One Laptop per Child

Networking
Principles; Caching

Dr. C. Scott Ananian <cscott@laptop.org>
Manifesto

- No Assumption of Universal Connectivity
- Direct XO-to-XO serverless communication
- Human-readable unique identifiers for each XO
- Direct presence interrogation
No Assumption of Universal Connectivity

• Every one is an island (of some size)
• Best service possible within our walls
Direct XO-to-XO communication

• Servers may be used as aides or proxies, but are never necessary

• Sockets and IP, like Jon Postel gave us

• Firewalls are there for a reason
  – But we can provide tunnels where needed
Human-readable ids

• Sometime I can tell my non-XO using friend
  – cscott.1cc-cambridge-ma.us.xs.laptop.org ?

• Indirect, but globally unique.

• Maybe more than one name!
Direct presence interrogation

• Allow many discovery mechanisms
• Once discovered, direct means for presence
  – Rate and bandwidth limited
• More efficient alternates may augment
Brass Tacks

- The previous slides presented the principles
- Now let's consider an implementation
- You're welcome to suggest others!
DNS

• XOs are identified as:

  name.xxx.school.country.xs.laptop.org
  - Name: encoding of XO nickname
  - Xxx: only used for serverless bootstrapping
  - school....laptop.org: filled in by registration
Resolving

• Standard dynamic DNS to school server/other
• Map to link-local IPv6 by hashing
My friends

• Standard XMPP scheme for adding friends:
  – `xmpp:xo@nickname.xxx.school.country.xs.laptop.org?roster;name=Full%20Name`

• Internally: 'user@domain' (usually `xo@domain`)
  – Add protocol?
Presence

• Lightweight XMPP server on the XO for basic IM presence
  – Using SD-DNS redirection on school server if present

• Additional XO specific info?
  – Xmpp extensions, separate service?
  – Should not interfere with IM/VOIP interop
The jungle

- Tunnels
- Split DNS
- Security
Tunnels

• When I register with my school server (or xofriends.org) I might get back some tunnel information
• I can establish an IPv6 tunnel using this to bypass NAT and allow my class to collaborate
• School-to-school tunnels to allow penpals
Split DNS

- cscott.1cc.xs.laptop.org might resolve to one thing at school, and something else at home
- Allows school server to remain firewalled off from external networking, without requiring students to use new identity at home
- Also provide tunneling?
XO-to-XO security

• When I befriend mstone, I might obtain a public key from him
• Lookups of mstone.1cc.xs.laptop.org notice the keypair and lie to me
  – They give me a localhost IP address
• Now connections to mstone get proxied
  – Verify that mstone is authentic
  – Protect content of communication
Asynchronous web

• We want to cache web content for offline use

• But these will still trigger DNS lookups
  – One solution is to provide “offline DNS” server as well, or use explicit proxy
  – OR: School server can provide unique link-local IPv6 addresses in response to query
  – Server (or peer) answers connections to these and responds
Bonus: reinventing .xol

- Define structure for cached web content
- Most .xols have two parts:
  - Push some content in the offline cache
  - Indexing information: sidebar links, etc
- But why not just push this into the .xo format
  - And kill the .xol
Super bonus: requests

• Once we have a cache, there will be misses
• How do we collect the misses...
• ...and fulfill them next time we have connectivity
• ...or our teacher has connectivity