GENI Meso-scale Prototype for MobilityFirst Evaluation

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WINLAB

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Objectives

- Software prototypes of main arch. pieces with end-to-end protocol implementations
  - Consider OpenFlow/SDN, FPGA platforms, and optical components

- Mobility, first
  - Mobile host platforms and multiple wireless access technologies
  - Ad hoc, disconnection, network mobility as common cases

- Meaningful at-scale evaluation
  - Realistic network conditions
  - Access-Core-Access evaluations
  - Target long running deployment and opt-in users
Prototyping and Evaluation: Execution Summary

Phase 1
- Context Addressing Stack
- Content Addressing Stack
- Encoding/Certifying Layer
- Global Name Resolution Service (GNRS)
- Storage Aware Routing
- Locator-X Routing (e.g., GUID-based)
- Context-Aware / Late-bind Routing

Phase 2
- Context Addressing
- Content Addressing
- Host/Device Addressing
- Encoding/Certifying Layer
- Global Name Resolution Service (GNRS)
- Storage Aware Routing
- Locator-X Routing (e.g., GUID-based)
- Context-Aware / Late-bind Routing
- IP Routing (DNS, BGP, IGP)

Phase 3

Prototype
- Standalone Modules
- Integrated MF Protocol Stack and Services
- Deployable s/w pkg., box

Evaluation
- Simulation and Emulation
- Smaller Scale Testbed
- Distributed Testbed
  E.g. ‘Live’ on GENI

Rutgers
Prototype: Click-based Router

User-level Processes

Click
- Forwarding Engine
  - Packet Classifier
  - Block Aggregator
  - Service Classifier
  - Next-hop Lookup
  - Forwarding Table
  - To/From Host
  - Host Rx Q
  - Host Tx Q
  - To Next-hop Lookup
  - Block Segmentor
  - Hold buffer
  - Rx Q
  - Tx Q

Wired and wireless i/f

Wired and wireless i/f

x86 hardware and runtime

Inter-Domain
- R3
- GSTAR
- Routing

Locality-Aware DNS
- DMap – DiHT
- Name Resolution

PacketCloud Framework
- Compute Services
- Content Cache Service
- Mgmt.

Early Dev.
Integrate

Rutgers
WINLAB
Prototype: Host Protocol Stack and Network API

Linux PC/laptop with WiMAX & WiFi

Android device with WiMAX & WiFi

Device: HTC Evo 4G, Android v2.3 (rooted), NDK (C++ dev)
GENI Deployment & Evaluation

Deployment Goals
• Large scale, multi-site
• Mobility centric
• Realistic, live

Mapping onto GENI Infrastructure
(ProtoGENI nodes, OpenFlow switches, GENI Racks, DieselNET buses, WiMAX/outdoor ORBIT nodes)
GENI Deployment: GEC-12 (Nov. ’11) Demo Topology

- Storage aware routing
- Name resolution
- Multihoming
GENI Deployment: Mapping to Logical Topology
Application: Content Delivery to Mobile Hosts

Mappings @ pg51.emulab.net
Time: 1320334245

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![Diagram showing network topology with nodes and connections]

BBN Wireless Edge

Rutgers Wireless Edge

- **NLR path using VLANs 3716, 3799 (Clemson)**
- **I2 path using VLANs 3715, 3745(BBN), 3798 (Clemson)**
- **ProtoGENI host running MF Router**
Visualization

Data collection framework with API, monitors, filters and data warehouse
E.g., Orbit Measurement Library (OML)

What’s on?
1. Network statistics
2. Packet and flow tracing
3. Routing events
4. Application events

Network map credits: ProtoGENI’s Flack tool. http://protogeni.net/trac/protogeni
Next Steps

• Applications, applications, applications
• Deploy and evaluate GNRS services across full GENI backbone and Spiral 4 GENI racks (~80-100 nodes)
• Deploy MobilityFirst services in overlay mode over the commodity internet
• Even larger scale with emulation co-deployment
• Multi-domain deployment using world-wide GENI collaborators