Network Management in the MobilityFirst Architecture

Suman Banerjee
Jim Kurose
Morley Mao
Byrav Ramamurthy
Dipankar Raychaudhuri
Principles

• **Isolation** of the management plane from data plane
  – Network virtualization
  – Provides resilience to key management functions

• **Engagement of clients** in management tasks
  – Client vantage point is critical in wireless environments

• **Manage mapping** between names, GUIDs, addressing, routing, context, content, and spectrum

• **A simple get/set API** for access and actuate management functions
  – Access security and privacy through credentials
Examples of applying principles

• “Find the highly mobile users”
  – Who are the most mobile users in a particular area
    • Can design algorithms to assign resources to them differently

• “Find link condition stats for specific wireless users”
  – Identify appropriate routing decisions for them
Logical overview of management plane
Implementation

• Physical implementation of management plane isolation will vary
  • e.g., sensor networks, DTNs, access networks, core networks, etc.

• Core networks: physical virtualization
• Access (wireless) networks: spectrum resource virtualization
• Sensor networks: abstraction of queries
Client-assisted management

Experience is property of location and cannot be always replicated

NSF FIA MobilityFirst Project - EAB Meeting Feb 28, 2011
Infrastructure-only management
Client-assisted management overview

Controller

GW-1

GW-2

NSF FIA MobilityFirst Project - EAB Meeting Feb 28, 2011
Which management tasks?

• Anything that is RF related
• Across all functional areas as defined by ISO
  – Performance management
    • Network-wide policy provisioning, network telescopy
  – Configuration management
    • Channel assignment, power control, energy efficiency
  – Fault management
    • Root-cause analysis
  – Accounting management
    • Traffic accounting
  – Security management
    • Rogue node detection, identity management
Example: Performance management
Example: Performance management

Controller

GW-1

GW-2

AP3

AP4

Autonomous client choice is sub-optimal

NSF FIA MobilityFirst Project - EAB Meeting Feb 28, 2011
Example: Performance management

"AP 3: RSSI -50, AP4: RSSI: -70"

NSF FIA MobilityFirst Project - EAB Meeting Feb 28, 2011
Example: Performance management

Globally informed decision client support

Controller

GW-1

GW-2

AP3

AP4

“Associate to AP4”

NSF FIA MobilityFirst Project - EAB Meeting  Feb 28, 2011
Example: Fault management

Coverage hole detection

"Report APs in range every 5 seconds"
A multi-network access example

60 sq. miles area in and around Madison, WI
(data collected through clients)

Implication for multi-interface system design

NSF FIA MobilityFirst Project - EAB Meeting Feb 28, 2011
API

• Get
  – variable, time, id, credentials

• Set
  – variable, value, start-time, end-time, id, credentials

• Security
  – Chain of credentials (much like the chain of trust)
  – Delegation
  – Deny-by-default

• Examples:
  – Set
    • cache size in CNF, 100 MB, 10AM, indefinite, Controller, Certificates
    • Name-address mapping, x.com = 10.2.3.2, 11.25pm, 11.55pm, DNS-controller, Certificates
Preliminary demos

• **Separation of management and data planes**
  – Show that data plane can fail, while management functions continue

• **Client assisted management**
  – Gather data from multitude of clients and aggregate them to answer performance questions about networks, visualization of performance
    • Client side software with cloud-based services