UIP: A Zero Configuration Architecture for Ad Hoc Internet Naming and Secure Global Connectivity

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Ubiquitous Networking is getting harder

• Unstable addresses
  ➢ DHCP addresses change
  ➢ Non-routable NAT addresses
• Domain names and dynamic DNS
• Security is inconvenient
• Devices can't talk without infrastructure
UIP Architecture

• Identity-Based Routing
  ➢ globally unique, self certifying endpoint IDs
  ➢ persistent, stable
  ➢ communications security
  ➢ mobility

• Meaningful names for manipulating EIDs
  ➢ DNS extensions
  ➢ Ad hoc DNS – each endpoint is a name server
Routing: Registration Servers

- Normal case
  - edge hosts register current location
  - reg servers lookup current location
  - direct route to destination
- Forward packets only when direct routes fail
NAT traversal

- Registration Servers mediate
- Supported by most NATs

A -> R: lookup B
R -> A: B is at ...

A -> B: ping B  (blocked by NAT)
A -> R: ping B  (relay succeeds)

B -> A: ack  (succeeds)
Routing: Local Resolution

- Avoid IP configuration
- Infrastructure-free operation
  - Link Layer Broadcasts
  - Ethernet, 802.11, etc
  - local nodes only
- Global names unavailable
- Same Endpoint IDs
Ad Hoc Naming

• Each endpoint has a local name space
  ➢ Users create bookmarks to name other hosts
  ➢ either encoded EIDs or relative to other EIDs
    • alice.bob.af34f....3df.eid
    • alice.bob.foo.net

• Registration servers act as secondary nameservers
Related Work

- Internet Indirection Infrastructure \(i3\)
  - Identity Based Routing via DHT
- Host Identity Protocol
  - Persistent Endpoint IDs
- Delegation Oriented Architecture (DOA)
- SFR
**Edge Node Implementation**

- UIP appears to applications as a new address family
- Intercept socket & resolver calls

### Diagram

1. `connect(EID)`
2. IPv6 address = `getipv6(EID)`
3. `connect(IPv6 address)`
4. TCP SYN packet
   - dst: IPv6 address

Local Host

- application
- stub library
- kernel
- local UIPd

UIPd or reg server

5. TCP SYN
   - over UIP
   - over Ethernet or IPv4/UDP
Status & Results

- Simple Registration Server
- Latency & Bandwidth
  - 20 Mbps, 1ms per packet overhead
- NAT traversal shortens paths
  - Supported by 75% of NATs
- Naming work underway