Prototyping and Evaluation of Mobility First Architecture

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Goals

- Prototype and demonstrate the working of the Mobility First architecture at ‘Internet scale’
- Focus on application scenarios and solutions that address mobility challenges
- Identify evaluation and deployment options for overall architecture as well as those to evaluate sub-components
  - Address challenges of large scale deployment
  - Emulating realistic topologies and data traffic
- Target production quality software for live deployment
  - Span multiple campus/testbed sites
  - Opt-in users and real applications
Phased Approach

Simulation/Emulation  
Emulation/Limited Testbed  
Testbed/‘Live’ Deployment

Evaluation Platform

Standalone Components  
Cross Layer Integration  
Production, Hardware Ready

Prototyping Status
Simulation – Emulation

More Realism

Custom
- ns-2, ns-3
- ONE simulator
- Shox
- OMNeT++

Click
- Quagga
- XORP

VROUTER

VDE/Virtual Square

Netkit network emulator

Openflow

Simulator

Graphical Network Simulator

Realism
Prototype Framework

- Portable implementation for multiple emulated and real open platforms
- Initial target: software router with well understood 2 level emulation
  - Routing and other services implemented as user level processes
Testbed Deployment Options

- ORBIT – Grid and Outdoor (GENI)
  - Wireless and mobile focus; wired infrastructure significant as well

- DOME/DieselNet (GENI)
  - Mobile, wireless focus

- ProtoGENI
  - 10-12 core nodes interconnected by Internet2 backbone
  - PrimoGENI - Large scale network simulator embeddable into GENI

- PlanetLab + VINI
  - Pure wired network emulation, most widely distributed

- Emulab
  - Mostly wired with flexible topology and delay/bandwidth control

- GpENI + VINI
  - 4+ clusters of nodes, with L1 Midwest optical backbone between clusters
Evaluation Scenario 1 - Core Network

- Multiple domains, core + edge routers, reliable connectivity with redundant paths
- Explore inter-domain routing, global services – e.g., GNRS

Testbeds:
- PlanetLab
- VINI
- ProtoGENI
- Emulab
Example Mapping - PlanetLab, VINI, I2

- Map real topologies onto testbed topology
- Emulate real network delay, bandwidth using delay nodes, etc.
Scenario 2 – Edge Only

- Ad hoc, multiple wireless technologies – WiFi, 3G, WiMAX
- Explore routing with mobility, handoff, multi-homing within single domain

Testbeds:
- ORBIT
- DieselNET
Sample Mapping: WINLAB GENI (ORBIT)
Scenario 3 – Core + Edge

- Similar to 2, except edge network access services within core.
- Explore:
  - core-edge routing
  - cross-layer interaction between global naming and routing services
  - in-core storage resources
- Testbed candidates: ORBIT GENI (outdoor + indoor), ORBIT GENI + ProtoGENI
**Goal: Live Edge-Core-Edge Slice**

- Entire MobilityFirst stack on network devices
- Explore inter-domain mobility, e.g., emulated as process migration
- **Real traffic** through applications: media, social, location, etc.
  - Live slice deployed in multiple sites/campuses with opt-in users

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**Legend**

- Target: large scale deployments with realistic (throughput, latency) core and multiple edge substrates
Work in Progress

- Evaluation of emulation and testbed options
- Extraction and mapping of GNRS, Routing algorithms/code from simulation to prototype framework
  - Targeting limited GENI (ORBIT, ProtoGENI) deployment of GNRS by Nov ‘11 – GEC12
- Resource investigation on NetFPGA
  - Store/forward scheduling aspects in STAR/CNF routing