Seminar in Distributed Systems

Separating Location and Identity

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Why?

- IP addresses are overloaded, they indicate both network locations and node identities
- Overloading provides minimal security
- But: what happens if you switch from WLAN to LAN on your notebook?
Why?
The papers

• FARA: Reorganizing the addressing architecture
  – focused on mobility

• The Split Naming/Forwarding Network Architecture (SNF)
  – focused on flexibility of routing

• Both papers published in 2003
FARA

• “Forwarding directive, Association and Rendezvous Architecture”
• Part of the NewArch project
• A work in process
• Abstract model for network architectures
• A top-down reasoning
3-Step Approach

Abstract architectural model

Instantiation of the model

Prototype of the Instantiation
Basic Components

• Entity
  – Generalization of an end-point
  – Smallest mobile unit
  – i.e. a process, a thread, an entire computer, a cluster

• Association
  – Logical communication link between entities
  – Roughly analogous to a transport layer
Basic Components

• Communication Substrate
  – Roughly a network layer
  – FARA assumes connectionless packet delivery with appropriate addressing and routing
  – But no restrictions on particular choices of mechanisms
  – A couple of functions have to be provided

- FARA - Entity
- FARA - Association
- Network
- Data Link
- Physical
Basic Components

Entity

Association State

Association

Association

Communication Substrate

the “red line“
Packet delivery

- Forwarding Directive (FD)
  - “Address” for packet delivery by the communication substrate
  - Not specified in FARA
  - A FD can change, but an Association ID never changes if an entity moves
Packet delivery

Entity

Ald1 Ald2

Send Packet to FD

Entity

Ald1 Ald2 Ald3 Ald4

FD
M-FARA

Core Network

FDdown

FDup

Private Domain
Packet delivery

Entity

Ald1, Ald2

Send Packet to FD

Entity

Ald1, Ald2, Ald3, Ald4

FD
FARA Assumptions

• Associations are not names for entities; there is no global name space for associations

• There doesn’t have to be a global namespace for entities names
  – No need to know the name of an entity to communicate with it; just need to know how to reach its unique location

• No global address space required
Security

• We have to deal directly with the end-to-end security issue

• In FARA this is a private matter between the consenting entities

• No restrictions on the protocols and mechanisms
Security

• Goal is to support different security mechanisms and levels
  – No authentication
  – Authentication during handshake
  – Authentication after each move
  – Authentication of each packet
Split Naming/Forwarding Network Architecture (SNF)

• Divides the network layer into naming and forwarding layers

![Diagram showing the split of network layers into naming and forwarding sections]
Forwarding layer

• Provides locators with which the network can deliver packets to a corresponding location
  – Locator can be an IP address

• Does not require globally uniform protocols or global address spaces
  – Translation gateways needed
  – i.e. IPv4 and IPv6 networks
Naming Layer

- Provides name to locator mappings
- Globally uniform, but multiple implementations are possible
Naming Layer

- **Client**
- **Server**

Addressing Domain A  Addressing Domain B
Implementing SNF

- On top of the current infrastructure
- Use of IP at the forwarding layer and DNS at the naming layer

<table>
<thead>
<tr>
<th>Unit</th>
<th>Implemented by</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>FQDN</td>
<td>Identifies a node</td>
</tr>
<tr>
<td>Locator</td>
<td>IP number</td>
<td>Denotes the location of node</td>
</tr>
<tr>
<td>ECI</td>
<td>64-bit number</td>
<td>Identifies a packet flow</td>
</tr>
</tbody>
</table>
Compatibility for SNF unaware Hosts
Conclusion

• FARA:
  – IPNL and TRIAD uses a similar concept of FD
M-FARA

Core Network

FDdown

FDup

Private Domain
Conclusion

• FARA:
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  – Mobility features are very similar to Mobile IP
Conclusion

• FARA:
  – IPNL and TRIAD uses a similar concept of FD
  – Mobility features are very similar to Mobile IP
  – Splitting into a end-to-end part and the communication substrate is not new

So, what’s really new?
  The assembly of the concepts
Conclusion

• SNF:
  – Splits network layer into a naming and a forwarding layer
    → Naming layer is an overlay network
  – Integration of DNS into the protocol stack

• After all nothing fundamentally different to TRIAD / IPNL
Conclusion

- FARA - Entity
- FARA - Association
- Communication Substrate
- Data Link
- Physical

- Application
- Transport
- Naming
- Forwarding
- Data Link
- Physical
Thank you for your attention