

Naming and Routing in MobilityFirst Future Internet Architecture

Rutgers, The State University of New Jersey



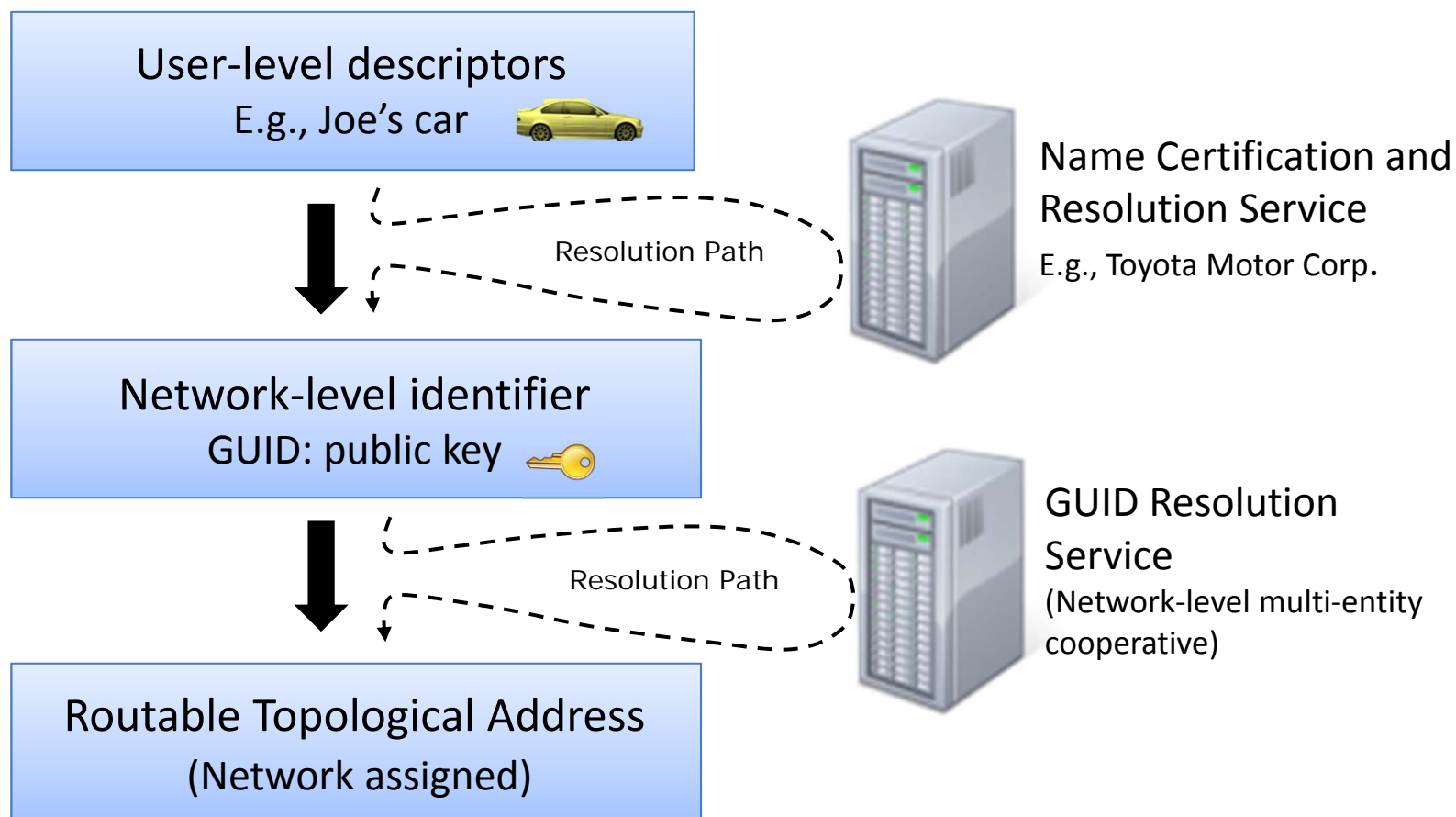
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MobilityFirst: Layered Names and Rich Delivery Services

- Current Internet supports only 1 level of name resolution (DNS) - Hostname → IP address
 - Relegates other objects (service, content, context) to indirect naming
 - Moreover, no support for fine-grain mobility
- Thin in network delivery services
 - End hosts do the heavy-lifting for intermittent problems en-route
 - Pre-eminence of overlay services
- MobilityFirst Proposal
 - Layered naming, and direct address for hosts, services, content, context...
 - Inherent support for mobility
 - Rich in-network services: multicast, multipath, multihoming, anycast

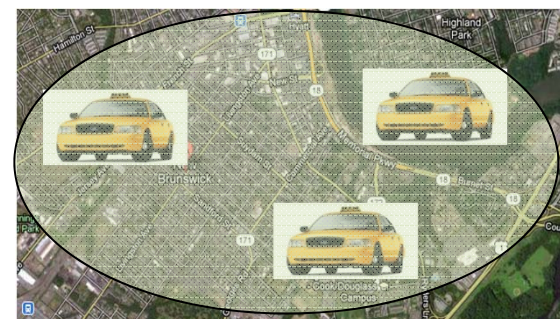
Layered Naming



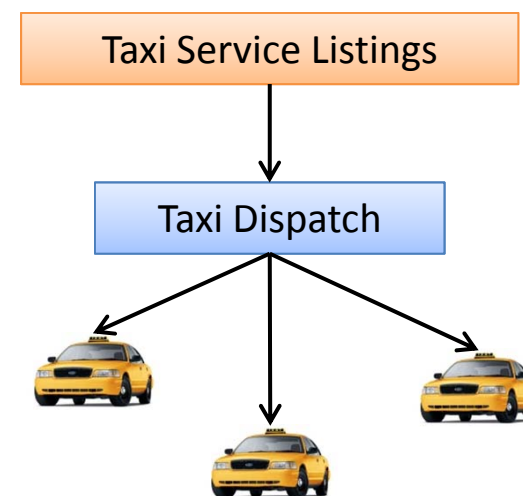
GUID Naming for Groups and Abstract Entities

- Aggregate objects under single GUID
 - Reference or Indirection GUID: GUID \rightarrow GUID-set
 - Example: All cabs of Yellow Taxi Cab company
 - Advantages: efficient group delivery, policy aggregation
 - Challenges: Efficient topological aggregation

GUID_(YTCC)



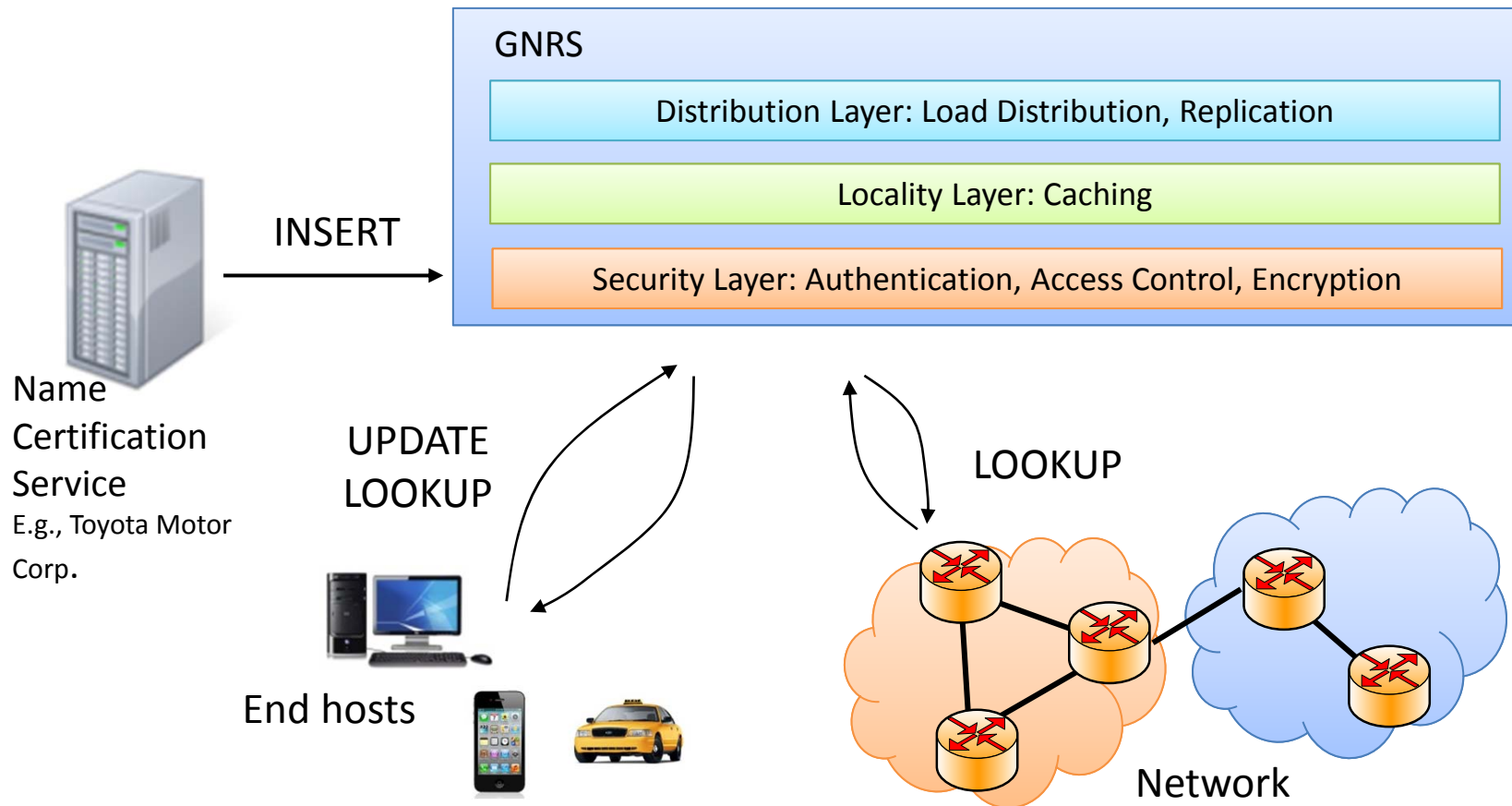
- GUID for Services or Context
 - Resolver Services ‘manage’ mappings : user level \rightarrow network-level (GUID)
 - GUID mapped to end points
 - “Connect me to a taxi service in New Brunswick” (Endpoint = a **Taxi Dispatcher Service**)
 - “Hail a taxi cab within 5 miles of here” (Endpoint = **Taxi**)



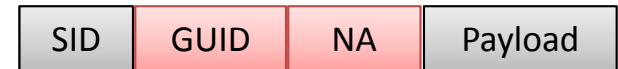
Dynamic Resolution of GUID to Network Address: Global Name Resolution Service (GNRS)



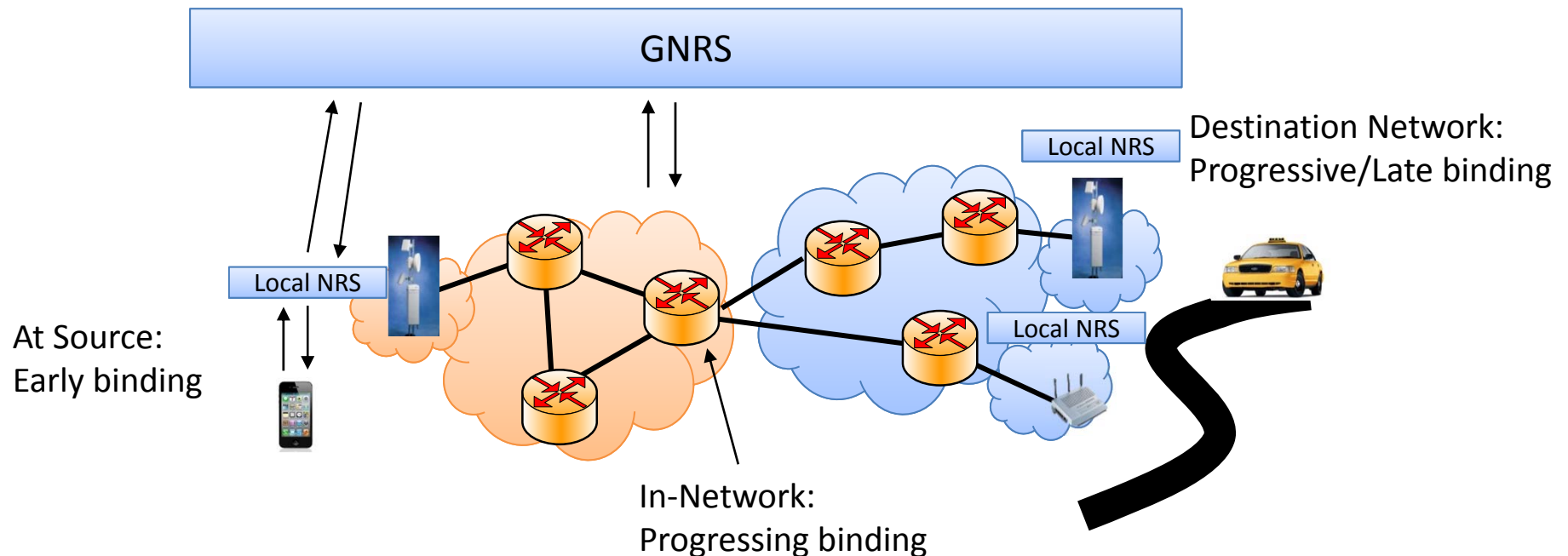
- Secure and policy-driven access
- Requirements: Low latency (< 100ms) to support mobile CBR apps
- GNRS operations: INSERT, UPDATE, LOOKUP



Progressive GUID-to-Address Resolution: Global/Local Resolution Services

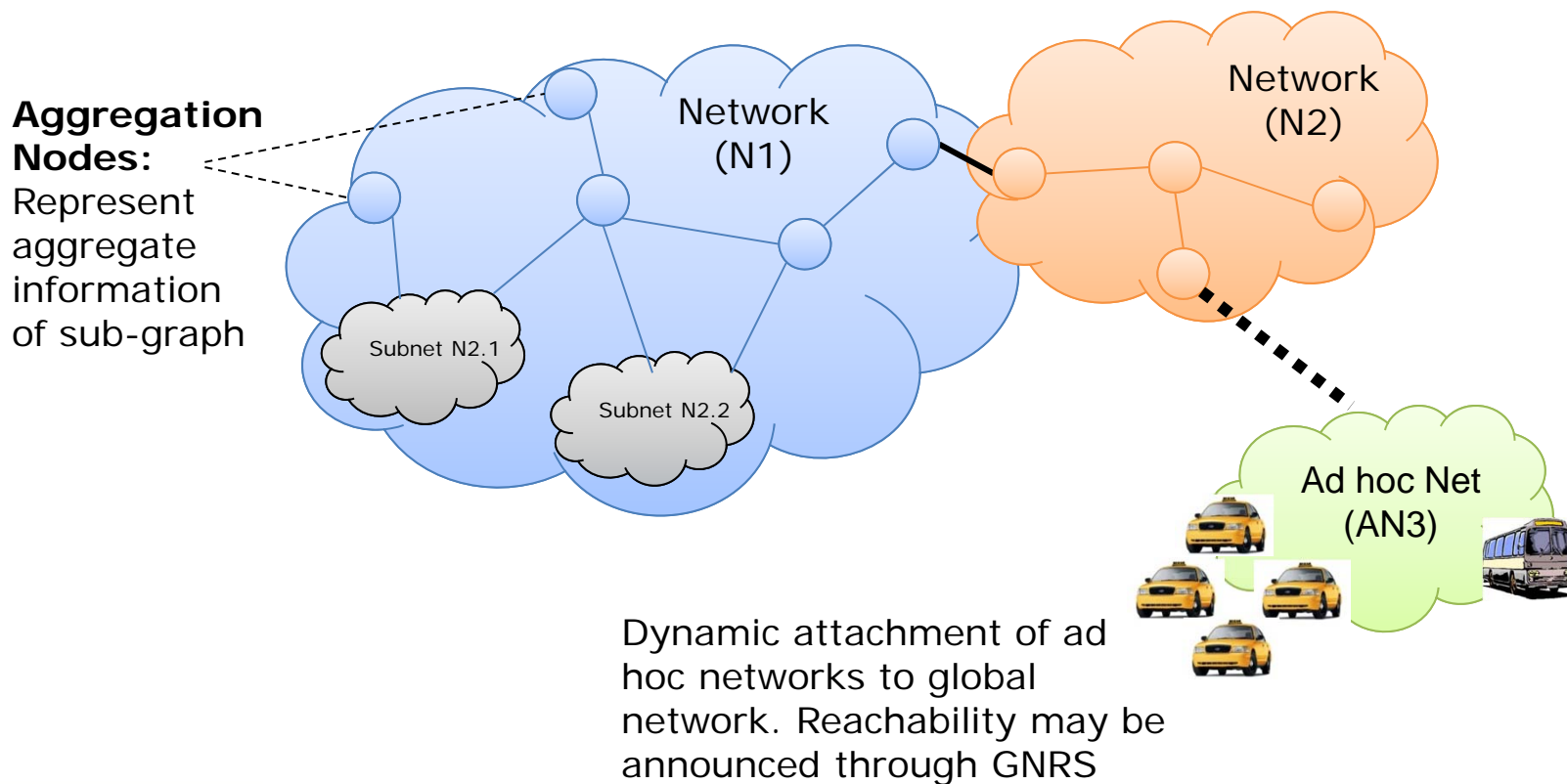


- Addresses resolved incrementally to progress the packet towards destination network
 - Limits granularity of location at GNRS with finer details at local resolvers
 - Direct binding is optional, but is less desirable for mobile scenarios
- Late binding or re-resolution upon failures



Routing: Flat Names, Edge-Aware, Service-Rich

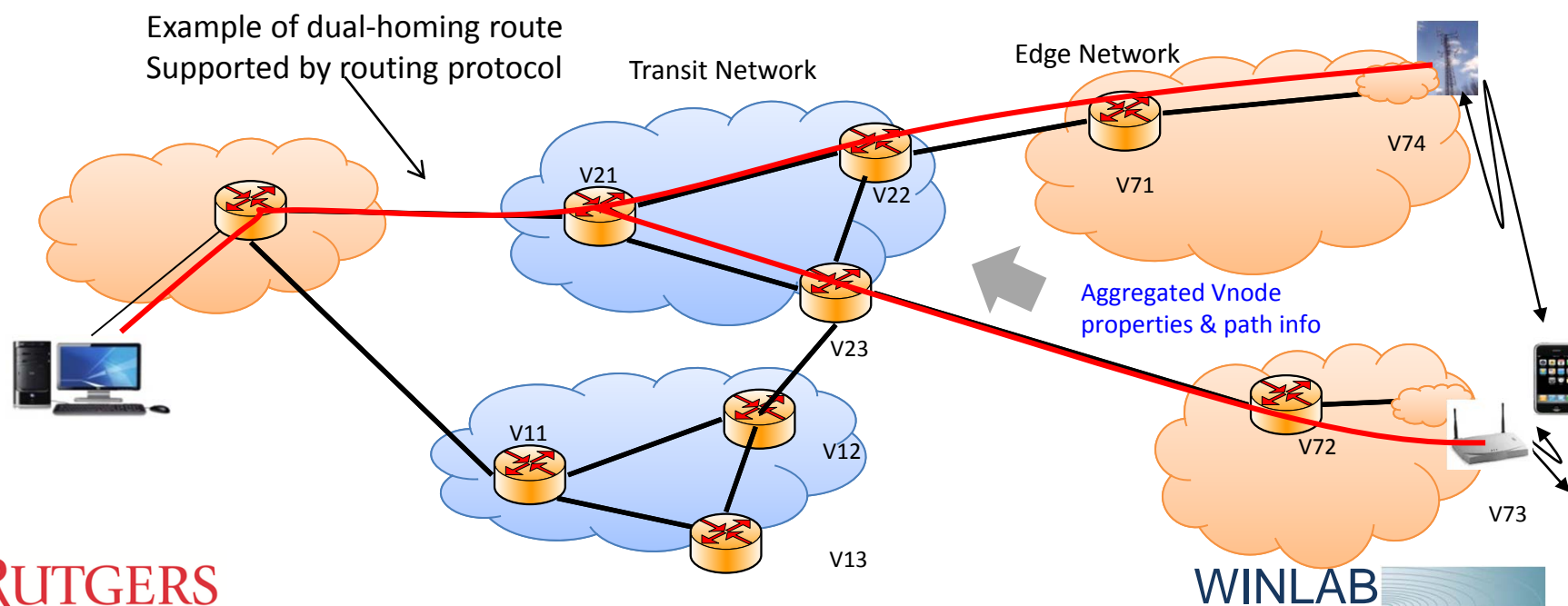
- Network Topology
 - Minimally hierarchical, flat names for networks
 - Aggregate topological constructs to expose finer topology within a network
 - Dynamic attachments of ad hoc and transient networks



Edge-Aware Inter-Domain Routing

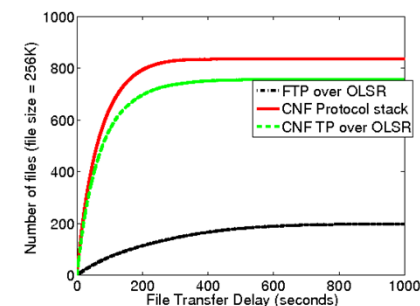
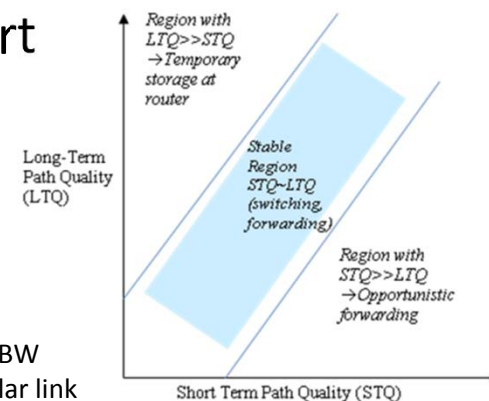
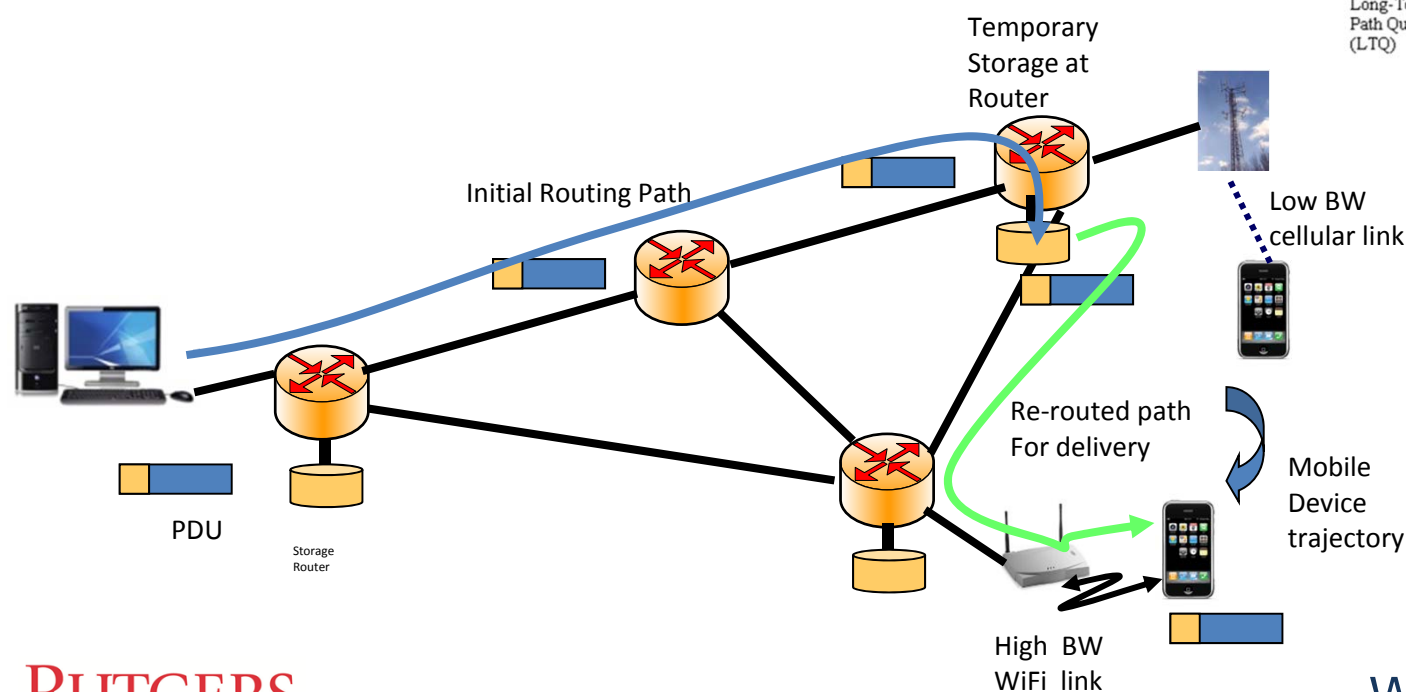
SID	GUID	NA	Payload
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- Approach under consideration is to enhance BGP-like protocols with summary node/link info (aggregate node)
 - Summary knowledge of access net properties (Mbps, % avail, etc.), ingress/egress points and alternate paths exchanged between networks/ASs
 - Network topology information for identifying multiple paths, storage points ...
- Inspired by “Vnode” concept in “Pathlet” routing (Godfrey, 2008)
- Support for multicast, anycast, multihoming and multipath



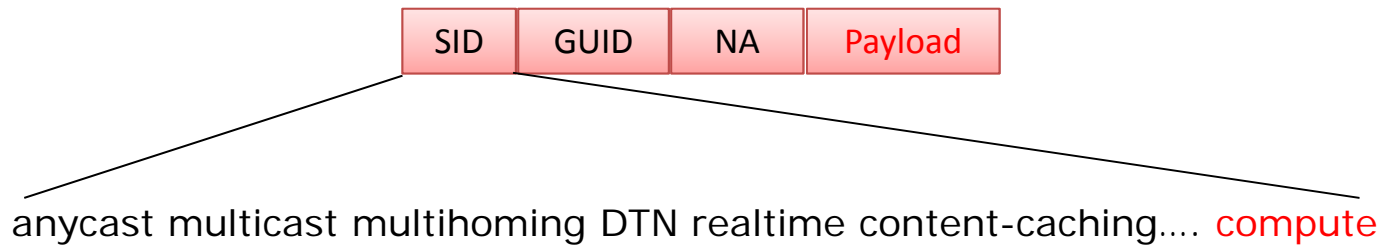
Storage-Aware, Disruption-Tolerant Local Routing

- Storage aware (CNF, generalized DTN) routing exploits in-network storage to deal with varying link quality and disconnection
- Routing algorithm adapts seamlessly from switching (good path) to store-and-forward (poor link BW/short disconnection) to DTN (longer disconnections)



Sample CNF routing result

Extensible, End-User Requested Delivery Services



- Compute plane services for in-network packet processing
 - ISP infrastructure services: DDoS prevention, content caching
 - Cloud-computing for end-user services
- Architecture allows for new services to be incrementally added

Summary of Naming and Routing in MobilityFirst

- Architecture embraces layered and direct naming for clean separation of identity and location
 - Mobility
- Groups and contexts named similarly as individual objects
 - Support for references and indirection
- Edge-aware routing to support efficient and flexible delivery options for mobile and multi-homed end points
- Extensible, service-oriented network