

SelNet

A Virtualized Link Layer

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March 31st, 2004

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Overview

- Context
- SelNet description
- Problem 1: Road Warrior scenario
- Problem 2: Distributed Proxy scenario
- Architectural discussion

SeINet Context: Internet IPv4 architecture

- Collapsing of identity, access & location
 - Mobility is hard to get right
- Lack of adjustable indirection
 - NAT, Proxies, CDNs...
- Lack of extensible naming & addressing schemes
 - Stuck with DNS + IPv4
- The deployment problem
 - No IPv6, Multicast, QoS, mobility...

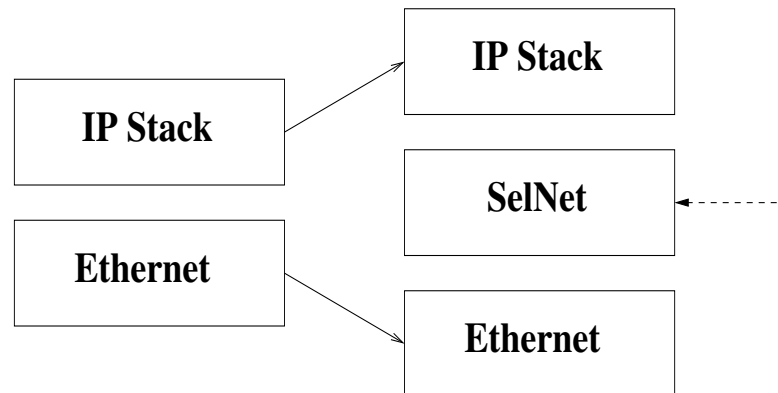
SelNet

SelNet is a virtualized link layer (underlay network)

Its components are:

- **Packet Processing Functions (PPFs)**— typically forwarding functions, but also transcoding, routing. . .
- **XRP** (eXtensible Resolution Protocol) — API for steering resolution process
- **SAPF** (Simple Active Packet Format) — Data forwarding via label switching

SelNet Approach



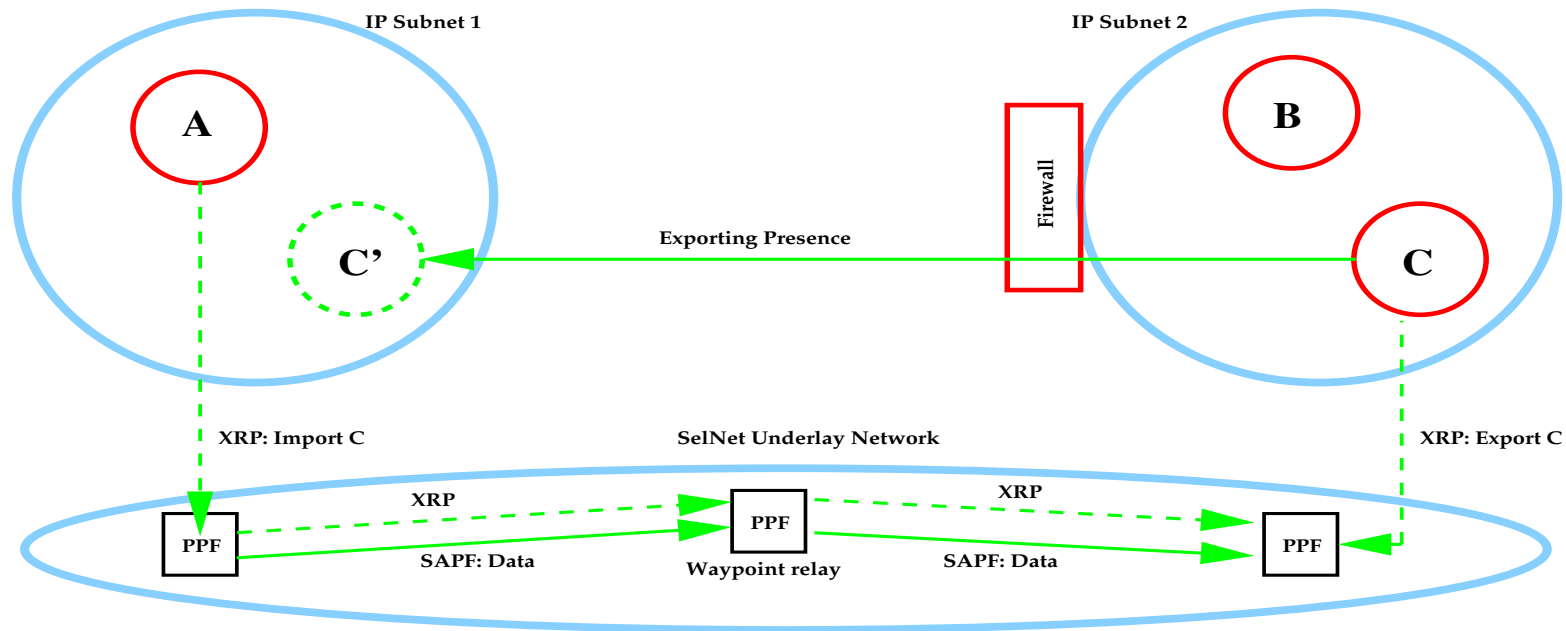
- Don't attack the network layer, go **under** it!
- Provide **flexible** indirection:
 - Network support (routing, mobility etc...)
 - Application support (CDN, Proxies etc...)

Problem Scenario 1: Mobile Road Warrior



- How to solve this with the IP toolbox
 - NAT for address rewriting?
 - Multiple addresses via Mobile IP?
 - Multiple namespaces via VPN?

SelNet-style Solution



- **XRP** – steering resolution activity
- **SAPF** – data forwarding via label switching

Under the hood

Remote node behind firewall

- Registers with distributed clearing house (i3?)

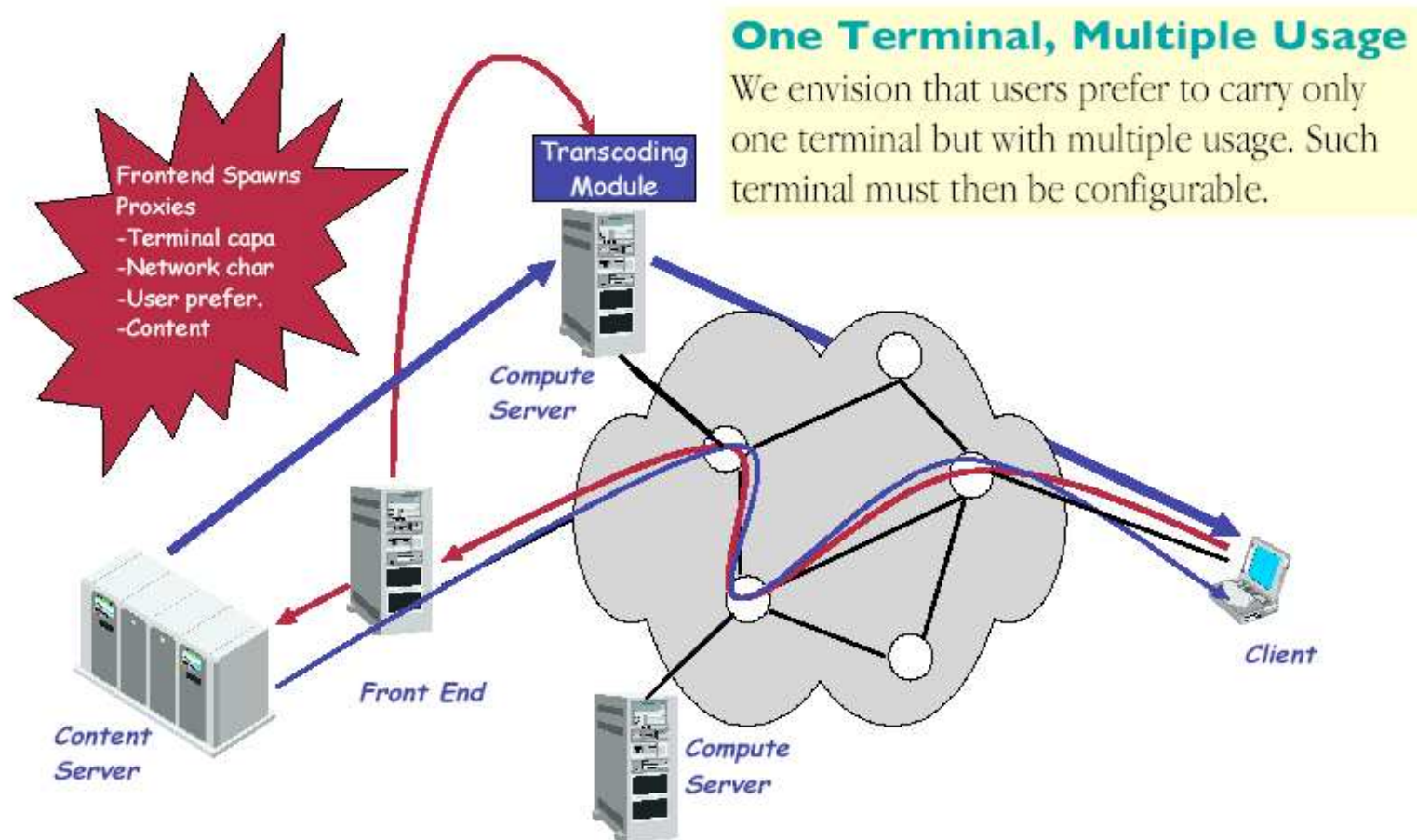
Client node

- Discovers current mappings from clearing house
- Contacts waypoint node via XRP
- Sets up SAPF path to destination via waypoint
- Resolution process **maps** remote node to local network

What's the difference?

- No IP-in-IP tunneling required
- Just SAPF header added to packet
- **Identity** of node not obscured, just location
- Network operator can **restrict** which nodes export their presence

Problem Scenario 2: Distributed Proxies



Problem Scenario 2: Distributed Proxies part II

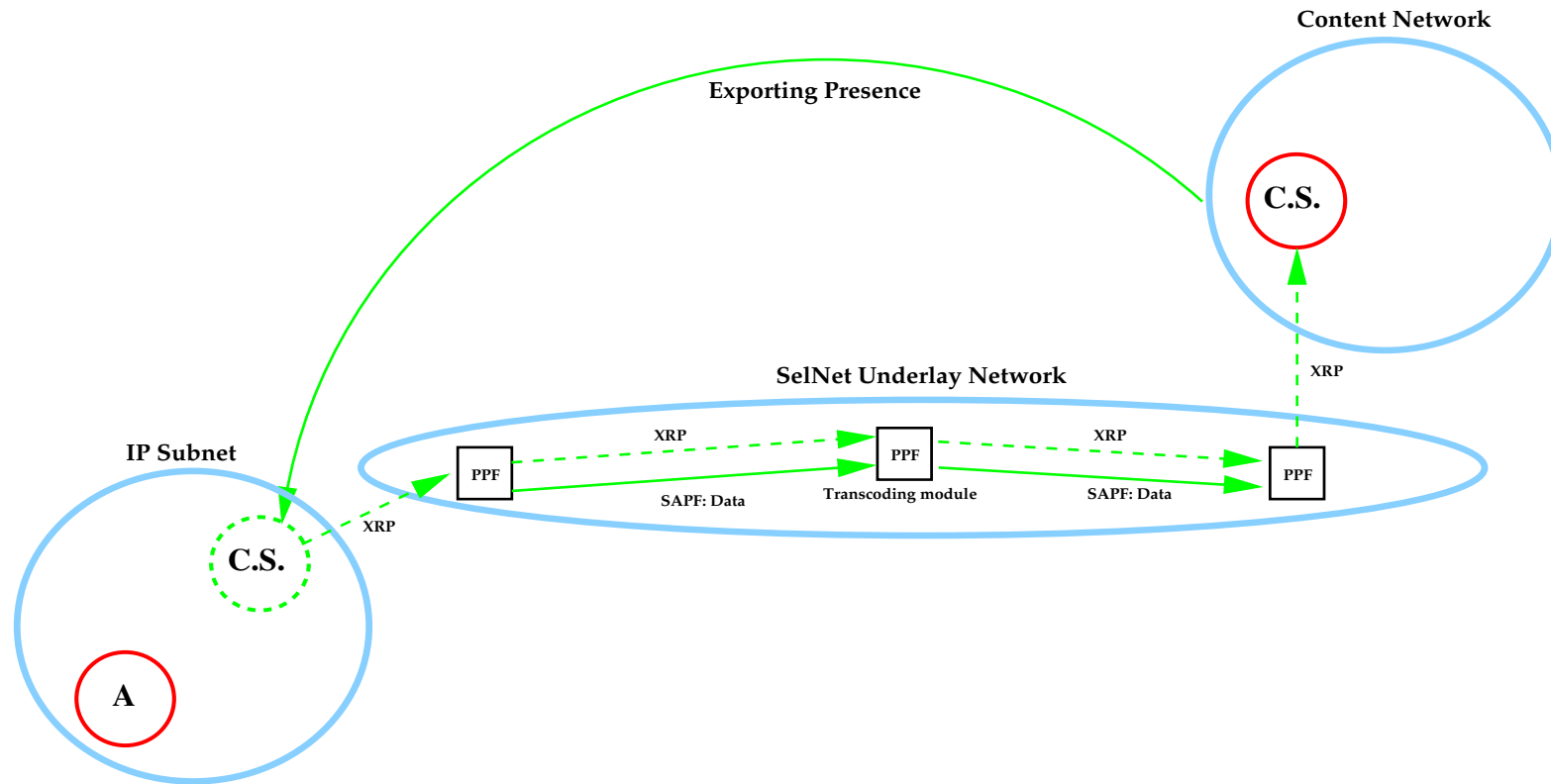
- Small, mobile devices with widely varying access networks
- Content **adaptation** for small displays or low-bandwidth links
- Create per-session **service overlay**
- Fight against the **overly** direct Internet

Issues with current distributed proxy architectures

- Source routing
 - How to route **between** proxies?
- Reverse path
 - Ensure that it is the **same** as the forward path

Indirection in a user-defined way is difficult

Another SelNet-style Solution



XRP query: **what** is desired & **how** to get it

Differences?

- Source routing
 - XRP discovery sets up **custom** route
- Reverse path
 - XRP back pointers force **correct** reverse path

User-controlled indirection **mediated** by server

Some thoughts on access control...

No communication can take place until resolution is complete

- Intermediate nodes have to approve
 - destination
 - method of reaching destination
- Can be complex or trivial:
 - Route all IPv4 traffic
 - Route only traffic which conforms to a policy

Who is allowed to do what indirection?

Temporary Networking

Temporary Networks are on the rise

- Custom, bespoke networks per service/application
- Short-lived but still full citizenship
- State/complexity trade-off a big issue
- Information flow – core to edge & vice versa

Architectural issues

Indirection seems to be a key issue

- Lack of controllability in the current Internet
- Loose-source routing was the way to go
- Also achievable via naming
- Cause of current stress + patches

Where is indirection placed currently?

Multiple proposals, multiple places

- Mobile IP – Attached to the side of IP
- NAT – indirection in the access network
- Dynamic DNS – naming is the key
- Proxies – application-specific indirection

Related Work on Indirection

- [Internet Indirection Infrastructure](#) (Stoica et al.)
 - Rendezvous-style communication for IP
- [Role-based Architecture](#) (NewArch project)
 - From Protocol Stacks to Protocol Heaps
- [Nimrod](#) (Chiappa et al.)
 - Loose Source Routing & LS Algorithms
- [Plutarch](#) (Crowcroft et al.)
 - Multiple Contexts bridged together with IFs

Conclusions

- Indirection scenarios problematic for IPv4 + DNS
- SelNet provides native support for adjustable indirection
- Rough prototype implemented, needs further refinement
- State/complexity management of XRP future challenge