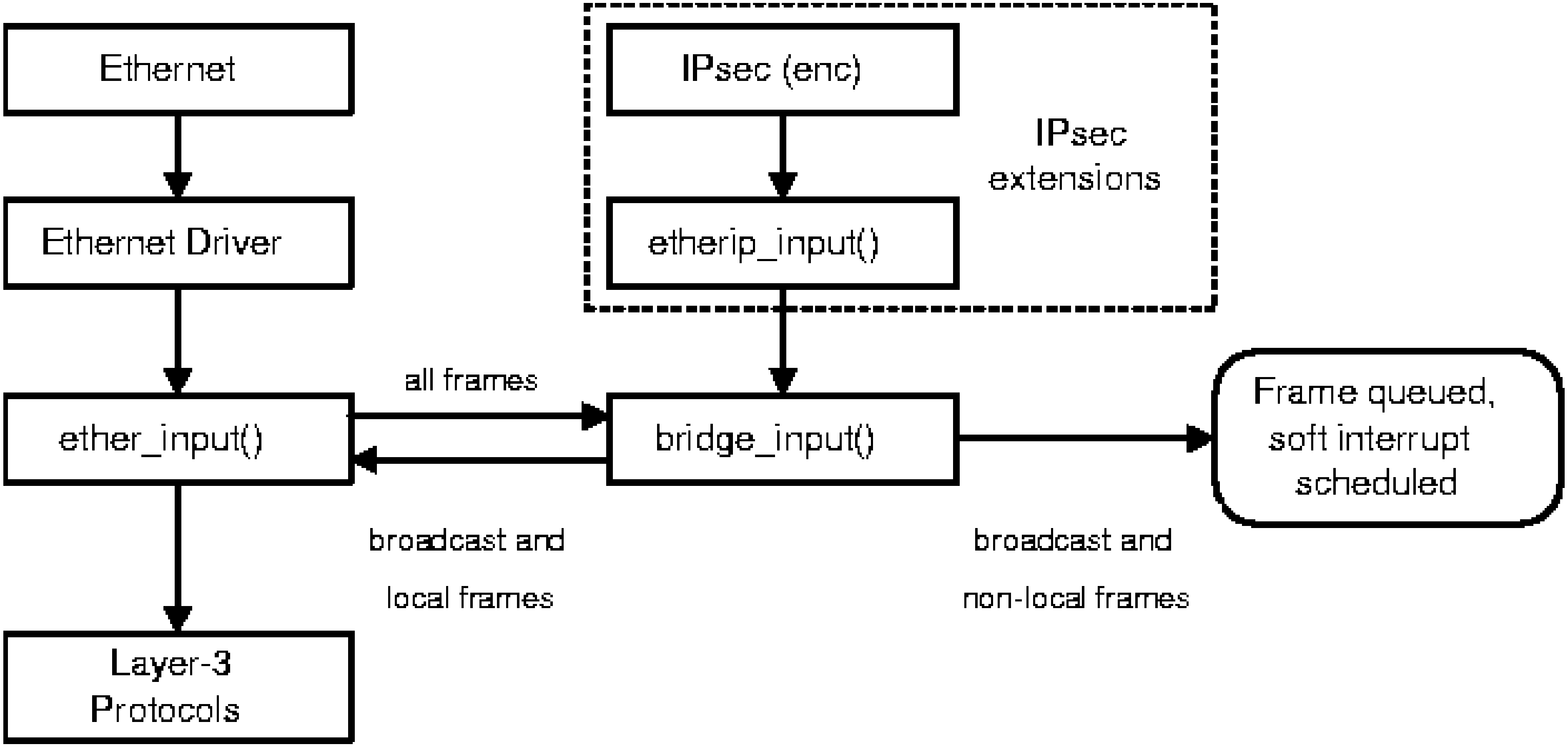
LAN extension

- Extend LAN over WAN
  - Nice for telecommuters
  - No routing/addressing voodoo needed
- Needed pieces
  - Mechanism to capture all frames -- Bridge
  - Encapsulation mechanism -- IPsec

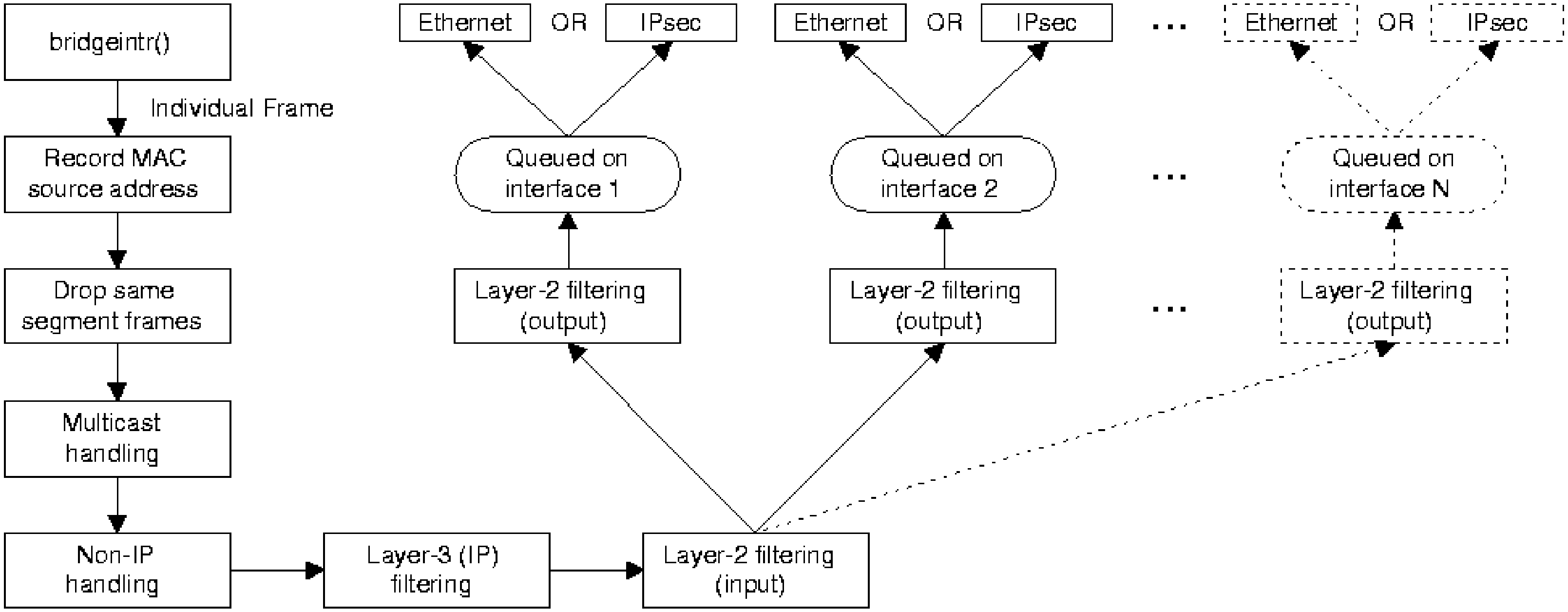
LAN extension implementation

- encapsulation (enc) interface
  - Virtual interface with IPsec Security Association (SA) attached
  - Originally used just for debugging
- Bridge Changes
  - Allow "enc" interfaces as members
  - Changes to allow member interfaces without MAC addresses
- Do Ethernet-in-IP over IPsec

Modified Input Processing



Modified Output Processing



Future/Current Work

- Desirable to have IPsec everywhere
  - Not possible to add to all systems
- Interim solution: bump-in-the-wire
  - Separate box (bridge) does IPsec on behalf of end-host
  - Pretends to be end-host when negotiating SAs
  - isakmpd changes needed

Conclusion

Where to find the code:

OpenBSD 2.7 - http://www.openbsd.org/

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Disclaimer

OpenBSD is based in Calgary, Canada. All individuals doing cryptography related work do so outside countries that have limiting laws.